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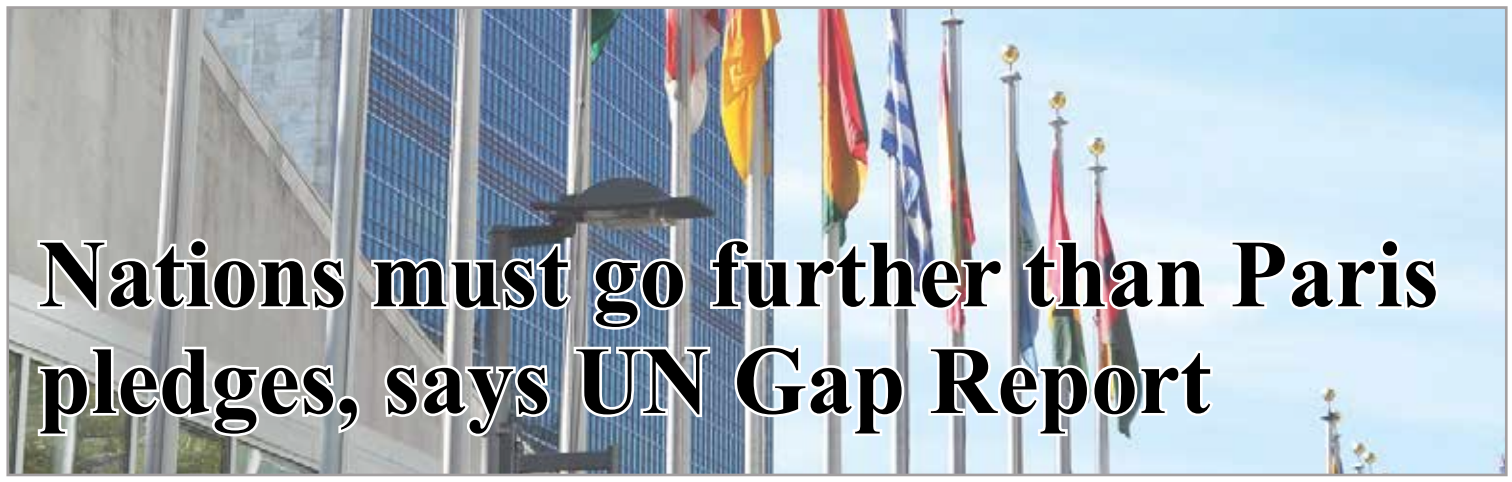


Nations must go further than Paris pledges, says UN Gap Report

The UNEP's Gap Report reveals a massive gap between current pledges on emissions and what is needed to avoid exceeding a 1.5°C rise in global temperature. It is hoped the report will stimulate governments to ramp up efforts to combat climate change at COP28.

Junior Isles

The recently launched Emissions Gap Report 2023 from the UN Environment Programme (UNEP) has found that current pledges under the Paris Agreement put the world on track for a 2.5-2.9°C temperature rise above pre-industrial levels this century. Released just ahead of the 2023 COP28 climate summit currently being held in Dubai, United Arab Emirates, the report is a stark reminder to world leaders of the urgent need to increase current efforts on climate action.

As temperatures hit new highs this year, the world has again failed to cut emissions, says the report, which stresses that global low-carbon transformations are needed to deliver cuts to predicted 2030 greenhouse gas emissions of 28 per cent for a 2°C pathway and 42 per cent for a 1.5°C pathway.

Current unconditional climate pledges imply that additional emissions cuts of 14 $GtCO_2e$ are needed in 2030 over predicted levels for 2°C. Cuts of 22 $GtCO_2e$ are needed for 1.5°C. The implementation of conditional Nationally Determined Contributions (NDCs) reduces both these estimates by 3 $GtCO_2e$.

If all conditional NDCs and long-term net zero pledges were met, limiting the temperature rise to 2°C would be possible, says the report. However, net zero pledges are not currently considered credible: none of the G20 countries are reducing emissions at a pace consistent with their net zero targets. Even in the most optimistic scenario, the likelihood of limiting warming to 1.5°C is only 14 per cent the UNEP predicts.

"We know it is still possible to make the 1.5 degree limit a reality. It requires tearing out the poisoned root of the climate crisis: fossil fuels. And it demands a just, equitable renewables transition," said Antònio Guterres, Secretary-General of the United Nations.

The report calls for all nations to deliver economy-wide, low-carbon development transformations, with a focus on the energy transition. The coal, oil and gas extracted over the lifetime of producing and planned mines and fields would emit over 3.5 times the carbon budget available to limit warming to 1.5°C, and almost the entire budget available for 2°C.

Policy progress since the Paris Agreement was signed in 2015 has reduced the implementation gap – defined as the difference between projected emissions under current policies and full NDC implementation. GHG emissions in 2030 based on policies in place – were projected to increase by 16 per cent at the time of the adoption of the Paris Agreement. Today, the projected increase is 3 per cent.

As of September 25th, nine countries had submitted new or updated NDCs since COP27 in 2022, bringing the total number of updated NDCs to 149. If all new and updated unconditional NDCs are fully implemented, they would likely reduce GHG emissions by about 5.0 $GtCO_2e$, about 9 per cent of 2022 emissions, annually by 2030, compared with the initial

Continued on Page 2

Air of international cooperation ahead of COP28

The US and China last month agreed to accelerate the rollout of renewable energy to displace their heavy reliance on fossil fuels, in what was seen as a positive "gesture" to co-operate on climate change.

The agreement, which came in the run-up to the COP28 climate summit in Dubai, is viewed as a sign of progress in global climate policy, despite the absence of any reference to the looming issue of the phase-out of fossil fuels.

The joint statement on climate diplomacy between the world's two biggest polluters came in mid-November, shortly before Joe Biden and Xi Jinping were due to meet in San Francisco as part of an effort to stabilise US-China relations.

"This is not as big as the agreement before Paris… but I think this is a significant statement. It really does signal that both countries want substantive progress," said Alden Meyer of the E3G climate policy think-tank.

The countries both support the key goal of tripling renewable energy capacity globally by 2030, saying they would "sufficiently accelerate renewable energy in their respective economies through 2030" to "accelerate the substitution for coal, oil and gas generation".

The most specific commitment from Washington and Beijing was to advance "at least" five "large-scale" carbon capture, utilisation and storage projects each by 2030.

Both countries also agreed to include a broader array of greenhouse gases in their existing 2035 climate targets, including methane and nitrous oxide.

This was regarded as a breakthrough by climate experts, as previous commitments by China covered only carbon dioxide. This agreement was "striking", said David Waskow of the World Resources Institute think-tank.

"China is the world's largest methane emitter and serious actions to curb this gas is essential for slowing global warming in the near term," he added.

The EU also held "very good and open conversations" with Chinese counterparts last month, despite unease in Brussels about expanding coal capacity in the world's number-two economy.

Wopke Hoekstra, the new EU Commissioner for climate matters and EU representative at the COP28 climate summit, said: "Even though we know at times of scarcity you might need to scale up a bit, that is a far cry from building new coal capacity. That is of course something we would rather not see and about which we are critical."

The phase-out of fossil fuels remains the main bone of contention among the almost 200 countries at COP28.

In September, China's climate envoy Xie Zhenhua told Chinese diplomats that it was "not realistic to phase out all fossil fuels". But he added that carbon-capture technology could be used to lower the emissions when fossil fuels are burned.

China relied on coal for nearly 60 per cent of its electricity last year.

Continued from Page 1

However, unless emission levels in 2030 are brought down further, it will become impossible to establish least-cost pathways that limit global warming to 1.5°C with no or low overshoot during this century. Significantly ramping up implementation in this decade is the only way to avoid significant overshoot of 1.5°C.

According to the report, maintaining the possibility of achieving the Paris Agreement temperature goals hinges on significantly strengthening mitigation this decade to narrow the emissions gap. This will facilitate more ambitious targets for 2035 in the next round of NDCs and increase the chances of meeting net zero pledges, which now cover around 80 per cent of global emissions.

COP28 will see the first Global Stocktake (GST), which will inform the next round of NDCs that countries should submit in 2025, with targets for 2035. Global ambition in the next round of NDCs must bring GHG emissions in 2035 to levels consistent with 2°C and 1.5°C pathways, while compensating for excess emissions until levels consistent with these pathways are achieved.

COP 28 will see the first Global Stocktake, which will inform the next round of NDCs

The preparation of the next round of NDCs offers the opportunity for low- and middle-income countries to develop national roadmaps with ambitious development and climate policies, and targets for which finance and technology needs are clearly specified. COP28 should ensure that international support is provided for the development of such roadmaps.

The low-carbon development transition poses economic and institutional challenges for low- and middle-income countries, but also provides significant opportunities. Transitions in such countries can help to provide universal access to energy, lift millions out of poverty and expand strategic industries. The associated energy growth can be met efficiently and equitably with low-carbon energy as renewables get cheaper, ensuring green jobs and cleaner air.

To achieve this, international financial assistance will have to be significantly scaled up, with new public and private sources of capital restructured through financing mechanisms – including debt financing, long-term concessional finance, guarantees and catalytic finance – that lower the costs of capital.

"There is no person or economy left on the planet untouched by climate change, so we need to stop setting unwanted records on greenhouse gas emissions, global temperature highs and extreme weather," said Inger Andersen, Executive Director of UNEP. "We must instead lift the needle out of the same old groove of insufficient ambition and not enough action, and start setting other records: on cutting emissions, on green and just transitions and on climate finance."

Countries step up push to halt new coal fired power

Several countries have called for a global agreement to end the use of coal for electricity generation, as world leaders prepare to engage in what is expected to be a fierce debate at the COP28 climate summit.

Junior Isles

Ministers from 15 countries have written a letter to the COP28 presidency urging the UN climate summit to deliver an agreement that will end public and private finance for new coal power projects.

The letter seen by the *Financial Times* says coal fired power generation remains the largest source of carbon dioxide emissions and "needs to be phased out first and fastest".

Signed by Canada, Germany and the UK, as well as Spain, Greece, Denmark, Chile, Colombia, Vanuatu and others, the letter called for "collective momentum at COP28 to develop a strategy for a coal power phase-out that generates the necessary financial flows and ensures that the appropriate guardrails are put in place to protect coal-dependent regions, workers and communities".

The call follows discussions in Abu Dhabi at the end of October, where France, Spain, Ireland, Kenya and 11 other countries pushed for an end to new oil and gas projects.

