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Upping the heat on decarbonisation

With the need to decarbonise now critical, many are pushing the envelope in terms of where industrial heat pumps are being applied. *Page 13*



Wind resilience

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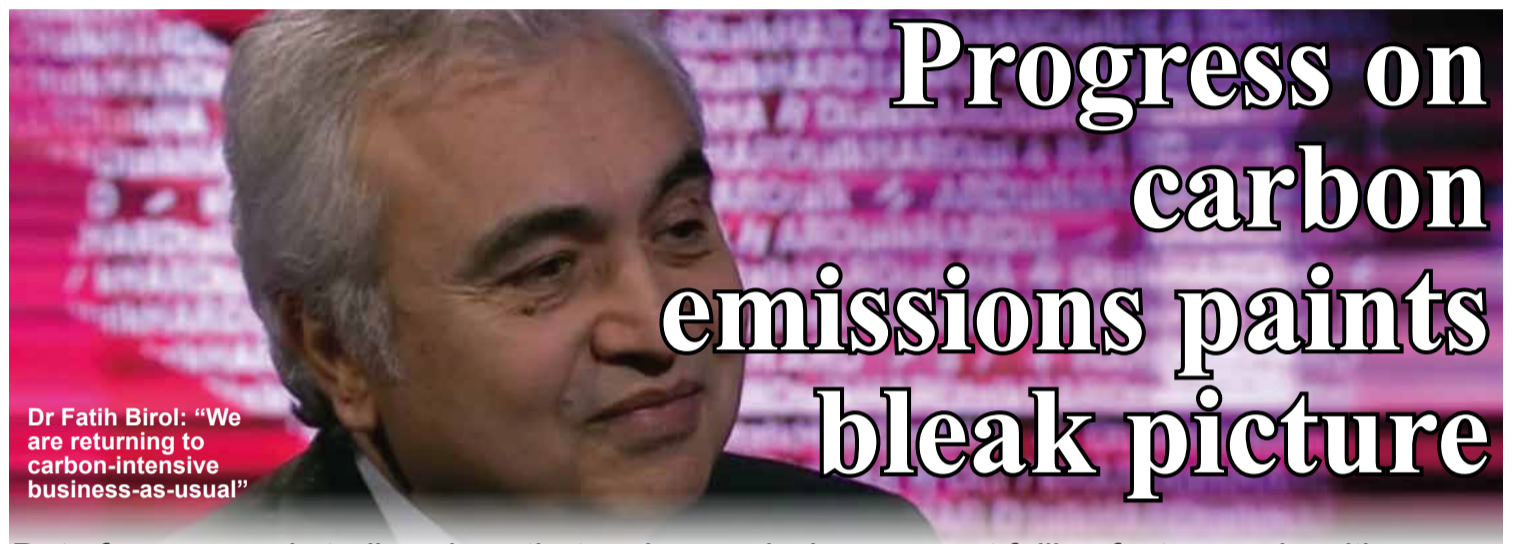
A project is underway in China that will demonstrate how heat pumps can sit alongside batteries to recover and re-use waste heat. *Page 15*

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Dr Fatih Birol: “We are returning to carbon-intensive business-as-usual”

Progress on carbon emissions paints bleak picture

Data from several studies show that carbon emissions are not falling fast enough, with the picture now being complicated by modelling that overestimates the potential impact of improved energy efficiency. **Junior Isles**

Recent data on carbon dioxide emissions and forecasts for reductions going forward paint a bleak picture for meeting climate targets, several reports have found.

According to a recent International Energy Agency (IEA) release, global energy-related CO₂ emissions were 2 per cent higher in December 2020 than in the same month a year earlier, driven by economic recovery and a lack of clean energy policies.

Dr Fatih Birol, the IEA Executive Director, said: “In March 2020, the IEA urged governments to put clean energy at the heart of their economic stimulus plans to ensure a sustainable recovery. But our numbers show we are returning to carbon-intensive business-as-usual. This year is pivotal for international climate action – and it

began with high hopes – but these latest numbers are a sharp reminder of the immense challenge we face in rapidly transforming the global energy system.”

The IEA said the 2020 trends underscore the challenge of curbing emissions while ensuring economic growth and energy security. Amid a growing number of pledges by countries and companies to reach net zero emissions by mid-century, the rebound in emissions shows what is likely to happen if those ambitions are not met with rapid and tangible action.

The findings follow a warning from the UN that the latest emissions-reduction plans set out by 75 signatories to the Paris climate agreement fell far short of what was needed to avoid the worst effects of a warming planet.

In its ‘Initial NDC Synthesis Report’ requested by Parties to the Paris Agreement to measure the progress of Nationally Determined Contributions (NDCs), the UNFCCC urged governments to set more ambitious goals and channel pandemic recovery funds into policies aimed at greening economies.

The report finds that total global energy-related CO₂ emissions in 2020 were about 6 per cent lower than the amount released the previous year, or almost 2 billion tonnes, at a total of about 32 billion tonnes. Total greenhouse gas emissions are estimated at about 50 billion tonnes.

UNFCCC Executive Secretary, Patricia Espinosa, said that the Synthesis Report is a “snapshot, not a full picture” of the NDCs as Covid-19 posed significant challenges for many

nations with respect to completing their submissions in 2020. She indicated that a second report will be released prior to COP26 and called on all countries – specifically major emitters that have not yet done so – to make their submissions as soon as possible, so that their information can be included in the updated report.

Espinosa encouraged all nations, even those who have submitted new or updated NDCs, to investigate further areas in order to create more robust NDCs. She added that an increase in ambition must be accompanied by a significant increase in support for climate action in developing nations, fulfilling a key element of the Paris Agreement.

Continued on Page 2

Kerry encourages more aggressive emissions-cutting commitments

US presidential climate envoy John Kerry has said the US will encourage China and others to make more aggressive emissions-cutting commitments under the Paris Agreement.

Speaking during the CERAWEEK conference by IHS Markit, Kerry said the Biden administration will push China on the issue, even as it confronts the world's top greenhouse-gas emitter over trade and intellectual property concerns.

“There are tensions today that did not exist back then,” but “we can deal with this as a compartmentalised issue,” Kerry said. “The climate crisis is not something that can fall victim to those other concerns and contests, because China is 30 per cent of all the world's emissions.”

The US formally re-joined some 195 other countries in the Paris Agreement in February, and the

Biden administration is developing a new emissions-cutting pledge that officials have said will be as “aggressive” as possible. The US is gathering some of the world's leading emitters in an April 22 virtual summit with the goal of raising ambition and pushing countries to keep average global temperatures from rising more than 1.5°C over pre-industrial levels.

Kerry also stressed that there are big opportunities in hydrogen. “That's jump ball right now,” Kerry said. “The test is going to be how do we produce the hydrogen in a way that isn't so damaging and carbon-intensive.”

President Biden has extolled the climate potential of hydrogen, which is widely seen as a lower-carbon alternative to natural gas in fuelling power plants and vehicles. While

most of it is currently extracted from natural gas, there is a drive to generate it from renewable energy, so-called green hydrogen.

When running for office, President Biden put forth a \$2 trillion plan to eliminate all greenhouse gas emissions from the US electricity grid within 15 years, a goal that was applauded by climate campaigners but was criticised for the enormous overhaul it will require.

As part of its clean energy agenda, the Biden administration last month said it is reviving an energy department programme that disbursed billions of dollars in loan guarantees to companies to incentivise clean energy innovation.

Energy Secretary, Jennifer Granholm said up to \$40 billion in guarantees will be made available for a variety of clean energy projects, including

wind, solar, hydrogen, advanced vehicles, geothermal and nuclear.

“It's got to be clean. That's it,” she said. “And when I say clean, you know, it's technologies that are being researched in the lab, like projects to capture and store carbon dioxide emissions, so-called green hydrogen fuel and other energy sources.”

The loan programme helped launch the country's first utility-scale wind and solar farms as part of the Obama administration's efforts to create green jobs but largely went dormant under Donald Trump.

While the programme boosted Tesla's efforts to become a behemoth in electric cars, critics note that it stumbled with a major loan guarantee to Solyndra, the California solar company that failed soon after receiving federal money a decade ago, costing taxpayers more than \$500 million.

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The climate change battle is further complicated by another recent piece of research, which claims that the predicted emissions savings resulting from greater energy efficiency might be overestimated.

Research led by academics at the University of Sussex Business School and the University of Leeds in the United Kingdom warns that efficiency gains, which are included in many influential computer models, can also encourage behavioural change towards more energy use, meaning some of the anticipated energy savings may be “taken back”. This is known as the ‘rebound effect’.

In a review of 33 studies, the researchers found that economy wide rebound effects may erode around as much as half of the energy and emission savings from improved energy efficiency.

The new study argues that economy-wide rebound effects are larger than commonly assumed, which may partly explain the close links between energy consumption and GDP over the past 100 years.

Improved energy efficiency is expected to play a central role in meeting the goals of the Paris Agreement, contributing up to 40 per cent of the envisaged reductions in global greenhouse gas (GHG) emissions over the next two decades.

However, the new research suggests that models used by the Intergovernmental Panel on Climate Change (IPCC), the IEA and others fail to adequately capture these rebound effects. As a result, their scenarios may underestimate future energy demand. In the absence of policies to mitigate rebound effects, this could make the Paris Agreement targets harder to achieve.

The authors argue that global energy modellers need to take rebound effects more seriously, and to find ways of capturing the full range of effects within their scenarios. They also recommend the use of carbon pricing to limit rebound effects and the targeting of energy efficiency policies to maximise their economic and environmental benefits.



Sorrell: Rebound effects are notoriously difficult to estimate

Steve Sorrell, Professor of Energy Policy in the Science Policy Research Unit (SPRU) at the University of Sussex Business School, said: “Rebound effects are notoriously difficult to estimate, but our understanding has improved enormously over the last decade.

“What we show here is that 33 studies from different countries using very different methodologies all reach broadly the same conclusion – namely that economy-wide rebound effects are large. Unfortunately, the models we rely upon to produce global energy and climate scenarios do not adequately capture these effects. This needs to change.”

The researchers said nearly all the scenarios for keeping global temperature increase to a manageable level rely on heavily improved energy efficiency “so understanding the potential for rebound – and what mitigates it – is critical”.

TenneT makes record investments

European grid operator TenneT is planning to significantly increase annual investment to accommodate offshore wind expansion in the North Sea. **Junior Isles**

As renewable energy sources continue to grow rapidly, TenneT says it is building new connections, strengthening and expanding its grid and upgrading its system operations to meet the EU’s new target to cut emissions by at least 55 per cent by 2030. At the same time, the Dutch/German high-voltage electricity transmission system operator (TSO) is making important contributions to pioneering work around future energy system planning in Northwest Europe, including market design, sector coupling and increased flexibility of electricity supply and demand.

Announcing its ‘2020 Integrated Annual Report’, Manon van Beek, TenneT’s CEO, said: “In 2020, TenneT set new records in terms of security of supply, investments and related financing and resourcing. Now, we are ready

for a decade full of challenges.”

TenneT is Europe’s only cross-border TSO, firmly embedded in Northwest Europe with unique access to a vast amount of North Sea wind power. As such, it has a key role in the growing European cooperation needed to facilitate the transition to a net zero carbon world. This, it says, requires “new concepts, new partnerships and swift action” to create a more integrated and affordable European energy system.

The North Sea has an estimated wind capacity of 300 GW by 2050 and the potential to drive new cooperation between neighbouring countries. TenneT aims to exploit this potential by helping to turn it into an international hub for green energy.

TenneT and National Grid Ventures

will explore the development of a multi-purpose interconnector to simultaneously connect up to 4 GW of British and Dutch offshore wind farms between the two nations’ electricity systems. And in close cooperation with the German, Dutch and Danish governments, TenneT is also exploring a joint energy hub in the North Sea connected to these three countries.

The company said it expects annual investments to increase from €3.4 billion in 2020 to €5-6 billion annually through to 2025 as it works towards providing 27 GW of offshore wind connections by 2030.

TenneT also said it is developing new standards in large projects in Germany and the Netherlands. A new high voltage direct current (HVDC) international technical standard will be used

to realise the 2 GW offshore programme planned by the Dutch and German governments.

Tim Meyerjürgens, TenneT’s Chief Operations Officer, said: “With the new 525 kV HVDC system, with a capacity of almost 2 GW per connection and our smart platform concept, we are defining the new global benchmark for the future.” With this concept, TenneT said it is accommodating the offshore wind industry’s desire for larger wind farms.

TenneT reported solid financial results again in 2020, with underlying revenue of €4450 million, an increase of 9 per cent compared to €4084 million in 2019. Underlying EBIT (excluding special items) increased to €796 million in 2020 from €753 million in 2019.

Transition financing could deliver \$1 trillion/year

In a new report, S&P Global Ratings says it believes transition finance, including issuance, could contribute up to 30 per cent of the estimated \$3 trillion per year required to meet net zero emissions by 2050.

Transition finance can be defined as any form of financial support that enables the largest carbon-emitting industries and companies – among them the oil, gas and transportation sectors – to contribute to a net zero emissions economy.

According to the report, transition finance, including issuance, could contribute up to \$1 trillion per year to the economy as companies in hard-to-abate sectors, such as energy, raise capital and use the proceeds for activities that help them reduce their carbon footprint.

Over the past few years, it has become clear that issuer and investor appetite for financing climate response and

other environmental objectives is strong and accelerating. The growth of the green bond market reflects this trend, with total annual issuance of over \$290 billion in 2020, a more than 5x increase from 2015, according to the Climate Bond initiative (CBI).

In its report, titled: ‘Transition Finance: Finding a path to carbon neutrality via the capital markets’, S&P Global Ratings says that if standardisation and comparability challenges are met, transition finance could see impressive growth to help companies and countries scale up capital allocation to meet their net zero emissions commitments.

“The transition issuance market is still relatively small, but is growing quickly,” commented Lori Shapiro, sustainable finance associate at S&P Global Ratings. “Beyond the use-of-proceeds bond model, transition finance could also grow to encompass

sustainability-linked instruments and other financial products. Many investors view these as strong drivers of change, because the environmental and social objectives apply to the whole entity, rather than to a specific transaction. For this to take off, however, current standardisation and comparability challenges with the asset class would have to be addressed.”

In a preview of the launch of its ‘World Energy Transitions Outlook’, the International Renewable Energy Agency (IRENA) recently stressed the need to act “fast and bold on global climate pledges” and highlighted the shift in capital markets away from fossil fuels and into sustainable assets like renewables.

