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Special Technology Supplement

Rapid grid evolution is crucial to carbon neutrality.

Working with startups

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US landmark clean energy bill will face obstacles

The American Clean Power Association's Heather Zichal hailed the climate bill as a "generational opportunity"

The US has passed a bill into law that will drive clean energy and help it meet its climate change commitments but some experts caution that there are potential challenges.

Junior isles

The landmark Inflation Reduction Act, recently passed into law in the US will pump a record $369 billion into clean energy but experts caution that the move to drive the country's green energy transition will face obstacles.

Jos Shaver, Chief Investment Officer at Electron Capital Partners, a renewables-focused asset manager said the new law was "absolutely game changing", but warned: "It's an energy transition, not an energy switch. It's not going to happen overnight and there's going to be a lot of bumps in the road."

The climate, tax and spending law signed by President Joe Biden has the potential to trigger a massive upsurge of new renewable power that would, according to the government, allow the country to slash greenhouse gas emissions by 40 per cent from 2005 levels by the end of the decade. This would see it inch closer to its commitment to cut emissions by 50-52 per cent by 2030 under the Paris climate accord.

Public investment in climate must be paired with private investment to meet ambition needed for Paris. The bill therefore provides $27 billion in support for green banks in the US, which will provide low-cost capital to accelerate private investment in climate projects.

Heather Zichal, Chief Executive of the American Clean Power Association hailed the climate bill as a "generational opportunity for clean energy" after years of uncertainty and delay. "This is the vote heard around the world. It puts America on a path to creating 550 000 new clean energy jobs while reducing economy-wide emissions 40 per cent by 2030."

Tax credits to spur investment in and production of renewable power form the centrepiece of the new bill. Such tax credits for wind and solar developments have been used for a number of years to help drive renewable projects but they have been short-term. This has made planning difficult and developers have often struggled to attract financing.

The new bill reinstates and expands production and investment tax credits for wind, solar and energy storage but with a 10-year time timeframe, which allows long-term planning. The 10-year credits will also feature a "transferability" mechanism that allows the credits to be bought and sold, thereby expanding options for financing projects.

In anticipation of the bill passing, Hanwha Solutions said it is considering expanding investment in its US photovoltaic plant construction plan, which was announced in May this year.

Some project developers, however, have expressed concern over the bill's goal of also promoting a home-grown green industry.

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Energy companies' profits under fire as energy crisis deepens

Energy companies have come under fire as profits soar while businesses and households struggle under the burden of record high energy prices.

Last month Saudi Arabia's state-owned energy corporation, Saudi Aramco, highlighted the huge earnings made by gas and oil-rich nations during the energy crisis after making revenues of $48.4 billion in the third quarter, up 90 per cent from $25.5 billion a year earlier.

Saudi Aramco is just the latest in a long line of oil giants to announce bumper profits this year. ExxonMobil's profit, for example, came to $17.6 billion in the second quarter, excluding special items. The company nearly doubled what it made in its very profitable first quarter as oil and gas prices started to soar driven by Russia's invasion of Ukraine.

Tradingplatforms' Edith Reads commented: "It is clear that the energy crisis is benefiting the oil-rich nations and those companies involved in extracting and selling fossil fuels. The high prices may be a cause for concern for consumers, but for now, it seems that the energy producers are reaping the rewards."

Record oil and gas prices have also contributed to a bumper year for oil giant bp, with half-year underlying profits almost tripling from $5.4 billion in 2021 to $14.6 billion in 2022. The company plans to boost dividend payments by 10 per cent and will also initiate a new share buyback programme, totalling $3.5 billion.

In response to bp reporting huge profits while household energy bills soar, Doug Parr, Chief Scientist for Greenpeace UK, said: "While households are being plunged into poverty with knock-on-impacts for the whole economy, fossil fuel companies are laughing all the way to the bank. The government is failing the UK and the climate in its hour of need.

"Government must bring in a proper windfall tax on these monster profits and stop giving companies massive tax breaks on destructive new fossil fuel investments."

Following the UK's windfall tax already imposed on oil and gas companies, Britain's electricity generators are facing pressure from ministers to invest their "extraordinary profits" in new green energy projects, rather than paying out the windfall to shareholders.

Although many UK energy suppliers have gone bust since the energy crisis, some electricity generators have made huge profits from surging electricity prices that have risen in line with the soaring cost of gas. Both Shell and Centrica smashed earning results, with Shell's profit reaching a record of $11.5 billion in the second quarter.

Pressure is now likely to increase on generators with the announcement that the UK will again raise its energy price cap for households by 80 per cent from October. This will see the average household energy bill jump to over £3500. The price cap was raised by 54 per cent in April pushing the average bill to just over £1900. Experts are predicting a further increase in January, which could see average annual bills reach in the region £5000, with another increase likely in April.

Earlier last month UK Chancellor Nadhim Zahawi and Business Energy and Industry Secretary Kwasi Kwarteng met generators including Centrica, Drax and RWE to discuss the energy crisis, including the sharp jump in household bills.

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In March the US Department of Commerce agreed to investigate alleged circumvention of anti-dumping and countervailing duties by solar manufacturers in Southeast Asia. The move has proven to be damaging to the US solar sector as it essentially froze the import of PV cells and modules to the country.

The potential for retroactive tariffs along with supply chain snags drove down solar installations in the last quarter to their lowest level since the start of the coronavirus pandemic, according to energy and commodities consultancy Wood Mackenzie.

Buttgenbach called for long-term policy certainty

Speaking to the *Financial Times*, Tom Buttgenbach, Chief Executive at 8Minute Solar, one of the biggest utility-scale developers, commented: "I need to know what my supply chain looks like in four to five years."

Meanwhile, offshore wind power developers are anxiously eyeing a separate piece of legislation that would require them to use only American vessels and crews when installing turbines. Pedro Azagra, Chief Executive of Avangrid, which owns utilities and is one of the biggest US wind developers, said: "It's something that is not realistic. You do not have them and it will take some time to build them, some time to train the crews."

The IRA makes hundreds of millions of US dollars available to governmental bodies to optimise and accelerate the processes behind bringing projects onto the grid. It calls for comprehensive permitting reform legislation to be passed before the end of the fiscal year, to unlock domestic energy and transmission projects, which will lower costs for consumers and help the US meet its long-term emissions goals.

This includes offshore wind development and transmission projects related to this energy infrastructure, including interconnections. The Act puts $100 million on disposal for the Secretary of Energy until September 30, 2031 to carry out activities related to the development of interregional electricity transmission and transmission of electricity generated by offshore wind.

Notably, the bill seeks to kick-start hydrogen by also offering tax credits for hydrogen production projects, with the of tax credit for projects based on the amount of carbon equivalent emissions for each kilogramme produced, starting at a basic rate of $0.60/kg of hydrogen produced.

This scale means that clean hydrogen producers can receive tax credits of up to $3/kg. Experts say the measures will make the US one of the lowest cost hydrogen producers in the world.

No clear sign of extreme prices abating soon

With gas prices continuing to climb and low nuclear and hydropower output in Europe, there is no sign that electricity prices will fall any time soon.

Junior Isles

European power prices hit new highs last month and show no signs of abating as natural gas extended gains, says independent energy research consultancy Rystad Energy AS.

According to the company, next-year electricity rates in Germany advanced as much as 3.7 per cent to €477.50/MWh ($487/MWh) on the European Energy Exchange AG. This was almost six times as much as this time last year, with the price doubling in the past two months alone.

Commenting on the latest numbers Rystad Energy analyst Fabian Ronningen said: "There's no clear sign of the extreme price rally abating soon. The continent's low nuclear, hydropower and coal capacities aren't enough to help ease that pressure."

The market price is being driven by concerns over whether Europe's tight gas supplies will be able to generate enough electricity this winter. France's nuclear capacity is extremely low, denting the possibility of power exports in the months ahead.

According to the forecast, European electricity prices are expected to peak during the winter of 2022-2023.

Day-ahead prices in Germany and the UK also set records last month, an indicator of high demand for cooling, with heat waves and drought on the continent straining infrastructure in the short-term.

According to the International Energy Agency (IEA), wholesale power prices in the first half of 2022 were three to more than four times as high as the average in the first half of 2016 to 2021, primarily due to gas prices climbing to more than five times the value of the reference period.

The IEA price index, representing the moving average of weighted prices in the main electricity markets for four quarters, reached almost 300 points in the second quarter of 2022, indicating three times higher average wholesale prices than in the reporting period of 2016, and 60 per cent higher prices than over the same quarter of 2021. The IEA also forecasts that European electricity prices are expected to peak during the coming winter.

With energy driving inflation across Europe, the deepening energy crunch is threatening to plunge the region into a recession.

In the UK, it was recently announced that the household energy price cap will increase by 80 per cent at the start of October on the back of rising wholesale costs. The wholesale price of UK electricity for that month has jumped about sevenfold in the past year to roughly £591/MWh ($713/MWh) on the Intercontinental Exchange AG.

Renewable energy sector defies supply chain challenges

Renewable energy sources, which account for the bulk of annual investments in power generation, are set to provide the majority of Europe's power by the end of the decade despite global supply chain challenges.

According to a recent report by S&P Global Ratings Renewables are forecast to increase to 60 per cent of power generation in Europe by 2030, and could approach 40 per cent in the US and China, according to S&P Global Commodity Insights (Platts).

BloombergNEF recently calculated that global investment in renewable energy totalled $226 billion in the first half of 2022, setting a new record for the first six months of a year. It said the uptick in investment reflects an acceleration in demand for clean energy supplies to tackle the ongoing global energy and climate crises.

Its Renewable Energy Investment Tracker 2H 2022 report says investment in new large- and small-scale solar projects rose to a record-breaking $120 billion, up 33 per cent from the first half of 2021. Wind project financing was up 16 per cent from 1H 2021, at $84 billion.

"Both sectors have been challenged recently by rising input costs for key materials such as steel and polysilicon, as well as supply chain disruptions and rising financing costs," it said. "Yet, today's figures indicate that investor appetite is stronger than ever, in part due to the very high energy prices currently being seen in many markets around the world."

As well as seeing booming project investments, the first half also saw an all-time record for venture capital and private equity investments into renewables and energy storage, with $9.6 billion raised – up 63 per cent on the previous year.

Albert Cheung, Head of Analysis at BloombergNEF, said: "Policy makers are increasingly recognising that renewable energy is the key to unlocking energy security goals and reducing dependence on volatile energy commodities. Despite the headwinds presented by ongoing cost inflation and supply chain challenges, demand for clean energy sources has never been higher, and we expect that the global energy crisis will continue to act as an accelerant for the clean energy transition."

EU needs energy storage but market lags behind US and China

Global cumulative energy storage deployments are expected to reach 500 GW by 2031 but demand in Europe lags behind China and the US despite the region's need for flexible power solutions.

According to Wood Mackenzie's 'Global Energy Storage Outlook' Europe's demand lags behind as its grid-scale market struggles to stabilise, with only 159 GWh forecasted for the region by 2031, compared to 422 GWh for China and 600 GWh for the US.

Commenting on the forecasts, Dan Shreve, Global Head of Energy Storage at Wood Mackenzie, said: "Growth has stalled in Europe as regulatory barriers fail to improve storage project economics. In addition, limited access to power markets and a lack of revenue stacking opportunities, combined with a lack of capacity market auctions, has lowered investment for grid-scale storage assets in Europe."

Despite this, Germany's energy storage market continues to grow and is set to become the third biggest energy storage market by 2030, following the US and China. With 32 GWh forecasted for the country, 61 per cent from the residential segment.

The European Commission's REPowerEU plan, launched as a means of the EU weaning itself off Russian fossil fuels, will boost the EU energy storage market further as it pushes for a higher share of renewable supply in EU Member States. Europe has already seen a 12 GWh increase since the plan was launched in May 2022, which set out a 600 GW target for the solar PV market and pledged to ease permitting processes for both storage and PV systems.

"While REPowerEU does not set out a specific target for energy storage, higher renewable supply targets will drive demand for flexible power solutions, including energy storage assets," Shreve said.

The report was followed shortly after by an announcement by the European Commission that it wants to boost output of its own raw materials needed for green energy. The plans, still at an early stage, would lower regulatory barriers to mining and production of critical materials such as lithium, cobalt and graphite, needed for batteries, wind farms, solar panels and electric vehicles.

"Demand is increasing dramatically due to the digital and green transition of our society [but] we are too often almost entirely dependent on imports, while the geopolitics of supply chains are increasingly unstable," said the EU's internal market Commissioner Thierry Breton.

Europe produces less than 1 per cent of the world's lithium ion cells compared with China's 66 per cent, according to a report issued by JRC last year. Mining lithium, however, has challenges as demonstrated by Portugal's efforts to unearth large reserves.

A potential cornerstone of Europe's green energy transition, the Barroso mine in northeastern Portugal was expected to start producing lithium for electric vehicle batteries in 2020. But the mine's owner, Savannah Resources, has been forced to push the start date back several times due to delays in environmental approval. In July Portugal's regulator added a phase to the process, causing Savannah to reset its first production date again to 2026.

Meanwhile, demand continues to grow. The EU target is for renewables to produce 32 per cent of the bloc's energy by 2030, potentially increasing to 45 per cent.

Dries Acke, Policy Director at SolarPower Europe, said the industry body expected EU installations of photovoltaic cells to reach an all-time high of 34 GW this year, up from 28 GW in 2021. But he said supply of raw and processed materials would determine the availability of solar products.