After those discussions the group of 15 nations known as the High Ambition Coalition joined a cohort of countries pushing for a global accord to dump oil and gas.

"Fossil fuels are at the root of this crisis. We must work together to develop a comprehensive global clean energy access approach to accelerate the transition away from fossil fuels," said a statement signed by 15 ministers, including some from poorer countries such as Ethiopia, Vanuatu and Samoa.

Meanwhile, as the European Union prepared for challenging discussions at COP28, Teresa Ribera, Spain's Environmental Transition Minister last month said that the bloc is in a stronger position than a year ago.

Ahead of COP27 last year, some European countries were criticized for firing up coal power plants after the Russian invasion of Ukraine. Since then, however, the EU has made significant strides in deploying renewable technology, reducing its reliance on Russian fossil fuels.

In an interview with *Bloomberg Green* in Madrid, Ribera said that the EU would once again advocate for countries to intensify efforts to reduce greenhouse gas emissions and phase out all fossil fuels at this year's summit.

"Last year was a year of paralysis in terms of emissions commitments, and all efforts were focused on mechanisms that covered losses and damages," Ribera said.

In a common position adopted by member states at the end of October, the EU said it would seek a global phase-out of fossil fuels and for their use to reach a peak in this decade. Half of the world's economies are already five years past a peak in power generation from fossil fuels, recent analysis from energy think-tank Ember shows.

The EU will also call for eliminating "as soon as possible" subsidies for fossil fuels, which do not serve to combat energy poverty or ensure a "just transition" – but without setting a deadline as NGOs hoped.

■ Last month the EU agreed on new restrictions on methane emissions aimed at Europe's energy sector as well as oil and gas importers Oil, gas and coal companies will have to monitor, detect and repair methane leaks across the bloc in rules that will also apply to the importers of fossil fuels from 2027, in regulations agreed on November 15. By 2030, importers will have to meet maximum methane intensity thresholds, yet to be defined.

Brussels may extend emergency state aid measures to combat potential energy price rises

The EU has decided to delay lifting the measures put in place to help the bloc address potential high energy prices this winter amid fears of an escalation of the conflict in the Middle East that could have a detrimental effect on supplies.

According to a draft proposal seen by the *FT*, the extension until the end of March next year is aimed at smoothing potential price rises, and comes despite a general improvement in energy markets with falling electricity prices and lower supply risks compared with last winter.

The decision to extend the measures, which include allowing states to invest in companies where they would otherwise be breaching the bloc's stringent state aid rules, comes after securing backing from France and Germany, and despite opposition from some smaller member states.

The European Commission told the *FT* it did not comment on leaks but the confidential document points to a deterioration in the bloc's economy and warns that "the current crisis continues to pose risks and remains a source of uncertainty", with reference to the continuing wars in Ukraine and Gaza.

Under the extended rules, member states will be able to pay up to €2 million in grants or loans to companies facing extra costs directly as a result of pressure from high gas and electricity prices.

The news came as Europe's two largest economies reached key power price deals in November that should set the stage for increased power consumption by industry from next year onwards.

Europe's largest economy and main manufacturer Germany reached a five-year agreement on November 9th on a package of measures designed to reduce power prices for energy intensive industries that have struggled with high energy costs since Russia's invasion of Ukraine severed gas supplies in 2022.

Germany's industrial output of key products has slumped due to higher energy costs. But those same businesses may now be primed to increase output in 2024 thanks to the new power deals that look set to drive energy costs lower and provide manufacturers with greater certainty about the energy price outlook over the coming years.

Meanwhile France's state-controlled power group EDF reached a deal with the government on future nuclear power prices, paving the way towards higher power sector investments and output in 2024.

Both power deals aim to reduce costs and boost energy supplies to households and businesses next year, and will likely spur a rise in total power consumption across Europe following a rare contraction in Europe's power use so far in 2023.

Fears over pace of green hydrogen development

The critical first wave of European renewable hydrogen projects are very close to becoming reality but many of them will only do so if certain measures are taken, says a group of CEOs representing renewable energy companies operating across the entire green hydrogen value chain.

In a letter to 27 European Ministers of Finance, the Renewable Hydrogen Coalition said only 4 per cent of projects have so far reached final investment decision and warned inflationary pressures and increasing interest rates among other factors, have cast a shadow over investment cases.

Fourteen CEOs from the coalition therefore urged European Ministers of Finance to streamline financing to renewable hydrogen and electrolyser manufacturing capacity within Europe and allocate national budgets to the European Hydrogen Bank.

The letter came as German energy giant E.On said the ramp-up of the hydrogen economy in Germany is slowing down – even if the overall positive development continues.

According to the company's third H2-Bilanz report, which is based on data from the Institute of Energy Economics at the University of Cologne (EWI), the planned hydrogen production capacity by 2030 has increased from 8.1 GW in February 2023 to 8.7 GW in August 2023. Even though there is still a slight upward trend, the increase is nowhere near as strong as in the months from July 2022 to February 2023. The German government's goal in the national hydrogen strategy is to have at least 10 GW of electrolysis capacity installed by 2030.

In the case of hydrogen infrastructure, the number of pure hydrogen pipelines in operation in Germany has remained almost the same. It notes, however, there is "clearly positive development" in the plans for a hydrogen network, the planned length of which has almost doubled. The construction of 5708 km of pipelines by 2035 is now planned, compared to the 2813 km announced this February.

There was some positive news for the sector on November 20th when European Commission President Ursula von der Leyen announced the second auction of the European Hydrogen Bank, as well as the signing of an historic agreement with the Brazilian state of Piaui. The announcement came only three days before the official launch of the €800 million Hydrogen Bank pilot auction.

In Spring 2024, the next round of auctions will take place with a budget of €2.2 billion, meeting the balance of the €3 billion budget first promised.

"This is a promise we made a year ago and it is now becoming reality," said President von der Leyen, referring to her 2022 State of the Union address in which the Hydrogen Bank was first announced – and the €3 billion figure was first floated.

IEA highlights Latin America's potential 'outsize role' in global clean energy economy

- Region rich in renewable energy and mineral resources
- 'Implementation gaps' in policy impeding ability to achieve targets

Janet Wood

Latin America and the Caribbean can play an increasingly influential role in the global energy sector, according to a new International Energy Agency (IEA) special report.

The IEA now includes five Latin American countries – Argentina, Brazil, Chile, Colombia and Mexico – but the new 'Latin America Energy Outlook' covers fuels and energy technologies in 33 countries. It finds a sizeable gap in policy implementation: although 16 countries in the region have pledged to reach net zero emissions by mid-century or earlier, current policies will see the region continue using fossil fuels to meet a large share of its energy needs.

The report says renewables generate 60 per cent of the its electricity, twice the global average (although the majority is currently hydropower) and it has some of the world's best wind and solar resources, notably Brazil, Mexico, Chile and Argentina. The region has about 15 per cent of global oil and natural gas resources and also minerals essential to clean energy technologies.

"Latin America and the Caribbean can play an outsize role in the new global energy economy. With incredible natural resources and a longstanding commitment to renewables, countries in the region already have a head start on secure and sustainable transitions to clean energy. Leaning into these transitions would ignite growth in local economies – and put the world's energy system on a surer footing," said IEA Executive Director Fatih Birol.

The report identifies four key actions needed to cut energy-related carbon dioxide (CO_2) emissions: ramp up the adoption of renewable energy, advance the electrification of industry and transport, drive energy efficiency to moderate demand growth, and boost access to clean cooking solutions. Notably, accelerating renewables accounts for 40 per cent of the emissions gap between what is projected based on today's policy settings versus a scenario in which announced pledges are achieved.

Investment in the region must also grow substantially, the report finds. Financing for clean energy projects must double to $150 billion by 2030 and rise five-fold by 2050.

"The special report is a milestone in our work with Latin American and Caribbean countries, and we look forward to further regional and bilateral collaboration inspired by its analysis, which lays out a clear pathway for countries to meet their energy objectives," said Fatih Birol. "The IEA stands ready to support governments across the region as they advance their clean energy transitions, building a more secure and fairer global energy system in the process."

Brazil looks to green energy co-operation with Japan

Two states in Brazil have signed agreements with Japanese groups to advance clean energy projects.

A 'state-to-state' Memorandum of Understanding between Brazil's Minas Gerais state and Japan's Yamanashi prefecture includes green hydrogen generation among its clean energy initiatives. The two parties aim to use solar power in the state to produce hydrogen.

Minas Gerais governor Romeu Zema noted that the state is currently the largest solar energy producer in Brazil with an installed capacity of 7 GW and the potential to raise it to reach 30 GW. The most recent PV development in the state is a 662 MWp solar farm developed by Comerc Energia and Vibra Energia. Named Helio Vagas, the solar project required an investment of $408.2 million. It benefits from federal tax incentives to companies investing in infrastructure projects considered strategic for the country's development.

Meanwhile Piaui state is pursuing wind co-operation. State governor Rafael Fonteles signed a memorandum of understanding with Japanese renewables developer Shizen Energy for feasibility studies for a $4.95 billion offshore wind project.

The Piaui government said that, eventually, the project could be used for green hydrogen production.

Utah nuclear project ends but Illinois revives nuclear interest

Plans to build the first small NuScale small modular nuclear reactor (SMR) in Utah have been terminated for construction. But NuScale said it appeared unlikely the project will have enough subscription to continue toward deployment.

In 2020, the Department of Energy approved $1.35 billion over 10 years for the plant and it was expected to be the first SMR to win a construction licence from the US Nuclear Regulatory Commission. NuScale hopes to build SMRs in Romania, Kazakhstan, Poland and Ukraine but its share price fell around 20 per cent after the news.

NuScale had planned to launch the six-reactor 462 MW project in 2030 but towns pulled out of the project as costs rose. An Energy Department spokesperson said it was unfortunate news, but added: "We believe the work accomplished to date… will be valuable for future nuclear energy projects."

Meanwhile the Illinois Senate has approved lifting a 36-year-old moratorium on new nuclear power and may consider using SMRs to power industry. Senator Sue Rezin said: "If we want to take advantage of the amazing advancements in new nuclear technology that have occurred over the past couple of decades and not fall behind the rest of the states, we need to act now."