Francesco La Camera, Director-General of IRENA said: “The window of opportunity to achieve the 1.5°C Paris Agreement goal is closing fast... Global capital is moving too. We see

financial markets and investors shifting capital into sustainable assets.”

According to the Transitions Outlook, energy transition investment will have to increase by 30 per cent over planned investment to a total of \$131 trillion between now and 2050, corresponding to \$4.4 trillion on average every year.

It said that renewable power, modern bioenergy and green hydrogen will dominate the world of energy of the future.

■ The H2 Green Steel industrial initiative, backed by EIT InnoEnergy, will build the world’s first large-scale fossil-free steel plant in Boden-Luleå, north Sweden, using green hydrogen. The initiative mobilises some €2.5 billion worth of investments and will start large-scale production as early as 2024. The annual throughput of 5 million tons of high-quality steel is planned to be reached by 2030.

China dominates wind turbine manufacturer rankings

Chinese suppliers now represent seven of the ten top spots in the global rankings of wind turbine manufacturers, according to data from GWEC Market Intelligence and BloombergNEF (BNEF). The findings come as the nation installed more new wind generating capacity than any other country in the world.

According to GWEC Market Intelligence, Danish manufacturer Vestas still held the title as the world’s largest supplier of wind turbines in 2020 across onshore and offshore, with new installations in 32 markets totalling 16 186 MW. That figure supersedes the figure published just weeks earlier by BNEF, which put Vestas’ total at 12.4 GW across 34 markets and in third place.

GE Renewable Energy ranked second with 14 135 MW, according to

GWEC and Goldwind third with 13 606 MW.

Chinese Envision ranked fourth in 2020, moving up from fifth position in 2019, by taking advantage of strong market growth in its home market, where more than 10 GW was installed by the company in a single year – a record for the company.

These rankings will be published in the ‘Global Wind Market Development – Supply Side Data 2020’, which will be released in late April 2021. Preliminary results are subject to change between now and the release date of the actual report.

“Our preliminary findings from the supply side confirm that 2020 was an incredible year for the wind industry. Chinese and American turbine manufacturers had a record number of new installations that saw most of them

moving up in global turbine OEM market rankings,” said Feng Zhao, Head of Strategy and Market Intelligence at GWEC. “This makes sense as it reflects the situation that the world’s two largest markets China and United States had the lion’s share in global wind installation in 2020.”

Last year, China broke the world record for most wind power capacity installed in a single year with 52 GW of new capacity – double the country’s annual installations compared to 2019.

The surge in installations saw seven of the top 10 spots on the global manufacturers list go to Chinese manufacturers, according to BNEF’s ranking released March 10th. In addition to Goldwind, the other Chinese manufacturers are: Envision (4th), Mingyang (6th) Shanghai Electric (7th),

Windey (8th), CRCC (9th), and Sany (10th).

Although Siemens Gamesa had installations in 31 markets last year, the manufacturer fell three positions to fifth place. Nevertheless, it retained its title as the world’s largest offshore wind turbine supplier in 2020.

Last year total investment in the offshore wind sector rose to \$50 billion, up from \$32 billion in 2019, according to data from BloombergNEF. However, the rush of investment into the sector, including from oil and gas companies, is expected to push margins down for turbine makers.

Last month Andreas Nauen, Chief Executive of Siemens Gamesa, said the high amounts recently bid for offshore wind development rights would “increase the pressure to deliver more competitive turbines”.



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Fallout from Texas blackouts continues

- Legislature considers backwards 're-pricing' over crisis period
- System operator ERCOT fires chief executive

Janet Wood

An 'unwinding' of peak power prices may be one outcome of a February cold snap in Texas that left millions without power, it has emerged, although the measure has hit opposition.

Bill Magness, Manager of Texas' power grid operator, the Electric Reliability Council of Texas (ERCOT) was fired following the blackouts. Some small and medium operators have gone out of business. ERCOT allowed real-time electricity prices to rise to the

maximum of \$9000 per megawatt hour to encourage electricity generation amid scarce supply, a hike agreed by the Public Utility Commission (PUC). But a new report from Potomac Economics, the commission's independent market monitor, said the cap was kept for at least 32 hours after most outages ended.

The Texas legislature is considering a plan that would unwind or 're-price' \$4 billion of electricity charges for the period. But some officials believe retroactively changing terms would

be counterproductive for the market. Texas House Speaker Dade Phelan said it would be "an extraordinary government intervention into the free market, which may have major consequences for both residential and commercial customers going forward". PUC Chair Arthur D'Andrea also warned the measure could raise new problems for customers and electricity providers.

Potomac Economics is a Virginia-based firm paid by the state to provide an arm's-length assessment of the

Texas power grid.

The firm's Carrie Bivins suggested as an alternative that ancillary service prices could be capped, which could reduce costs to the public by nearly \$1 billion. "That's a direct impact that I feel comfortable saying reduces costs to consumers," she said. Any repricing proposals are likely to be subject to legal action.

Meanwhile the progress of the event is not fully clear, including which power assets failed, although ERCOT recently released a partial list of the

356 generating facilities that suffered forced outages.

Some companies have now admitted problems. "Two of our power plants failed because of winterisation... That's my fault," said Thad Hill, Chief Executive of Calpine Corporation.

Mauricio Gutierrez, Chief Executive of NRG, also admitted power failures at two plants and said: "We are going to look at our winterisation programmes with a new benchmark, with a new baseline, that was defined by this unprecedented winter storm."

Massachusetts offshore wind approval heralds tens of gigawatts by 2035

The US Interior Department has recently completed an environmental analysis of Vineyard Wind, the USA's first major offshore wind farm, and a long-awaited decision on go-ahead is expected in the next few weeks. The Federal Bureau of Ocean Energy Management gave Vineyard Wind, which is around 15 km offshore of Massachusetts, a favourable review.

"We look forward to reaching the final step in the federal permitting process and being able to launch an industry that has such tremendous potential," said Lars Pedersen, Vineyard Wind Chief Executive.

So far the USA has just one small offshore wind farm in waters controlled by Rhode Island and another offshore of Virginia. But the 800 MW

Vineyard Wind project would be much larger and the first utility-scale wind power development in federal waters.

The approval is set to be the first of up to two dozen offshore wind projects along the East Coast, where more than 40 GW of wind capacity is expected to be installed by 2035. That requires an investment of \$140 billion, according to a new report commissioned from BVG Associates by the North Carolina Department of Commerce.

"Wind energy means new jobs for North Carolinians. Just like biotechnology was for us many years ago, today clean energy represents an industry of the future and North Carolina always embraces the future," said Mabelle Sanders, North Carolina's Commerce Secretary.



Massachusetts: offshore wind could be a key energy source

Storage investments prove attractive, offering fast response or long duration

A new 100 MW energy storage facility could be installed in Texas by mid-year. The battery storage project, which will offer fast response and flexibility to the grid, is being built in Angleton by Tesla subsidiary Gambit Energy Storage. The modular installation, made from arrays of Megapacks, was announced recently by The Electric Reliability Council of Texas (ERCOT), which said it could begin operating as soon as the start of June.

Meanwhile Arizona has announced the first step in developing new large-

scale long-duration storage in the form of a proposed 2.2 GW pumped storage hydropower project, to be called Navajo Energy Storage Station. The US Federal Energy Regulatory Commission has granted a preliminary permit for the project on Lake Powell.

Daybreak Power is developing the project, which will include construction of the powerhouse, turbines, tunnel, upper reservoir, penstocks as well as a 29 km, 500 kV transmission line. The developer aims to secure licences by 2026 and begin operations around 2030.

Mexico energy market restructure suspended as it hits legal block

- 'Dozens' of injunctions filed
- Wind council says political fears cost Mexico its investment lead

Janet Wood

Mexico has dropped from first to fourth in the wind power growth ranking in the Americas, according to recent figures from the Global Wind Energy Council (GWEC). It installed just 574 MW in 2020, down from 1284 MW in 2019, and was overtaken by Brazil, Chile and Argentina.

That was seen as an early indication of industry reaction to an overhaul of the electricity market set in motion by President Andrés Manuel López Obrador. The change would cancel renewable energy auctions and renewables' priority grid access and curb private investment in the industry.

The new market entered into law at

the start of March, but it was suspended just two days later, after a court granted provisional injunctions against the law reportedly requested by France's EDF, Naturgy of Spain and Mexico's Zuma.

"Argentina and Chile have recorded record years helping the region grow over the past year, while the development of the wind sector in Mexico – one of the largest markets in the region – slowed due to political challenges for the sector," said GWEC. The wind body joined other renewables organisations to urge the federal administration maintain previous national commitments on the energy transition. Julio Valle, spokesman for the wind and solar power associations Amdee

and Asolmex, said more than two dozen proposed injunctions had been filed.

A federal judge said in a recent ruling that the injunction would be extended collectively to shield all participants from the law, in order to avoid distorting the market.

"We're happy, but this is just the first battle," Valle said. The provisional ruling could still be struck down and the law is expected to face further constitutional challenges.

"I think here the big question is what happens when this gets to the Supreme Court," said Lourdes Melgar, a former Energy Under-Secretary at the time of Mexico's previous energy reforms in 2013-2014.

Brazil plans world-beating green hydrogen plant

Black & Veatch has begun feasibility studies in Brazil central to the development of the world's largest green hydrogen plant. When operational, Enegix Energy's Base One facility in Ceará, Brazil, will produce more than 600 000 tonnes of green hydrogen annually.

The new-build electrolysis facility will be powered entirely by renewable energy, from already contracted 3.4 GW of combined baseload wind and solar power through a partnership with Enerwind.

Gary Martin, Managing Director in Black & Veatch's Oil & Gas business, said: "Facilities such as the one proposed by Enegix are at the heart of making hydrogen a core component of a zero-carbon global economy."

Ceará has huge potential for renewable energy generation and is a focus of renewables construction.

Although Brazil is set to increase its thermal power capacity from 30.3 GW in 2020 to 36.3 GW in 2030, it will remain a minority player in the country's generation portfolio at just

under 15 per cent.

New thermal plant will be natural gas fired, while the use of oil and coal fired power will decline as a result of Brazil's focus on expanding hydro-power, natural gas fired power capacity and non-hydro renewable power sources.

Meanwhile Chile is also investigating the construction of a green hydrogen plant. AES Gener, part of AES Corporation, has begun studying the feasibility of building the project to be used for producing ammonia plant.



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Australian hydrogen will support Japan's net zero ambition

■ Coal-to-hydrogen project key to Japan's net zero plan ■ Eco Energy World unveils green hydrogen project

Syed Ali

A Japanese-Australian venture has begun producing hydrogen from brown coal in a A\$500 million (\$390 million) pilot project that aims to demonstrate how liquefied hydrogen can be produced commercially and exported safely overseas.

The project, run by Kawasaki Heavy Industries, is located in the state of Victoria, home to a quarter of the world's known brown coal reserves. The plan is to create the first international supply chain for liquefied

hydrogen and the next major step will be to ship a cargo on the world's first liquefied hydrogen carrier. The project is seen as key to helping Japan meet its target of net zero carbon emissions by 2050.

Japan is the world's fifth-largest energy consumer and aims to boost its annual hydrogen use ten-fold to 20 million tonnes by 2050.

Commenting on the project, Hirofumi Kawazoe, general manager of Kawasaki's Hydrogen Engineering Australia unit, said: "The important thing is hydrogen should be cost

competitive, and Victorian brown coal is a cheap source of hydrogen."

Australia, already dominant in global liquefied natural gas (LNG) trade, is hoping liquefied hydrogen will give it a greener market for its coal and gas.

Australian Energy Minister Angus Taylor told *Reuters*: "We have the potential here to be world leaders in the production and export of hydrogen and this project is developing up that technology to do exactly that."

Critics, however, argue that any investment in coal-to-hydrogen infrastructure will quickly become "a white

elephant". Environment Victoria campaigns manager Nicholas Aberle, said: "The technology will be superseded in the next few years by clean hydrogen sourced from renewable energy."

Australia is already a world leader in clean hydrogen, with numerous projects already underway. In March, Eco Energy World (EEW) unveiled plans to develop a green hydrogen project in Queensland. The nearly A\$500 million (\$387.9 million) project, located in Raglan near the Port of Gladstone, will comprise green hydrogen and solar photovoltaic (PV)

developments.

■ South Korea's five major conglomerates plan to invest 43 trillion won (\$38.2 billion) in the hydrogen industry. Under the plan, SK, Hyundai Motor, POSCO, Hanwha and Hyosung will build a wide range of hydrogen infrastructure, such as production and storage of hydrogen by 2030, according to the Ministry of Trade, Industry and Energy. SK plans to start the supply of the gas starting in 2023 in the greater Seoul area. The hydrogen will be used to power some 200 000 units of hydrogen fuel cell cars.

China's Five-Year Plan in line with forecast

China's 14th Five-Year Plan (FYP) had limited mentions about decarbonising the energy sector, but still remains in line with existing views and forecasts for its power and renewables sector, says a Fitch Solutions Sector Intelligence report.

The organisation said while it initially expected climate considerations to be a key policy focus of the 14th Five-Year Plan (FYP), which was released on 12th March 2021 by China's National People's Congress, "there were limited mentions" about decarbonising the energy sector specifically.

"The FYP, which runs from 2021-2025 did include targets for energy intensity and carbon intensity, but both areas have already been established prior and merely reaffirmed. The FYP has also proposed to increase the share of 'non-fossil energy' in total energy consumption to 20 per cent by 2025, although this remains non-binding.

"That said, we expect more detailed targets to be announced in the sector-specific plans that will be released in the later half of this year. Broadly, the 14th FYP still remains in line with our existing views and forecasts," the report stated.

The 14th FYP has reaffirmed China's targets to peak carbon emissions by 2030, in accordance with the country's intended nationally determined contribution target, and to achieve carbon neutrality by 2060.

In line with this, the Ministry of Ecology and Environment has called for

provincial governments to formulate a 'peak emission action plan' along several indicators – including energy mix targets and carbon emission caps – across several key sectors by April 2021. This will be formulated into a nationwide plan by early 2022.

In a move to help transform the country's industrial and energy structures, in February China issued its first batch of carbon-neutral bonds, valued at Yuan 6.4 billion (\$992.3 million), as part of its efforts to allocate more financial resources to green and low-carbon fields of the economy.