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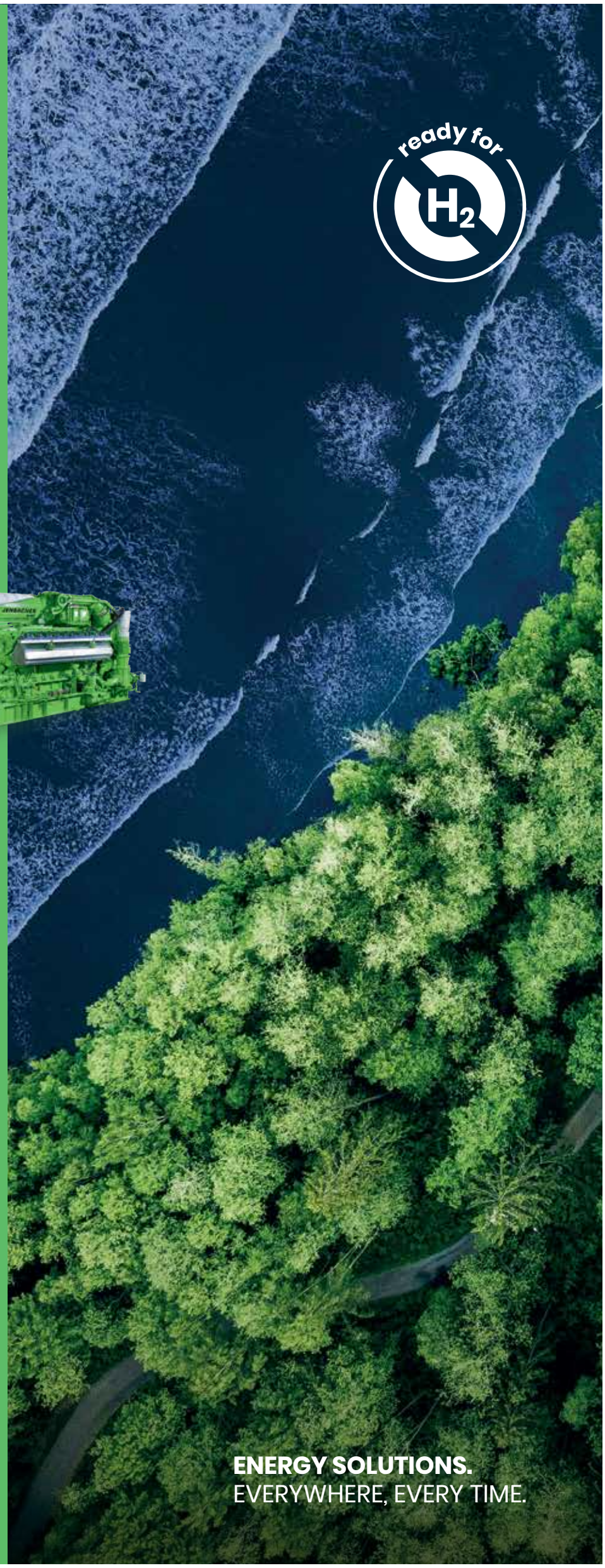


Nuclear's low carbon offering retains interest

■ California mulls closure delay ■ NRC issues licences for fuel loading, new designs

Janet Wood

California Governor Gavin Newsom has proposed allowing Diablo Canyon, the state's last nuclear power plant, to remain in operation for 5-10 years beyond its 2025 planned shutdown. The proposal is expected to face concerns about seismic faults in the area and the requirement for seawater cooling.

The proposal came as part of a package of legislation that included aggressive action against climate change and Newson argued that Diablo Canyon, which supplies 5-10 per cent of California's electricity, would support that goal and help maintain supplies over an expected tight period this year. He said: "We are behind where we need to be in bringing our clean resources online." The plan also includes much-increased offshore wind targets.

The plant's two units are currently set to be shut down in 2024 and 2025. The new plan would see the state provide the plant's operator with a $1.4-billion loan to remain up and running.

Elsewhere, new nuclear units have made progress. Westinghouse Electric Company, Georgia Power, Southern Nuclear and other project partners recently celebrated authorisation from the US Nuclear Regulatory Commission (USNRC) that they could load fuel and begin operation at Vogtle 3 in Georgia.

The new nuclear unit is the first built under a new, simplified combined construction and operating licence. Now the operators will load fuel into the reactor, begin the startup sequence, and move towards commercial operation.

"This tremendous accomplishment is a result of the hard work and dedication from thousands of team mates across Southern, Westinghouse, Bechtel, and our local suppliers and vendors," said Patrick Fragman, Westinghouse President and Chief Executive Officer.

Smaller reactors are also in the pipeline. The USNRC has certified NuScale's small modular reactor design for use in the USA.

The design uses passive processes such as convection and gravity in its operating systems and safety features. Up to twelve 50 MW modules are submerged in a safety-related pool built below ground level. "NRC certification means the design meets the agency's applicable safety requirements," the NRC said.

Meanwhile TerraPower, a company working on small-scale nuclear reactor development backed by Bill Gates, has raised $750 million in investment, including from South Korea's second largest conglomerate, to pursue its plan to manufacture mini-reactors.

Offshore wind opens for business in Colombia

Colombia has launched its first offshore wind leasing round and is scheduled to award the first permits in the second half of 2023. Colombia's offshore wind potential is estimated at 50 GW.

The news was announced by the Ministry of Mining and Energy, led by Diego Mesa, just before Colombia's new President Gustavo Petro was sworn in, and follows a recent government resolution that establishes the rules, requirements and conditions for sea area tendering procedures.

Colombia's national maritime authority DIMAR has selected areas offshore of the Bolivar and Atlantico departments where promoters will be able to build wind farms rated at 200 MW or above, which must be commissioned within a decade of winning the permit. The bids will be for a 30-year concession with a possible 15-year extension.

Meanwhile, German state-owned development bank KfW has agreed a $200 million loan to support renewable energy in Colombia. It will help devise a roadmap to increase solar and wind power to 12 per cent of the country's energy mix from 0.2 per cent (hydropower has 66 per cent share).

KfW executive Christiane Laibach said that Germany supports Colombia in making its policy more environmentally friendly and creating the necessary conditions to steer private and public investments to green projects.

US DOE to offer targeted research funding to cut hydrogen costs

The US Department of Energy (DOE) has flagged up plans for "multiple financial assistance awards" in the form of cooperative agreements to accelerate the research, development, and demonstration of clean hydrogen technologies and grid resilience.

"Today's announcement marks an important milestone to advance critical technologies for clean hydrogen and to make our grid more resilient," said Kelly Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy. "These efforts will help lower the costs of clean hydrogen, increase grid resilience, catalyse industry investment for market uplift, and result in a cleaner environment for all Americans, especially historically disadvantaged communities."

The funding will support diverse work including solar-based hydrogen fuel production; materials-based hydrogen storage and transport systems; and development of high performance, durable, low-cost fuel cell components for medium- and heavy-duty vehicles. The projects will last 2-4 years. DOE will also fund a "grid resilience consortium" of universities in the US, Canada and Mexico to foster information sharing on best practice.

Overall, DOE says the funding will advance the Biden administration's 'Hydrogen Shot' goal to reduce the cost of clean hydrogen to $1 per 1 kilogramme in a decade.

Enel steps away from transmission business in Chile

Enel Chile has sold its transmission business in Chile. It recently agreed the deal with Sociedad Transmisora Metropolitana SpA (STM) and its controlling company Inversiones Grupo Saesa Ltda (itself owned by Ontario Teachers' Pension Plan and Alberta Investment Management Corporation).

The assets comprise 683 km of transmission lines and 57 substations (along with management of three others owned by third parties) in Santiago's metropolitan area.

STM committed to launch the takeover following approval from Chilean antitrust authority Fiscalia Nacional Economica. It will pay $1345 million and the transaction is expected to close by the end of the year.

Inversiones Grupo Saesa is the second largest electricity distributor in Chile in terms of geography. It has 950 000 customers and owns 63 476 km of distribution lines, 2280 km of transmission lines and 75 substations. It also owns 275 MW of wind, hydropower and diesel generation capacity.

Enel said the disposal was in line with its strategic plan to focus on core businesses. It distributes electricity to more than 75 million end users while Enel Green Power has more than 54 GW of wind, solar, geothermal, and hydroelectric power. It claims world leadership in demand response with capacity of around 6.6 GW managed globally Enel X Way is a new business line dedicated to electric mobility.

US steps up plans for offshore wind

■ Iberdrola takes on flagship project
■ Higher targets in state energy plans

Janet Wood

Iberdrola is to operate and maintain a flagship offshore wind farm in the USA. Avangrid, the company's US subsidiary in the country, has reached an agreement to take over the management of the assets and the operation and maintenance of the 800 MW Vineyard Wind 1 plant.

Iberdrola is already a 50/50 joint venture in the project between Avangrid and Copenhagen Infrastructure Partners (CIP).

The new wind farm is 25 times the size of the only existing US offshore wind farm, in Rhode Island. But a boom in offshore wind is set to follow the success of its onshore counterpart.

Recent figures from the US Department of Energy show that wind power remains one of the US's fastest growing energy sources, accounting for 32 per cent of US capacity growth in 2021. "These reports show US wind energy deployment and generating capacity are booming, delivering cheap, reliable, and clean energy to power even more American homes and businesses," said Secretary of Energy Jennifer M. Granholm. "The rapid technological and industrial advances in the domestic wind sector are creating new jobs for the clean energy workforce and assuring wind power's critical role in achieving President Biden's climate and decarbonisation goals."

Among the first states to push for offshore wind development was California and recently the state's Energy Commission adopted increased offshore wind targets. They were raised after Governor Gavin Newsom called for a target for 2045 to be set to at least 20 GW. The initial targets were 3 GW of offshore wind by 2030, 15 GW by 2045, and 20 GW by 2050.

Massachusetts has also been a promotor of the technology and its Governor Charlie Baker also recently set a new goal for offshore wind procurement. The new target is to contract 5.6 GW by end-June 2027. At present, the state has contracted for around 2.5 GW of capacity.

New York State also recently opened its third offshore wind solicitation, seeking to procure at least 2 GW of offshore wind energy. That procurement included investment of $500 million in offshore wind ports, manufacturing, and supply chain infrastructure and in a "meshed ready" offshore transmission network.

The Virginia State Corporation Commission also recently approved Dominion Energy's plan to build the 2.6 GW Coastal Virginia offshore wind project. It will have 176 Siemens Gamesa turbines. Turbine installation is planned to start in 2024, with full operation by the end of 2026.

Australia looks offshore, as government passes new climate legislation

■ Six offshore wind zones proposed ■ New climate legislation sets tougher emissions targets

Syed Ali

Australia's recently elected government is taking the next steps in creating a new renewable energy industry following its decision to pass the country's first climate change legislation in more than a decade.

In early August the Albanese government announced six proposed regions for offshore wind development. It also began consultation on one of the regions – an area in the Bass Strait off Gippsland.

The government has invited the public to comment on the notice for the proposed Gippsland zone, with submissions to be received by October 7, 2022 in order to be considered.

The other regions for offshore wind energy projects include: the Pacific Ocean region off the Hunter in New South Wales (NSW); the Pacific Ocean region off the Illawarra in NSW; the Southern Ocean region off Portland in Victoria; the Bass Strait region off Northern Tasmania; and the Indian Ocean region off Perth/Bunbury, WA.

The Department of Climate Change, Energy, the Environment and Water will facilitate the consultation process in the proposed regions.

Unlocking the offshore wind industry is seen as "an exciting new chapter for Australia". Climate Change and Energy Minister Chris Bowen has been fighting to unlock Australia's offshore wind capacity for years.

He said many other countries have been successfully harvesting offshore wind energy for years, and "now is the time for Australia to start the journey to firmly establish this reliable and significant form of renewable energy".

"We have some of the best wind resources in the world," said Bowen. "The world's climate emergency is Australia's regional jobs opportunity and offshore wind is just one example.

Australia's stance on tackling climate change has been a political touchpaper for some time but in early August the House of Representatives passed a new climate bill that is expected to become law. The main part of the previous bill – an emissions trading scheme, introduced by the Gillard government with the support of Greens and independents – was repealed by the Coalition under Tony Abbott in 2014.

The new bill sets two national greenhouse gas emissions targets: a 43 per cent cut below 2005 levels by 2030, and a reduction to "net zero" by 2050.

The bill emphasises that the 2030 target is a floor not a ceiling, which means it is the minimum cut that can happen but there is nothing to legally prevent deeper cuts. The legislation requires several government agencies to consider the targets – that is, factor in climate change – when making investment decisions.

The legislation strengthens the role of the Climate Change Authority, a decade-old agency responsible for giving policy advice. The authority was cut back and largely ignored under the previous Coalition but will now be expected to give annual advice on progress towards meeting Australia's climate targets and to advise later this parliamentary term on a new target for 2035.

The government will have to release the advice and publicly explain why if it does not follow it.

The climate change minister is required to give an annual statement to parliament on progress towards the targets. Bowen has likened it to the annual Closing the Gap statement.

The new legislation, however, does not include a mechanism or funding to cut emissions from electricity, industry, transport, agriculture or other parts of the economy.

There are still several details to be fleshed out and the bill still has to clear the Senate when parliament next sits in September, but this is now seen as a formality.

■ Copenhagen Energy has filed a proposal with the Federal Department of Water and the Environment for initial review of a 3 GW offshore wind farm off the coast of the state of Western Australia.

Japan accelerates nuclear to secure energy supply

Japan has announced plans to return to nuclear power in a move to halt soaring energy costs and secure power supply. Late last month Prime minister Fumio Kishida threw his support behind accelerating the restart of reactors which have been closed since the Fukushima Daiichi nuclear plant disaster in 2011, and signalled the construction of new plants.

"As a result of Russia's invasion of Ukraine, the global energy situation has drastically changed," Kishida said. "Whatever happens globally, we need to prepare every possible measure in advance to minimise the impact on people's lives," adding that the government would aim to come up with concrete plans for the nuclear sector by year-end.

The plan to research the construction of new nuclear reactors, which experts say could be safer than those using existing technologies, marks a U-turn in government policy since the Fukushima crisis.

Earlier in August, new Minister of Economy, Trade and Industry, Yasutoshi Nishimura, had said he had no intention or plan to allow power companies to build new nuclear power plants or replace existing ones. Nevertheless, Kishida had expressed hope that his new industry minister would find a way to secure stable energy supplies at reasonable prices.

Japan had already announced the restart of some nuclear plants after Tokyo came close to suffering a power blackout this year. With the acceleration, it will aim to bring back 17 out of a total 33 operable reactors by summer next year and also to extend the life of existing plants.

Oil majors target Asian clean energy opportunities

Asia is becoming the focus of oil and gas majors looking for clean energy opportunities.

Last month a unit of US oil supermajor Chevron Corporation said it plans to explore hydrogen, carbon capture and other more environmentally friendly energy operations in Central Asia with a local partner.

Chevron Munaigas and KazMunayGas (KMG) said they would evaluate the potential for carbon capture, utilisation, and storage as well as hydrogen production and methane management.

The news came as French energy giant TotalEnergies and Eneos received clearance to form a joint venture (JV) for developing 2 GW of business-to-business solar projects in Asia over the next five years.

The deal to create the TotalEnergies ENEOS Renewables Distributed Generation Asia JV was first announced in April this year.

TotalEnergies Renewables Distributed Generation Asia Head, Gavin Adda, said: "Together with our partner, we will mobilise our know-how and expertise for more projects in the coming months which puts us firmly on track to achieve the goal of 2 GW within the next five years."

TotalEnergies also said it plans to produce and commercialise green hydrogen across India and beyond with its purchase of a 25 per cent stake in Adani New Industries Ltd. (ANIL) from its parent, Adani Enterprises Ltd.

Cost of renewables rise but still gains on fossil fuelled power

China's worst heat wave since records began 60 years ago has caused drought in the parts of the country, forcing a switch from hydropower to coal in an effort to keep the lights on.

Extreme temperature, which has lasted more than two months, and a lack of rain have starved dams of water in Sichuan Province forcing authorities there and in the neighbouring municipality of Chongqing to ask companies to temporarily shut factories.

In an effort to secure electricity supplies, Vice-Premier, Han Zheng said Beijing would provide support for the coal sector.