US offshore wind projects hit by cancellations and cost rises

- Developers complain of fixed delivery contracts as input prices rise
- New projects likely to seek higher prices

Janet Wood

The Biden Administration's goal of building 30 GW of offshore wind by 2030 has been hit by recent project cancellations and increasing costs.

Josh Irwin, Senior Vice-President of offshore wind at Vestas, said recently that the 2030 target was "widely and regretfully acknowledged" to be unrealistic and added that "the US industry is in the middle of a fundamental reset to restore economic viability".

Siemens Energy, General Electric and Vestas have all reported losses over the year and Richard Voorberg, Chief Executive of Siemens Energy North America, was quoted as saying that the market had a problem because "the big players, we're all losing money… That's not a sustainable model".

The Inflation Reduction Act has provided stimulus to the industry and at least 10 offshore wind ports and five projects to build vessels and structures for offshore wind have been announced. But rising project costs and expectations that interest rates will remain higher for longer are hurting the sector's prospects, analysts have said. A nacelle factory planned by Vestas to supply offshore wind projects in New Jersey and New York could be shelved if the Atlantic Shores, a project planned by Shell and EDF Renewables offshore of New Jersey, does not go ahead.

"We're taking a wait-and-see approach because we need to gain confidence in a multi-year, multi-project pipeline of demand," Irwin said.

So far just one 30 MW offshore wind project has entered full operation in the US, off the coast of Rhode Island. BP and Equinor booked $840 million in impairments from fixed price contracts for their two New York projects after the state rejected their requests to renegotiate contracts.

Meanwhile, in Massachusetts, SouthCoast Wind and Commonwealth Wind terminated agreements for 2.4 GW of wind farms.

Ørsted said it is cancelling its Ocean Wind I and II projects in southern New Jersey, but it said it would progress its Revolution Wind project in Connecticut and Rhode Island.

Despite cancellations, the offshore wind sector remains a pivotal part of the clean energy and other projects are moving forward.

In Virginia, Dominion Energy recently received a favourable decision from federal environmental regulators who reviewed a 176-turbine project more than 32 km offshore. New Jersey still has several other offshore wind projects in various stages of development, with four new proposals submitted in August alone.

"While macroeconomic headwinds are creating challenges for some projects, momentum remains on the side of an expanding US offshore wind industry — creating good-paying union jobs in manufacturing, shipbuilding, and construction; strengthening the power grid; and providing new clean energy resources for American families and businesses," said Michael Kikukawa, White House Assistant Press Secretary.

Canada looks at new capacity, smart grid, to meet growing demand

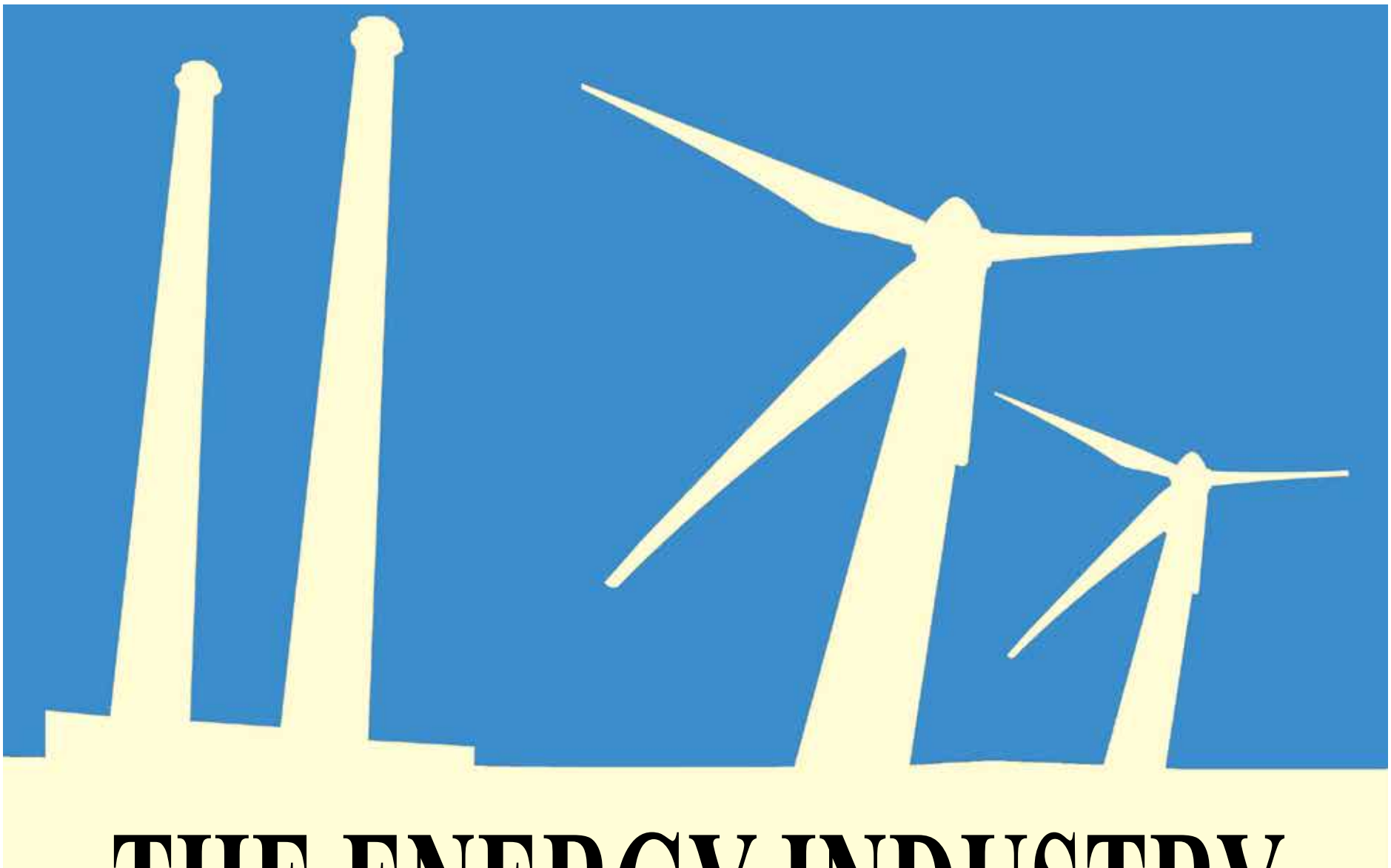
Hydro Quebec is planning to spend up to C$185 billion over the next 12 years to increase capacity and reliability to meet growing demand for electricity from industry and electric cars. The Canadian utility anticipates it will see demand rise to twice what Quebec consumes now by 2050.

"The plan is an ambitious one but so is the need to decarbonise our economy and invest in economic growth for the future of Quebec," said Hydro-Québec Chief Executive Michael Sabia. It includes $155-185 billion by 2035 to add around 8.5 GW to its generating capacity and strengthen its electricity transmission network.

Meanwhile the federal government has called for smart grid proposals to apply for funding under its C$3 billion Energy Innovation Programme, which includes expansion of renewables, smart grids and Canadian offshore wind power.

The government seeks significant improvements to enhancing grid reliability, resiliency and flexibility; energy affordability; enabling greenhouse gas emission reductions; and creating market conditions that are more favourable to scaling successful innovations.

The Honourable Jonathan Wilkinson, Minister of Energy and Natural Resources, said: "Smart grid investments optimise the use of existing electricity system assets – supporting a 'use what you already have' and 'doing more with less' approach."



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Halt on US Clean Power Plan may have wider implications

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Pakistan plans for jump in renewables

■ Installed capacity to reach 63 GW by 2031 ■ Renewables share to reach 62 per cent

Syed Ali

Pakistan is planning to boost its installed power generation capacity by 40 per cent in the next eight years, as it seeks to meet the growing demand for electricity and shift to cleaner sources of energy.

The country aims to increase its power capacity from 45 GW to 63 GW by 2031, according to an official document. The plan, which is under the Special Investment Facilitation Council (SIFC), is based on a projected 5 per cent average annual growth in the next eight years.

Touted as "powering the future", the focus of the energy plan is to rapidly increase renewables, doubling its share in installed capacity. Under the planned energy transition for the period under review, Pakistan aims to expand the share of renewables in the energy mix, including hydropower, from 31 per cent today to 62 per cent. This will help reduce reliance on fossil fuel and support the transition towards green energy.

The country has recently made some headway in realising its vision. In early November, K-Electric (KE), the primary electricity provider for Karachi, took a significant step in a plan aimed at adding 640 MW of renewable capacity to the local grid.

KE's revised Requests for Proposals (RFPs) submitted include four renewable energy projects, all in line with open competitive bidding regulations established by the National Electric Power Regulatory Authority (NEPRA). These projects aim to diversify the city's energy mix while driving down costs and reducing environmental impact.

Two of the projects, the 50 MW solar project at Winder and the 100 MW solar project at Bela, are particularly strategic. KE is planning to invest in new 132 kV transmission lines and grids running from Hub to Bela – a move aimed at enhancing the reliability of power supply to the Lasbela region in Balochistan.

The Asian Development Bank (ADB) recently announced support for the country's need to strengthen its power transmission network with the approval of $250 million in loans for the Punjab and Khyber Pakhtunkhwa provinces. ADB's 'Power Transmission Strengthening Project' will help reinforce the stability of the national grid by increasing its transmission capacity. The project will expand the high-voltage transmission network to close 500 kV and 220 kV transmission line loops and reduce transmission losses in Lahore city in Punjab by replacing old lines.

"Reliable power supply is essential to inclusive, sustainable economic growth, and it will also provide economic opportunities to rural communities," said ADB Director General for Central and West Asia Yevgeniy Zhukov. "We are pleased to continue supporting Pakistan in its efforts to achieve energy security while improving energy efficiency."

China's carbon emissions could start falling next year

China's carbon emissions could peak this year before falling into a structural decline for the first time from next year after the country saw a record surge in clean energy investments, according to research undertaken for Carbon Brief.

The research found emissions rebounded this year after the government dropped its Covid restrictions in January. However, the rebound in fossil fuel demand emerged alongside a historic expansion of low-carbon energy sources that was far in excess of the government policymakers' targets and expectations.

Beijing's solar and wind installation targets for the year were met by September, according to the report, and the market share of electric vehicles is already well ahead of the government's 20 per cent target for 2025. Notably, solar installations increased by 210 GW this year alone, which is twice the total solar capacity of the US and four times what China added in 2020.