A carbon-neutral bond is a sub-category of green debt financing instruments, through which the funds raised will be specially used for projects that reduce carbon emissions.

"As China announced its new climate goals, we expect to see breakthrough growth in the domestic green bond market, starting this year. We forecast the annual volume of green bond issuance will increase by more than 30 per cent year-on-year in the next five years," said Hu Kun, General Manager of the investment banking and asset management department at Bank of China.

■ State Grid Corporation of China (SGCC) has released its plan for achieving carbon emissions peak and carbon neutrality goals. SGCC estimates that the portion of non-fossil energy used for electricity generation will be reduced to 20 per cent and 25 per cent of primary energy consumption in 2025 and 2030, respectively.

Indonesia gets green projects boost

Indonesia is to receive €2.5 billion (\$2.9 billion) in funding from Germany to support green infrastructure projects in urban areas to reduce carbon emissions.

The fund will be disbursed over five years through a partnership between Germany and German National bank (KfW) under an Indonesian-German Infrastructure scheme, according to a report.

Speaking in Pinstent Masons' newsletter *Out-Law*, John Yeap, an energy and infrastructure consultant at the UK law firm, said: "Decarbonisation and reducing emissions in rapidly growing nations such as Indonesia will require not just investment into low or no emission projects, but also investment into energy efficiency, particularly using technological solutions.

"Germany is well placed to support Indonesia's plans to reduce its emissions through deploying its know-how and capital. This arrangement between the two nations should therefore be a win-win-win, for Indonesia, Germany and the environment. A clear and robust policy and regulatory framework will, however, have to be put in place for such technology transfers and investments to take place."

The funding follows an announcement in February that Indonesia's Ministry of State Owned Enterprises is planning to form a geothermal group in 2021. The group, which is expected to become the largest in the world, will manage PT Pertamina Geothermal Energy (PGE), PT Geo Dipa Energi, and PT Perusahaan Listrik Negara (PLN) Gas & Geothermal.

This year, the group plans to begin operation of the Lahendong power plant with a capacity of 80 MW, Ulumbu power plant with 10 MW, and Mataloko power plant with 2.5 MW.

In addition, PLN Gas & Geothermal will also run a joint study with PGE and Geo Dipa to develop a power plant with a total capacity of 30 MW at the existing plants of Lahendong, Ulubelu and Dieng, in Central Java.

The Indonesian government says the country could reach as much as 1 GW of geothermal projects by 2030, as outlined in the roadmap developed by the Ministry of Energy and Mineral Resources.

Indonesia has considerable geothermal energy potential, estimated at 25.3 GW but only 2130 MW has been developed for power generation.

India imposes customs duties on solar components

India's Ministry of New and Renewable Energy (MNRE) is to impose a basic customs duty (BCD) on imported solar cells and modules starting April 1, 2022.

The government said it will add a 40 per cent BCD on solar modules and 25 per cent on solar in a move said to be aimed at avoiding future supply chain disruptions.

According to data and analytics company, GlobalData, the BCD will reduce India's dependence on imports, avert any imminent supply chain disruptions and expand domestic manufacturing base.

The import of components used in solar industry has seen significant growth since the launch of India's ambitious solar policy aimed at deploying 100 000 MW by the year 2021-22.

According to GlobalData, India saw

a sudden surge in annual solar PV installations in 2015, with the subsequent two years witnessing new highs in annual installations driven primarily by cheaper solar component imports from countries like China and Malaysia.

This caused several domestic producers to cease production, resulting in heavy losses thereby crippling the domestic industry. To protect domestic manufacturers, in 2018 the government introduced the safeguard duty (SGD) on solar cells and modules imported from China and Malaysia. This caused a drop in annual solar PV installations.

Mohit Prasad, Project Manager of Power at GlobalData, noted that the country wants to achieve its solar target "but at the same time also wants to reduce the reliance on imports to avoid any supply chain disruptions"

in the future.

"To bridge the demand-supply gap, a production-based incentive programme of Rupees 45 billion (\$603 million) has been introduced for domestic solar PV manufacturers over the next five years," he said. "With the SGD on the imports of solar cells and modules from China going away after July 2021, the domestic manufacturing industry was looking for an alternative option. The implementation of BCD will be a good measure to safeguard the domestic manufacturing industry."

■ The Solar Energy Corporation of India (SECI) has invited bids to develop 1785 MW of solar power projects (Tranche IV) in Rajasthan. The last date to submit the bids online is April 15, 2021. Bids will be opened on April 20.



China is aiming for carbon neutrality by 2060

Low-carbon hydrogen moves towards commercial production

- Portugal promises 'at scale' production next year
- UK announces projects for heat and transport around Teesside

Janet Wood

Green hydrogen will be in production at scale by the end of 2022, with eight private investments worth about €10 billion expected to proceed, according to environment Minister Joao Matos Fernandes. "Green hydrogen will, over time, allow Portugal to completely change its model and become an energy exporting country," he said.

Plans for green hydrogen (using renewable energy and electrolysis) and blue hydrogen (from gas with carbon

capture) are proceeding at pace in Europe as markets develop for the hydrogen produced. In Belgium, for example, hydrogen will replace natural gas at the INEOS Phenol site, where it will be used in a commercial scale cogeneration plant. The pilot project by INEOS and ENGIE will initially replace 10 per cent of the gas feed with hydrogen. If this goes well the feed will be increased to 20 per cent – the first time that such tests have been carried out on an industrial scale in Belgium.

The UK is banking on hydrogen as a

low carbon fuel for both industry and transport applications and it recently announced projects designed to scale up both uses.

BP announced plans for the UK's largest blue hydrogen production facility at a site in Teesside, targeting 1 GW of hydrogen production by 2030. It signed a Memorandum of Understanding (MOU) with Northern Gas Networks, with an initial focus on studies to ensure that the hydrogen production facility can meet the demands of industrial and domestic consumers in the

Teesside area. Mark Horsley, Chief Executive Officer at NGN, said: "We're very excited to be working with BP to explore further the potential of a hydrogen gas network to play a lead role in industrial and domestic heat decarbonisation."

Nearby, Mott MacDonald has developed a masterplan for the UK's first ever multi-modal hydrogen transport hub. With the Department for Transport, the Department for Business, Energy and Industrial Strategy, and Tees Valley Combined Authority, the

hub will be kick-started with £3 million in government funding and could be fully operational by 2025.

Facilities include green hydrogen production, storage, distribution, and refuelling stations from which existing and evolving transport networks and services can feed.

Tees Valley Mayor Ben Houchen said: "Our region already produces more than 50 per cent of the UK's hydrogen so it was a no-brainer for the Government to set up the UK's first Hydrogen Transport Hub in Teesside."

UK seeks to hold offshore wind lead as leasing rounds offer new seabed areas

- New industrial groups form around floating technology
- Denmark project links wind with ammonia

Striving to retain the UK's leading position in offshore wind, its two owners of the seabed are preparing for new leasing rounds and have tried to bridge the development gap between fixed installations and the nascent floating industry.

Crown Estate Scotland confirmed recently that its long-planned Scot-Wind leasing round would open between April and June. The option fees will be capped at ten times the level originally planned, following the high fees achieved during a recent leasing round run by The Crown Estate for areas offshore of England and Wales. Amanda Bryan, Chair of Crown Estate Scotland, said: "This would reflect the recent changes we have seen in the UK offshore wind market so that we could arrive at a pricing structure which properly reflects those changes."

Meanwhile The Crown Estate said it would be working on a further leasing

round for early commercial scale floating wind projects off England and Wales. Huub den Rooijen, Director of The Crown Estate's Energy, Minerals and Infrastructure portfolio said the announcement is "an important step" in providing the market the confidence it needs to plan and invest. It will look for projects sized at around 300 MW, a step up from its current largest planned floating project, Blue Gem Wind's 96 MW Erebus.

Among groups forming to take on floating wind around the UK, Bechtel is partnering with Sweden's Hexicon. Marcus Thor, Hexicon Chief Executive, said: "Our technology is one of a handful of solutions that can support deep water offshore wind projects, which will massively increase the potential for offshore wind power generation."

The UK is struggling to hold on to its lead in floating wind as the technology sparks interest elsewhere. Ocean

Winds (a Joint Venture between EDP Renewables and Engie) and Terna Energy recently announced plans to collaborate in Greece. George Peristeris, Chairman of Terna Energy, said: "Floating offshore wind is ideal for the Greek seas, due to their depth and unique characteristics."

Among the UK's North Sea competitors in the offshore market, Denmark recently won State Aid approval from the European Commission for the Thor offshore wind farm. Margrethe Vestager, in charge of EU competition policy, said: "This Danish measure is a very good example of how Member States can provide incentives to companies to take part and invest in green energy projects."

Denmark's Copenhagen Infrastructure Partners (CIP) has also recently unveiled plans to use offshore wind to power a new plant in Esbjerg that will use electrolysis to produce 'green' ammonia.

One step back, one forwards, for central European nuclear

After years of disputes, the German government recently came to an agreement with EnBW, E.On, RWE and Vattenfall over compensation payments for the early closure of their nuclear reactors.

In 2010, the German government decided to extend the life of the country's 17 nuclear power plants until 2036, but after the 2011 earthquake and tsunami in Japan Merkel's government decided to phase out nuclear power altogether by the end of 2022. It has now agreed to pay €1.43 billion to Vattenfall, €880 million to RWE, €80 million to EnBW and €42.5 million to E.On.

In contrast the Czech State Office

for Nuclear Safety has issued a permit for the construction of a new reactor at the Dukovany nuclear power plant, enabling Elektrárna Dukovany II to open a tender for the €6 billion (\$7.17 billion) project. The permit allows for two reactors of up to 1.2 GW each and one is currently planned, to start up by 2036.

Meanwhile Poland's Deputy Prime Minister Jaroslaw Gowin recently said that "Poland must quickly take a binding decision" regarding the development of nuclear energy. It has plans for six nuclear reactors to be in operation by 2043. Gowin added: "French companies are among the firms with which serious talks are being held."



Nuclear generation is a mixed bag in Europe

Undersea interconnectors to strengthen Mediterranean grid

Cyprus, Israel and Greece have signed a memorandum of understanding on the 1200 km EuroAsia Interconnector, which will be the world's longest undersea interconnector.

Cyprus Energy Minister Natasa Pilides, Israeli Energy Minister Yuval Steinitz and Greece Minister of Energy and Environment Kostas Skrekas said they have agreed "to promote

cooperation to examine the possibility of planning, as well as the potential development and implementation of the project".

The European Commission has listed the 2 GW connection as a "Project of Common Interest" for the bloc, making it eligible for EU financing. The first phase is expected to be operational by 2025, linking the three countries to

energy grids in Asia and Europe, said Pilides.

Greece is also set to be connected with Crete. The European Investment Bank recently agreed a €200 million loan deal Independent Power Transmission Operator of Greece for a 1 GW subsea power interconnector between the Crete and Attica in mainland Greece.

Prospect of lower returns is no bar to network acquisition

UK transmission network owner National Grid has announced that, subject to regulatory approval, it will acquire WPD, the UK's largest distribution network operator (DNO).

The surprise bid came despite a warning from regulator Ofgem that DNOs could expect to make much lower returns in the next five year 'price control' period. Jonathan Brearley, Ofgem Chief Executive, said the plans for local electricity networks would "significantly cut investor returns to make sure consumers pay a fair price for energy whilst networks attract the investment they need

to be safe and green".

Alistair Cromwell, Acting Chief Executive of Citizens Advice, described the statement as "a win for consumers".

The DNOs' price determination follows a year behind that of transmission networks and gas distribution networks, nine of which have challenged Ofgem's decision on their allowed return. National Grid is one of the nine challengers. Its Chief Executive, John Pettigrew, said: "It's really important from a UK perspective that investors get a fair return that reflects the cost of capital for the risks that they are taking."

IEA praises Turkey's energy security efforts

■ Security of supply progress ■ Sustainability still a concern

Nadia Weekes

Efforts to boost renewable energy production and improve energy efficiency will help Turkey achieve its energy security goals, a report by the International Energy Agency (IEA) has said.

In its first policy review of the country since 2016, the agency finds that Turkey has made solid progress in recent years in improving the security and diversity of its energy supplies. However, it urges the country to pay close attention to the sustainability and longer-term carbon footprint of its energy sector.

Rapid economic and population growth in the past two decades have driven Turkish energy demand but also an increase in import dependency, especially for oil and gas, according to the IEA. As a result, Turkey has emphasised security of energy supply as one of the central pillars of its energy strategy, including domestic oil and gas exploration and production.

In a recent address to parliament, Turkey's President Recep Tayyip Erdoğan said that the country's total

installed power capacity had tripled since 2002, to reach 96 000 MW.

The agency praised Turkey for increasing production of renewable energy and reducing energy consumption through increased energy efficiency. Auctions, in particular, have proven successful in driving down costs and increasing investments in renewables.

"Turkey has seen significant diversification of its energy mix in the past decade. In particular, bolstered by a supportive policy environment, renewable energy has grown impressively, led by hydropower, solar and wind," said Dr Fatih Birol, the IEA Executive Director.

Turkey's renewable energy capacity grew 50 per cent over the past five years. The IEA report notes that further growth is possible, especially in solar, wind and geothermal, given the country's considerable resources. Turkey uses only an estimated 3 per cent of its solar and 15 per cent of its onshore wind potential. According to President Erdoğan, capacity from solar, wind and geothermal resources stands at more than 17 000 MW.

For Turkey to establish a modern and competitive economy, the IEA report highlights that the government should pay close attention to the sustainability of its energy sector and the country's longer-term carbon footprint. In particular, Turkey should reconsider the role of lignite-based power generation in a low-carbon future.

Russia is building Turkey's first nuclear power plant on the Mediterranean coast, in Mersin province, under a co-operation agreement made in 2010. The plant is expected to fulfil about 10 per cent of the country's electricity needs, and is due to be commissioned in 2023.

Under a five-year plan unveiled in February by Energy and Natural Resources Minister Fatih Dönmez, Turkey plans to invest TL66.56 billion (\$9.3 billion) in electricity distribution.

Turkey has made significant progress in liberalising energy markets, but additional reforms to make gas and electricity markets more competitive will help mobilise the investments needed by these sectors, including for clean energy technologies, the report adds.

MEA banks on solar power rollout

Middle East and African countries seek partnerships and support in bid to rapidly expand solar capacity, says Nadia Weekes.