"[We need to] guarantee safe electricity supply for the people… and key sectors," he said during a visit to the State Grid Corporation of China. The government will "enhance policy support [and] take multiple measures to help coal plants ease actual difficulties".

David Fishman, an analyst who covers Chinese energy at The Lantau Group, told the *Financial Times* that the province would inevitably turn to coal, which has become more expensive due to high demand. Government support could include a price cap, he added.

"[Provinces where] coal capacity [is] deployed to support hydropower in the dry season will be looking to maximise usage of their coal capacity as hydro production drops," said Fishman. "Under these conditions, there's no choice but to run the coal plants at maximum capacity."

Although necessary, the move will slow China's effort to combat climate change. Nevertheless, the country's clean energy sector will continue to see expansion this year, according to experts. The clean energy sector will continue fast expansion in the second half, said Su Xinyi, an analyst with China Electric Power Planning & Engineering Institute.

China's installed capacity of wind and solar PV added 12.94 GW and 30.88 GW, accounting for 18.7 per cent and 44.7 per cent of total new capacity, respectively, in the first half of 2022, according to data from the National Energy Administration.

China's newly installed capacity of wind and solar PV for the entire year is expected to exceed 100 GW, while the consumption of power produced by the two energy sources is estimated to reach over 12.2 per cent of total power consumption, Su said.

Malaysia speeds up shift to clean energy

The Malaysian government will stop building coal power plants starting in 2040, and shift its focus toward clean and renewable energy, according to Mustapa Mohamed, the minister in charge of economy in the Prime Minister's department.

Speaking at a question and answer session of the Malaysian Parliament's second meeting, Mustapa said the ongoing global energy crisis will accelerate the transition to cleaner energy, adding that Malaysia will improve its renewable energy capacity to fulfill the set targets.

A number of renewable energy sources identified for development include hydroelectricity, solar energy, biogas and biomass, he said, noting that battery energy storage technology will also be introduced to ensure quality and guaranteed power supply.

The government will also expand the use of hydrogen, and develop technology related to carbon capture and storage, he went on.

According to Mustapa, the Economic Planning Unit is finalising a national energy policy, which is in line with Malaysia's commitment to Sustainable Development Goal 7 (SDG7) of the UN to ensure access to affordable, reliable, sustainable and modern energy for all. The policy is expected to be released this year.

State-owned utility Tenaga Nasional Bhd (TNB) via its New Energy Division (NED) is focused on exploring new markets to grow its renewable energy (RE) portfolio in Southeast Asia, as well as Europe.

TNB President and CEO Datuk Baharin Din said its NED aims to increase participation in solar, offshore and onshore wind to potentially capture 14 GW of RE capacity by 2050.

TNB Renewables Sdn Bhd will focus on Southeast Asia – exploring new markets that include Thailand, the Philippines, Vietnam, Taiwan, South Korea and Australia.

In a separate development TNB also said it plans to begin the process next year for a potential listing of its power generation business. In what would be the country's largest initial public offering (IPO) in a decade, TNB Power Generation Sdn Bhd, known as TNB Genco, could be valued at about $4 billion.

Sources close to the matter told *Reuters* Proceeds from the offering will be used to grow TNB Genco's renewable energy portfolio.

The clean energy market is estimated to be worth MYR65-80 billion ($14.54-17.9 billion) in Malaysia by 2050, and Tenaga aims to have TNB Genco take MYR40 billion of it.

France loses top spot in European power export league

■ Nuclear outages cut exports ■ Norway exports cut by low water levels

Janet Wood

France has lost its position at the top of the list of power exporting countries in Europe. Sweden overtook France as the biggest net exporter during the first half of this year. The new figures came from an EnAppSys report on flows in Europe during the first six months of 2022. It found that Sweden's total net exports amounted to 16 TWh.

Usually, France exports more power than it imports but structural problems with its nuclear fleet meant that it had to source significant amounts of power from other countries in the first half of 2022. Exports from France were half those in the previous half-year.

The change benefitted German generators. Germany was the second largest net exporter across the period (15.4 TWh). This doubled the previous 2021 half-year levels, with generation in Germany responding to the demand for imports from France. Great Britain also saw higher exports to France, becoming a net exporter for the first time in the second quarter.

Jean-Paul Harreman, Director at EnAppSys BV, said: "France's nuclear issues have resulted in an exceptional net-import position for the French market. This has been exacerbated by high gas prices, which has made it less financially attractive for France to export the usual amounts of gas into Europe. This in turn has pushed gas assets out of merit across Europe."

There were also changes in power flows in the north of the continent. Most of Sweden's exports flowed to Finland (7 TWh) and Denmark (4 TWh). But low water levels in Norway saw that country reduce export flows.

Harreman said: "Norway also saw significant changes in its interconnector flows during the first half of this year. Historically a net exporter due to its high levels of renewable hydro generation, Norway has suffered a prolonged drought which has reduced water reservoir levels and thereby limited its renewable generation."

Bulgaria was the third largest exporter (6.6 TWh), up slightly from the previous half-year.

Italy remained the biggest net importer during the period, sourcing 22 TWh from outside of the country, of which 9.6 TWh came from Switzerland and 6.7 TWh from France.

Great Britain also saw a sharp increase in gas exports to the EU. GB has little gas storage of its own but it has several liquified natural gas (LNG) terminals while the EU has limited regasification terminals for LNG. Cargoes of LNG arriving at British ports are being exported to refill storage facilities on the continent.

Work starts on new phase of East Anglia wind array

Work has begun on the East Anglia Three offshore wind farm, which together with East Anglia One and North and East Anglia Two, will provide total installed capacity of 3 GW and require €7.7 billion of investment.

Owner Iberdrola said East Anglia Three, which itself has capacity of 1.4 GW, will start operating in 2025. It will have more than 100 turbines, four offshore substations and four export cables, in an area of 305 km^2.

It comes as the company announced plans for a green hydrogen plant in the port of Felixstowe that is expected to use its East Anglian offshore wind farms to power electrolysis at the onshore site. Due to open in 2026, the first phase will be able to produce 14 kt of hydrogen per year.

Barry Carruthers, Hydrogen Director at ScottishPower, said: "This strategically important project could potentially create a clean fuels hub that could unlock nationally significant decarbonisation for the region, as well as playing a role in international markets. It's perfectly located not far from our existing and future offshore windfarms in the East Anglia region, and demonstrates how renewable electricity and green hydrogen can now start to help to decarbonise road, rail, shipping and industry."

Wind ventures for Latvia and Greece

Latvia and Greece have entered parts of the wind industry for the first time.

Latvia's state-owned power and energy generation company and forest resource management company has launched a joint project to build an 800 MW onshore wind farm. Latvenergo already manages hydroelectric and thermal power plants and it has joined with Latvian State Forests to form Latvian Wind Farms. Latvian Prime Minister Krisjanis Karins said planned €1 billion wind farm investment would be one of the largest investments in the country's history.

"This is a medium-term solution that will allow us to be completely independent in terms of energy supply and we will thus have to use less fossil resources," he said. Karins said that the plans for the wind farm were conceived before the Russian invasion of Ukraine in February, but that the war endowed them with a special urgency and they should allow the country to avoid imports from Russia.

Economy Minister Ilze Indriksone said that 800 MW of wind capacity could meet a third of the country's total energy production and may allow for export.

Meanwhile, the Greek Parliament recently made the country's first legislative move on offshore wind energy, passing a bill to set out regulations on the permitting of offshore wind projects and their development and operation.

Nuclear mooted to meet short and long term needs

■ Germany softens towards shutdown delay
■ Poland and UK want new units

Janet Wood

Uncertainty remains over Germany's remaining nuclear power plants after recent comments from the government suggested they might be held open over the winter to help alleviate the effects of high power prices. The ruling coalition of the Social Democrats, liberal FDP and anti-nuclear Greens had committed to shut them down by the end of this year. But recently the FDP has joined calls by the opposition Christian Democrats to keep the plants running. Chancellor Olaf Scholz was equivocal, saying the decision "could make sense".

The three operators, E.On, RWE and EnBW, said they had not procured fuel to extend the life of the Isar 2, Emsland and Neckarwestheim plants beyond the end of the year, when they are legally mandated to close.

"Based on the existing legal situation, we assume that our nuclear power plant will still have to be shut down at the end of this year," said EnBW's Finance Chief Thomas Kusterer.

Markus Krebber, Chief Executive of Essen-based RWE, said a political choice had to be made before any extension plans could be put in place, "and after the decision, we will move in the direction that the politicians want".

The decision may hinge on the result of a 'stress test' of the German electricity system being carried out for the government.

Germany's indecision is in contrast to neighbouring Poland's positive approach to nuclear new-build. Recently small modular reactor (SMR) company Last Energy announced a $1 billion agreement with the Legnica Special Economic Zone (LSSE) to develop 10 SMRs in the LSSE to fuel booming industrial activity. The 10 SMRs will deliver 200 MW of capacity to the region. Damian Jamroz, General Manager of Last Energy Polska, said: "We're glad that the Legnica Special Economic Zone has expressed its interest in locating one of the planned investments in their area, as well as the intention to sign a long-term contract for the energy produced. Now, we will begin the process of identifying potential locations."

The UK, meanwhile, has seen the start of a nuclear handover, as the Hinkley Point B plant closed after four decades. The closure came as plans for a new plant, Sizewell C, was awarded development consent and it was rumoured that the government, which already has an option to purchase a stake in the project, would make a further financial commitment.

UK urged to speed up hydrogen infrastructure plans

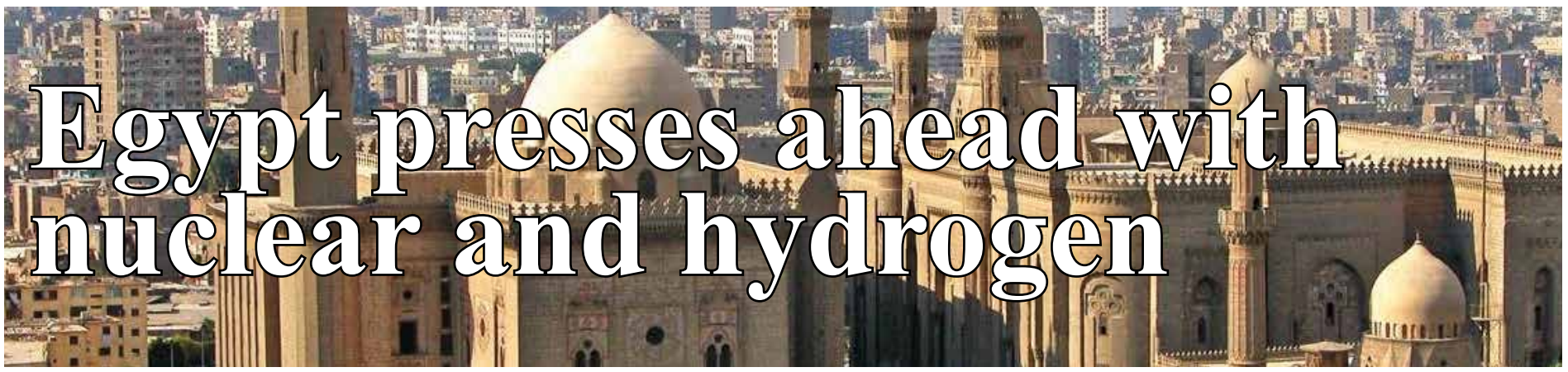
The UK government has been urged to accelerate its plan for hydrogen storage business models, soon after it published a Hydrogen Sector Development Action Plan.

The government has set a target for the models of 2025. But North West Hydrogen Alliance (NWHA) says this is an insufficiently ambitious target and is calling for it to be brought forward to at least 2023. It wants a hydrogen transport network to be developed in tandem.

Professor Joe Howe, Chair of the NWHA and Executive Director, Thornton Research Institute at the University of Chester, said: "Storage is vital to unlocking the full potential of hydrogen and is essential for UK energy security."

The call comes in response to a 'fast track' approach to major hydrogen developments in the UK. Six projects in the HyNet Northwest cluster have received the go-ahead from government in Phase-1 of a cluster sequencing process, including producing 1 GW of low carbon hydrogen. Also part of the cluster is a plan by INEOS to store hydrogen in Cheshire salt caverns.

Hydrogen is also expected to come from offshore. Source Energie has unveiled further plans for floating wind in the Celtic Sea that would produce green hydrogen offshore and transport it to shore. Following the company's 300 MW Dylan project it has now announced plans for a 1 GW offshore wind farm named Myrddin.



Egypt presses ahead with nuclear and hydrogen

■ El Daaba nuclear power plant to come online by 2029 ■ MoU signed for hydrogen production plant

Nadia Weekes

The start of construction in July at unit 1 of the El Dabaa nuclear power plant has been hailed as "a very important milestone in Egypt's path to meeting its energy needs" by Sama Bilbao y León, Director General of the World Nuclear Association.

When complete, the four-unit plant will have a capacity of 4800 MWe and produce enough electricity to meet 20 per cent of Egypt's current demand. The plant will support thousands of jobs during construction and for its 60-year operation.

Plant owner Rosatom, the Russian state nuclear corporation, said it expects to start building the second unit of the power plant in November. The agreement between Russia and Egypt to build a nuclear power plant dates back to November 2015. Construction of all four units is due to be completed by 2029.

Meanwhile, Indian renewables company ReNew Power is planning to build a facility in Egypt's Suez Canal Economic Zone for the annual production of up to 220 000 tonnes of green hydrogen.

A Memorandum of Understanding (MoU) was signed in August between ReNew Power, the General Authority for the Suez Canal Economic Zone (SCZONE), Egypt's Sovereign Fund, the Egyptian Electricity Transmission Company and the Authority for the Development and Use of Renewable Energy.

Under the terms of the MoU, ReNew will start a preliminary feasibility study to establish a production site with investments totalling $8 billion.

The project is to be implemented in several phases, starting with a 150 MW pilot electrolysis plant powered by 570 MW of renewable energy and capable of producing 20 000 tonnes of green hydrogen a year. In the next phase, ReNew will add 1.5 GW of electrolysis capacity powered by 5.68 GW of green energy.

The electricity generated at the plant will be delivered through the national power grid, said the Minister for Electricity and Renewable Energy Mohamed Shaker El-Markabi.

Ambitious interconnection projects are also making progress. Majority state-owned Saudi Electricity has obtained $568 million in financing over 14 years to fund a Saudi-Egypt electricity interconnection project first mooted in 2012.

The interconnector is meant to be the main axis in new infrastructure allowing for electricity trade between Arab countries.

In October 2021, the two countries signed contracts for a $1.8 billion electricity interconnection project capable of exchanging 3000 MW of electricity.

Standard Chartered Bank and Sumitomo Mitsui Banking secured the loan, while the Swedish Export Credit Agency (EKN) will act as guarantor.

The Egyptian Ministry of Electricity and Renewable Energy is also considering cooperation with Slovenia in the fields of electricity, new energy and green hydrogen.