The analysis, which is based on official figures and commercial data, found that China installed 70 GW of wind power this year – more than the entire power generation capacity of the UK. It is also expected to add 7 GW of hydropower and 3 GW of nuclear this year, said the report.

"These record additions are all but guaranteed to push fossil-fuel electricity generation and CO_2 emissions into decline in 2024," said Lauri Myllyvirta, a lead analyst at the Centre for Research on Energy and Clean Air and the author of the report.

Myllyvirta added: "If this pace is maintained, or accelerated, it would mean that China's electricity generation from fossil fuels would enter a period of structural decline – which would also be a first. Moreover, this structural decline could come about despite the new wave of coal plant permitting and construction in the country."

■ Shanghai Electric Wind Power Group, a subsidiary of Shanghai Electric, has completed what is claimed to be the world's first maritime renewable energy project to combine deep-sea floating wind and solar energy with aquaculture. Notably, the project features a hexagonal space within the platform's central area that is specifically designed for fish farming.

Indonesia unveils clean energy investment plan

Indonesia has officially released its Comprehensive Investment and Policy Plan (CIPP) 2023, which envisages an initial commitment of $20 billion to support the country's energy transition.

The estimated initial financing commitment is split between contributions from international partners such as the governments of the partnership co-leaders – Japan and the US – and private finance.

The CIPP estimates that over $97.1 billion has to be invested in the period 2023-2030 and $580.3 billion between 2023 and 2050. The cost for just transition assessments and interventions will separately reach at least $0.2 billion by 2030. The initial commitment is expected to cover about one-fifth of the total investment needed to reach the JETP targets set in 2030.

Written by the Just Energy Transition Partnership (JETP) Secretariat team, this strategic "living document" serves as an energy transition roadmap and includes a number of scenarios with renewable energy and carbon dioxide (CO_2) reduction targets. In addition, it gives policy reform recommendations and establishes a just transition framework.

The JETP Scenario for the period 2023-2050 assumes a renewable energy share of 44 per cent in 2030 and 92 per cent in 2050, a variable renewable energy (VRE) share of 14 per cent (38 GW) in 2030 and 36 per cent (309 GW) in 2050, as well as no more than 250 million tonnes of CO_2 emissions in 2030. In this scenario, net zero emissions in the power sector are expected to be achieved in 2050.

Indonesia took a significant step in expanding its renewable generation capacity last month with the inauguration of Southeast Asia's largest floating solar plant. The 145MW (192MWp) Cirata plant, developed by Masdar and PLN Nusantara Power (PLN NP) will power 50 000 homes and offset 214 000 tons of carbon dioxide emissions. It is Masdar's first floating solar PV project.

Masdar and PLN NP also recently signed an MOU to develop Phase II of Cirata with up to 500 MW additional capacity, following a regulatory development from the Ministry of Public Works and Housing in Indonesia that has increased the portion of water that can be covered, for renewable energy uses, to a maximum of 20 per cent.

Last month also saw PLN NP sign a collaboration agreement with Powerchina International Group Limited (Powerchina) to develop wind energy in Indonesia. The country is said to have a wind energy potential of as much as 155 GW.

At the same time the government said it is exploring cooperation with Chinese state-owned electricity utility State Grid Corporation of China (SGCC) to develop Indonesia's electricity transmission grid network.

Philippines could be 100 per cent renewables by 2050

The Philippines is capable of running almost solely on renewable energy by 2050, according to a new report commissioned by the sustainability think-tank, Center for Energy, Ecology and Development (CEED).

The analysis, undertaken by Berlin-based global science policy institute Climate Analytics, said it is entirely feasible for the Philippines' power sector to decarbonise by 2050, ditching both coal and gas and embracing renewables, and deliver beneficial outcomes for the country.

Among the report's key findings is that coal fired power could be phased out of the power sector by 2035, and gas almost entirely phased out by 2040, given the Philippines' abundant renewable energy potential estimated at around 1200 GW.

The report said the Philippines' power sector can attain a 1.5°C compatible emissions pathway without resorting to "false solutions like retrofitting the coal fleet for green hydrogen, carbon capture and storage, or building new nuclear power capacity".

"We find that with the right international funding and policies in place, the Philippines could transition its power sector to near-100 per cent renewable energy without compromising on the costs of electricity, reducing its reliance on expensive imports of both coal and gas, and creating up to a million jobs by 2050," Climate Analytics analyst and project lead for the report, Nandini Das said.

The report claims its findings contrast with the latest available updates on the new Philippine Energy Plan (PEP) set to be published by the Department of Energy this year, "which purports the need for additional coal and gas capacities, and integration of new technologies like nuclear and carbon capture utilisation and storage".

■ Last month the Philippines signed an agreement with the US clearing a path for US investment to jumpstart nuclear power in the country. During an Asia-Pacific summit in San Francisco, the Manila Electric Co. (Meralco) also entered into a cooperative agreement with US-based Ultra Safe Nuclear Corp. (USNC) to study the potential deployment of at least one micro-modular reactor energy system in the country.

European Commission acts to drive wind deployment in the bloc

- Offshore wind a major target in doubling wind capacity
- North Sea countries join to remove deployment barriers

Janet Wood

The European Commission has produced a new Wind Energy Action Plan for a "massive increase" in wind power in the bloc, up from 204 GW today to 500 GW in 2030, which would mean that wind will contribute 34 per cent of the EU's electricity by the end of the decade, compared with 16 per cent now.

"This package will help the European wind sector to grow internally and compete globally, thus reducing dependence on external suppliers and creating green jobs for workers," said Maros Sefcovic, European Commission Vice-President. It has six lines of action: acceleration of deployment through increased predictability and faster permitting; improved auctions that reward better projects; access to finance, particularly through the EU's Innovation Fund and European Investment Bank; a 'fair and competitive' international environment in which the EU will monitor trade practices which benefit foreign wind manufacturers; skills development with training academies in new green technologies; and Member State commitments.

The action plan particularly aims to speed deployment of offshore wind and it will provide guidance on how to share project costs or ports.

The acting Spanish Minister for Ecological Transition, Teresa Ribera, said: "It is not about creating one, two, three national champions, but the whole value chain that allows us to further develop the potential of wind energy."

Offshore wind has been boosted further as nine countries joined with the European Commission to work on collective tenders for deployment. Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, and Sweden jointly form the North Seas Energy Cooperation (NSEC) and together they want to translate broad ambitions into tangible progress, auctioning around 15 GW every year and awarding almost 100 GW by 2030.

"The North Sea is leading the way in their deployment, and has the potential to become Europe's 'Green Power Plant'," said Kadri Simon, European Commissioner for Energy.

"Our discussions showed the joint determination and commitment to continue the work to deliver on our offshore ambitions, and to take the work forward to boost the competitiveness of this vital sector."

The countries will also better coordinate their offshore network planning. In January 2024, the European Network of Transmission System Operators for Electricity (ENTSO-E), will publish a shared plan for infrastructure in the North Sea, with input from NSEC.

Joint planning was recommended in a recent study by the Netherlands Enterprise Agency (RVO) and Royal HaskoningDHV for NSEC, which also said NESC targets are unlikely to be met without new and upgraded port infrastructure.

Germany plans electricity subsidies for industry as European prices rise

The German government has proposed a five-year plan to reduce the burden of energy costs on industry. The plan would see tax cuts and subsidies that will cost the state €28 billion over the half-decade.

The plan follows several months of discussion between Social Democrats, environmentalists and liberals – all part of the ruling coalition – and manufacturers and trade unions.

Lower electricity prices for industry over five years, will particularly benefit energy-intensive companies and aims to prevent companies from relocating production to countries with lower energy costs.

"The government will greatly relieve industry of its electricity costs," Chancellor Olaf Scholz said.

The plan comes as Europe has seen rising electricity costs despite subsidies introduced by several countries after gas supplies were interrupted in the wake of the Ukraine invasion. Recent data from Eurostat showed that in the first half of 2023, prices rose in 22 member states and the average price of electricity in the EU for domestic consumers was up 14.2 per cent on 2022. Prices were highest in Netherlands, Belgium, Romania and Germany. Five countries Denmark, Portugal, Malta, Spain and Luxembourg. Prices were lowest in Bulgaria, Hungary, Poland, Malta and Spain

Sweden sets out roadmap for 10 new nuclear plants

A new roadmap on nuclear power published by the Swedish government, which proposes a risk-sharing model, has been welcomed by Fortum and Vattenfall.

The plan estimates the country will need the equivalent of 10 new conventional nuclear reactors by 2045 and the government outlined plans for two nuclear reactors by 2035. Energy Minister Ebba Busch said the plan would be a further step towards Sweden "becoming a strong nuclear nation again". She added: "In the next 25 years, we must double Sweden's electricity production."

Vattenfall is the largest owner of Swedish nuclear power plants, and is conducting a preliminary study on constructing small modular reactors (SMR) at Ringhals.

Fortum has also launched a two-year feasibility study on the conditions for possible new reactors.

Elsewhere, Slovakia is working with Czechia on a project to build a new large nuclear power plant or SMRs in western Slovakia. Prime Minister Robert Fico said: "The schedule of work in cooperation with the Czech Republic, where we are preparing the construction of another unit of the nuclear power plant in Jaslovske Bohunice, is still in operation."

Boost for UK energy sector decarbonisation

- Faster connections and strategic planning introduced
- Offshore wind price cap raised and new projects exempted from windfall tax

Janet Wood

The UK government has taken action to remove blocks to decarbonising its energy system and tried to regain a leading position in the move to net zero. Measures were announced in a recent fiscal plan (the Autumn Statement) and the government's legislative programme laid out in the King's Speech.

The Department of Energy Security and Net Zero (DESNZ) and regulator Ofgem have worked on new rules that would speed up electricity grid connections. Already new rules will favour viable projects and force out stalled or speculative projects – a move from the 'first-come, first-served' approach, which had led to a 400 GW 'queue' for connections. Legal and technical changes are expected to unlock around 50 GW of new capacity and Ofgem and DESNZ will consult jointly on further measures.

Other measures include introducing Regional Energy Strategic Planners (RESPs), which will work to the Future System Operator (FSO). The new FSO is part of a restructured governance in energy, which will see the electricity system operator take on more responsibility for strategic network planning and delivery.