Iraq's Ministry of Oil is in discussions with a number of energy majors regarding the construction of seven solar PV plants with a combined capacity of 700 MW in the country, according to a report by Fitch Solutions.

The move comes as several countries in the Middle East and Africa (MEA) region set out plans to expand their solar capacity. Iraq has an ambitious goal of 10 GW by 2030.

In Ethiopia, the government has signed a memorandum of understanding with the Abu Dhabi Future Energy Company, better known as Masdar, to explore the possibility of developing 500 MW of solar projects and related grid infrastructure. According to Masdar's CEO Mohammed Jamel al-Ramahi, Ethiopia has great potential for solar and wind energy development.

Ethiopia's Finance minister Ahmed Shide was quoted by local news agency ENA to have said that Masdar will work on 300 MW of solar capacity in the first phase of the cooperation.

In Egypt, a 200 MW solar plant is planned for Kom Ombo on the river Nile, 800 km south of Cairo. It will be owned by ACWA Power, a leading Saudi Arabian developer and operator.

The African Development Bank (AfDB) has approved a \$27 million loan to part-finance the project's design, construction and operation, which is estimated to cost \$156.4 million. Other institutions including the European Bank for Reconstruction and Development, the Green Climate Fund, Arab Bank and the OPEC Fund for International Development will contribute funding.

Egypt's electricity grid is linked to Libya's and Sudan's, and the plant has the potential to greatly contribute to

energy trading and electricity access in the region.

The project aligns with Egypt's national Integrated Sustainable Energy Strategy and the AfDB's New Deal on Energy for Africa, which aims to increase the share of renewable energy in Africa's energy sector through innovative financing. Egypt has a target to generate 20 per cent of its electricity from renewables by 2022.

Meanwhile, Singaporean company B&S Power Holding PTE has signed an agreement with Nigeria's Sunnyfred Global for the financing and construction of a solar power plant under a public private partnership (PPP) arrangement.

To be located over 304 hectares of land near the southern village of Ashama, Delta State, the project has a planned capacity of 200 MW. Once operational, it will be the largest solar power plant in West Africa.

Despite being the leading economy on the African continent with a GDP of \$443 billion in 2020, Nigeria has an installed power capacity of just over 12 GW. Its electricity supply is not diversified, with the vast majority relying on thermal power plants and the remaining 2.4 MW supplied by hydroelectric installations.

Less than half of the Nigerian population has access to reliable electricity, and the use of generators is a daily occurrence. In rural areas, two thirds of the population lack access to electricity. Under the Nigeria Electrification Project (NEP), financed by the World Bank and the AfDB, the federal government is banking on the deployment of off-grid solar capacity to rapidly boost access to electricity for the local population.

Saudi eyes top spot in global hydrogen race

Saudi Arabia is building a \$5 billion solar and wind powered hydrogen plant north of the Red Sea in a bid to become the world's largest supplier of hydrogen, according to local press reports.

The plant is to be located in the planned megacity of NEOM, in a move prompted by growing global demand for zero-carbon energy.

China and Europe are setting their sights on the growing hydrogen business, which BloombergNEF predicts to be worth as much as \$700 billion by 2025.

A number of countries including the UK, China, Japan and the US have expressed a desire to use more hydrogen, and the EU alone has earmarked a \$500 billion investment in hydrogen production.

Thanks to excellent solar irradiation, wind resource and land availability, Saudi Arabia is considered a strong contender in the global race to produce green hydrogen. Producing a kilogram of the gas currently costs about \$5, but Saudi Arabia could drive this cost down to \$1.5/kg by 2030, according to Bloomberg's energy research arm.

Angola embarks on AfDB-funded transmission boost



The African Development Bank (AfDB) is funding a \$530 million electricity project to expand the electricity transmission network in Angola through the construction of a 343 km, 400 kV transmission line that will connect grids in the north and south of the country.

The north of Angola has a surplus of more than 1000 MW of mostly renewable power generating capacity, whereas the south relies on expensive diesel generators supported by government subsidies.

The project aims to increase transmission capacity by 2250 MW and eliminate the need for diesel-powered generators in the south. Once commis-

sioned in 2023, the project is expected to cut 80 megatonnes of CO₂ emissions while saving the Angolan government more than \$130 million a year in diesel subsidies.

The finance package consists of \$480 million from the AfDB, along with \$50 million from the Africa Growing Together Fund, a \$2 billion facility sponsored by the People's Bank of China and administered by the AfDB.

The new transmission line will become the backbone for the distribution of power to the southern provinces of Angola and Namibia – the first step to enabling a connection to the Southern Africa Power Pool, enabling power trading between countries in

the region.

It will also allow more residential customers to be grid-connected and metered, reducing their reliance on government subsidies. Around 80 per cent of Angolan residential customers are not metered at present.

The funding follows a \$1 billion AfDB power sector reform loan to Angola in 2015, which resulted in the creation of an independent regulator and the unbundling of the sector into generation, transmission and distribution companies.

Angola more than doubled its renewable energy installed capacity to 2763 MW between 2015 and 2019, mainly through hydropower.

Uniper decarbonisation in full swing, earnings up 16 per cent

■ EBIT hits nearly €1 billion ■ Invests in Liquid Wind to support eMethanol production

Junior Isles

German utility Uniper says the decarbonisation of its portfolio is “in full swing”, as it reported that it “significantly surpassed” its prior-year earnings despite difficult market conditions. The company posted adjusted earnings before interest and taxes (EBIT) of €998 million, up 16 per cent on last year (2019: €863 million).

The company said the 2020 financial year benefitted in particular from a successful gas business in the Global Commodities division but noted that earnings declined in this segment’s power business.

In a virtual press conference CEO Andreas Schierenbeck also said that

Uniper’s plan announced one year ago to make its power generation business in Europe carbon-neutral by 2035, remains on track.

“In a difficult market environment, we managed to achieve our 2020 targets and to initiate a profound transformation of Uniper into a sustainable energy company of the future. With our majority shareholder Fortum, we also launched projects that will be crucial for the future and beneficial for both companies,” he said.

Uniper said it has been systematically implementing its coal exit plan and other measures will enable it to achieve more than 50 per cent of this target by 2030. In December 2020, Uniper and Fortum agreed on joint

sustainability targets for both companies. A key objective is to make both companies carbon-neutral by 2050, fully in line with the Paris climate agreement.

In addition to reducing its own carbon emissions, Uniper said it will expand renewables. It plans to develop 1 GW of solar and wind capacity by 2025 and to add another 3 GW in subsequent years. This will lay the foundation for Uniper to grow in the emerging global markets for green hydrogen.

“By 2050, the hydrogen market could be worth €820 billion. We are making a major contribution to the development of this market of the future,” said Schierenbeck.

Uniper is present at all stages of the

hydrogen value chain and has more than ten projects in its development pipeline.

In the Netherlands, for example, Uniper and the Port of Rotterdam Authority are studying the large-scale production of green hydrogen at Maasvlakte. The aim is to build a hydrogen plant with a capacity of 100 MW at the site of Uniper’s power station by 2025, and later to expand the plant’s capacity to 500 MW. The feasibility study should be completed this summer.

Last month Uniper invested in Sweden’s Liquid Wind, an emerging developer of hydrogen-based electro-fuels.

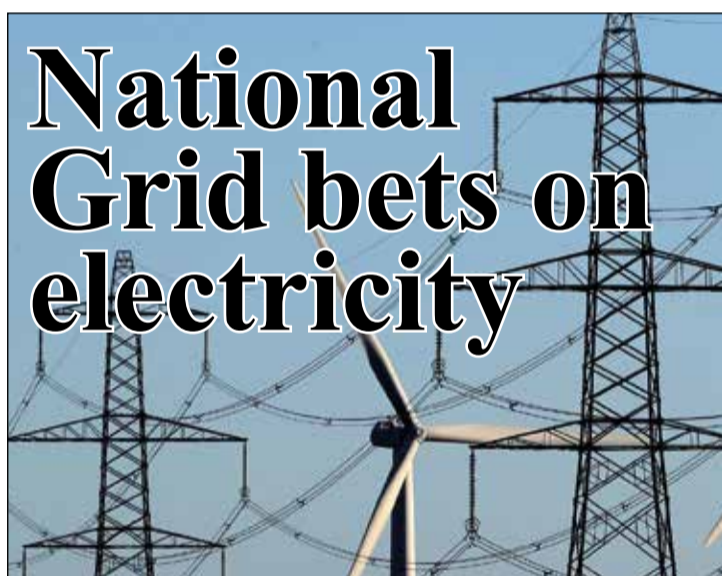
The transaction, details of which were not disclosed, will make Uniper the second largest investor in Liquid

Wind, according to a press release.

The Swedish company is currently working on developing its first eMethanol production plant in Ornskoldsvik, on the northeast coast of Sweden. This facility will be capable of producing 50 000 tonnes of eMethanol per year using captured biogenic CO₂ and wind energy to run the electrolyzers, the company said.

Liquid Wind has already assembled an expert consortium consisting of Siemens Energy AG, Haldor Topsøe A/S, carbon capture specialist Carbon Clean, and Nordic energy player Axpo, which will integrate their technologies into commercial-scale facilities.

The first plant would start operation from late 2023 or early 2024.



National Grid bets on electricity

UK-based electricity and gas transmission company National Grid is pivoting its business away from gas to place greater focus on electricity, with the purchase of UK local electricity network company Western Power Distribution.

Last month the company said it would buy WPD from American utility PPL Corporation for \$10.7 billion and sell its Rhode Island gas and electricity business The Narragansett Electric Co (NECO) to PPL for \$5.2 billion, including debt. Later, National Grid also plans to dispose of a stake in its UK gas transmission business.

The acquisition of WPD is subject to approval by the buyer’s shareholders in late April. The two transactions also depend on regulatory clearances. National Grid expects to complete the purchase of WPD within the next four months and to close the sale of NECO before the end of the first quarter of 2022.

“Together these transactions will strategically pivot National Grid’s UK portfolio towards electricity,” the company said.

John Pettigrew, National Grid’s Chief Executive, said the deals would increase the company’s exposure to electricity markets from about 60 per cent to 70 per cent, allowing it to “enhance” its role in helping the UK reach its 2050 net zero emissions target.

Gas was once seen as a vital transition fuel on the road to net zero but many are increasingly seeing electricity as the main energy carrier by 2050.

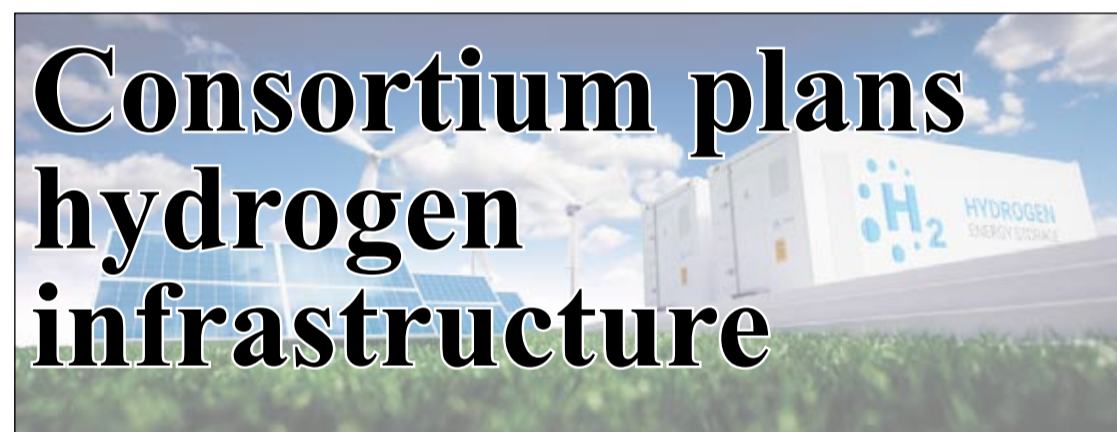
Hargreaves Lansdown analyst Laura Hoy said: “National Grid’s Western Power acquisition draws a line in the sand for the utility’s strategy moving forward – electric or bust.”

“From a strategic standpoint, it makes sense as the world shifts away from fossil fuels usage. Not only are homes consuming more, but the boom in electric cars represents an opportunity for NG, and the WPD acquisition puts it one step closer to seizing it.”

WPD owns and manages local electricity networks in the Midlands, southwest of England and Wales and serves about 8 million customers. It made a pre-tax profit of £750 million for the year to March 31 2020.

PPL put WPD on the block in August 2020, following a detailed strategic review and before the start of the next price control period for power distribution companies in the UK.

Pettigrew said he was confident the transactions would deliver “strong” and “longer” growth, despite UK regulator Ofgem saying in March it would crack down on the returns it allows local electricity grid companies – which are effectively monopolies – such as WPD to make from 2023 onwards.



Consortium plans hydrogen infrastructure

A seven company-strong consortium, which includes RWE, BP, Evonik Industries, Nowega GmbH, OGE Energy Corp, Salzgitter Flachstahl GmbH and Thyssengas is planning to build a cross-border infrastructure for hydrogen – from the production of green hydrogen to transport and industrial use.

The series of projects under the GET H2 Initiative includes the transport, storage and industrial use of green hydrogen across several stages between 2024 and 2030 and could save 16 million tonnes of CO₂ emissions, said RWE.

The move is one of several recently announced by utilities with strategies aimed at leveraging the nascent hydrogen economy.

Last month Danish energy company Ørsted said it believes that investments in the transformation of wind power into green hydrogen are an important part of its overall strategy. Thomas Thune Andersen, Board Chairman of Ørsted, said the segment could potentially see explosive growth, even though it might take a few years before this takes place. Ørsted has announced plans to investigate and develop hydrogen projects in Denmark, the UK, Germany, and the Netherlands.

Meanwhile, in late February Yara, Statkraft and Aker Horizons signed a letter of intent for a partnership to produce and develop a value chain for green hydrogen and green ammonia in Norway, with Herøya as the first project.

The agreement between Yara, Stat-

kraft and Aker Horizons involves a collaboration to electrify and decarbonise Yara’s ammonia production at Herøya while producing emission-free fuel for shipping, carbon-free fertiliser for agriculture and help remove CO₂ in other energy-intensive industries. The project could be realised over a 5-7 year period, provided power is available on Herøya and authorities support the project.

Also in late February, Aker Horizons launched a new platform company, Aker Clean Hydrogen. The new firm has a portfolio of nine clean hydrogen projects with 1.3 GW of net capacity under development. It has an additional pipeline of projects with 4.7 GW capacity. The firm is targeting a net installed capacity of 5 GW by 2030.