At a meeting in August, Shaker El-Markabi and the Ambassador of Slovenia to Cairo, Mateja Prevolšek, discussed ways to strengthen cooperation between the two countries, including greater private sector participation in new renewable energy projects.

Egypt is working on a national strategy to boost the contribution of renewable energy to the energy mix to over 42 per cent by 2035.

Uganda looks to Russia for nuclear help

Uganda is seeking Russian assistance to develop East Africa's first nuclear power plant, President Yoweri Museveni said in talks with Russian Foreign Minister Sergei Lavrov.

Uganda has rich uranium reserves, essential for nuclear power generation, and unveiled plans in 2017 to build a 2 GW nuclear facility by 2032.

The country predominantly relies on hydropower at present but has plans to boost its electricity generation 12-fold to 17 GW in the medium term, according to the Electricity Regulatory Authority.

Meanwhile, Uganda's plans to bundle and nationalise the three agencies in its electricity sub-sector – Uganda Electricity Generation Company (UEGCL), Uganda Electricity Transmission Company (UETCL) and Uganda Electricity Distribution Company (UEDCL) – have been called into question by the World Bank.

The unbundling of generation, transmission and distribution in the late 1990s has attracted private sector participation and boosted capacity, increasing Uganda's access rate from 9 per cent in 2005 to 41.3 per cent in 2019.

The World Bank accuses the government of "dilly-dallying on the future of these concessions" as it explores options to rebundle the utilities and nationalise distribution when the current concession expires in March 2025.

"Uganda has had previous experience with a monopoly structure that produced very poor outcomes," the report warns. "A reversal to public management carries a potentially significant risk of derailing progress made in efficiency… access and affordability efforts."

Solar PV to power desalination plant in Oman

TotalEnergies and Veolia have signed an agreement to start the construction of the largest solar PV facility powering a desalination plant in the city of Sur, Oman.

The power plant will be located on the site of the Sharqiyah Desalination plant, which supplies drinking water to more than 600 000 people.

This 17 MW solar power project, to be equipped with more than 32 000 high-efficiency solar panels over an area of 130 000 m^2, will be the first of its kind to be installed in the region.

It will produce an estimated 30 GWh of electricity a year representing more than a third of the desalination plant's daily consumption.

Oman's National Energy Strategy is designed to convert 30 per cent of its electricity use to renewable sources by 2030.

South Africa lays out emergency energy plan

■ Eskom to get funding boost in improvement drive
■ Streamlined procedures to support renewables expansion

Nadia Weekes

President Cyril Ramaphosa has announced a raft of sweeping measures to overcome the energy crisis that has plagued the country for years and culminated in a summer of brutal power cuts.

After a decade of unstable power supplies, "South Africans are justifiably frustrated, and they are also angry," Ramaphosa said. "The shortage of electricity is a huge constraint on economic growth and job creation," he added.

At the top of the to-do list is improving the performance of state-owned power company Eskom, as well as opening up electricity generation to private companies.

Eskom will see its maintenance budget increase to fix its ageing fleet of power stations. Eskom will also be sourcing power from neighbouring Botswana and Zambia through the Southern Africa Power Pool.

The President has pledged to remove bureaucratic hurdles for renewable energy projects and to offer incentives to businesses and individuals to install and sell surplus power to the national grid, which will continue to be owned by the state.

While the plan is still light on details and timelines, analysts think it should boost solar PV deployment by reducing the time and cost involved in obtaining permits to build.

South Africa has a large pipeline of renewable energy projects ready to be developed, but approval constraints are slowing down their progress.

"If we can get a lot of the red tape out of the way, and get the registration process for new projects streamlined or automated, we'll see a lot of capacity coming online quite quickly," said Wikus Kruger, research lead and lecturer at the University of Cape Town's Graduate School of Business. He added that municipalities' control over their own zoning bylaws would also have to be addressed if solar projects are to be fast-tracked.

Transmission remains a challenge, however. It is estimated that the process of acquiring land to locate new transmission lines takes about seven years at present.

Ramaphosa has not said whether he plans to confiscate land for the purpose of boosting transmission capacity. Northern and Western Cape provinces especially have several solar projects on track but cannot get them onto the grid because of inadequate transmission capacity.

South Africa plans to double its procurement of renewable energy this year to more than 5 GW. Removing limits for generation licences will ease the process for mines and other businesses to set up their own projects, such as solar farms, and sell the excess power to Eskom.

The licence threshold was raised from 1 MW to 100 MW last year, a barometer of efforts to use private sector supplies as Eskom's decline accelerated. But even without the need for licensing, investors have warned that the paperwork for setting up generation is still too complex, leading to projects being delayed by years.

An imminent procurement round (Bid Window 6) is to double from 2.6 GW to 5.2 GW. A request for proposals for battery storage will be released in September, followed soon after by a request for gas fired facilities.

The government will also develop a plan by October to deal with Eskom's debt of nearly R400 billion ($24 billion), Ramaphosa said. "These actions are directed at fundamentally transforming the electricity sector and positioning it for future sustainability," he added.

A National Energy Crisis Committee chaired by the Presidency Director-General, Phindile Baleni, has been established and brings together all the departments and entities involved in the provision of electricity. The South African Police Service has also set up a special law enforcement team to help Eskom in confronting crime and corruption.

South Africa's installed capacity of electricity is 46 GW against peak demand of about 32 GW, but only 60 per cent of the installed capacity is available at any given time due to planned maintenance and unplanned outages. Eskom already imports electricity from Mozambique to cover the 6 GW shortfall.

Turbine manufacturers continue to face strong headwinds

- Vestas reports 2H losses of near $900 million
- Siemens Gamesa moves to turnaround struggling business

Junior Isles

Europe's wind turbine manufacturers showed poor first half results as they continue to struggle with the effects of the pandemic and the war in Ukraine.

Danish company Vestas Wind Systems reported a net loss of €884 million ($890 million) in the first half of the year. The result is mainly explained by problems in the global supply chain, although this has been added to inflation, losses due to asset impairment and costs arising from the withdrawal of Vestas from the Russian market due to the conflict in Ukraine, which has led to a loss of €367 million.

"The first half of the year was marked by geopolitical uncertainty and supply chain problems that have driven up costs and caused an energy crisis," said Vestas CEO Henrik Andersen, who called for greater political support for renewables.

Last month, the company agreed to sell its converters and controls business to KK Wind Solutions (KK) in a move aimed at easing supply chain issues. The deal includes Vestas' three converters and control panels factories in Denmark, India, and China and associated staff functions. In total, around 600 Vestas employees are in line to become part of KK. As part of the agreement, KK will exclusively supply converters and control panels to Vestas from the three factories.

"Across our global supply chain footprint, we are increasingly collaborating with partners to scale efficiently and build on the foundations we have established," said Tommy Rahbek Nielsen, Executive Vice President and COO at Vestas.

"This includes focusing our own resources to where they are most efficient and moving parts of our business to be run by other industry leaders who can create more value and secure additional long-term jobs. I'm therefore very excited about the agreement with our partner KK Wind Solutions, which can help grow and mature the wind energy supply chain."

Meanwhile, its main rival Siemens Gamesa announced decisive steps under its Mistral strategy programme designed to accelerate the company's turnaround after ending a challenging third quarter marked by ongoing difficulties in the wind energy industry as well as internal challenges mainly impacting the onshore pipeline.

The company reported revenue of €2436 million (-10 per cent year-on-year) in the three months up to June 30, 2022. EBIT pre PPA and before integration and restructuring costs stood at -€343 million, equivalent to an EBIT margin of -14.1 per cent. Reported net income attributable to Siemens Gamesa equity holders amounted to -€446 million between April and June 2022.

The company said its performance continued to be negatively affected by volatile market dynamics – inflation of energy, raw material and logistics costs, non-availability of key wind turbine components, port congestion, and supply delays.

While German rival Nordex said that its business performance in the first six months of 2022 was "in line with expectations", it saw sales decrease to €2.1 billion as a result of fewer installations (H1 2021: €2.7 billion). Gross revenue fell by 4.5 per cent to €2.2 billion (H1 2021: €2.3 billion).

"With markets remaining challenging, our business performance in the second quarter was as expected. In this environment, we nevertheless succeeded in significantly strengthening our capital structure. We continue to see a strong order book and have a competitive product portfolio. We are therefore confident that we will benefit from the positive growth prospects of our industry in the mid-term," said José Luis Blanco, CEO of the Nordex Group.

The Group made a successful start to the third quarter of 2022 with ten new orders amounting to a total 102 MW in the German market.

EDF sues government after large losses

French state-owned power company EDF is suing its own government for €8.3 billion in compensation after it was forced to sell energy to consumers at a loss.

EDF, which is already 84 per cent owned by the government and is in the process of being fully nationalised, is forced to sell the electricity it produces to rival power plant operators to increase competition in order to counterbalance to its market monopoly position.

However, Emmanuel Macron's government forced EDF to sell more of its power to rivals at prices below the market rates as officials attempted to tackle the cost of living crisis and support households.

The initial government decree states that suppliers can purchase up to 25 per cent of EDF's annual nuclear output between July 2011 and December 2025 at a fixed, discounted price of about $47/MWh. However, in January this year, the government implemented a larger cap at one-fifth in order to reduce consumer energy bills for this year. Then, in March, the government issued additional decrees, further increasing the volume and reducing the price for EDF.

The losses cited by EDF stem from this time period.

In June, EDF reported earnings showing its largest ever half-year loss. EDF lost €5.3 billion in the first half of this year, compared to €4.2 billion in profit for the same period of 2021.

EDF's power stations account for 70-75 per cent of France's power consumption, and the government is keen on nationalising the giant in order to ensure energy supplies amid a looming crisis that began when Russia invaded Ukraine.

Russia-Ukraine fallout impacts German companies

The ongoing war in Ukraine is continuing to weigh heavy on German companies that had ties with Russia prior to its invasion of its neighbour.

German energy company Uniper narrowly avoided collapse in late July after it received a €15 billion ($15.2 billion) bailout from the German government.

As part of the deal, the German government will take a 30 per cent stake in Uniper. Fortum's stake in Uniper will be diluted to 56 per cent, down from around 80 per cent currently as a result.

Following the rescue, Uniper, Fortum and the German government will work on a long-term solution to reform the company's wholesale gas contract architecture, which has exposed the group to billions in losses.

Allegra Dawes, Analyst for Industrials, Materials & Energy at global primary research firm Third Bridge, commented: "The €15 billion German government's bailout package saved Uniper from the imminent danger of insolvency and prevented it from becoming the first casualty of the Russian gas squeeze. Even with the bailout, Uniper will struggle without continued government support given 50 per cent of Uniper's profit margin comes historically from Russian generated gas.

"On a positive note, Uniper should be more financially stable due to the cost-absorption mechanism and that it is now allowed to pass through costs to customers through the renegotiation of its current long-term contracts.

"The German government will use all its means to stop Uniper from touching its gas reserves to ensure energy security and prepare for the winter."

E.On also said it was feeling the impacts of Russia's war in Ukraine but announced that net debt was down significantly, declining by €1.3 billion to €37.4 billion.

CEO Leonhard Birnbaum said: "E.On is living up it to its responsibilities. We're helping Germany and our European markets respond to the extraordinary crisis in the short term and also working to establish long-term energy security by accelerating the energy transition. Our crisis management has enabled us to deliver solid half-year results. We again reaffirm our forecast for full-year 2022."

German equipment manufacturer Siemens Energy, meanwhile, has announced the start of withdrawing from Russian assets, which it plans to complete by this autumn.

"Siemens Energy started the restructuring of its business activities in Russia in the third quarter which burdened the result of GP [Gas and Power] by €0.2 billion, reported as strategic portfolio decisions under special items. These restructuring activities are expected to be concluded by end of this fiscal year without further significant financial impact," the statement said.

Iberdrola and bp to collaborate on EV charging infrastructure and green hydrogen

Iberdrola and bp today announced their intention to form a strategic collaboration aimed at helping to accelerate the energy transition. Together, the companies intend to collaborate to significantly expand fast EV public charging infrastructure to support the adoption of electric vehicles, as well as to develop large scale green hydrogen production hubs in Spain, Portugal and the UK.

The plan includes installing and operating an initial 5000 fast charge points by 2025, and up to a total of 11 000 by 2030, including bp and Iberdrola's existing and future fast charging hubs.

The companies also plan to form a joint venture for large-scale integrated green hydrogen production in Spain, Portugal and the UK as well as production of derivatives such as green ammonia, and methanol, that can be potentially exported into Northern Europe.

Chairman of Iberdrola, Ignacio Galán, commented: "With this agreement, we continue advancing in the decarbonisation and energy self-sufficiency through the electrification of two key sectors of our economy, transport and industry. The scale of this challenge requires alliances between companies such as Iberdrola and bp, which have the technology and knowledge necessary to help accelerate Europe's industrial development… through clean energy."

Bernard Looney, CEO, bp, said: "Creating the lower carbon energy solutions that our customers want and need requires the integration of different technologies, capabilities and forms of energy. We can deliver this faster and at scale when we work in partnership with others."

Rapid grid evolution is crucial to carbon neutrality

An enhanced, resilient, electricity network is the key to delivering the massive amounts of renewables planned around the world. Hitachi Energy's Niklas Persson discusses the key power grid technologies and project development strategies that are urgently needed to accelerate the transition to a carbon-neutral energy system.

Junior Isles

Since setting global ambitions for climate change through the Paris Agreement in 2015, many would argue that the speed and level of action needed to combat global warming has been insufficient. But in the last couple of years, there has been a real feeling that the pace of change is gathering momentum. The EU has been at the vanguard of accelerating that change with its European Green Deal, which encompasses the 'Fit for 55' proposals, as well as the more recent REPowerEU plan aimed at reducing dependence on Russian fossil fuels.

Much of those plans are underpinned by a massive rollout of wind – offshore wind in particular – and solar, as well as energy efficiency and green hydrogen. But the key facilitator will be the power grid and how it will evolve to enable the energy transition.

Niklas Persson is Managing Director of Hitachi Energy's Grid Integration business. Having worked in the sector for the best part of 25 years, he has no doubt that the grid is central to accelerating the energy transition.

"Until fairly recently, the pace of change has not been what we hoped for and expected. But now we see the industry is coming together and pushing the transition forward – even if political decisions are lagging in some areas such as a regulatory framework for a future offshore grid, for example." he said. "Certainly, in the last two or three years, independent of the Ukraine situation, there has been increased awareness and momentum. This was clear at COP26.

"As a technology leader, we are seeing much more demand from customers looking at how to manage the network through digitalisation, greater efficiency, more sustainable and even more innovative technologies and solutions. They have to manage a network that is much more complex in terms of both consumption and generation. On the generation side, new capacity is being added but without inertia when that capacity is wind or solar."