Nicholas Geddes, Business Leader for Whole Systems and Networks at Energy Systems Catapult, said: "Regional Energy Strategic Planners will play a vital role in driving this and will be a key actor in the wider institutional and governance landscape, linking whole systems approaches at the local level, in the form of LAEPs, with whole systems approaches at the national level, in the form of the Strategic Spatial Energy (SSEP)."

The government also won praise for acting to increase the maximum price available to offshore wind developers in the next Contracts for Difference auction. The most recent auction attracted no offshore wind bids, so the government has raised the price ceiling by two-thirds in an effort to revive new projects in a sector that is struggling with surging costs. The price for floating offshore wind farms will increase by around 50 per cent.

Also in the Autumn Statement the government announced it would exempt low-carbon power generating schemes, including wind farms, from the UK's windfall tax on the sector.

The Treasury said the exemption from the so-called Electricity Generator Levy, would come into effect immediately for projects awaiting approval. Rod Wood, Managing Director of onshore wind developer Community Windpower, said the exemption was a "step in the right direction".

He said: "We have worked hard to express just how much damage the Electricity Generator Levy has been doing to investment in new renewable developments."

'Agrivoltaic' project shows potential of combining solar and other land uses

An 'agrivoltaic' solar PV project has entered operation in Latina in Lazio, Italy. Cero Generation's 70 MW Pontinia project is backed by 10-year virtual power purchase agreements (PPAs) with Philips and Heineken.

Around 65 per cent of the plant's 135 ha will also be used for crops in collaboration with a social farm, Fattoria Solidale del Circeo.

Marta Martinez Queimadelos, Chief Executive of Cero Generation, said: "The virtual PPAs with Heineken and Philips and the project's clever integration with agricultural crops embodies the scale of innovation needed to combat the climate crisis."

The project is one of a large number of initiatives that combine solar PV with other land uses, including domestic rooftop PV.

A new report by the Karlsruhe Institute of Technology (KIT) said half of Europe's single family homes could be fully energy self-sufficient with a combination of solar energy and storage systems. The potential for self-sufficiency was highest in places like Spain, where climatic conditions are favourable, and Germany, where grid fees are comparatively high. A combination of solar systems, retrofitting, storage and heat pumps could fully cover energy demand for space heating and cooling, hot water, lighting and cooking, the report found.

But author Max Kleinebrahm said: "Even in 2050, disconnecting from the power grid will not be the most economically advantageous decision."

China's 'Belt & Road' brings 128 GW of capacity despite project hurdles

- Around $200 billion delivers 128 GW of power over ten years
- Asia and Africa benefit the most, but one in five projects fail

Nadia Weekes

Chinese companies have completed more than 300 overseas power projects over the past decade under the Belt & Road Initiative (BRI), with an estimated investment value of around $200 billion delivering 128 GW of installed power capacity.

However, more than 20 per cent of projects have been cancelled or shelved to date, according to Wood Mackenzie's report 'Belt & Road at 10: powering on through growing pains', which highlights the achievements and challenges Chinese firms encountered in overseas power projects in the first decade of China's Belt & Road Initiative (BRI).

Asia has emerged as the primary destination for BRI power projects, accounting for 75 per cent of total capacity, with 62 coal and 30 gas power projects representing 57 per cent of BRI project capacity, and 199 renewable energy projects contributing to 68 per cent of projects and 37 per cent of capacity. The remaining 6 per cent of the capacity is from nuclear and other sources.

Over the decade, the share of renewables in new-build capacity has increased significantly from 19 per cent to 47 per cent in 2022.

According to Wood Mackenzie, Pakistan, Vietnam and Indonesia were the top three markets for BRI power projects, out of a total of 72 countries. The top 15 markets totalled 103 GW, representing 80 per cent of all completed projects.

Most of the troublesome projects were in Asia and Africa. The cancelled or shelved projects had a capacity of 54 GW, which included 33 GW of coal, 12 GW of hydro, 6 GW of gas, 2 GW of solar, and 0.4 GW of wind.

Coal power projects were the most affected, primarily due to changes in policy and increased political pressure to reduce carbon emissions. China's 'no new overseas coal power' policy, announced in September 2021, has had a significant impact on the BRI project pipeline. Renewable projects also faced challenges, with 33 projects being cancelled or shelved, primarily due to commercial risks such as cost inflation and over-optimistic financial assumptions.

"The most common factors that led to the failure of overseas projects were the changes in policy and cost. Chinese companies faced more risks when developing greenfield projects, with a 27 per cent rate of cancellation or shelving, compared with a 9 per cent failure rate for pure EPC (engineering, procurement, and construction) turnkey projects," said Alex Whitworth, Vice President, Head of Asia Pacific Power and Renewables research at Wood Mackenzie.

The BRI project pipeline is estimated at about 13 GW per year, with renewables projects accounting for 57 per cent of 80 GW of planned capacity. Asia and Africa will remain the top two markets, accounting for 93 per cent of future projects.

Oman eyes up to $30 billion from second green hydrogen auction

After a successful first round of auctions resulting in five project awards worth more than $30 billion, Hydrogen Oman (Hydrom) is now expecting to attract $20-30 billion worth of investments through the second round of auctions for large-scale green hydrogen projects in the sultanate.

Agreements from the first round of public auctions were signed in June 2023 with major international consortia and companies to establish large-scale green hydrogen and ammonia projects in Oman. In the second round of public auctions, Hydrom plans to award three land blocks in the Dhofar region by the end of March 2024.

Eng Abdulaziz al Shidhani, Managing Director of Hydrom, told the local press that he expected investments in the green hydrogen sector in Oman until 2050 to amount to $140 billion. "The public auctions help achieve transparency on the one hand and attract serious investors who have the financial solvency to implement such projects on the other hand," he said.

Commenting on the success of the first round, Shidhani said that the turnout was good, with participation from many major international companies. He said that the preliminary data for the second round was also promising.

Production from the five projects for which agreements were signed in June 2023 is projected at about 750 000 t of green hydrogen. Oman aims to produce more than one million tonnes of green hydrogen by 2030, reaching 8 million t by 2050.

Hydrom's goal is for the first green hydrogen project to be commissioned no later than 2030, according to Shidhani. "The agreements were designed on the basis that the development of projects until they enter the production stage, will take about seven years, including three and a half years to take field measurements of the quality of solar and wind energy."

Egypt to export renewable energy to Europe

Greek infrastructure group Copelouzos, on behalf of its subsidiary Elica, has applied for a project to transfer 3 GW of energy into Greece's Attica peninsula via a subsea cable.

The project, also known as GREGY, aims to replace Europe's usage of 4.5 billion m^3 of natural gas per year and reduce CO_2 emissions by 10 million tonnes annually. The subsea power cable project has a total budget of €4.2 billion.

The Egyptian Electricity Transmission Company (EETC) and Belgium's engineering company Jan De Nul have signed a memorandum of understanding (MoU) for the project.

Egypt is seeking to position itself as a regional hub for renewable energy and a strategic partner to Europe. The EU is considering adding the electrical interconnection project to its list of Projects of Common Interest (PCIs), which will facilitate funding and the issue of permits.

The European Commission's list will be submitted to the European Parliament and Council, with a decision due in two months, or up to four months upon request.

The Minister of Electricity and Renewable Energy, Mohamed Shaker, announced in September that Egypt plans to become a leading green hydrogen producer and exporter.

Over the past year, the country has signed many MoUs with various international entities to attract foreign investment in green hydrogen and to become a regional hub for hydrogen production.

Egypt and the International Energy Agency (IEA) signed up to a two-year joint work programme in early November aiming to address the environmental challenges associated with fossil fuel use, and boost renewable energy deployment and hydrogen production.

The programme will focus on Egypt's clean energy transition, energy security and climate resilience. It will aim to reduce emissions in oil and gas activities, promote the use of hydrogen and renewables, and foster collaboration on data and statistics.

Abu Dhabi inaugurates world's largest single-site solar power plant

- 2 GW single-site project to power 200 000 homes
- Tariff set at $1.32 cents/kWh

Nadia Weekes

HH Sheikh Hazza Bin Zayed Al Nahyan, Deputy Ruler of Abu Dhabi, has unveiled the 2 GW Al Dhafra solar photovoltaic (PV) power project, said to be the world's largest single-site solar power plant. It will power almost 200 000 homes and eliminate more than 2.4 million tonnes of carbon emissions every year.

Abu Dhabi Future Energy Company (Masdar) and its partners Abu Dhabi National Energy Company (TAQA), EDF Renewables and Jinko Power, together with procurer Emirates Water and Electricity Company (EWEC), inaugurated the facility ahead of the UAE hosting the UN's COP28 climate summit in early December.

TAQA owns 40 per cent of the project, with Masdar, EDF Renewables and Jinko Power owning a 20 per cent stake each.

"We are witnessing, day after day, project after project, that the UAE is at the global forefront of developing and adopting innovative clean energy solutions," said Sheikh Al Nahyan.

Located 35 km from Abu Dhabi city, the landmark solar plant spans more than 20 km^2 of desert and was built in a single phase creating 4500 jobs during construction. It uses almost four million bi-facial solar panels to maximise yield.

The project led to one of the most competitive tariffs for solar power set at AED 4.97 fils/kWh ($1.35 cents/kWh), which upon financial close was further improved to AED 4.85 fils/kWh ($1.32 cents/kWh).

The plant will supply power to the procurer EWEC under a power purchase agreement (PPA) signed in 2020, and will raise Abu Dhabi's solar power production capacity to 3.2 GW.

Since Masdar switched on the country's first 10 MW solar project in 2009, the UAE has made huge strides in solar energy deployment and use, now ranking second globally in terms of per capita solar energy consumption. Masdar has ambitions to deploy 100 GW of renewable energy capacity by 2030.

Meanwhile, Masdar and Emirates Steel Arkan have agreed to develop the MENA region's first green hydrogen-based project to decarbonise the UAE's hard-to-abate steel sector by using green hydrogen instead of natural gas to extract iron from iron ore, a key step in steelmaking.

The pioneering green steel demonstration project is currently being installed in the Emirates Steel Arkan production facilities at the Industrial City of Abu Dhabi. Electrolysers have already been delivered to the site and commissioning is expected in early 2024.

Green shoots for Vestas, as Siemens Energy battles headwinds

- Siemens Energy to cut costs as Gamesa woes drag group
- Vestas returns to profit

Junior Isles

Siemens Energy is targeting €400 million of cost cuts at its struggling wind turbine business after huge losses forced it to take a €15 billion government-backed bailout.