Renewables focus drives utility earnings

Enel and EDP have posted strong earnings as both utilities accelerate renewables investments.

Italian energy giant Enel posted a 9 per cent year-on-year rise in group net ordinary income to €5.2 billion (\$4.37 billion) despite a 19.1 per cent drop in revenues.

There was a slight improvement in ordinary earnings before interest, tax, depreciation and amortisation (EBITDA) off the back of a €103 million higher contribution from Enel Green Power. This was the result of better performance in Italy and the entry into service of new plants in the US, Canada, Spain, Brazil and Greece.

“During 2021, in line with the Strategic Plan and its decarbonisation as well as digitalisation objectives, we plan to accelerate investments in renewables, in the improvement of the quality and resiliency of networks, and in the electrification of consumption,” said Francesco Starace, CEO of the Enel Group.

Meanwhile Spain’s Endesa increased its EBITDA in 2020 on a like-for-like basis to €4027 million, up 5 per cent on the previous year. The company showed resilience despite the challenges posed by the impact of the pandemic and announced that it can now meet its CO₂ emission-free electricity

generation targets two years ahead of schedule. Specifically, the year closed with 85 per cent of mainland generation free of GHG emissions, a goal initially planned for 2022.

■ Portuguese utility Energias de Portugal SA (EDP) said it aims to add over 50 GW of renewables by 2030 to become a 100 per cent green energy producer. This is a new goal included in the company’s Strategic Update for the period 2021-2025, which sees EDP being coal-free by 2025 while doubling installed wind and solar capacity to 25 GW from the current 12 GW. The utility plans to invest a total of €24 billion (\$29.3 billion) to fund the initiative.

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Americas

Storage projects for Wärtsilä in Texas

Wärtsilä has won a contract to supply two projects in southern Texas, USA, with advanced energy storage technology. The interconnected stand-alone systems will have a combined rated capacity of 200 MW. Wärtsilä has also signed ten-year guaranteed asset performance agreements for the installations.

The order was placed by Able Grid Energy Solutions, a utility scale energy storage project development arm of MAP RE/ES.

The Madero and Ignacio energy storage plants will deliver valuable grid support to the Electric Reliability Council of Texas (ERCOT). Wärtsilä will supply its next generation, fully integrated GridSolv Quantum energy storage solution. The modular solution is designed for ease of deployment and sustainable energy optimisation. The energy storage systems will also feature Wärtsilä's GEMS smart energy management platform to monitor and control the flow of energy, enabling these projects to provide grid support for critical periods during extreme weather or grid instability conditions.

Sungrow to supply inverters to Brazil

Sungrow Power Supply of China will supply inverters and transformers for the 852 MW Futura I solar photovoltaic (PV) project in Brazil. The order was from the Brazilian energy company Focus Energia.

Sungrow will deliver over 100 MVS6300-LV transformers and more than 3000 of its SG250HX inverters. Sungrow will also provide commissioning and start-up services.

Installation of Futura I is set to start in April 2021, with commercial operation scheduled for the first half of 2022.

With 22 solar PV parks, each with 38.73 MW of capacity, Futura I is the first phase of what is planned to become the 3 GW Futura solar complex. The Futura complex will be located near Juazeiro in Bahia state.

Sungrow said that Futura I will require an investment of \$375 million.

Asia-Pacific

Wärtsilä to convert Taiwan HFO plant to gas

Ta Yuan Cogen has awarded an EPC contract to Wärtsilä to convert a cogeneration plant from operation on heavy fuel oil (HFO) to natural gas. The cogeneration plant, located in Taoyuan City, Taiwan, was originally equipped with three Wärtsilä 46 engines. These will be changed to three Wärtsilä 50DF dual-fuel engines providing a power output of 32 MW.

Electricity from the plant will be delivered both to the grid and to local industrial consumers, while the generated heat will be supplied to local industries.

The project is scheduled to commence in autumn 2021 and is expected to be fully completed in early 2022.

The conversion will increase the plant efficiency, provide flexibility to allow participation in the ancillary service market, reduce emissions, and support grid balancing.

Nicolas Leong, Director, North & South East Asia for Wärtsilä Energy, said: "The goal for Taiwan's power utilities is to have 20 per cent of their energy from renewables by 2025. This will affect the stability of the grid, and efficient balancing to offset

the inherent fluctuations in supply is essential. The Wärtsilä engines have the fast-starting and stopping flexibility to meet this need and to deliver the system reliability required."

Siemens F-class GTs for Shenzhen Energy

Shenzhen Energy has selected Siemens Energy to supply two 460 MW F-class gas turbine power islands for Phase 2 of its Fengda Power Plant Natural Gas Power Generation Expansion Project.

Under the terms of the technology supply agreement, Siemens Energy will supply two SGT5-4000F gas turbines, steam turbines, generators, and related auxiliary equipment for the project.

The project is located in Huizhou City, Guangdong Province, and is scheduled to be in operation in 2023.

When completed, the expansion project will generate an estimated 2.7 TWh annually, as well as significantly reduce CO₂ and NO_x emissions.

Inox Wind and Integrum sign wind power deal

Inox Wind has signed an agreement with Integrum Energy Infrastructure to set up 92 MW of wind power projects in India. The agreement is for the erection and commissioning of a total of 92 MW comprising 2 MW wind turbines.

Inox Wind will supply, erect, and commission the wind turbines at various locations in Gujarat, Karnataka, Maharashtra, and Tamil Nadu by the end of 2022.

Inox Wind said the agreement includes a turnkey order of 26 MW for which it will provide Integrum Energy with complete solutions from development and construction to commissioning and providing long-term O&M services.

Transformers for Yuhuan 66 kV offshore wind farm

Siemens Energy will install 22 distribution transformers at China's first commercial 66 kV offshore wind farm, the 300 MW Yuhuan Offshore Wind Power Project Phase 1, located in Taizhou, Zhejiang Province, China.

The fluid-immersed type FITformer WIND transformers will support China Huadian Corporation (CHD) to optimise energy supply in the Yangtze River Delta region.

The first phase of the Yuhuan Offshore Wind Power Project is scheduled to be completed by the end of 2021.

Beatrix Natter, Executive Vice President Transmission at Siemens Energy, said: "To successfully drive the energy transition, it is essential to increase the share of renewables in the energy mix. Equipped with innovative state-of-the-art transformer technology, China's first 66 kV offshore wind farm will lead the way to a significant increase of clean, renewable wind energy to the grid and will contribute to China's goal of carbon neutrality by 2060."

Biogas plant for South Korea

Biogest has won an order to build an agricultural and food waste biogas plant on the southern region of South Korea. The project, located close to Daegu, has been developed in cooperation with HC Energy and DoBangYukJong Farm and is supported by the Changnyeong-gun city office.

The biogas plant is fed with pig slurry and the food waste will be delivered from an organic waste collection point. The plant is able to

produce both electric and thermal power.

Europe

Vattenfall to trial Siemens heat pump

Vattenfall Wärme Berlin AG and Siemens Energy have signed an agreement to demonstrate and trial a new large-scale, high-temperature heat pump in Berlin. In the Qwark project (the German acronym for 'coupling of district heating, power, and cooling'), they will test the technology for the first time at Berlin's Potsdamer Platz to generate green district heating using waste heat and electricity from renewables, and feed it into Berlin's district heating network.

Siemens Energy is delivering a new type of large-scale, high-temperature heat pump to provide thermal capacity of up to 8 MW, which will be capable of flexibly delivering flow temperatures in the district heating network of between 85°C and about 120°C, depending on ambient conditions.

The heat pump will substantially reduce the amount of heat dissipated to the environment and provide additional heat for the district heating network, amounting to about 55 GWh per year, with an estimated annual saving of about 6500 tonnes of CO₂ emissions and 120 000 m³ of cooling water.

Linxon substation supports German energy transition

Linxon will supply a 380 kV gas insulated switchgear (GIS) substation for the German transmission system operator TransnetBW in the town of Bühl, southwestern Germany.

For this project, Linxon will design, supply, install and commission a 380 kV GIS substation to replace an existing 220 kV substation, which it will dismantle as part of the contract once the new GIS equipment has been put into operation.

The upgrade includes 4 new GIS bays, double-busbar, control and protection systems, substation automation, measurement and telecommunication systems, new auxiliary supplies, 2 x 20 kV compact stations, a 110 kV cable connection between 380/110 kV transformers and an existing 110 kV substation as well as all buildings, infrastructure and roads.

The new installation will be equipped with Hitachi ABB Power Grids' GIS technology. The ELK-3 GIS supplies reliable power up to a rated voltage of 420 kV.

Upgrading and strengthening the 'Badische Rheinschiene' power link in the Rhine valley will give TransnetBW a stable grid to transmit electricity generated by northern wind farms to consumers in the south. It also supports stronger grid interconnections between Germany and other countries, such as France and Switzerland.

Haldor Topsøe SOECs feed green ammonia plant

Aquamarine is developing a large-scale green ammonia facility to be constructed in northern Germany in multiple stages. In the first stage of the project, the facility will use Haldor Topsøe's solid oxide electrolyser cells (SOEC) to produce green hydrogen from 100 MW of offshore wind power. The hydrogen will be further processed into 300 ton/day of green ammonia. The facility is scheduled to be commissioned in 2024.

Joel H. Moser, CEO of Aquamarine, said: "We are delighted to be working with Haldor Topsøe toward the commercial application on its

cutting edge SOEC technology to bring green products to market as part of the global move toward decarbonisation. We expect to be soon announcing other partners who will be joining the effort, as we move forward to build HydrGEN into a global green hydrogen products leader."

Spain announces 1 GW wind turbine deal

Capital Energy of Spain has selected GE Renewable Energy as its turbine technology partner on wind projects between 2021 and 2023. The company said it has signed a framework agreement to purchase up to 1000 MW of turbines from GE to equip the next group of wind farms.

Under the agreement, the parties committed to contribute to social and economic development in the projects' area of influence. GE will manufacture much of the turbine components in Spain. Blades would be made by LM Wind Power's factories, while other parts would come via the local supply chain.

Siemens Gamesa wins big Spanish wind contract

Siemens Gamesa has signed one of its largest contracts in Spain, a 150 MW agreement with Elawan Energy to supply 30 SG 5.0-145 turbines.

The complex will be formed by three 50 MW wind farms in Fuente Álamo, Frontones, and Derramador in the province of Albacete in central Spain. It is scheduled for commissioning in mid-2022. The contract with Elawan also includes a long-term service agreement for 20 years.

The 30 nacelles will be assembled at Siemens Gamesa's plant in Ágreda (Soria), the gearboxes will be produced at the plants in Asteasu (Guipúzcoa), Lerma (Burgos) and the city of Burgos, and the electrical components will be produced at the factories in Reinosa (Cantabria), San Fernando de Henares (Madrid) and Benisanó (Valencia).

International

Safeguarding power supplies in the Arctic

Norwegian utility Arva will use three Rolls-Royce mtu EnergyPack battery energy storage systems to stabilise the power grid of the Norwegian island of Senja in the Arctic.

The EnergyPacks QL, with an output of 4.25 MVA and 3.79 MWh of capacity, will be used to iron-out voltage fluctuations in the towns of Husøy and Senjahopen.

Rolls-Royce will be involved in the research project for five years and will provide maintenance for ten years under a long-term service agreement.

Senja has modern fish processing facilities that require reliable power supplies, which the grid is currently unable to provide due to the town's location on the outside periphery of Arva's supply area. The energy storage systems will solve quality problems in the power supply.

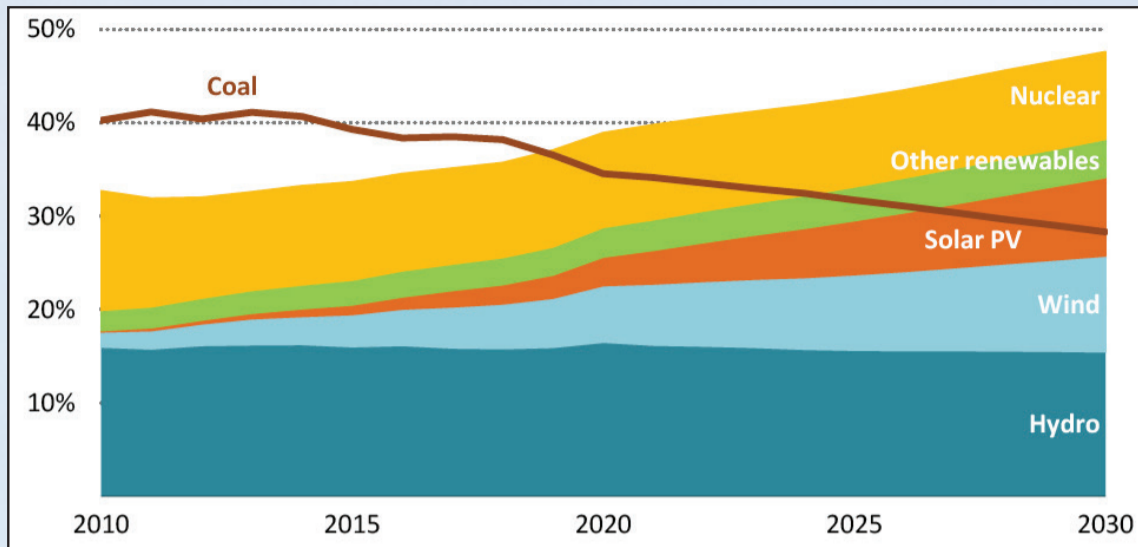
400 kV transmission line for Cameroon

Cameroon's state-run Société Nationale de Transport de l'Électricité has awarded KEC International a \$55.3 million contract to build a 400 kV power line in the country. The line will connect Edea in Littoral region to Nyom II in Yaoundé region.

The transmission line is scheduled to be operational by 2022.