He noted that in the past, grids have been "very rigid and stable", existing as islands within each country, unconnected to neighbouring countries, or sometimes as regions within a country. With the influx of renewables, however, grid operators now have to mitigate load flows through enhanced grid performance, and in many areas start to use power electronics that provide more dynamic solutions for a more complex grid.

Just last month, Hitachi Energy secured the contract for SuedLink DC4 in Germany, a ±525 kV HVDC link that will transmit up to 2 GW of wind power from the north to the industrial south, or alternatively solar power from the south to the north when needed.

Persson says the industry is "coming together and pushing the transition" forward

Wilster HVDC converter station. SuedLink DC4 will transmit electricity between Wilster in the north and Bergrheinfeld in the south

At the same time, the EU has made great strides in expanding its interconnected electricity system. Persson cited examples such as the NordLink interconnector linking the power grids of Norway and Germany. Commissioned in 2020, it enables the integration and exchange of wind, solar and hydro power between the two countries. NordLink was not only the world's longest voltage source converter (VSC) cable connector at 623 km, but was also Europe's longest HVDC power grid interconnection, and the first interconnection to link the Norwegian and German power grids.

Hitachi Energy's delivery included the design, engineering, supply and commissioning of two 1400 MW ±525 kV converter stations, using Hitachi Energy's VSC technology, known as HVDC Light®. The project is significant since it is the world's first HVDC Light® bipole installation to perform at 525 kV and 1400 MW, nearly doubling the power transmission capacity compared with earlier systems, while improving overall reliability and availability in the grid.

Hitachi Energy has since used the same concept to connect the Nordic and British power markets. Commissioned in October last year, the 1400 MW capacity NSL (North Sea Link), 720 km interconnector, built for Statnett and National Grid, is the longest subsea link in the world. It is also the first interconnection between the UK and Norway.

The link will help evacuate power from the UK when, for instance, wind power generation is high there and electricity demand low, thereby conserving water in Norway's hydropower reservoirs. When demand is high in the UK and wind power generation is low, low-carbon energy can flow from Norway, helping to secure the UK's electricity supply. The link will also facilitate power trading and electricity price arbitrage between the countries.

"The EU has a clear vision that interconnection is the key to make use of the new energy system," noted Persson, adding that HVDC is moving from what used to be a technology for very specific applications to one that will be the basis of a future meshed DC grid.

"Our first HVDC technology, HVDC Classic, was seen as a very niche solution used for point-to-point bulk power transmission to load centres over very long distances, because it has lower losses and a much smaller footprint [than AC

transmission]. This made it suitable for transporting power over thousands of kilometres in countries like China, India and Brazil. We later developed HVDC Light® based on VSC [Voltage Sourced Converter] technology to transmit power underground and underwater, as well as over long distances. We now have more than 25 years of development of HVDC Light®, and stepwise development has seen the transmission levels go from 80 kV and about 50 MW, to 640 kV and 3 GW, with the proven capabilities for managing frequency fluctuations, voltage dips, and transients. But now there is a need for multi-purpose and multi-terminal connections."

He used Kriegers Flak Combined Grid Solution (KF CGS) as an example of what he describes as "a kind of first multi-purpose" connection that demonstrates how new HVDC hybrid solutions can optimise power grids and make new and larger applications of offshore wind possible to further support EU targets

Erstmyra converter station in Norway: the NordLink interconnector links the power grids of Norway and Germany

for achieving climate neutrality by 2050.

Commissioned in 2019, the HVDC system helps secure the energy supply in both countries and supports cross-border energy trading while reliably integrating the Baltic 1, Baltic 2 and Kriegers Flak offshore wind farms.

The innovative hybrid HVDC Light® system digital master controller manages the complex task of controlling the entire KF CGS. By adjusting power flows in real-time, the system integrates and supports the wind farms and the two asynchronous AC power grids in Denmark and Germany, ensuring sustainable and reliable energy to consumers.

The 410 MW/150 kV converter station is located in Bentwisch, northern Germany where it connects the Kriegers Flak offshore grid, part of the Danish electricity network, to the German network. The economic back-to-back set-up minimises the environmental footprint of the installation.

More recently, in 2020 Hitachi Energy won an order from Scottish and Southern Networks Transmission (SSEN) for the Shetland link, which is seen as significant for the industry. The link will allow SSEN to efficiently combine wind and hydro power to meet user needs while also increasing the reliability and capacity of the power grids in Scotland and on Shetland. According to Hitachi Energy, the 600 MW link completes the first multi-terminal HVDC system in Europe.

The Shetland interconnector will connect to the existing 320 kV/1200 MW Caithness-Moray Link to form a three-terminal HVDC network. Caithness-Moray is a subsea link connecting the electricity grid on either side of the Moray Firth in Northern Scotland. This link has two land-based 320 kV HVDC Light® converter stations, one rated 1200 MW at Blackhillock in Moray and another rated 800 MW at Spittal in Caithness.

Persson noted: "This is a significant step in showing you can connect several converters instead of just having point-to-point. This could be developed into a multi-purpose connector scheme, where the energy systems of one, two, three, or four countries are connected. This would form a ring and suddenly you have a DC grid."

From a technology aspect, Persson says there is no issue in implementing DC grids, noting that the key component – the HVDC breaker – has been type-tested. He says Hitachi Energy has also engineered a control function that can handle inputs from various OEM systems.

"This has all been proven as part of a European programme," he said. "It has not been proven at a large scale yet, so some project development is still needed. But we are very confident that technically, it is not a big issue."

The main challenge, says Persson, is the regulatory framework. "If, for example, you look at this cluster between the Netherlands and the UK, where there are three wind farms, if the wind is blowing who will get what energy and why? And at what price? And if all the wind farms are generating, will the price be zero because there is an over-capacity? The regulatory framework is not yet in place."

It is a challenge, however, that will no doubt be overcome as transmission system operators (TSOs) start to collaborate and set up pilot projects such as the energy island being built off the coast of Denmark, which is being designed to transmit wind power to various countries, as well as hydrogen produced by electrolysers powered by wind.

"Denmark will build it and then make the energy available to maybe Germany, Norway, the UK, etc., since they won't use all the energy themselves. This is how I see it. So we will go from radial interconnectors, to multi-purpose interconnectors, and then eventually it will be a grid," said Persson. "This type of scheme will harvest all the energy that is the vision for Europe's offshore wind sector. Many have learned that for this to happen, you need a DC grid structure."

While Persson believes this will happen, he acknowledges that it will take some time. "Permitting and financing, etc., has to be in place, but 10 years is a short time in this industry. Multi-terminal is already here and we are starting to see multi-purpose projects such as in Denmark but you are looking at about 10+ years before we really see the DC grid."

Other countries outside of Europe are also embracing HVDC technology to help integrate renewables. In December last year Hitachi Energy secured a contract for what it says is the world's most powerful 'power from shore' solution. Here, Hitachi Energy will supply the enabling technology – its HVDC Light® converter stations and MACH digital control platform – to connect two large offshore oil and gas production hubs to the mainland grid for the Abu Dhabi Oil Company (ADNOC). The project will reduce CO_2 emissions from ADNOC's production operations by up to 30 per cent by replacing gas turbines at the hubs with electricity generated onshore by emission-free solar and nuclear power.

The contract follows an earlier contract in October last year that will see Hitachi Energy lead a consortium that will deliver the first HVDC link between the Middle East and Africa. The link will allow Saudi Arabia and Egypt to exchange up to 3 GW of electricity – much of which is expected to be generated from renewable energy sources in the future.

More recently, in Mumbai, India, a contract was awarded to Hitachi Energy for what is called a "city centre in-feed application" where an HVDC Light® transmission system will help bring 1000 MW of power into the city.

"In mega cities like Mumbai, it's not easy to build new stations to get power into the city. With this project we are able to connect solar power from outside Mumbai, with a very small footprint inside the city. This is the first of its kind," said Persson.

The massive worldwide deployment of renewables, however, comes at a price in terms of grid stability, since wind and solar are intermittent and cause fluctuations in terms of voltage and frequency.

Kriegers Flak Combined Grid Solution in Denmark. The multi-purpose connection demonstrates how new HVDC hybrid solutions can optimise power grids

As the grid is forced to accommodate more distributed energy sources and loads such as electric vehicles (EVs), this also creates transients and fluctuations. According to Persson this means that the grid will increasingly need to be based on power electronics and digitalisation.

"In the future, you will not only see HVDC links and STATCOM devices here and there; there will be power electronics solutions in wind generation, with digitalisation for managing the load flows and stability, which vary according to how the wind is blowing or the sun is shining. This will be the grid of the future."

Power quality will also be an issue in AC grids since there is less short-circuit capability due to a lack of the system inertia that comes from conventional power plants.

Persson explained: "One of the concerns we have is that there is a lot of focus on wind generation, HVDC and meshed grids, which is good, but then you need to receive all of this energy and transmit it to the load centres. This means you also need to invest in the AC grid. And this is where many countries have been taken by surprise on the needed investments to get an efficient grid in place, in time."

He says, there is therefore a growing need for what is known as 'grid forming' capability, where the control function in a STATCOM is used to rapidly control swings in the grid. Like synchronous machine technologies, this enables the provision of grid services such as inertia and grid strength in the fastest timeframes.

An HVDC platform at the Dogger Bank wind farm. HVDC systems support cross-border energy trading while reliably integrating offshore wind farms. *(Photo courtesy of Aibel)*

In January this year, Hitachi Energy achieved the first-step target set out in its Sustainability 2030 plan

Though grid-forming control concepts are not new to the industry, they have received renewed attention with the proliferation of inverter-based resources such as wind and solar in recent years. While the industry has made tremendous progress in the space and many vendors are offering and have installed grid-forming inverters, there is a lot more work to be done around the development of the technology, applications, and the impact on operations and transmission planning.

"A network with a high degree of power electronics interfacing renewable generation will face problems with low inertia. This requires a new type of solution for stabilisation," said Persson. "We have SVC Light®, which is an enhanced STATCOM with built-in super-capacitors, that has active power capability for synthetic inertia, and fast frequency regulation to support the grid in terms of stability. This is the technology of the future and we are now offering this technology."

He also said there is a need to deploy more standard network solutions on the AC side (the onshore network) to upgrade old substations, etc. Accordingly, the company has introduced its Grid-eXpand™ range of modular and prefabricated grid connection solutions that make it faster, simpler and more efficient to expand power grid capacity.

Grid-eXpand™ comprises a comprehensive range of air-insulated and gas-insulated grid connections that cover the most frequently used grid voltages worldwide. Grid-eXpand™ solutions are engineered, assembled and factory-tested by Hitachi Energy before delivery, ready for speedy and easy energisation on-site while reducing site-based construction risks.

The modules are available in containers, on skids or trailers for permanent or mobile deployment, in kits for gas-insulated solutions, and with complete power collection and grid connection packages for offshore wind farms and solar parks. Site installation is up to 40 per cent faster, the footprint up to 60 per cent smaller and civil work up to 70 per cent lower in costs than for conventionally built grid connections, which require extensive construction work and equipment assembly on-site.

Crucially for many of its customers, Hitachi Energy says the solutions can be tailored to meet specific needs and grid code requirements.

"It's an important innovation," explained Persson. "In the traditional way, you would build and assemble the grid connection on-site. Our concept is modularised, containerised, pre-tested from a functionality perspective in a controlled environment and sent to the site, ready for energisation. This allows us to reduce both equipment size and commissioning time."

One recent example of the efficacy of Grid-eXpand™ is a 170 kV containerised gas-insulated (GIS) grid connection for a combined fish farm and 312 MW solar photovoltaic power plant in South East Asia. Owned by Sunny Rich Group, the site uses solar power and advanced technologies to farm fish sustainably. According to Hitachi Energy, compared to a conventional GIS grid connection, the Grid-eXpand™ solution has a 25 per cent smaller footprint, was delivered and energised 15 per cent faster, and reduced the cost of civil works by 50 per cent.

Such developments are essential in order for grid infrastructure to facilitate the energy transition. But technology will also have to be combined with a more coordinated approach to grid design and development, all underpinned by the right regulatory framework.

The UK is a good example of how the grid of the future could be designed and developed. In July the National Grid ESO published its Pathway to 2030 Holistic Network Design (HND) to accelerate the connection of 23 GW of wind to help deliver the government's ambition for 50 GW of connected offshore wind by 2030. The HND, which will call for £54 billion ($65 billion) investment, is seen as a first step towards more centralised, strategic network planning.

At the same time, regulation will have to keep up with technology, if the world is to realise the smart, resilient grids of the future that also allow consumers to play their part in the energy transition. Persson noted that Hitachi Energy has the digital technologies to provide smart grid solutions but stresses that there is still much to do for the industry and government as a whole.

He said: "You can have houses with solar panels, for example, where households can buy and sell energy, etc. I believe this will happen. But if a transmission system operator has to respond to an issue, it needs to know when and how energy is available. There would need to be a commercial agreement between the TSO or DSO [distribution system operator] and every household to ensure energy is available when it's needed. There is still a lot of work to be done from the regulatory and policy perspective for this to happen, so it will be quite a long time before houses are really participating in stabilising the grid."

Such commercial and regulatory issues, which include standardisation and grid compliance, calls for collaboration in the market, Persson says.

"There is ongoing collaboration between TSOs, DSOs, politicians, OEMs, etc., to understand how we can standardise and do this as a community," he said, adding that there will also need to be collaboration in how projects are executed, as the sector continues to inch closer to its vision.

"This market is very interesting and there is a huge demand. I really see movement from the TSOs, DSOs and the industry. Project developers including oil giants like BP, Equinor and Shell are investing, so money is available," said Persson. "But you still have to look at the industry's capacity to respond to this demand."

He believes the need to meet this massive demand requires a shift away from the traditional turnkey EPC approach, where OEMs also take on the civil work for a project.

"At Hitachi Energy we believe each partner should do what it is good at. So we work with our customers to define who should deliver what in order to speed up the whole process. We deliver what is in our DNA, i.e. the technology – manufacturing, system engineering and project execution. For project execution, we form partnerships and get customers to be more involved in defining the scope."

Hitachi Energy is keen to lead the transition by example. "Industry and technology providers really want to support the momentum. This manifests itself in our Sustainability 2030 strategic plan, where we have committed to achieving carbon neutrality in our own operations and only using fossil-free electricity," said Persson.

In January this year, the company announced that it had achieved the first-step target set out in its Sustainability 2030 plan – the use of 100 per cent fossil-free electricity in its own operations.

Work in helping its customers reduce carbon emissions is also progressing well. Hitachi Energy has launched the first SF_6-free high-voltage products, under the name EconiQ™, which will make a "significant contribution" to its customers' sustainability journey.

Persson summarised: "With projects all over the world – in Europe, the Middle East, Asia and the US, I really feel there is momentum in the market to make this [energy transition] happen.

"Our vision 2030 is to significantly contribute to the green energy transition. And we will be doing that by being more sustainable ourselves, providing technology solutions and continuing to invest in innovation and people, as well as innovating together with customers and partners. Given our global footprint, we believe we are well positioned to do this."