The group is undertaking a major shake-up of its wind business, looking at outsourcing production for important components of its wind turbines, narrowing its international focus and revising unfavourable contract terms with customers.

Speaking at an investor day last month, Siemens Energy Chief Executive Christian Bruch explained: "We are making sure we are streamlining wherever possible," promising the company would break even in fiscal year 2026.

He warned that the turnaround at Siemens Gamesa, its wind division, would be "painful" but said there was a plan in place to put the business back on track within three years.

Gamesa reported a €4.4 billion loss this fiscal year, leading to a €4.6 billion group loss. Technical problems with its onshore platforms 4.X and 5.X are expected to see the division hit by a further €2 billion of losses in 2024, the company said.

Jochen Eickholt, Head of Gamesa said that of the 65 000 turbines installed by Gamesa so far, the faults affected about 2900 turbines and only a few turbines have failed. The company has therefore been trying to model the problem and see how many might be theoretically affected, since it is typically responsible for maintenance over a 30-year time horizon.

Siemens Energy stressed, however, that its financial challenges were not being experienced in other parts of the group.

Figures showed other business lines, representing 70 per cent of group revenues, in gas technology, power grids and industrial transformation, were performing strongly. The company also reported a record order backlog of €112 billion, which the government-backed rescue package will allow it to fulfil.

Siemens Gamesa's problems have been compounded by an offshore wind market that has seen turbine suppliers and project developers hit by increasingly unfavourable contracts, supply chain delays and rising interest rates.

At the end of October, Danish project developer Ørsted recognised impairment losses of DKK 28.4 billion (about €3.8 billion) in the first nine months of 2023.

There are, however, signs that the winds are changing. After almost two years of losses, Vestas the Danish wind turbine manufacturer made a slim profit in the third quarter. Henrik Andersen, Chief Executive of Vestas, said supply chain pressures had eased during the third quarter, with supplies arriving on time to its factories worldwide, which was a "huge relief".

Vestas reported third-quarter profits of €70 million and said it was on track to be profitable in 2023, compared with a €1.6 billion loss in 2022. The company said it was now on course to make an annual profit margin of up to 2 per cent. It took orders for 4.5 GW of wind turbines during the quarter, 138 per cent higher than the same quarter in 2022.

Vestas was the first among the turbine suppliers to raise prices for new turbines after 2021, a move that now appears to be delivering positive results. Revenues in the third quarter were 11 per cent higher-year-on year on stable volumes. Vestas says the average selling price it achieved this quarter was up 5 per cent compared with the previous three months, while the cost of steel and logistics continue to fall.

SMR doubts hit NuScale

US-based NuScale Power called off a deal to build small modular nuclear reactors (SMRs) in Idaho, USA, last month, dealing a major blow to its prospects and triggering a collapse in its stock price.

NuScale, which has received key regulatory approvals for its SMR design and secured $600 million in federal backing, has announced deals with several utilities around the world to explore building reactors.

NuScale's deal to build 12 modular reactors in Idaho for Utah Associated Municipal Power Systems was among the company's best prospects and was originally due to begin operating in 2027.

Delays, however, pushed the project out to 2030, and some communities served by the Utah power agency pulled out of the deal amid rising costs. This led NuScale to announce last month that the project would not go forward because it did not have sufficient customers.

NuScale reported early this year that the rising costs of building materials and higher interest rates had increased the project's cost by 75 per cent, to $9.3 billion. The target price for power from the project had increased by more than 50 per cent.

Following the collapse of the deal, the company moved to restore investor confidence in the technology and the market.

"We will continue to progress the commercialisation of our technology with our other existing and future customers," NuScale CEO John Hopkins wrote in an email to shareholders and business partners. He said there is continued, strong demand for nuclear power because it does not generate the carbon emissions that contribute to climate change.

Other SMR developers also remain positive. In early November Ansaldo Nucleare, ENEA, RATEN, SCK CEN, and Westinghouse Electric Company formed a collaboration to accelerate the industrial deployment of SMRs. The partners signed a Memorandum of Understanding, with the aim of showcasing the potential of Lead Fast Reactor Technology developed by Westinghouse.

The partners will work towards the commercial-scale deployment of lead-based SMRs, which offer robust safety, efficient nuclear fuel utilisation, and reduction of long-lived radioactive waste.

Hydrogen collaborations

Several major equipment manufacturers last month announced significant collaborations that will serve to ramp-up global green hydrogen production.

Most recently, GE Vernova's Power Conversion business and Next Hydrogen Solutions Inc. signed a memorandum of understanding (MoU) to integrate Next Hydrogen's electrolysis technology with GE Vernova's power systems offerings to produce green hydrogen.

In its initial phase, GE Vernova and Next Hydrogen plan to pioneer advanced power systems that align with the forthcoming generation of Next Hydrogen electrolysers, which are scheduled to launch in 2024. This collaborative effort will encompass installation, rigorous testing, and the integration of a Next Hydrogen water electrolyser with a power supply designed and fabricated by GE Vernova.

Subsequent phases of this dynamic partnership will focus on near-term market demonstrations and deployments, paving the way for expanded large-scale commercial green hydrogen initiatives.

The MoU follows a Memorandum of Intent (MoI) signed earlier in the month between Topsoe, ULC-Energy and Rolls-Royce SMR. The MoI will jointly investigate the production of hydrogen using Topsoe's solid oxide electrolyser cell (SOEC) technology and electricity and heat produced from a Rolls-Royce SMR nuclear power plant.

Under the MoI, the parties will also prepare a valuation of the operational flexibility of the Rolls-Royce SMR/Topsoe SOEC combination in the future energy market based primarily on renewable energy. Initially, the parties are looking at a conceptual study to demonstrate synergies between SMR and SOEC.

Dirk Rabelink, CEO of ULC-Energy, said: "Hydrogen will play an increasingly important role in balancing future energy markets. We expect nuclear energy, especially in combination with high temperature electrolysis, to be able to produce zero-emission hydrogen competitively on a stand-alone basis. Additional value associated with the operational flexibility will further enhance the business case for this solution."

- The new gigawatt electrolyser factory of Siemens Energy and Air Liquide was officially inaugurated in Berlin last month. With an annual production capacity of 1 GW, Siemens Energy and Air Liquide expect a ramp-up to at least 3 GW by 2025 with potential for more. With an installed electrolysis capacity of 3 GW, an average of 300 000 t of green hydrogen can be produced per year when operated with renewable energies.

Octopus Energy banks on offshore wind

Octopus Energy is ramping up its activities in renewables and offshore wind in particular as it accelerated plans last month to become a major global player.

In mid-November the UK-based energy company launched a fund to invest £3 billion ($3.78 billion) in offshore wind by the end of the decade. The company's new Octopus Energy Offshore Wind fund is opening with a £190 million cornerstone investment from Tokyo Gas, the Japanese utility that owns almost 10 per cent of Octopus, while Octopus is in the process of raising the rest from outside investors.

Executives said it was part of plans Octopus announced in July to deploy £15 billion of investments in offshore wind by 2030. The Octopus Energy Offshore Wind fund will look at both traditional offshore wind turbines which are fixed to the seabed and floating offshore wind turbines.

"Tokyo Gas has set a target to acquire and trade 6 GW renewable power sources by 2030. To accomplish this goal, we have proactively taken multi-faceted approaches for offshore wind projects, and will accelerate developments of offshore wind, including floating offshore wind," said Kentaro Kimoto, Representative Corporate Executive Officer and Vice President of Tokyo Gas.

Octopus's generation arm started investing in offshore wind in 2022, taking stakes in major projects including Ørsted's 1.2 GW Hornsea One wind farm in the North Sea.

In mid-November the company took a stake in North Sea offshore wind farm Butendiek. The deal is the fifth investment in the German wind market in just over a year.

Americas

Hitachi Energy to upgrade Garabi converter station

Taesa, one of Brazil's largest electric energy transmission groups, has awarded Hitachi Energy a contract to upgrade its Garabi HVDC converter station.

Hitachi Energy will upgrade the control and protection system with its latest MACH technology, allowing a high degree of integration. This will be the first HVDC upgrade in Brazil.

The Garabi converter station connects to a 2200 MW HVDC link that enables power exchange between Argentina and Brazil, which is normally not possible as Argentina's power system operates at 50 Hz, and Brazil's operates at 60 Hz. The transmission system comprises 490 km of AC overhead lines between the substations in northern Argentina and southern Brazil and the HVDC converter station at Garabi in Brazil, near the border.

Canadian Solar awarded Arizona 200 MW BESS

Canadian Solar won an order to supply a 200 MW/800 MWh battery energy storage system (BESS) for a site being developed by DEPCOM Power and Tucson Electric Power (TEP) in southeast Tucson, Arizona, USA.

Canadian Solar will supply its lithium iron phosphate (LiFePO4) battery, the SolBank, which will be installed as part of the Roadrunner Reserve System project. The facility will be built by DEPCOM Power and will be owned and operated by TEP.

GE Vernova stabilising grid on Guadeloupe

EDF Systèmes Energétiques Insulaires (SEI) has chosen a consortium of GE Vernova's Power Conversion business and Eiffage Énergie Systèmes to supply and install a turnkey synchronous condenser system at the EDF SEI TAC Jarry Sud plant in Guadeloupe. The system will assist in stabilising the island's electrical grid.

GE Vernova will supply a 200 MW/25 MVA synchronous generator along with its auxiliaries and the plant control system. The contract includes a 12-year equipment maintenance agreement.

Eiffage Énergie Systèmes is responsible for electrical distribution from the main transformer to the equipment's interface point, as well as civil engineering, installation, and site management.

Asia-Pacific

Vestas to supply wind turbines for South Korea

Vestas has won a contract to provide 33 units of the V236-15.0 MW wind turbine for BadaEnergy's Ulsan Gray Whale 3 floating offshore wind farm in South Korea. The turbines will be installed on floating foundations.

Hyundai Heavy Industries (HHI) was selected as preferred bidder for the EPC of the 504 MW Ulsan Gray Whale 3 floating offshore wind farm.

HHI is collaborating in a task force with BadaEnergy and Vestas to optimise design of the fabrication of the 33 hulls, the integration of the turbines, and the installation to the offshore site.

Construction is due to begin in stages by 2025, with the goal of commercial operation commencing in 2028. Ulsan Gray Whale 3 is planned to be constructed 60 to 70 km from Onsan Port.