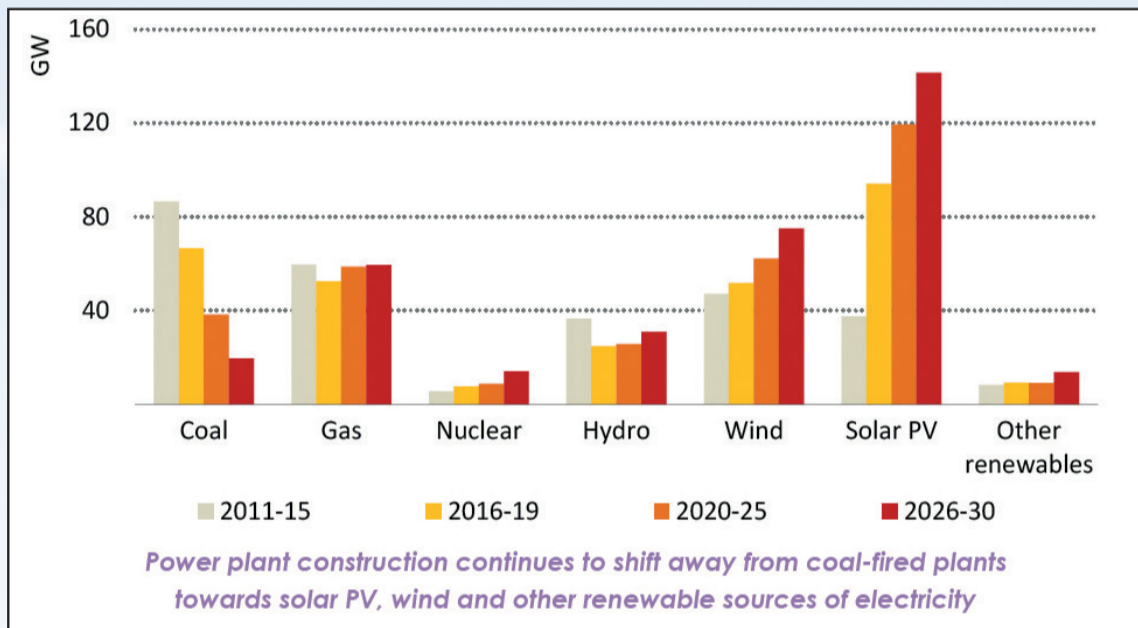
Renewables, nuclear and coal shares of global electricity supply in the Stated Policies Scenario, 2010-2030



World Energy Outlook 2020, © IEA/OECD, Figure 6.7, page 223

For more information, please contact:
International Energy Agency
 9, rue de la Fédération
 75739 Paris Cedex 15
 France.
 Email: bookshop@iea.org
 website: www.iea.org

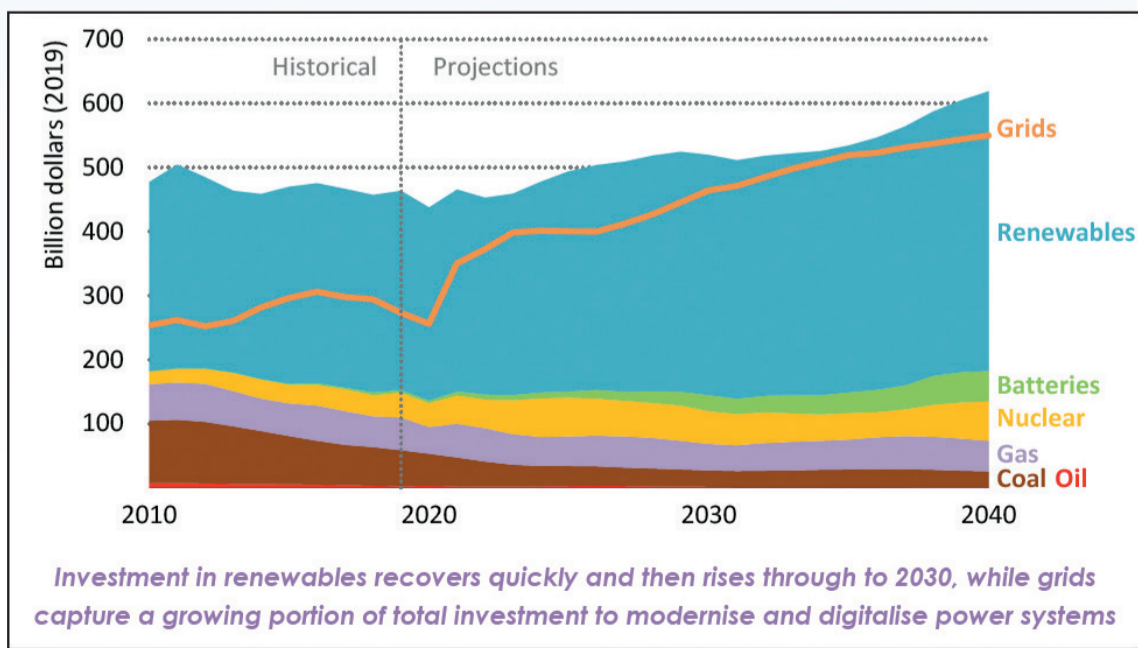
Global average annual power capacity additions in the Stated Policies Scenario



Notes: GW = gigawatts. Other renewables includes marine, concentrating solar power and geothermal.

World Energy Outlook 2020, © IEA/OECD, Figure 6.8, page 224

Global power sector investment in the Stated Policies Scenario



Note: investment for oil includes only utility-scale facilities.

World Energy Outlook 2020, © IEA/OECD, Figure 6.9, page 225

Hydrogen

Biden administration scurries to put hydrogen energy, climate policies in place

- Clean Hydrogen Future Coalition will support federal clean hydrogen policies
- Department of Energy provides grants for R&D projects and is designing long-duration energy storage facility

Gary Lakes

The administration of US President Joe Biden is moving quickly to ensure the growing number of innovations in the blooming hydrogen industry will have an impact on the future US economy. And at the same time, his administration is forming a climate and environmental policy to present to the world before Earth Day on April 22 when the president will host a virtual global climate summit.

Since coming to office less than three months ago, Biden has been pressed by his supporters to take big steps towards hydrogen and move the economy to a green energy future. Some impact on the energy sector will be made with the \$1.9 trillion stimulus bill that has recently passed Congress, and he is reported to be planning to soon introduce an infrastructure bill that will carry through on the 'Build Back Better' slogan he used during the election campaign. The infrastructure package is likely to amount to more than \$3 trillion with the intention to

create jobs, build modern sustainable infrastructure, boost US manufacturing and aim for a clean energy future.

Biden announced in February that his administration would accelerate research and development for low-cost hydrogen production. One step he has taken is that of forming the Climate Innovation Working Group, which is to coordinate and strengthen efforts within the federal government to set a course for net zero carbon emissions by 2050, in keeping with the Paris Climate Accord.

Since Biden took office on January 20, energy industry leaders and other stakeholders in clean energy have met with government officials and expressed their support for policy proposals. In mid-March CEOs from a number of major oil companies – including ExxonMobil, BP, Shell, Chevron, and ConocoPhillips – attended a meeting with White House National Climate Adviser Gina McCarthy and agreed to collaborate with the administration to work towards halting climate change.

The CEOs agreed to support federal

regulations limiting methane emissions from wells and oilfield equipment, and the expressed support for the US return to the Paris Climate Accord. They urged the government to provide support for carbon capture and hydrogen technology that would reduce emissions of carbon dioxide.

Following the meeting, the White House said that McCarthy "made it clear that the administration is not fighting the oil and gas sector, but fighting to create union jobs, deploy emission reduction technologies, strengthen American manufacturing and fuel the American economy".

The Clean Hydrogen Future Coalition (CHFC) also expressed in mid-March a shared vision by a number of groups, including energy companies, labour unions, utilities, NGOs, equipment suppliers, and project developers. The group said in a statement that it will support federal clean hydrogen policies that promote clean hydrogen as a key pathway to achieve global decarbonisation objectives that also increase US global competitiveness.

"Clean hydrogen sits squarely with President Biden's plan to 'Build Back Better' as it has the potential to decarbonise all sectors of the US economy, create and transition good-paying jobs, and grow our economy. The [CHFC] is calling upon policymakers to ensure that clean hydrogen plays a significant role to advance a national energy and climate strategy," Erik Mason, the incoming chair of the group and Nikola Global Head of Energy Supply & Trading said in the statement.

Several small steps have already been taken in an effort that will ultimately require an investment of trillions of dollars. The Department of Energy in mid-March provided a grant worth \$2 million to four research and development projects designed to create clean hydrogen production technologies. The recipients are involved in exploring different ways to produce hydrogen. The money will go to research groups at Auburn University, Electric Power Research Institute, University of Utah and University of Kentucky Research Foundation.

The DoE also announced last month that it is in the early stages of designing and building a grid energy storage facility worth \$75 million in Richland, Washington. The Grid Storage Launchpad will be hosted by the Pacific Northwest National Laboratory and will serve as a hub for the accelerated development of long-duration and low-cost grid energy storage. The facility is due to be complete in 2025.

The US media is reporting that the economic plan that Biden's team is drawing up calls for spending and tax credits that will amount to between \$3 billion and \$4 billion, and that a significant part of it will go towards infrastructure that will incorporate clean energy with the intention of sparking jobs growth.

Building a clean energy system across the US is reported to be central to all aspects of Biden's economic plan. However, the administration has yet to introduce a carbon tax, which would likely make a real difference in efforts to transform the country's energy usage.

Gas

Total to return to Mozambique LNG project despite continuing violence

Ongoing violence is jeopardising Mozambique's efforts to develop its gas resources, and delays in bringing gas resources on-stream may leave the fuel struggling to compete in a market with an already uncertain long-term future.

Gary Lakes

A project to develop huge natural gas resources offshore Mozambique continues to be threatened by a radical Islamic insurgency that has plagued the country's northern Afungi Peninsula since 2017. In late March, shortly after French energy major Total announced that it planned to resume work on its \$20 billion LNG project in Cabo Delgado, the militants attacked Palma, a town 10 km from the worksite.

An attack near the project earlier this year prompted Total to move its personnel to the French-administered island of Mayotte in the Mozambique Channel, but following arrangements with the government in Maputo over increased security, Total said it is preparing to restart work once the situation

is in hand and a 25 km radius security zone is established around the project site. The government has declared the area around the project a special security zone.

The development of Mozambique's offshore natural gas resources means a great deal to the country's future. Mozambique ranks as one of the world's poorest countries and the fighting in the northern province is only straining the country's resources further. Besides the insurgency, the country is struggling to combat the coronavirus and trying to recover from a hurricane that struck in March 2019. But once the LNG projects are operating, it is estimated that Mozambique could earn as much as \$96 billion over the life of the projects.

There are gas resources estimated at

more than 100 trillion cubic feet off the country's coast and several major companies have signed up for their development. In total, some \$120 billion might be invested over the life of the projects. Total leads a group on the \$20 billion Mozambique LNG project, which will process gas from Offshore Area 1 into LNG through two trains with a combined capacity of 12.88 million tons per year. Total and partners made a final investment decision (FID) on the project in 2019 and the project obtained \$15 billion in financial backing in June last year from eight export credit agencies, 19 commercial banks, and the African Development Bank. The US Export-Import Bank is providing \$5 billion and Japan Bank for International Cooperation is supplying \$3 billion.

ExxonMobil plans to build another LNG facility adjacent to Total's but it has delayed making an FID on the \$30 billion Rovuma LNG until 2022 because of low oil and gas prices. Rovuma LNG will process and export gas from Offshore Area 4 while partner Eni will concentrate on developing a floating LNG (FLNG) project – the Coral South project, which will have a capacity to produce 3.4 million tons per year. The onshore facility will be capable of producing 15.2 million tons per year.

The Coral South project got underway in 2018 and is due to start operations next year. The FLNG vessel is located 80 km offshore and will load LNG directly onto tankers, thus enabling it to avoid any violent disruptions that might arise onshore.

Total has scheduled exports to begin

in 2024, but if the insurgency continues and spreads, it could push the start of operations past 2025 and by that time there is no telling where the LNG market will be. While gas is seen as remaining a big part of the energy mix in the coming years, a number of countries are planning to move as quickly as possible into expanding their use of renewable fuels with a likely result of lowering gas demand. Europe is especially heading in that direction and other major energy consumers are also moving that way.

Already there are questions in the market about current gas demand and prices, as well as in the middle of the decade. Further delays with Mozambique bringing its gas resources on-stream may leave it struggling to compete in a market that is already troubled.

Turning up the heat on decarbonisation

There has been a demand for heat pump solutions that are increasing in scale and complexity, pushing the envelope in terms of where industrial heat pumps are being applied. But more education around the benefits is needed in many core industrial market segments.

Dave Dorney and Morten Deding

Dorney: Heat pumps are moving into a range of applications with outputs of between 40-70 MW



There is no doubting the importance of managing energy consumption in heating and industry in order to meet global carbon reduction and sustainability goals.

According to the International Energy Agency (IEA), almost one-fifth of the growth in global energy use in 2018 was due to hotter summers pushing up demand for cooling, and cold snaps leading to higher heating needs. And looking at energy consumption by sector, data from the IEA's 'World Energy Outlook 2019' shows that industry will replace the buildings sector as the biggest energy consumer before 2030.

Fossil fuel fired boilers have long been the go-to technology for meeting heat demand in buildings and industry, despite having a significant environmental impact. According to the IEA's 'World Energy Outlook 2020', the direct use of fossil fuels in the buildings sector resulted in just over 3 Gt of CO₂ emissions in 2019, with a further 6.4 Gt in indirect emissions coming from the use of electricity and district heat. Meanwhile, the industrial sector was responsible for more than 8.5 Gt of CO₂ emissions in 2019, of which around 70 per cent were from the direct combustion of fossil fuels and the remainder from industrial processes.

There has therefore been a growing interest in the electrification of heating, not only as a way of decarbonising heat by using electricity generated from renewables to drive heat pumps, but also to improve energy efficiency in heating.

Typically heat pumps are more efficient than a conventional boiler from a heating perspective – whether in a district heat application or municipal application. A heat pump (HP) might typically have a Coefficient of Performance (COP) of 3.5 to 5 (or higher depending on the application), i.e. it can transfer 500 per cent more energy than it consumes. Put another way, it produces 5 kW of heat for every 1 kW input of electricity. In contrast, if a high-efficiency gas boiler is, say, 95 per cent efficient, this means 95 per cent of the energy in the gas comes out as useful heat, with the other 5 per cent being lost as heat through the flue.

In the energy provider or utility space we have been witnessing a growing interest in HPs being used as a primary source of generation, replacing fossil fuelled boilers in the generation of steam or steam and power.

Notably, of late there has been a demand for HP solutions that are increasing in scale and complexity, pushing the envelope in terms of where industrial heat pumps are being applied. They are moving into a range of applications with outputs of between 40-70 MW, which would have traditionally been served by a series of boilers or a combined heat and power (CHP) plant.