The Grid-eXpand™ range of modular and prefabricated grid connection solutions will make it faster, simpler and more efficient to expand renewables power grid capacity

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Americas

BayWa r.e. wins 30 MW EPC contract in Hawaii

BayWa r.e. Power Solutions, an affiliate of BayWa r.e, has won an engineering, procurement and construction (EPC) contract to develop a 30 MW solar PV plant with a 30 MW/120 MWh battery energy storage system in Hawaii, USA.

The facility will be called Waikoloa and will be owned and operated by AES. The facility has a 25-year PPA with the Hawaiian Electric Company.

It will feature bifacial PV modules mounted on single-axis trackers and lithium-ion batteries. Project completion is scheduled for Q4 2022.

Paraguay substation contract for Atome

A front-end engineering and design (FEED) contract for the substation for the 60 MW Villeta project in Paraguay has been awarded to Atome. The FEED is for the civil and electromechanical works for the adaptation of the Ande substation.

The FEED contract was signed with Concret-Mix, a Paraguay company. The contract is scheduled to be complete by the end of September 2022, after which Atome will move to procurement and nomination of the EPC contractor.

Olivier Mussat, CEO of Atome, said: "The entry into the FEED contract is the next step in what will culminate in an aggregate of 400 MW of green hydrogen and ammonia production in Paraguay, the first phase of which at Villeta is expected to commence production by Q1 2025."

Battery project order for Mitsubishi Power

San Diego Gas & Electric Company (SDG&E) has awarded a contract for 39 MW/180 MWh of battery energy storage system (BESS) projects in San Diego, California, USA to Mitsubishi Power.

SDG&E said that the order includes Mitsubishi Power's Emerald storage solution, to be deployed at four microgrid facilities due to begin operations in the middle of 2023. The selected solution for the sites includes an integrated plant controller with a real-time monitoring and supervisory control platform.

The Elliot, Clairemont, Paradise, and Boulevard projects were approved by the California Public Utilities Commission in June. Once commissioned, the BESS will provide dispatchable power during periods of high demand.

The four battery facilities will be connected to existing infrastructure in the San Diego region. They will be serviced by Mitsubishi Power under a 10-year contract.

Waste-to-hydrogen plant powered by Jenbacher

Raven SR has announced plans to use Innio's Jenbacher 60 Hz reciprocating engines with a "Ready for H_2" option to produce renewable energy. The energy system will power and heat Raven SR's S- Series hydrogen production facility at a landfill in Richmond, California.

Landfill gas (LFG) will be the primary fuel to provide power for the non-combustion process that converts waste to hydrogen. The hydrogen product will be resold to power fuel cells. The Raven SR process will also provide a residual fuel containing residual green hydrogen from the concentration process to supplement the LFG to fuel the Jenbacher Ready-for-H_2 engines to generate renewable power in a continuous loop.

Raven SR plans to bring its S-Series online in the first quarter of 2023 at the Republic Services West Contra Costa Sanitary Landfill in Richmond, California. This project will initially process up to 99.9 tons of organic waste per day and produce up to 2000 tonnes tons per year of hydrogen.

Asia-Pacific

Azure Power orders 96 wind turbines for India

Azure Power has awarded a contract to Siemens Gamesa to supply 96 SG 3.6-145 wind turbines for a 346 MW project in the state of Karnataka, India. This is Siemens Gamesa's first contract award from Azure Power in India.

Navin Dewaji, India CEO of Siemens Gamesa, said: "We are delighted to begin this new partnership with Azure Power on this large-scale project. The contract provides new impetus to the wind industry at a key juncture in the country's energy transition. We are confident of delivering the right renewable energy solutions to the market."

ACEN awards Capa wind farm contract

Siemens Gamesa was won a contract from ACEN to supply 14 units of the SG 5.0-145 wind turbines in the Philippines following the country's first round of renewable energy auctions.

The awarded 70 MW Capa wind farm, located in Caparispisan, Ilocos Norte province, is expected to be completed and start operations by the first quarter of 2024. Siemens Gamesa also secured a contract to provide five years of operation and maintenance services for the wind project.

Mart Huismans, Sales head of Siemens Gamesa in Southeast Asia, said: "We're pleased to strengthen the partnership with ACEN to develop more wind power in the Philippines, which accounts for just 1 per cent of electricity production, while the target is to achieve 9 per cent by 2030 and 13 per cent by 2035."

SNC Lavalin to extend Candu life at Qinshan

Candu Energy, a member of the SNC-Lavalin Group, is engaged in pre-project design and engineering work with the Third Qinshan Nuclear Power Company Limited (TQNPC), operator of the Qinshan Phase III Nuclear Generating Station located near Shanghai, China.

The project will be carried out over two phases and will facilitate a 30-year life extension to the two Candu reactors at the site.

The two reactors are approaching the end of their initial 30-year design life. TQNPC is undertaking a programme to refurbish the reactors and associated fuel channels.

Phase one of SNC-Lavalin's mandate has involved producing engineering input planning, a retube preparation plan, auxiliary services design, and a scope summary for phase two of the work.

Phase two involves SNC-Lavalin producing technical specifications and renderings for key reactor components and services to assist TQNPC in proceeding with procurement activities associated with reactor refurbishment. Phase two work will begin this year and be completed in 2024.

Japanese offshore wind order for Siemens Gamesa

Green Power Investment was awarded a contract for the 112 MW Ishikari offshore wind power project to Siemens Gamesa. This is Siemens Gamesa's first firm offshore order in Japan.

The order includes 14 SG 8.0-167 DD offshore wind turbines, each with an 8 MW capacity and featuring a 167 m rotor. The order also includes a 15-year full-scope service agreement. Installation is scheduled to begin in July 2023.

Europe

Power upgrade for Wylfa nuclear plant shutdown

UK Power Networks Services has been commissioned to install an electrical distribution system at the Wylfa nuclear site in Anglesey, North Wales, to enable the continued decommissioning works of the former power station. It was awarded the 16-month project by Magnox Ltd, a subsidiary of the Nuclear Decommissioning Authority (NDA).

When the new system is installed, Magnox can deactivate most of the existing electrical infrastructure at the site and begin decommissioning work on the main turbine hall. The system will also be flexible, allowing Magnox to reconfigure its network as it continues to downscale the plant.

Throughout the project, UK Power Networks Services will provide the design, manufacture, supply, build, testing, delivery, installation, and commissioning of the new system, as well as its supporting civil infrastructure. Work is scheduled to start in summer 2022 and finish in late 2023.

Hitachi Energy to supply German interconnection

In early August, Hitachi Energy won an order from TenneT and Transnet-BW, two of Germany's four transmission system operators, to supply a transmission solution for the SuedLink DC4 HVDC interconnection between north and south Germany.

SuedLink DC4 will be able to transfer up to 2000 MW. The link will transmit for 550 km underground at ±525 kV, transmitting either wind power from the north southwards or solar power from the south northwards.

Hitachi Energy will supply an HVDC Light converter station at each end of SuedLink DC4. The contract includes three cable section stations to speed up fault detection in the link.

Deutsche Windtechnik subsea inspection

Deutsche Windtechnik has signed several contracts for underwater inspections at offshore wind farms in the North Sea and Baltic Sea.

As part of the cluster campaign approach, more than 300 annual inspection reports will be generated in the next two years for wind farm owners. Deutsche Windtechnik will conduct back-to-back inspections in Trianel Windpark Borkum I, Sandbank, DanTysk and Butendiek wind farms this year.

Inspections will include a range of structures such as jacket and monopile foundations of wind turbines, substations and meteorological masts. The work also includes cable inspections that cover everything from the entry point on the tower to the point of burial.

Westinghouse to decommission reactors

Norsk Nukleær Dekommisjonering (NND) awarded Westinghouse Electric Company an engineering contract to plan the decommissioning of Norway's two nuclear research reactors in Halden and Kjeller. The three-year agreement is valued at $100 million.

Sam Shakir, President of Westinghouse Environmental Services said: "We are pleased to bring our global expertise and technical innovation in decommissioning and waste management to this important work for NND to remove and dispose of the Halden and Kjeller research reactors. We will reimagine the sites as safe, thriving, and sustainable and ensure the decommissioning projects are completed efficiently and in a manner that returns them to green fields."

International

Bahrain launches 72 MW solar plant tender

Bahrain has announced a tendering process for a 20-year contract for bidders to build, own, operate, and maintain grid-tied solar PV panels with a minimum capacity of 72 MW in multiple locations in Sakhir in the south of the country. The tender was launched by Bahrain's Ministry of Electricity and Water Affairs.

To qualify, bidders need to have successfully commissioned at least 10 grid-tied solar PV projects of a combined capacity of at least 40 MW in the last three years.

Yasser bin Ebrahim Humaidan, Bahrain's Minister of Electricity and Water Affairs said: "The launch of this tender comes as part of the Kingdom's wider vision to adopt a circular carbon economy, with the aim to bring carbon emissions in Bahrain to net zero by 2060 in line with its national commitments to protect the environment and combat climate change."

Wärtsilä upgrades Senegal power plant

Wärtsilä will supply an 18 MW extension and upgrade the electrical and automation system of the existing power plant at the Sabodala-Massawa gold mine complex in Senegal. The mine is owned by Endeavour Mining.

The project will allow the complete integration of all the site's generating capacity and enable expansion of the mine's production schedules.

"Not being connected to the grid means that the captive plant has to be capable of providing a reliable supply of electricity at all times, since no power equals no production," said Marc Thiriet, Energy Business Director, Africa West, Wärtsilä.

The project will be delivered under an EPC contract.Wärtsilä will install three Wärtsilä 32 engines which are 20 per cent more fuel efficient than the plant's existing engines. The project is scheduled to be commissioned before the end of 2023.

Hyundai to expand Shoaibah PV substation

Saudi Electricity Company (SEC) has signed a $100 million contract with Hyundai Engineering & Construction to expand the Shoaibah PV substation in Saudi Arabia.

The scope of work includes expanding the existing 380 kV substation to interconnect the future Renewal Energy solar plant in the Shoaibah area. Under the turnkey contract. Hyundai will be responsible for design, engineering, materials procurement, quality management, factory inspection/testing, transport and delivery to site, installation, construction, site inspection, testing and commissioning works. The project is due to complete in 24 months.

Hydrogen

‘Hydrogen Alliance’ will offset Germany’s reliance on Russian gas

Canada and Germany last month established what they describe as a ‘hydrogen alliance’ with the intention of creating a transatlantic supply chain of green ammonia between Europe and North America that will offset Germany’s reliance on Russian natural gas. Based on wind and other renewable energy sources, the project will become productive in 2025.

Gary Lakes

Canadian Prime Minister Justin Trudeau and German Chancellor Olaf Scholz have launched a transatlantic hydrogen alliance that could very likely lead to an important trade relationship that will speed the energy transition.

Meeting in the small town of Stephenville in Newfoundland, Canada, the two leaders signed a Declaration of Intent and the German firms Uniper and E.On signed memoranda of understanding with Canadian company EverWinds Fuels to begin lifting 1 million tons of green hydrogen and ammonia in 2025.

The agreement between the two countries is seen as solid encouragement to move towards and expand the production and export of clean energy for Canada, and the decarbonisation of the German economy.

Both countries have targets to reduce carbon emissions in order to combat climate change before the middle of this century.

The European Union, the US, Canada and many other countries have turned to hydrogen as the best viable source to replace oil and gas as their primary sources of energy, but while the rhetoric complies with the urgency of climate change events, actions are not taking place as fast as many people believe is possible.

Critics accuse governments of endorsing policies that continue to allow carbon a place within supposed green energies. Hydrogen and ammonia can be produced with hydrocarbons, but to be green, they must be produced with renewable sources of power through the electrolysis of water.

Canada’s Trudeau remarked that the deal with Germany – and Europe’s switch away from Russian oil and gas – would serve as a catalyst for Canadian investors and industry. “The market case and the need to scale up was coming and wasn’t quite here yet,” he said. “Russia’s illegal and unjustifiable invasion of Ukraine has meant that everything gets accelerated.”

Scholz commented on Canada’s potential to provide carbon-free fuels. Canada “has almost boundless potential to become a superpower in sustainable energy and sustainable resource production,” he said. “Germany, for its part, stands ready to become one of your closest partners.”

John Wilkinson, Canada’s Minister of Natural Resources also attended the ceremony and reiterated Ottawa’s desire to establish a green energy industry: “Unlocking the potential of hydrogen is an essential part of our government’s plan for a sustainable economic future – and not just for the domestic opportunities for emissions reductions but also for its potential as an export opportunity – to provide clean energy to countries around the globe.”

Germany’s Vice Chancellor Robert Habeck told participants at the event: “We must resolutely pursue climate change mitigation in order to secure our prosperity and freedom. This is more important and urgent then ever at this time.”

“The Hydrogen Alliance between Canada and Germany is a significant milestone as we accelerate the international market rollout of green hydrogen and clear the way for new transatlantic cooperation,” Habeck said, adding: “Specifically, we aim to build up a transatlantic supply chain for green hydrogen.”

While in Canada, the German delegation also pursued deals with Canada regarding access to raw materials such as lithium, nickel, and cobalt needed for the production of batteries and other highly technical goods.

Newfoundland and Labrador, a northeastern province of Canada, has an abundant potential for wind power. Two large wind power plants are planned for construction in the area that will be used for water hydrolysis, necessary for the creation of hydrogen.

Canada’s Miapukek First Nation has joined efforts to produce green hydrogen by recently announcing three renewable wind-to-hydrogen projects in the province. The projects involve Red Earth Energy, Source3 Energy and Fortescue Future Industries. The chief of the Miapukek said including the tribe in green energy projects is an example of industry, indigenous governments and government working together.

“Producing zero carbon fuels and doing our part to transition Canada and the world to net carbon zero aligns with the values of our First Nation and the economic benefits these projects will provide will be significant for our community.”

Further steps are needed between Canada and Germany in building infrastructure for hydrogen and ammonia production in Canada’s remote northeast coast, and the two countries have also to work out shipping systems to put the transatlantic trade in motion.

Gas

New gas discovery off Cyprus renews promise of East Med supply potential

The East Mediterranean has been the subject of speculation as a possible new source of natural gas for more than a decade but the region has yet to receive the level of exploration and investment it needs. However, a new discovery in Cyprus Block 6 last month might serve to move the region forward as a supply source for the EU.

Gary Lakes

The Eni/TotalEnergies partnership in Cyprus last month announced the discovery a natural gas resource with an estimated reserve of 2.5 trillion cubic feet (tcf). The well is located in Block 6 some 160 km southwest of the island within the Cyprus EEZ. Drilled by the Tungsten Explorer, the Cronos-1 well “encountered several good quality carbonate reservoir intervals and confirmed overall net gas pay of more than 260 m”, according to company statements. Furthermore, the discovery indicates additional resources in the area that warrant further exploration.