Gujarat wind power order for Suzlon

Juniper Green Energy has awarded a contract to the Suzlon Group for 16 wind turbines each rated at 3.15 MW for a project located in the Dwarka district of Gujarat, India. It is scheduled to be commissioned in 2025.

Suzlon will supply the turbines, oversee erection and commissioning, and manage O&M services post-commissioning. Each turbine will be mounted on a hybrid lattice tubular (HLT) tower.

JP Chalasani, CEO of Suzlon Group, said: "We are delighted to announce our second order with Juniper Green Energy in a short period of time for our 3 MW series. Juniper Green Energy is a committed renewable energy IPP in India with a comprehensive wind, solar and hybrid power projects."

Wärtsilä wins Masbate Gold O&M contract

Wärtsilä has signed a five-year extension of its O&M agreement with Phil Gold Processing & Refining for the Masbate Gold Project (MGP) power plant located on Masbate Island in the Philippines. Wärtsilä has operated and maintained the power plant since 2009.

Phil Gold operates the processing plant in the MGP operations.

The Masbate mine is remotely located some 360 km southeast of the country's capital, Manila and has no connection to the grid. The power plant, which has recently been expanded, has a maximum output of 47 MW.

GE Vernova retrofitting Sembcorp's Sakra plant

Sembcorp, IHI, and GE Vernova's Gas Power business have signed an MOU to jointly explore the potential retrofitting of Sembcorp's Sakra power plant in Singapore with ammonia-firing capabilities.

The agreement builds upon a separate cooperation between IHI and GE Vernova on developing a retrofittable, 100 per cent ammonia-capable combustion system that is compatible with specific GE Vernova turbine models.

The project will potentially assist Sembcorp to generate low-carbon energy from its existing power plant assets and support Singapore's efforts to diversify its energy sources and decarbonise the power sector. This is also expected to bolster industry confidence for the development of an ammonia value chain in Singapore.

AFRY wins contract for Kuala Selangor

Worldwide PMC (WPMC) has awarded AFRY a contract to provide owner's engineering services for a waste-to-energy project in Kuala Selangor, Malaysia.

The Jeram WtE project will consist of the construction of a plant with a capacity of approximately 2700 t/day, producing a net electrical output of up to 52 MW for export to the national grid.

AFRY's assignment encompasses the provision of project management services, engineering review and monitoring of construction, erection, commissioning as well as testing activities.

Offshore wind contract in Taiwan

Van Oord has signed a contract for the transport and installation of three export cables, totalling about 175 km in length, for the Greater Changhua 2b and 4 offshore wind projects.

Van Oord will deploy its cable-laying vessel Nexus and the company's own trencher Dig-It to bury the cables to the required depth. It will also deploy its LNG-powered hopper dredger Vox Apolonia to pre-excavate cable joint pits down to the necessary burial depth. The works in Taiwan are scheduled to start in 2024 and are expected to be finished in 2025.

The 920 MW Greater Changhua 2b and 4 offshore wind farms will comprise around 65 wind turbines with an individual capacity of 14 MW, installed some 35-60 km off the Changhua coast.

Europe

GE to build 150 MW Tarbert power plant

A contract to build temporary generating capacity at SSE's Tarbert site in County Kerry, Ireland has been won by GE Vernova's Gas Power business. The 150 MW plant will consist of three GE Vernova LM6000PC Sprint aeroderivative gas turbines. GE Vernova will also provide O&M services for the simple cycle power plant.

The LM6000 units will be manufactured in Veresegyház, Hungary.

Vestas selected for Swedish and German projects

Vestas has won an order in Sweden for wind turbines from Vattenfall for the 67 MW Velinga wind project.

Vestas will supply, deliver and commission 12 units of its V150-6.0 MW model in 5.6 MW operating mode. Delivery of the turbines is planned to start in Q2 2025, with commissioning expected in the second half of the same year. The order also includes a long-term service agreement.

In addition, Vestas has won a contract for the 42 MW Bosau wind project in Germany from Strom 2020. The order is for seven V150-6.0 MW wind turbines and includes their supply, delivery, and commissioning. Vestas will also provide maintenance for 20 years under a service agreement.

Sizewell C design contract for key components

A contract to design key components for the Sizewell C nuclear power station in Suffolk, UK, has been awarded to AtkinsRéalis. The company will design the conventional island, balance-of-plant, heat sink and concept design for permanent roads and networks to facilitate construction and long-term operation.

AtkinsRéalis has been working on Sizewell C since 2014, contributing to site establishment, enabling works, detailed design of earthworks, and concept designs for the campus, desalination plan and 132 kV system. EDF Energy is responsible for the overall construction of Sizewell C, which, when finished, will produce 3.2 GW.

Vattenfall wins Norfolk Vanguard HVDC contract

Vattenfall has secured a new HVDC contract for the Norfolk Vanguard West Wind Farm, the first phase of Vattenfall's whole Norfolk Offshore Wind Zone.

The contract gives Siemens Energy and Aker Solutions responsibility for EPC and installation of the onshore and offshore converter stations for Norfolk Vanguard West.

Date for Lithuania's offshore wind tender

The Lithuanian government has confirmed that the country's second offshore wind tender will be opened on January 15, 2024.

The Ministry of Energy brought forward an amendment package to the Laws on Renewable Energy and Electricity, which facilitates the country's second 700 MW tender and accelerated tendering procedures in July 2022, with the second offshore wind farm expected to produce its first power as early as 2028.

The area of the territory planned for the second offshore wind farm in the Baltic Sea is about 136.39 km^2.

Lithuania's Environmental Protection Agency has approved the environmental impact assessment report on the 700 MW offshore wind farm. The project, for which the European Commission has approved a €193 million state aid scheme, will be developed within 2 km of the boundary of the Natura 2000 protected area.

European Energy Italian solar farm approved

European Energy has won authorisation from Puglia Region in Italy to build a 90 MW solar farm project through its subsidiary, Cerano Energreen. The solar farm will be located in the municipality of Cerano, Puglia.

As a part of the project, a substantial area of 35 ha will be allocated for reforestation. The venture also encompasses various works to enhance the region's infrastructure.

Financing for 600 MWh BESS project in UK

Lloyd's Bank has awarded Statera Energy of the UK up to £300 million of debt financing for a 300 MW/600 MWh battery energy storage system (BESS) at Thurrock, Essex, England.

The Thurrock project combines the BESS with a 270 MW gas fired power plant. £144 million of the financing is for the BESS while the remainder will fund the gas fired power plant.

Statera has planning consent for up to 900 MW of energy storage and generation at the site. It has not stated a timescale for completion of the projects.

International

Egypt signs power plant agreement with Mitsubishi

Egypt has signed an agreement with Mitsubishi Power Company to develop the Sidi Krir and El-Atf power plants, as part of the Japan International Cooperation Agency (JICA)-financed agreement.

The agreement will extend the lifespan of the power plants, improve power supply stability, and support the country's transition to renewable energy. Mitsubishi will increase the efficiency of the gas turbines by 2.5 per cent, and capacity by 6 per cent.

EU to invest €60 million upgrading Uganda plant

The EU is investing €60 million into upgrading the 380 MW Nalubaale and Kiira hydropower plant complex located at the source of the River Nile at Jinja in east Uganda.

The power plant was commissioned in 1954, and was operated by Eskom of South Africa under a 20-year concession that ended earlier this year, after which the Ugandan government retook control.

It has not yet been announced when the upgrading work will begin.

Hydrogen

Canada boosting energy transition with new green hydrogen plans

While today Canada uses almost no hydrogen at all, the country is looking to source 30 per cent of its energy mix from hydrogen by mid-century and establish itself as one of the world's largest producers. Three new green hydrogen projects announced in recent weeks are designed to set Canada on that road.

Gary Lakes

Canada will be making advances in the transition to clean energy in coming years through the construction and operation of a number of green hydrogen plants sited across the country in the provinces of Quebec, Nova Scotia and British Columbia.

TES Canada H2, a subsidiary of Belgium-based Tree Energy Solutions (TES), said last month that it will invest $2.9 billion (C$4 billion) in a green hydrogen plant in Quebec that will produce 70 000 tons of green hydrogen exclusively for use within the province. The Projet Mauricie project is scheduled to be commissioned in 2028 with an electrolyser and other renewable energy production assets, TES Canada said in a statement.

The TES parent company will provide 60 per cent of the financing for the project while 40 per cent will be provided by a Canadian investment fund controlled by the Desmarais family.

The company said Projet Mauricie is one of the largest decarbonisation projects announced for Quebec to date with the intention to reduce carbon dioxide (CO_2) emissions by 800 000 tons annually. The project is expected to contribute to reaching 3 per cent of Quebec's greenhouse gas reduction target for 2030.

Approximately one-third of the green hydrogen produced will be dedicated to decarbonising long-haul transportation, according to TES Canada H2. That sector accounts for nearly 10 per cent of Quebec's annual emissions. The bulk of production will be synthetic natural gas produced with green hydrogen, which the company refers to as "electric natural gas" or e-NG. It is a near emissions-free fuel created by combining captured carbon and green hydrogen. The fuel works well with those industries whose emissions are hard to abate.

Most of Projet Mauricie's own energy needs will be met with a 1 GW wind and solar farm, reducing the draw on the province's hydro-electric grid and capable of offering load-shedding during peak demand in the winter months.

"We are proud to be developing this major project in the Mauricie region, the cradle of renewable energy in Quebec," Eric Gauthier, General Manager of TES Canada H2 said in a statement. "The region, at the heart of the Vallée de la transition énergétique, offers many advantages to deliver hydrogen to Quebec users. The economic spin-offs will be significant for Shawinigan and the Mauricie region and will position Quebec as a leader in decarbonisation," he said.

The company said the project will contribute to the economic development of the region and estimates that construction work will generate 1000 jobs along with 200 jobs that will be permanent.

TES has expressed its confidence that the use of electrolysers will increase as bans on gasoline and diesel driven automobiles expand and more electrolysers are produced, eventually making the production of e-NG cheaper than oil. Earlier this year, TES and France's TotalEnergies agreed to build a $2 billion e-NG plant in the US, taking advantage of tax benefits offered in US President Joe Biden's Inflation Reduction Act (IRA). That plant is expected to produce 100 000-200 000 tons of green hydrogen annually.

Canada introduced a $12.8 billion tax credit in its 2023 budget to assist investors to make one-time capital expenditures, but future budgets are likely to include production tax credits for electricity, batteries and clean hydrogen.