Importantly, there is also great potential where there are significant cooling requirements, for example in data centres. And where there is cooling, the natural by-product is waste heat. This means that while cooling a space, there is the opportunity to build a simultaneous application, whereby heat could be provided to, for example, a district or location. With a heat pump, cooling and heating can effectively be done at the same time – something that is not possible with a boiler.

Yet despite their benefits and maturity, more education is needed. While energy companies and utilities are quite familiar with the technology, energy managers within many core industrial market segments have a more risk-averse approach even though heat pump technology has been available for many years as an alternative to conventional boilers.

Whether it is for a cooling application at a pharmaceutical facility or in a brewery, there is an opportunity here for them to address both their explicit cooling needs and their commitment to energy sustainability.

It is a case of the energy manager

at the pharmaceutical facility or brewery having the confidence to convince all stakeholders that, in this scenario, the heat pump is a proven technology that can address their cooling needs and at the same time serve to replace the boiler to meet the ongoing requirements for hot water.

Energy managers can be confident in not only the capability of heat pumps, but also in the fact that they can be readily adapted to specific installations.

There are various types of heat pump and choosing the right one depends on a number of factors. It depends on the kW load requirement – different loads will move you into different technologies – and grade or temperature of heat. It is also about matching the heat pump running conditions to the needs of the application. Number of running hours is therefore a factor. Similarly, operating conditions will affect maintenance and therefore operating expenditure (opex). Factors such as uptime and the need for redundancy must also be taken into consideration, along with choice of refrigerant and its associated potential health and safety impacts.

Ultimately, the choice of technology – whether selecting between heat pump technologies, or between a heat pump and an alternative technology such as a gas boiler – is determined by the Net Present Value (NPV) of the installation. For cooling, which is a necessity at a dairy or an abattoir, there is no option to using a cooling plant. But for a heating application, where there is always an alternative to heat pumps, it comes down to total cost of ownership and return on investment. Industrial heat pumps are more expensive than oil, biofuel or gas boilers but payback times can be as little as two years. While climate and sustainability commitments are the main drivers for market growth, the actual technical and operating benefits compared to conventional boilers are slowly being acknowledged and subsequently embraced by energy companies and energy managers.

According to market research company Technavio, the global industrial heat pumps market is expected to achieve a CAGR of close to 5 per cent during the period 2019-2023.

This growth, however, will vary from country to country. The market for heat pumps is most mature in Nordic countries, which have been at

the forefront of sustainability. Here they are being used for: cooling in data centres; in hospitals for space cooling in areas such as operating theatres, for example, while providing hot water; and by municipalities for district heating.

In mainland Europe, we are now seeing Germany, Switzerland and the Netherlands pushing forward. And in the UK, the government's Renewable Heat Incentive (RHI) provides funding to encourage the generation of heat from renewable sources. Similar grants have also been available in France for a number of years for almost completely funding such capital investment. Elsewhere, warmer countries like Spain and regions like the Middle East, where the need is more for cooling, are further behind the maturity curve but still project emergence in this market.

Legislation such as the UK's RHI and the announcement from the European Commission on the "Green Deal" is certainly having an impact in shifting the needle in the utility and energy providers' space, as we see energy utilities step up their activity. For this to continue, governments have to continue providing the framework to drive the change.

Advances in technology will also drive uptake. With many industrial applications needing heat at higher temperatures, there is ongoing work to develop refrigerants to allow heat pumps to accept heat at a temperature of 60-100°C and upgrade it to 200°C and beyond. In the future we may see units based on water vapour that could even go to nearly 300°C.

As energy prices increase, along with downward pressure on carbon emissions, the incentive for transforming high temperature heat from sources other than fossil fuels will drive the development of very high temperature heat pumps. And this could really change the game.

Certainly as the world continues its low carbon transition, the use of heat pumps will be an integral part of decarbonising heat in the creation of smart, sustainable cities and cutting emissions in the industrial sector while improving process efficiency in both heating and cooling.

Dave Dorney is Vice President & General Manager Industrial Refrigeration at Johnson Controls.

Morten Deding is Heat Pump Product Director BE Europe, Johnson Controls.



Despite a difficult year plagued by the Covid-19 pandemic, the wind power sector witnessed record-breaking capacity installations, particularly onshore. **TEI Times** looks at the Global Wind Energy Council's latest global wind report.

Global onshore and offshore wind installations (in 2020 and cumulative)

According to a report just published by the Global Wind Energy Council (GWEC), 2020 was the best year in history for the global wind industry, showing year-over-year (YoY) growth of 53 per cent.

With the COP26 climate conference set for November the GWEC's Global Wind Report 2021 focuses on the role of renewables and wind energy in particular in the world's net zero objectives. The report bears out findings presented earlier this year by the International Energy Agency, which said that although last year was a difficult one for the power industry as a whole due to the Covid-19 pandemic, renewables fared better than most.

Introducing the report, Feng Zhao, Head of Strategy and Market Intelligence, GWEC wrote: "Installing more than 93 GW wind power in a challenging year with disruption to both the global supply chain and project construction has demonstrated the incredible resilience of the wind industry."

Notably, although offshore wind continues to show robust growth, it is the onshore wind sector that continues to account for the bulk of new capacity. The 93 GW of total new installations brings global cumulative wind power capacity up to 743 GW, a growth of 14 per cent compared to 2019. In the onshore market, 86.9 GW was installed, an increase of 59 per cent compared to 2019 and the highest in history for new onshore installations. Cumulative onshore wind capacity passed the 700 GW milestone.

China and the US remained the world's largest markets for new on-

shore additions, and the world's two major economies together increased their market share by 15 per cent to 76 per cent, driven by the January 1, 2021 Feed-in Tariff (FiT) cut-off date in China and the scheduled phase-out of the full-rate Production Tax Credit (PTC) in the US.

In China, the National Energy Administration (NEA) reported 68.6 GW of grid-connected onshore wind installations last year, boosting its total onshore installations to more than 272 GW. Out of the 68.6 GW of grid-connected onshore wind, however, about 26 GW was installed by the end 2019, but did not actually achieve grid connection until 2020.

Excluding this latent volume, grid connected new installations in China in 2020 were 42.3 GW. Not including grid connection, new installations were 48.9 GW.

The US onshore wind sector, meanwhile, reported its highest-ever year of new installations in 2020. Nearly 17 GW was commissioned, bringing its total above the 120 GW threshold.

In addition to China and the US, the top five onshore wind markets were Brazil (2.30 GW), Norway (1.53 GW) and Germany (1.43 GW).

At the regional level, 2020 was also record year for onshore installations in Asia Pacific, North America and Latin America. The three regions combined installed a total of 74 GW of new onshore wind capacity last year, or 76 per cent more than the previous year. Due to the slow recovery of onshore installations in Germany last year, Europe saw only a 0.6 per cent YoY growth in new onshore wind installations. Developing markets in Africa and the Middle East reported 8.2 GW onshore installations

last year, almost the same as in 2019.

Looking at the market support mechanisms behind the new onshore wind capacity added in 2020, GWEC says the situation remains the same as the previous year. Excluding China and US, where the FiT and PTC were the key support schemes, mechanisms such as auctions, tenders and Green Certificates were the main drivers. Last year, 23 per cent of new installations originated from these market mechanisms.

While the first half of 2020 saw auctions being postponed or cancelled due to Covid-19, the sector bounced back strongly in the second half of the year, as key mature and emerging wind markets began to overcome the impacts of the pandemic.

Overall, 33.7 GW of new onshore wind power capacity was auctioned globally in 2020, of which China accounted for 67 per cent of the global onshore wind power capacity awarded in 2020. Since the majority (96 per cent) of the awarded onshore capacity in China last year was based on the grid parity scheme, GWEC says grid parity onshore wind is expected to be a key element of new installations in next year's Global Wind Report.

According to GWEC Market Intelligence, nearly 30 GW of total new wind power capacity, onshore and offshore, was awarded globally through auctions in the second half of 2020, which is a slight increase compared to the 28 GW awarded during H2 2019.

The report notes that there has been a "surge" in new capacity to be auctioned, particularly in offshore. This, it says, is "a clear signal that the industry is back on track" and that the global pipeline of wind power

projects continues to grow. "Through technology innovations and economies of scale, 2020 saw wind power continue to build its competitive advantage throughout the world," the report stated.

In Latin America, as wind power already had very competitive prices, private auctions or bilateral power purchase agreements (PPAs) have already emerged as an alternative mechanism to government auctions to drive growth. According to BloombergNEF, 6.5 GW of wind power was signed through corporate PPAs globally last year, 29 per cent lower than the previous year.

"Considering the fact that Covid-19 disruptions across the world have caused revenues to plummet for many corporates, the level of commitment to sustainable green energy remains impressive," said Zhao.

GWEC Market Intelligence says that after an unusual 2020, global wind market growth is likely to slow down in the near-term primarily due to an expected drop in onshore installations in China and the US following the expiry of incentive schemes. Nevertheless, the market outlook for GWEC's forecast period remains positive.

The organisation expects that more than 469 GW of new onshore and offshore wind capacity will be added in the next five years – that is nearly 94 GW of new installations annually until 2025, based on present policies and pipelines.

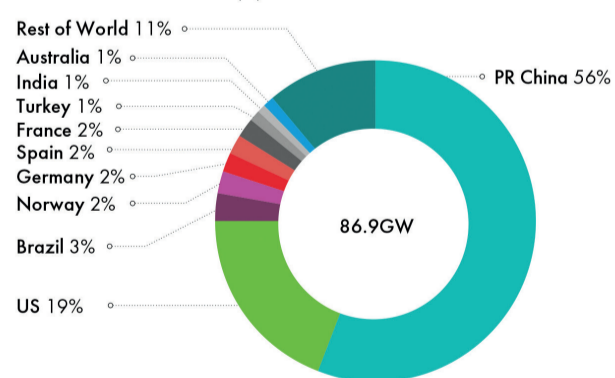
It expects that governments will significantly increase their ambitions and targets following COP26, and is therefore upwardly revising its forecasts for the Global Wind Report 2022.

The CAGR for onshore wind in the next five years is 0.3 per cent and GWEC expects annual installation of 79.8 GW. In total, 399 GW is likely to be built in 2021-2025. The CAGR for offshore wind in the next five years is 31.5 per cent. The level of annual installations is likely to quadruple by 2025 from 6.1 GW in 2020, bringing offshore's market share in global new installations from today's 6.5 per cent to 21 per cent by 2025. In total, more than 70 GW offshore is expected to be added worldwide in 2021-2025.

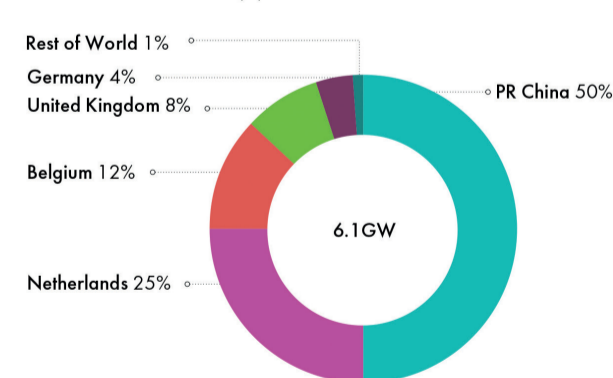
Last year also witnessed governments of countries such as China, Japan and South Korea making net zero/carbon neutrality commitments, and similar commitments were also made by major corporates including oil and gas companies. To reach the net zero targets, the report says completing a "systematic and radical" energy transition from fossil fuels to renewable energy and low-carbon solutions "is imperative".

Zhao concluded: "The current crisis offers a unique window of opportunity to put the world on a sustainable trajectory and meet our international climate goals, but we must act now – or miss the opportunity. Although reaching net zero will require bold actions by a large number of sectors and actors, wind power is placed to be one of the cornerstones of green recovery and to play an important role in accelerating the global energy transition."

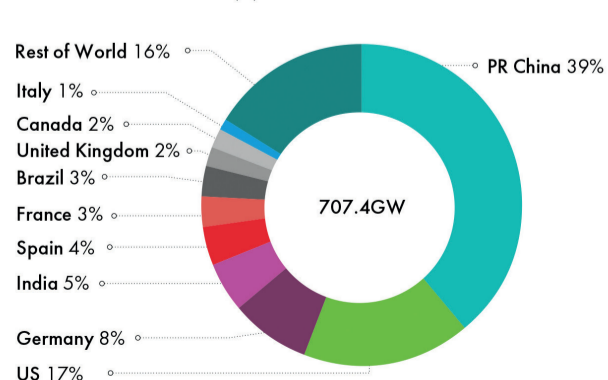
New installations onshore (%)



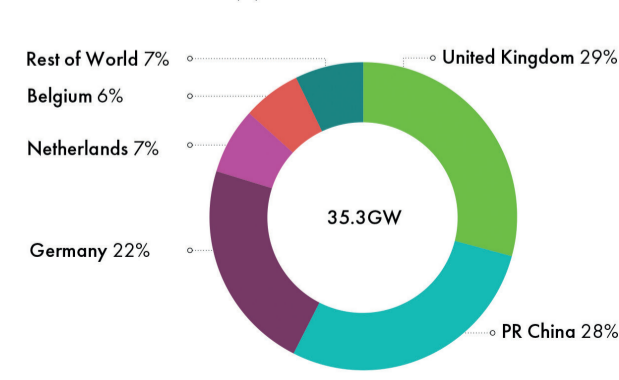
New installations offshore (%)



Total installations onshore (%)



Total installations offshore (%)



Heat pumps add another level to storage

The growing amount of battery storage deployed to support variable renewable energy sources presents a big opportunity for heat pumps. A project is underway at a massive facility in Dalian, China, which will demonstrate how heat pumps can sit alongside batteries to recover and re-use waste heat. **Junior Isles** explains.

China has been increasing its use of wind and solar in an effort to green its economy and last year announced a target to reach carbon neutrality by 2060. As the country installs more variable wind and solar power, it is also deploying battery technology to help stabilise the grid.

One important battery project that is now being built in Dalian, north-eastern China, will be the largest in the country and one of the largest in the world. With a peak capacity of 200 MW and electricity storage capability of 800 MWh, the battery will serve as a fast-reacting reserve capacity for wind power. But notably, it will also fulfil another role. Through the use of heat pumps (HPs), supplied by Finnish company Oilon, it will also use heat from the batteries to provide heat to the city's district heating network.