Commenting on the success of the Cronos-1 well, Cypriot Energy Minister Natasa Pillides said that another well has already started in Block 6, the Zeus-1. “Additional quantities of gas may be discovered and add value to this discovery,” she told reporters.

Cronos-1 is the partnership’s second discovery in Block 6. In 2018, they reported a find at the Calypso-1 well estimated at around 1.5 tcf. Eni is operator of Block 6 with a 50 per cent share. The Italian energy giant is the largest investor in Cyprus offshore exploration. It is operator in Blocks 2, 3, 6, 8, and 9, and it is partnered with TotalEnergies in Blocks 7 and 11 where the French company is operator. The two European companies formed a partnership several years ago and cooperate jointly in all the blocks they have licensed. Eni has drilled two other wells in Cyprus, while Total has drilled one.

“The discovery of Cronos-1 creates the conditions to lead to the development of further potential volumes of gas in the region and represents one of the actions achieved by Eni in support of the supply of additional gas to Europe,” Eni said in a statement.

South of Block 6, in Block 10, the ExxonMobil/Qatar Petroleum partnership announced in 2019 a discovery at the Glavcos-1 well that holds an estimated reserve of 5-8 tcf. An appraisal well, Glavcos-2, has in recent weeks finished its work at the site. It will be several months before the results are known.

Slowly the gas discoveries in the Cyprus EEZ are beginning to add up, but there has yet to be anything on the scale of Zohr (30 tcf) in Egypt, which lies very near Cyprus Block 11, where TotalEnergies drilled an unsuccessful well, or the Leviathan (22 tcf) well offshore Israel, which lies close to the Cypriot Aphrodite field, discovered by Noble Energy in 2011, and now operated by Chevron, as are most of Israel’s, originally-Noble Energy-discovered, gas fields.

Prior to the war in Ukraine, when Europe considered Russia as a reliable partner and counted on Moscow to supply 40 per cent of its natural gas needs, the East Mediterranean was well down the list of resources to develop. There was no infrastructure and from the beginning, development was viewed as costly. Even the price of building a 200 km gas pipeline from Aphrodite to Cyprus, which has no gas supply, was seen as prohibitive.

But circumstances have changed and much of that was caused by the discovery of Zohr rather than by the war in Ukraine. Eni discovered Zohr in 2015 and because of the huge demand for gas in Egypt, fast-tracked development. Prior to Zohr, the gas shortage in Egypt had forced that country to stop LNG exports. They have resumed, and Israeli gas from Leviathan is now being shipped to Egypt, where some of it is reported to be channelled to Egypt’s LNG export facilities.

For now, this is the option that Cyprus is also looking at – shipping gas to Egypt for re-export as LNG, according to Minister Pillides.

“For the time being, transporting natural gas to Egypt is the most prevalent scenario and even following the recent discoveries, no changes to the plans are in sight,” she said. Later, on state radio, Pillides said that Chevron is expected to carry out additional drilling at Aphrodite and begin exports from that field by 2026-27, some 15 years after discovery.

Another point the minister has made is that with discoveries so close in Blocks 6 and 10, it may in future prompt cooperation between Eni/TotalEnergies and ExxonMobil/QP. Ultimately, that is a scenario that Cyprus is hoping for – a large discovery or a collection of discoveries that would pull all the licensed companies together around an LNG export facility located on the island.

Startup support is key to unlocking clean energy innovation

Strategic collaboration and co-innovation between energy companies and emerging startups is key to the energy sector's future and achieving net zero goals. AWS Energy's **Hassane Kassouf** explains why.

The greatest promise of startups has conventionally been the promise of innovation – the capacity to invent and reinvent, chipping away the status quo incrementally or sometimes through sheer disruption. However, there is a realisation amongst the more traditional energy players today that innovation is only part of the equation and that even greater collaboration with startups may hold the key to bridging the CO_2 emission reductions gap to meet global net zero 2050 targets.

According to the International Energy Agency (IEA), to meet 2050 ambitions, a 40-50 per cent reduction in carbon emissions will need to come from technologies not yet commercially deployed, especially in sectors where emissions are particularly challenging to reduce, such as shipping, aviation, chemicals and heavy industry. With the energy transition advancing, the new landscape emerging is one where energy systems of the future will be more decentralised, more complex, and rely on greater interactions with partners in the system. Fresh thinking is a key output of clean energy partnerships, in addition to a freer flow of data.

Energy players are starting to look to startups more than ever as one way to overcome this challenge, realising that co-innovation and collaboration will be key. An example of this shift in behaviour towards the impact of clean energy startups is the significant increase in investment over the last year alone. In Europe, more early and mid-stage venture capital funding flowed to clean energy startups in the first half of 2021 than in 2019 and 2020 combined. Public spending also ramped up, with markets for clean technology innovation receiving a global boost, triggered by fit for 2050 ambitions, COP26 commitments, and climate agenda of the US Inflation Reduction Act.

The digital fitness of these startups has also been a sought after core capability for energy companies. Most clean energy startups are cloud-native from inception, understanding the benefits from a cost perspective but also how the cloud helps achieve scalability, speed, agility, security and automation. Fostering innovation with startups that have digital hardwired into their DNA provides an opportunity for bigger energy companies to make greater strides forward, faster. As the landscape shifts, a new ecosystem develops and an explosion of data continues, the ability to respond to this and be digitally smart is more important than ever.

There is also a realisation of the economic value these partnerships can bring. It's estimated that successful partnerships in the pursuit of net zero could create a market for clean energy technologies worth over $1 trillion a year by 2050 with the development of hydrogen electrolysers and fuelling, wind turbines, solar panels, long duration energy storage, carbon tracking tech, and advanced materials. Exposure to innovating startups in these spaces is crucial to competitively participating in this market. Some startups already making an impact include Ionomr and E-zinc (Canada), Ethosgen, Persefoni, Utility Global, Power to Hydrogen, Shifted Energy, Urban Electric Power, Cemvita Factory, Uprise and WindESCO (USA), SmartPulse (Turkey), Flexidao, Barbara ioT and Rated Power (Spain),SmartHelio (Switzerland), Hybrid Greentech (Denmark) Sunai (Chile), SwitchDin and UPowr (Australia), and Hydro Wind Energy (UAE), to name a few.

Advancing clean energy will also require re-skilling along two dimensions: what needs to be learned; and who is learning. There is a skills gap to sustain the rate of growth and innovation by 2030 and beyond – particularly when it comes to digital and data-driven skills. Building the net zero workforce and skills can provide opportunities for both public and private sectors, some of which could come from bringing in external skill-sets coming from startups

The AWS Clean Energy Accelerator 2.0 programme was set up to boost growth of clean energy innovators and encourage collaboration between startups and global energy companies, to co-create solutions to tackle climate change, while building skills for the future. It encourages open innovation, an entrepreneurial culture, and fresh thinking – helping both startups and traditional companies realise the value in learning from each other. It's about having a broader perspective and thinking outside of your everyday bubbles to really champion change. By providing mentorship and a co-innovation opportunity for mature startups, the accelerator programme is part of AWS's efforts to help address the innovation gap. Lyft, Stripe, Slack, Klarna, Grab, Netflix, Airbnb and DoorDash are among the successful companies who have built their businesses on AWS, and then gone on to help define their industries.

Similarly, the aspiration is to empower the clean energy technology startups of today so that they can shape the evolution of the wider energy sector. In much the same way that technologies such as quantum computing and artificial intelligence that were previously only accessible to academics and researchers, but are now household terms, clean energy technology development is now within reach for almost anyone with a passion for making energy cleaner, more affordable and crucially, more accessible. Cloud computing has played a key role in this, owing in part to its impact on speeding up experimentation and democratising machine learning. Just like the unicorn startups before them, the AWS Clean Energy Accelerator is helping the innovators of today define the clean energy industry of the future.

The startups from AWS's inaugural accelerator are already making an impact in their respective fields. Notably, e-Zinc, which is advancing long-duration battery storage by storing electrical energy within zinc metal, creating hundreds of hours of energy capacity. Another startup, Persefoni, is furthering intelligent carbon footprint management and sustainability reporting with their dedicated reporting platform. The second cohort of selected startups, announced in May 2022, are well on their way to leveraging the AWS Clean Energy Accelerator for greater collaboration and industry-shaping innovation.

The competitiveness of startups is also a draw. This is not just down to how they manage to creatively address key industry topics and challenges, it's also embedded in how these young firms subvert traditional organisational structures. Tackling a problem with a willingness to experiment and taking risks lies at the core of innovation.

One example is Octopus Energy, a 'digital-first company' that provides millions of households in the UK with clean, green energy. Octopus Energy uses the breadth and depth of AWS services, including data storage, to build insights on its customer service platform, Kraken. These insights are helping the organisation to understand energy consumption rates across the business, down to individual households. To do this, Octopus Energy trains neural networks on billions of rows of smart meter data, looking at energy consumption at different times of the day. These insights can then be used to predict energy use across Octopus Energy's network and inform when it buys energy from the wholesale market.

Achieving net zero carbon goals is simply not a journey that can be taken alone. This journey will require working effectively with innovators from outside bigger organisations to bring both an unbiased perspective and fresh ideas.

Another output of collaboration is building strategic organisational capabilities. While mentoring and supporting startups to scale their commercial models, bigger organisations' partnership with startups will require working effectively with innovators from within to bring the startups' new skills into the organisation. It's crucial to understand startups' procurement frameworks and their pace of work, and to learn from them along the way.

No matter the framework, gaining competitive advantage in this new era of energy is unquestionably going to be a tall order for organisations. Strategically partnering with startups, supporting their growth while learning how to work with them and from them, will continue to be a promising way of gaining access to, and expediting, the game-changing clean energy solutions the world needs to achieve net zero emissions.

Hassane Kassouf is Head of Innovation Programs at AWS Energy.

Kassouf: there is also a realisation of the economic value these partnerships can bring

New long-duration storage technology is key to energy security

Lithium-ion technology is currently used for most energy storage applications but as demand for batteries grows, challenges to adequate and reliable supply of this technology are emerging. New iron-flow long-duration energy storage technologies employing earth-abundant materials offer an alternative. ESS's **Alan Greenshields** explains.

The transition to clean energy, driven by the need to combat climate change, has taken on a renewed urgency in recent months following the Russian invasion of Ukraine and recognition, both in Europe and worldwide, that reliance on supply chains dominated by challenging geopolitical partners carries significant economic and energy security risk.

A wholesale and rapid shift to renewable energy is complicated by the need for energy storage to balance the intermittent nature of wind and solar generation. While some energy storage already exists, current storage deployment is just 2.9 per cent of that which the world will require by 2030 to achieve existing clean energy and decarbonisation targets.

Further exacerbating this challenge are ongoing supply chain disruptions, which are affecting many industries and the lithium-ion battery industry in particular. Lithium-ion technology is currently used for most energy storage applications – from mobile phones to electric vehicles to grid-scale storage – but as demand for batteries grows, challenges to adequate and reliable supply of this technology are emerging.

But the technology brings potential supply chain woes. Lithium-ion batteries are dependent on materials such as cobalt, nickel and lithium; supply chains for these minerals run through several challenging regions and are dominated by China or Russia. Just as Russia strategically locked the EU into energy dependence for fossil fuels, China is a major supplier of nickel, controlling most of the market for processing and refining cobalt, lithium and other critical battery minerals. This raises concerns that a political or security crisis could cause China to cut off access to mineral supplies as happened in 2010, when China embargoed the export of rare earth elements to Japan because of tensions in the Senkaku islands.

Setting aside the energy security risks, there are practical limitations to meeting current demand for grid-scale energy storage with lithium-ion technology alone. An International Energy Agency (IEA) report predicts over 300 million EVs will be on the road in 2050, compared to 10 million in 2021, which will put a huge strain on lithium-ion battery production. Growing demand for EVs has already started driving up costs; Tesla and VW recently lowered delivery expectations due in part to strains on battery supply.

Given the world's parallel ambitions of electrifying transportation and reaching grid net-zero, lithium-ion batteries should be reserved for EVs and applications where the positive attributes of that technology are required.

Fortunately, innovative energy storage solutions are now commercially available that avoid the challenges associated with the lithium-ion supply chain and provide the opportunity to build a sustainable, resilient energy grid. New iron-flow long-duration energy storage (LDES) technologies employ earth-abundant materials such as iron, salt and water and offer an alternative for grid-scale LDES applications and an opportunity to achieve needed climate and clean energy goals.

Iron flow battery technology is ideally suited to supporting the energy grid, providing storage in durations ranging from 4-12 hours. In addition to energy storage, iron flow batteries are capable of providing key ancillary grid services such as frequency response and voltage regulation, which enables them to deliver clean energy 24/7 and support a stable, resilient energy grid.

If we are to reach the clean energy target of 66 per cent of total primary energy supply (TPES) by 2050, sufficient long-duration energy storage must be in place to balance intermittent solar and wind and ensure grid stability.

Currently, renewable intermittency is balanced by fossil fuel generation, often natural gas or in some cases, diesel. As countries work to limit the increase in global temperature to 1.5°C by 2050, it will be necessary to retire gas peaker plants and diesel backups and instead rely on long-duration energy storage to balance energy supply with demand and provide reliable, low-cost clean energy.

According to the IEA, world electricity consumption in 2021 was 2.29x104 TWh. Meanwhile, deployed energy storage in 2020 was 17 GWh – or 0.074 per cent of energy consumption – of which just 10 GWh, or 0.043 per cent, was for grid-level energy storage.

To meet the needs of a decarbonised energy system, the LDES Council and McKinsey have estimated that the world's electricity grids must deploy between 85-140 TWh of long-duration energy storage by 2040.

This is key to realising energy independence. In 2021, the EU depended on Russia for 40 per cent of its gas, 45 per cent of its coal and 25 per cent of its oil. Simply replacing this supply with fossil fuels from different countries will prove challenging, expensive, will not mitigate financial exposure to global fossil energy markets, and will require the continued burning of fossil fuels despite the global climate emergency.

In March, Ursula von der Leyen, the European Commission President said: "We must become independent from Russian oil, coal and gas... we need to act now to mitigate the impact of rising energy prices, diversify our gas supply for next winter and accelerate the clean energy transition."

The situation has since become more challenging, with Russia cutting gas deliveries to Germany by 80 per cent, forcing the government to reverse the planned shut-down of coal generation. More recently, von der Leyen acknowledged this dilemma: "We have to make sure that we use this crisis to move forward and not to have a backsliding on the dirty fossil fuels… It's a fine line and it's not determined whether we are going to take the right turn."

The turn that is needed is towards an energy system that relies on renewable energy and incorporates energy storage systems that enable the use of clean energy 24/7, creating a locally powered, resilient and reliable grid. While supply chain issues and electricity grids predominantly powered by fossil fuels remain formidable obstacles to the clean energy transition, the availability of new long-duration energy storage technologies, and iron flow batteries specifically, means that a grid powered 100 per cent by renewable energy sources can become a reality. A reality that can rely on earth-abundant, non-conflict materials and one that we urgently need.

Alan Greenshields is Director of Europe ESS Inc.

Flow batteries explained

Flow batteries, like the iron-flow battery, store energy in tanks of liquid electrolytes – chemically active solutions that are pumped through the battery's electrochemical cell to charge and discharge electrons via a process called a redox reaction. The flow battery's storage capacity is increased by simply increasing the size of its storage tank.

Inside the flow battery's electrochemical cells, two electrolytes are separated by a membrane. One electrolyte flows past a positive electrode as it is pumped through the cell, and the other electrolyte flows past a negative electrode. ESS's iron-flow battery uses the same electrolyte on both the negative and positive sides – iron salts dissolved in water – eliminating cross-contamination and degradation.

As the electrolytes flow through the cell, chemical reactions take place on both sides of the membrane. When an electric current is charging the battery, the electrolyte at the battery's negative electrode gains electrons, and dissolved iron salts are deposited onto the electrode's surface as solid iron.

When the battery discharges, the process is reversed: the electrolyte loses electrons at its negative electrode, the plated iron returns to its dissolved form, and the chemical energy in the electrolyte is converted back to electricity. At the positive electrode, the opposite process occurs: the electrolyte loses electrons and "rusts" to a brownish fluid while the battery is charging, and this process reverses during discharge.

In a conventional lithium-ion battery the cell and electrolyte are contained inside a single package and cannot change. But with a flow battery, keeping the electrolyte in an external tank means that the energy-storing part is separate from the power-producing part. This decoupling of energy and power enables a utility to add more energy storage without adding more electrochemical battery cells.

Greenshields: new long-duration iron flow batteries can make a grid powered 100 per cent by renewable energy sources become a reality

Power grids regain missing inertia with synchronous condensers

Power grids are evolving to become more decentralised while the penetration of renewable resources is increasing. These two factors are causing a steady decrease in the level of inertia essential to maintain stable operation. ABB's **Kristina Carlquist** explains how synchronous condensers can restore inertia in applications as diverse as urban networks and remote islands.

Spinning inertia, otherwise known as kinetic reserve, is vital for power grids. It helps to resist sudden changes, such as when a generator trips offline, so that the grid frequency remains within tightly controlled limits. Its role can be compared to the way a car's shock absorbers smooth out a sudden bump in the road to keep it safely on course.

Historically, power grids have relied on the inertia inherent in large, centralised generation plant to keep them in balance. However, as large fossil-fuel plants are decommissioned in favour of renewable energy, usually wind and solar power, there is an ongoing, dramatic reduction in the amount of spinning inertia available within the grid.

The loss of inertia presents a challenge for many types of public utility and private grids, including large networks serving urban areas, island networks and microgrids that power remote mining facilities. That is prompting operators to seek ways to restore their reserves of inertia. Many are finding the answer in the well-proven technology of synchronous condensers (SCs). These are large rotating machines that can restore physical inertia to grids to deliver instantaneous support. This ensures that stable operation can be maintained, irrespective of the upstream network voltage or frequency.

SCs appear similar to large motor and generators in design. The difference is that they are not motors since they do not drive anything. Equally they are not generators as they have no prime movers. The historic application for SCs was to produce reactive power to balance out highly inductive loads on the grid, like electric motors.

Fifty years or more ago, SCs would have been found in almost every power grid. But since then, their reactive power role has been replaced by power electronics equipment. There is now new interest in the capability of SCs to mimic the operation of large generating plant by providing an alternative source of spinning inertia.

SCs are able to both supply and absorb reactive power, delivering voltage support and dynamic regulation. This makes them a very cost-effective and reliable way to maintain power quality. A critical added advantage is that they also provide the fault current essential for the strengthening of a weak grid. This makes SCs a key enabler for the introduction of more renewables within a grid.

Normally, SCs are based on small or medium sized modules that can be strategically sited for optimal results. SC systems are tailored for specific locations, according to network studies. This enables the creation of pre-designed SC packages that are easy to transport, install, commission and integrate for a decentralised solution to increase grid strength and stability.

A typical size for the new generation of SCs is in ratings up to 80 MVAr of reactive power and 3-15 kV system voltage. When higher outputs are required then several modules can be linked together. This approach offers better redundancy and availability compared to deploying one large unit.

Some operators ask if it is possible to convert an old, unused generator they have into an SC? Technically, this is entirely possible and there are a number of these projects operating successfully. However, this may not always be the optimal solution. The reason is that the existing equipment will, by definition, be old technology and its actual condition unknown. Before starting a project, it is advisable to have the condition of the generator assessed thoroughly, such as by ABB's Lifetime Expectancy Analysis Program (LEAP) service. In any case, modern SCs are smaller and simpler, enabling them to be installed in any location. They also come with the benefits of modern control and communication technology.

The Faroe Islands in the North Atlantic will rely on SCs to reach an ambitious 100 per cent renewable energy target by 2030. They want to become the world's greenest group of islands and power utility, SEV, intends to use green electricity from hydropower, solar, wind, and potentially tidal streams. The initiative also holds economic benefits for the Faroes since they will no longer be dependent on expensive fossil-fuel imports.

A significant challenge for SEV is that switching off its current diesel-fuelled generating plant could impact the stability of the grid. Any grid instability could affect the fish processing and aquaculture industries that are a major contributor to the Faroese GDP. Furthermore, there are no power cables connecting the Faroe Islands to neighbouring countries, so external grid support is not available.

ABB is working with SEV to deliver SCs to keep the grid in balance. The first installation is at the 6 MW Porkeri Wind Farm on Suðuroy, the southernmost, electrically isolated island of the archipelago. This unit is currently undergoing trial operations and is scheduled to be fully up and running in 2022. Together with battery energy storage, the SC could enable 100 per cent of the island's demand to be met with wind energy at times with good wind conditions.

SEV has placed an order for a similar unit at Sund, close to Tórshavn, the Faroese capital on the island of Streymoy. The unit is scheduled to be online in 2023.

ABB is currently delivering a contract for Europe's largest renewable energy producer, Statkraft, to design, manufacture and install two high-inertia SC systems for the Lister Drive Greener Grid project in Liverpool, England. The innovative project will play a key role in stabilising the local grid to handle more wind and solar power. This will help National Grid meet its target of operating a zero-carbon electricity system by 2025.

This project is ABB's first anywhere in the world to feature a high-inertia SC configuration. This couples a 67 MVAr SC with a 40-tonne flywheel that increases the instantaneously available inertia by 3.5 times. The advantage of combining a mid-size SC with a flywheel is that it multiplies the inertia several times, while the losses will be much lower compared to installing the whole inertia as SC. This is also a cost-effective way of using up to two mid-sized SCs coupled together with the benefits of a high level of redundancy, increased inertia and greater controllability.

Decentralised solutions will be vital to help the networks of the future maintain grid stability and resilience. SCs are a well-proven solution that can be deployed to strengthen weak networks in remote areas. They offer a number of advantages such as inertia support for frequency stability, fault level contribution and voltage regulation. These are all functions that can be demanding to provide using power electronic systems on their own.

The need for SCs is set to grow significantly as grid operators seek new approaches to address their network quality issues and ensure reliability and continuity of supply. It is possible that over the next decade several hundreds of SCs might be deployed worldwide, either as stand-alone solutions or in combination with static power electronic devices.

To gauge the potential for SCs, the two Statkraft units in Liverpool will provide a total of more than 900 MWs (megawatt-seconds) inertia. For comparison, the UK has a current total of around 220 GWs (gigawatt-seconds). That means Lister Drive will provide about 0.5 per cent of the UK's total inertia. That contribution might seem relatively small. But it is certain that the traditional source of inertia from large generating plant will diminish, and SCs will be needed to fill the gap.

It is anticipated that the same pattern will be repeated globally. This is because existing SC installations are already playing a vital role in reinforcing networks in Australia, Canada and Scotland, where they support a wide variety of applications from solar power farms to remote mining operations.

The worldwide drive for decarbonisation will continue to gather momentum. That means synchronous condensers will become an increasingly important technology for maintaining grid stability.

Kristina Carlquist is General Manager, Synchronous Condensers, ABB.

The Faroe Islands in the North Atlantic will rely on SCs to reach an ambitious 100 per cent renewable energy target by 2030 (inset: ABB synchronous condensers)

Junior Isles

We are now entering the tunnel

Finding reasons to remain positive among the deluge of depressing headlines about the global energy crisis is not easy. Yet news of the US passing the Inflation Reduction Act (IRA) into law and Germany signing a deal on energy with Canada, offers some light at the end of what looks like a long, dark, tunnel.

Since autumn last year, the world has been dogged by rising gas prices sent into overdrive by Russia's invasion of Ukraine.

Tracking gas prices, electricity prices have also been spiralling. According to the International Energy Agency's (IEA) Electricity Market Report, the price index for major global electricity wholesale markets reached levels that were twice the first-half average of the 2016-2021 period. In Europe, during the first half of 2022, average natural gas prices were four times as high as in the same period in 2021, resulting in wholesale electricity prices more than tripling in many markets. And the outlook continues to worsen, especially for those countries highly dependent on Russian gas.

At the time of writing, Gazprom was planning maintenance on a gas turbine at the Portovaya compressor station from August 31-September 2, which would halt gas flows along the Nord Stream 1 pipeline linking Russia and Germany across the Baltic Sea. Before the Ukraine War, Germany imported over half of its gas from Russia, and most of it came through Nord Stream 1.

Berlin accused Moscow of using the turbine as a pretext to restrict gas flows and said it is using energy as a political weapon in an attempt to weaken the European Union's resolve over sanctions.

News of the pipeline's closure, which was operating at just 20 per cent capacity, sent already high energy prices soaring and prompted countries across Europe to roll-out emergency energy-saving plans. August saw the EU put its emergency gas plan into force with member states being asked to reduce their gas use and work toward filling gas storage ahead of winter.

With most industry experts and analysts predicting that gas prices will remain high and volatile throughout 2023, citizens and businesses will, unfortunately, have to get used to high prices. At the same time, governments will have to hope these short-term emergency plans, combined with various means of state support, are sufficient to see us through to better days.

And better days will come. Late last month German Chancellor Olaf Scholz and Canada's Prime Minister Justin Trudeau signed what they called a "joint declaration of intent" that calls on the two countries to invest in hydrogen, establish a "transatlantic Canada-Germany supply corridor" and start exporting hydrogen by 2025.

Commenting on what he called a historic moment, Trudeau said: "We must look to resources like hydrogen which can and will be clean and renewable. We can be the reliable supplier of clean energy a net zero world needs."

Scholz said the wind conditions on the German coast could not match those found in Newfoundland and Labrador, where wind turbines will be sited for hydrogen production. He said hydrogen will play a major role in Germany's future energy supply, especially in industries that are hard to decarbonise, noting that Germany "expects a need of 90 to 110 TWh of hydrogen in 2030".

The 'Hydrogen Alliance' will build on Canada's Hydrogen Strategy and mark a step toward Canada's objective of becoming a top global supplier of clean hydrogen. Natural Resources Canada said in a statement: "This Declaration sends a clear signal to the private sector and to sub-national leaders in both countries that Canada and Germany are committed to a policy and regulatory environment that will facilitate and encourage investment in the hydrogen value chain in both countries."

It follows the signing in March last year of an energy Memorandum of Understanding to provide a general framework for the two countries to cooperate in the energy sector, using synergies between existing bilateral and multilateral dialogues on energy and climate issues.

The hydrogen alliance was the second major global development announced last month aimed at reducing energy prices and volatility in the longer term, while tackling the ever-growing climate crisis.

Also in August the US, Canada's main energy trading partner, moved to support its fledgling hydrogen market with the passage of the IRA. The Act provides for $369 billion in energy security and climate change investments and notably provides tax credits for hydrogen production.

Håkon Volldal, CEO of Norwegian pure-play hydrogen technology company, Nel ASA, said the IRA "completely transforms" the outlook for green hydrogen in the USA. "We can say that the USA is going to be one of the cheapest places in the world to produce clean hydrogen," he said.

The much-anticipated passing of the bill through the House of Representatives follows significant progress in the North American market for Nel, which in July secured its biggest electrolyser order. The 200 MW stack, worth €45 million ($46 million) and potentially twice that amount with additional hardware, will go live in 2024.

"What makes this record order particularly special is that it represents a change in market dynamics. The customer has secured power supply over 20 years, and end-product demand over the same time period. Similar long-term prospects will only inspire further investment in green hydrogen and related infrastructure," Volldal said.

The US hydrogen initiative is seen by some as a game-changer, being more flexible than the plan set out by the EU. Under the EU's Delegated Acts, by 2026 the bloc will only be permissible to use electricity from new wind and solar plants to generate green hydrogen.

The US rules are more flexible, using a scale to determine the level of tax credit for hydrogen projects based on the amount of carbon equivalent emissions for each kilogramme produced, starting at a basic rate of $0.60/kg.

This scale means that green hydrogen producers can receive tax credits of up to $3/kg. Experts say the measures will kick-start the US nascent green hydrogen industry by making it one of the lowest cost producers in the world. Last month the cost of producing hydrogen on the US Gulf coast was $6.55/kg, according to S&P Global Commodity Insights.

The bill will also make green hydrogen more competitive with grey hydrogen, the most common form of hydrogen production. This process involves natural gas via steam methane reformation, without capturing the emissions. S&P says the cost reduction makes the cheapest clean hydrogen production "immediately cost-competitive".

Environmentalist will no doubt spell-out the dangers of subsidising non-green hydrogen production but the US' approach will spur the global market and make the country less of a hostage to LNG price volatility.

Europe's decision to drive green hydrogen only is admirable from the climate perspective. With the extreme weather being experienced, many would argue it is the right one. Some, however, point out that the bloc could be in danger of losing out to investments that could instead head to the US.

Fortescue Future Industries, a global green energy company committed to producing green hydrogen, struck a non-binding agreement in March to provide Germany with enough green hydrogen to replace about a third of its gas imports from Russia, or 5 million tonnes a year by 2030.

Speaking to the *Financial Times* Mark Hutchinson, the company's recently appointed head, said Europe will struggle to meet its ambitious targets for green hydrogen and reduce its dependence on Russian gas unless it can match the lead of the US. He said: "The US has changed the game. They have created an industry out of nowhere." Hutchinson warned that if Brussels was serious about replacing Russian gas it would need to improve its incentives. "Otherwise, what's going to happen? All the green capital is going to be flowing into the US and you're just going to miss out," he said.

No doubt as markets develop there will be leaders and laggards and it will not be a case of sitting back and enjoying the ride – for anyone. But we can take some comfort in knowing that the hydrogen train is gathering speed as we enter the tunnel. Its arrival time may be uncertain but the important thing is, we are all on it and heading in the same direction.

Cartoon: jemsoar.com