Explaining the rationale behind the decision to include HPs in the project, Tero Tulokas, CEO, Oilon, said: "There are both environmental and economic drivers for such projects but in the long-run waste heat streams will increasingly be utilised to reduce emissions."

The project is the culmination of several years' work, which roughly two years ago also saw Oilon and Dalian Henliu Energy Storage Power Station Company Ltd (Dalian Henliu) build a pilot plant to prove the concept of applying this type of industrial HP for simultaneous cooling and district heating. The pilot allowed the partners to confirm key parameters such as HP efficiency and capacity, etc., with actual devices.

Satisfied with this pilot, Dalian Henliu decided to order eight HPs for the commercial project. These first eight units are scheduled to be up and running this spring, with a second batch of eight planned for a

second stage in the future.

The Dalian installation is a government-approved demonstration project primarily to test the functionality of vanadium batteries connected to the grid. It will serve as a fast-reacting reserve capacity for wind power when there is no wind and will also curtail the peaking power requirements in the area by about eight per cent.

The Dalian battery project consists of large vanadium redox flow batteries, wherein the energy storage capability is based on ion reactions of the electrolyte solution flowing inside the batteries. Unlike lithium-ion batteries, vanadium batteries are free of fire safety issues and are also long-lived. They can be charged more than 20 000 times without reducing the storage capacity, and they allow charging and discharging at the same time.

Like most batteries, however, they still require cooling and for this purpose Oilon will supply eight of its containerised ChillHeat P-series high-temperature heat pumps, each with a capacity of over 1 MW, depending on the temperature levels. When used for both district heating and cooling, they can reach an overall efficiency (COP_{tot}) of 8.6.

Commenting on the choice of HP technology, Tulokas said: "In this type of application, there are options. You could use air-to-water, waste heat-to-atmosphere or even air-to-air heat pumps. Because Dalian is a big installation and the owners wanted to be even greener, they wanted to utilise the waste heat.

The HPs at Dalian are 'liquid-to-liquid' units, meaning that both the heating and cooling sides have liquid connections. The water is heated on the district heating side and cooled on the battery cooling side.

Waste heat from the batteries will

have a temperature of about 25-35°C. This is cooled by the HPs and fed back to the batteries for cooling. HPs then boost it to the temperature needed for district heating, i.e. around 80°C.

"What's great in this application is that both the heating and cooling sides are valuable. Usually in cooling applications, the waste heat is discarded," said Tulokas. "Here, there is a cooling circuit, where water is circulating. Heat is taken from that water and fed back to the batteries to cool them and the remaining heat is utilised for district heating."

While capex, opex, environmental impact of the refrigerant, etc., were all important in selecting the most suitable HP technology, Tulokas said the district heating temperature was key. "It puts limitations on the refrigerants and compressor type. Not all types of compressor can go up to these temperatures. Normally these type of cooling systems go up to 40-60°C. So here we are using high temperature HPs."

He added: "The flexibility of the system is also very important; there has to be a wide enough turndown ratio to ensure the conditions are stable enough for the main process." He says operating between 1 and 100 per cent is "is not a problem" due to the use of frequency converter-driven compressors and the fact there are several compressors in each heat pump.

The project, which will be built in two stages, will feature a total of 16 pumps on final completion with a capacity of approximately 16 MW for each application.

"The heating output will be about 16 MW and the cooling output just under 16 MW since some of the electricity is consumed by the heat pumps in the cooling application. The heating COP is equal to the cooling COP plus the electricity used by the heat pumps. So the heating COP is always slightly more than the cooling COP," explained Tulokas. "So the total useable heating and cooling is about 30 MW."

The HP installation has a combined COP, i.e. heating plus cooling, of 8.6. This means that each 1 kW of electricity can provide 8.6 kW of heating and cooling. Commenting on this level of efficiency versus, say, a gas boiler, which could only be used for heat, Tulokas said: "We still provide burners for boilers but we are seeing this desire to reduce emissions and many energy companies are finding it is very cost efficient to use heat pumps in situations where low grade heat is needed."

He added: "There are also many cases where combustion is already in place but there is an opportunity for heat pumps to reduce the amount of combustion needed. Here heat pumps are used first, with the remaining capacity or reserve served

by boilers." According to Tulokas, there are a large number of projects where companies are opting for this hybrid, boiler plus HP, approach.

"It can be that the heat capacity of the heat pump is only 20-30 per cent of the maximum load but it can still provide 80-90 per cent of the needed energy. In this situation it is not cost effective to have a heat pump capacity that fully covers the required maximum heat capacity – it is better to have a boiler where you have these peak hours," he said.

Oilon has been making burners for conventional boilers for decades but notes that the HP business is growing. "We have been doing heat pumps for years but now it seems this sector is growing rapidly all over the world. There are huge possibilities for green heating using waste heat from cooling."

The economics of each installation varies from project. Much comes down to the cost of electricity, which is the main operating cost. Tulokas says payback time can be as little as one year but is often 3-5 years, and sometimes more. "At the moment, the industry is prepared to accept the longer payback times because of the need to reduce CO₂."

As pressure grows on countries to cut emissions, Tulokas believes there will be more of these projects where waste streams are utilised. "With the climate targets, they have to do everything they possibly can."

Looking at the market, he noted there have been a number of announcements in places such as Baltic countries, the US and France, and countries where battery energy storage is being used to complement fluctuating renewable electricity generation. "Our main market for industrial heat pumps is definitely Europe. But we have also done projects in China, North America and South America," said Tulokas. He also noted that the proliferation of data centres also presents opportunities to use waste heat for district heating.

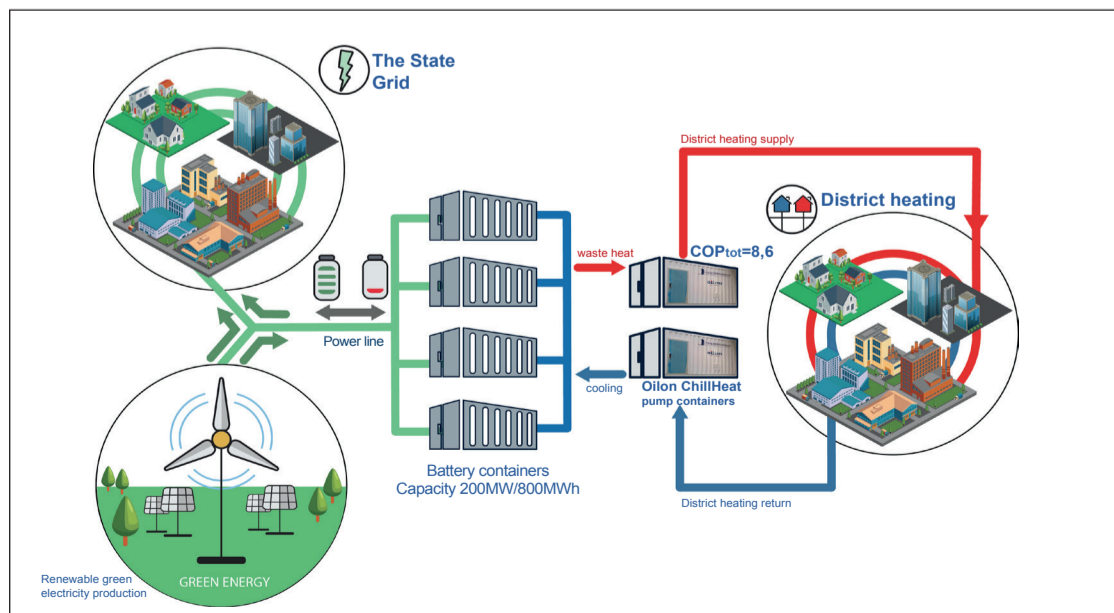
"Companies and industries with a need for cooling can use heat pumps to provide district heating. Recently we sold a project in Europe to a company that is manufacturing products from moulded plastics. The heat pumps provide cooling for the process machines and then use the heat to allow the plant to also sell district heating." He added: "There is also interest from district heating companies to have this kind of heat in their networks to reduce CO₂ emissions in their production."

Assessing the future of HPs, Tulokas concluded: "There needs to be greater awareness about what heat pumps can do but it is gaining momentum. I don't see any big technological barriers or breakthroughs that are needed; it's mature technology. It's just about understanding the possibilities."



Tulokas: There needs to be greater awareness about what heat pumps can do

Waste heat from the batteries is cooled by the HPs and fed back to the batteries for cooling. HPs then boost it to the temperature needed for district heating





Junior Isles

Stick to the programme

The countdown to COP (the Conference of Parties) is well underway. But as the clock ticks towards the 26th United Nations Climate Change Conference (COP 26), scheduled for November, there is mounting evidence that drastic action will be needed if we are to stick to agreed targets on climate change.

With just seven months to the gathering in Glasgow, UK, the pressure is on. The upcoming conference, which was postponed from November last year due to the Covid-19 pandemic, will be the first time that Parties are expected to commit to increased ambition since the landmark climate agreement was signed in 2015 at COP 21 in Paris.

Under the Paris Agreement nations agreed to keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.

The Paris Agreement requires all Parties to put forward their best efforts through their emissions targets – known as Nationally Determined Contributions (NDCs) and to strengthen these efforts in the years ahead. Informally known as the “ratchet mechanism”: Article 4 of the Paris Agreement says that countries will revise their NDCs and communicate them every five years. This is essentially a periodic global stocktake to assess the collective progress towards achieving the purpose of the agreement and to inform further individual actions by Parties.

Unfortunately, it looks increasingly likely that COP26 will show ‘global

stocks’ to be in a parlous state.

Last month a UNFCCC report claimed climate commitments were “not on track” to meet the Paris Agreement goals. Its Initial NDC Synthesis Report, showed nations must “re-double efforts and submit stronger, more ambitious” national climate action plans in 2021 if they are to achieve the Paris Agreement goal of limiting global temperature rise by 1.5°C by the end of the century.

UN Secretary-General, António Guterres, called 2021 “a make or break year” to confront the global climate emergency. “The science is clear, to limit global temperature rise to 1.5°C, we must cut global emissions by 45 per cent by 2030 from 2010 levels,” he said.

According to Guterres, the interim report is “a red alert for our planet”. It shows governments are “nowhere close” to the level of ambition needed. He said: “The major emitters must step up with much more ambitious emissions reductions targets for 2030 in their Nationally Determined Contributions well before the November UN Climate Conference in Glasgow.”

The report was requested by Parties to the Paris Agreement to measure the progress of NDCs ahead of COP26. Covering submissions up to 31 December 2020, it shows 75 Parties have communicated a new or updated NDC, representing approximately 30 per cent of global greenhouse gas emissions.

The report shows that while the majority of nations represented increased their individual levels of ambition to reduce emissions, their

combined impact puts them on a path to achieve a less than 1 per cent reduction by 2030 compared to 2010 levels. The Intergovernmental Panel on Climate Change, by contrast, has indicated that emission reduction goal should be around 45 per cent lower.

Responding to the publication of the UNFCCC Synthesis Report, Christian Aid climate policy lead, Dr Kat Kramer, said: “It is unutterably appalling that the combined impact of the pledges that have been made put the world on course to achieve only a 1 per cent reduction in emissions by 2030 from 2010 levels. The science suggests that even for a 50 per cent chance of limiting warming to 1.5°C, emissions will need to roughly halve over that same period. Those are the same odds as playing Russian roulette with three bullets in the chamber. This is a call to action.”

Certainly the time for action is now. The UNFCCC sees 2021 as an “unprecedented opportunity” to make significant progress on climate change and urged all nations to build forward from Covid-19 with more sustainable and climate-resilient economies. “This is a rare moment that cannot be lost,” said UNFCCC Executive Secretary, Patricia Espinosa. “As we rebuild, we cannot revert to the old normal.”

Yet it seems her words come too late. There is worrying evidence that the old normal has already returned, and with a vengeance.

Last month, the International Energy Agency (IEA) revealed that, following a steep drop in early 2020, global

carbon dioxide emissions have rebounded strongly. The Paris-based agency said global energy-related CO₂ emissions were 2 per cent, or 60 million tonnes, higher in December 2020 than in the same month a year earlier. The resurgence was attributed to a pickup in economic activity, which pushed energy demand higher, and a lack of clean energy policies.

Dr Fatih Birol, the IEA Executive Director, said: “The rebound in global carbon emissions toward the end of last year is a stark warning that not enough is being done to accelerate clean energy transitions worldwide. If governments don’t move quickly with the right energy policies, this could put at risk the world’s historic opportunity to make 2019 the definitive peak in global emissions.”

Emissions in China for the whole of 2020 increased by 0.8 per cent, or 75 million tonnes from 2019 levels, driven by China’s economic recovery over the course of the year. China was the first major economy to emerge from the pandemic and lift restrictions, prompting its economic activity and emissions to rebound from April onward. China was the only major economy that grew in 2020.

In India, emissions rose above 2019 levels from September as economic activity improved and restrictions were relaxed. In Brazil, the rebound of road transport activity after the April low drove a recovery in oil demand, while increases in gas demand in the later months of 2020 pushed emissions above 2019 levels throughout the final quarter.

Emissions in the United States fell by 10 per cent in 2020. But on a monthly basis, after hitting their lowest levels in the spring, they started to bounce back. In December, US emissions were approaching the level seen in the same month in 2019. This was the result of accelerating economic activity as well as the combination of higher natural gas prices and colder weather favouring an increase in coal use.

It is a bleak picture, and one that is driving some climate activists to acts of desperation. Last month, two members of the UK public took a stand, or perhaps it was a seat, in protest against what they see as government inaction on climate change.

Christian Climate Action (CCA) members, Reverend Tim Hewes and Ben Buse were jailed for 14 days each for contempt of court after they glued themselves to court furniture in protest at what they called the “Court’s complicity with the government’s lack of action” on the climate emergency. Days later Rev Sue Parfitt and Ruth Jarman, also CCA members, were arrested for contempt of court after they also glued themselves to furniture at the same court.

Buse said in court: “I am protesting in court, for time has run out. The Earth is dying, species are dying, island states, livelihoods and cultures are dying, the coral reefs are dying. We are crossing the global climate system tipping points, and are on the brink of runaway heating, mass migration, immense suffering and destruction. It fills me with grief that we are continuing as normal as everything precious is dying around us. Protestors are dismissed and prosecuted, whilst business as normal continues.”

It seems normal citizens are prepared to stick to the programme in fighting climate change – literally – even if the glue binding countries to the Paris goal appears to be coming unstuck.

Cartoon: jemsoar.com