In Nova Scotia, the Canadian federal government provided a loan of C$125 million to EverWind Fuels for a green hydrogen plant at the Point Tupper Industrial Park. EverWind has already invested some C$200 million in the planned facility, which will rely on solar energy as well as electricity generated by three new wind farms to extract green hydrogen from water. Wind turbines and solar panels are currently going through the regulatory process, *CBC News* reported. Site preparation is already underway, it added.

The company has already purchased a petrochemical storage plant in the industrial park that has access to rail and pipeline connections as well as a ship-loading facility located on the Strait of Canso. EverWind will also invest in the province's power grid in order to transport the wind energy to its production facility.

The overall investment is expected to reach C$3 billion and the hydrogen produced will be used in Nova Scotia as well as be exported.

In British Columbia, the government there and McLeod Lake Indian Band have signed an agreement to establish an energy transition hub in the northern region of the province. The agreement calls for investments of some C$7 billion with the help of international investors.

The native American group said it has been in talks with Mitsubishi Power Americas regarding a C$3.6 billion hydrogen plant to supply industries that are difficult to decarbonise. Mitsubishi has similar facilities in Japan and Spain.

The proposed plant would be designed to produce significant amounts of green hydrogen that would be used to decarbonise industries in British Columbia.

Gas

Greece prepares for expanded role in EU energy security with FSRU delivery

In recent years Greece has taken on a new role as a main player in energy security for the European Union. That role is about to expand again as the country prepares to see a floating storage and regasification unit (FSRU) installed at the Aegean Sea port of Alexandroupolis.

Gary Lakes

Sometime early next year a new gateway for natural gas will come into operation off the Aegean Sea port of Alexandroupolis with the intention of enhancing energy security for the countries of Southeast Europe. The region used to be supplied in large part by Russia via Ukraine, but over the last 10 years, business and geopolitical events have led the EU to support alternative systems for energy supply, although some Russian gas continues to arrive.

The Southern Gas Corridor (SGC), carrying gas from Azerbaijan, is a major new system delivering 10 bcm/year of gas into Southeastern Europe with the Trans Adriatic Section (TAP) stretching through northern Greece from the Turkish border to Italy.

A floating storage and regasification unit (FSUR) in the port of Omisalj, Croatia (Krk LNG), with a capacity of 2.9 bcm per year contributes to the region's gas imports, and gas pipelines from Turkey into Bulgaria continues to deliver Russian gas to the Balkan states.

In January next year, the Greek company Gastrade will take delivery and oversee the installation of a FSRU offshore the northern Aegean Sea port of Alexandroupolis. The company in late October launched a tender for a cargo of LNG that will be used to commission the 153 300 m^3 capacity vessel, which has been named after the port. Gastrade plans to unload the first LNG cargo in January and the FSRU is expected to be in operation during the first quarter of 2024.

The FSRU – operating as the Independent Natural Gas System – is the first FSRU in Greece and the country's second LNG terminal, the other being a land-based facility on the island of Revithoussa south of Athens. The Alexandroupolis will be anchored some 18 km offshore in the Sea of Thrace and be linked to the mainland by a pipeline extending 28 km with offshore and onshore sections.

The pipeline will connect with the existing TAP and the Interconnector-Greece-Bulgaria (IGB) pipeline that carries gas into Bulgaria, from where it contributes to gas supplies to other Southeast European countries. Opening the FSRU at Alexandroupolis will allow Cyprus, which has undeveloped offshore natural gas resources, to eventually fulfill its expressed desire to contribute to EU energy security with shipments of LNG produced with that gas. In Cyprus' case, its gas will likely be exported to Egypt, where it will be processed into LNG and re-exported.

With plans for the opening of the Alexandroupolis FSRU taking shape, the EU is supporting that capacity for the IGB be expanded. The pipeline is jointly owned by Greece and Bulgaria and the operators are reported to be planning to expand its capacity during 2024 from 3 bcm/year to 5 bcm/year.

For the EU, the IGB is essential to keep gas flowing to countries in the region, particularly Moldova and Ukraine, and provides countries within the region with an alternative to Russian gas, which continues to enter the region through pipelines operated via Turkey. Turkey is itself supplied by Russia through the Blue Stream and TurkStream subsea pipelines across the Black Sea.

An expansion of IGB capacity was recently discussed by its operator (ICGB) and officials from the transmission companies of Greece, Bulgaria, Hungary and Romania – all of which have agreed to take part in the EU-supported Vertical Natural Gas Corridor. That gas project calls for the interconnection of bi-directional gas pipelines between those countries and possible links with northern EU member states.

Greece has also recently concluded an agreement with Northern Macedonia to build a 123 km gas pipeline that would connect with the TAP pipeline and provide an alternative to an existing pipeline that supplies Russian gas through Bulgaria. The pipeline connecting Greece and North Macedonia is under construction and is due to be complete and operating by the end of 2024 with a capacity of 1.5 bcm/year. This may later be expanded to 3 bcm/year.

The new pipeline systems in operation and those that are planned has made Greece a gas hub in Southeastern Europe as gas flows in and then flows out. This will only increase in the years ahead as Azerbaijan plans to double its gas exports via the SGC to 20 bcm/year by 2027 and the new FSRU begins operations at Alexandroupolis.

Citing the agreement with North Macedonia, the Greek Foreign Ministry released a statement saying that Greece aspires to position itself as a pivotal transit hub for energy, facilitating the flow north, south, east and west.

"Greece is actively championing the realisation of the Vertical Natural Gas Corridor, designed to transport natural gas from diverse sources," the statement said. "This includes the Revythoussa LNG terminal, the planned FSRU Alexandroupolis, the TAP pipeline, and a route through Bulgaria to serve the nations of Central and Eastern Europe."

Unleashing the power of AI

Artificial intelligence (AI) has the potential to enhance efficiency while ensuring sustainability in the power sector. DNV's **Kjell Eriksson** explores AI's current impact, prospects, and recommended practices.

The energy sector is undergoing a transformative shift with the widespread adoption of artificial intelligence (AI), as revealed by a recent DNV survey. While only 12 per cent of surveyed companies have already implemented advanced AI, a significant 73 per cent are actively piloting or planning to do so. Another recent survey by CapGemini reveals that globally, 39 per cent of energy and utility companies have dedicated teams and budgets for AI, closely aligning with the 40 per cent all-industry average.

Utilities, unlike some sectors, view generative AI (AI capable of generating text, images, or other media, using so-called generative models) as a growth accelerator, intending to leverage it for technical purposes (from OT to IT) and/or sales teams. Overall, there is no doubt that AI is witnessing a surge in applications within the power sector, from research and development to mature implementations.

This wave of enthusiasm is, in part, a sign of the times, reflecting the widespread awareness of AI's capabilities – particularly after the much-publicised, industry-shattering breakthroughs in large-scale generative models. In the power sector, however, the progression from analogue to digitalisation, then machine learning, and finally advanced AI, signifies an ongoing and continuous journey towards a more intelligent and sustainable energy system, taking incremental steps. AI's integration predates the current hype, with machine learning enhancing the benefits of digitalisation, and smart grids being an early focus.

Machine learning (ML) has played a critical role in improving energy forecasting, demand management, and predictive maintenance (data lakes and modelling systems for complex correlations are already relatively well-established in some areas of the industry), and advanced AI has even more transformative potential.

With capabilities surpassing ML in controllability, big data handling, cyber attack prevention, and efficiency optimisation, advanced AI also incorporates natural language processing, computer vision, and deep learning for autonomous, complex, and dynamic decision-making, and is capable of adapting to changing conditions. Its superiority positions it as a tool for unlocking unprecedented efficiencies.

Looking forward, advanced AI is set to speed up the transformation towards a fully digitalised energy landscape characterised by increased automation, innovation, and efficiency. Its scalability makes it a key tool for expediting the transition to cleaner energy systems.

Beyond predictive maintenance and energy management, advanced AI is driving advancements in grid optimisation and renewable energy integration in response to the growing importance of better demand-response capabilities. The tech is poised to become a cornerstone of the utility sector, enabling it to address supply and management challenges posed by the combination of a global transition to cleaner energy sources and mounting electricity demands over the next 10 to 20 years.

The fast adoption of virtual power plants, as well as initiatives like GE's enhanced wind turbine efficiency, Google's reduced data centre cooling power consumption, and National Grid's decreased damage to gas infrastructure already showcase the benefits of advanced AI for cost reduction. Further, grid optimisation is exemplified by collaborations like Linevision and Xcel Energy deploying Dynamic Line Rating and Stem's AthenaAI VPP, enhancing battery storage portfolios.

Already there are examples of the benefits of advanced AI for cost reduction and grid optimisation but challenges still hinder its widespread adoption

But despite AI's potential, significant challenges still hinder its widespread adoption: at the global scale, the cost-benefit balance of digital transformation, cited by 34 per cent, tops the list, alongside resistance to change and the digital skills gap.

Beyond these considerations, a reliance solely on IT proves inadequate in implementing AI within the energy sector, with potential hazards emerging from black boxes. The imperative lies in entrusting the design and implementation of AI to professionals who possess a deep understanding not only of the AI algorithms, but also of the domain of application of the systems they work on. This expertise is crucial to mitigate risks associated with poor data quality and the outcomes derived from its analysis. Without such a nuanced approach, the data's business and practical value remains limited.

The full implementation of some AI use cases may also face extended timelines, spanning years, due to regulatory challenges – particularly for utilities and state actors, as safety, privacy, and information security is paramount for these entities. Even for more agile commercial companies who can adopt AI at a faster pace, black boxes may raise transparency issues, and given the imperfections in, and ongoing evolution of current AI techniques, ensuring the effectiveness of safeguards is crucial when integrating them into power systems.

The overall large-scale expansion of truly innovative solutions is also constrained by the limited availability of advanced AI professionals, as the demand for expertise outpaces the current educational capacity. As the technology continues to surge in various industries, bridging the gap between the growing demand for skilled professionals and the capacity of educational institutions becomes crucial for sustaining innovation and addressing workforce needs.

Reflecting on previous waves of enthusiasm fuelled by ambitious visions and technological promises, one cannot help but be reminded of digital twins and agile processes. While these are undoubtedly promising, the transition from conceptualisation to tangible application is proving to be a challenge, as the resource-intensive and complex leap from theoretical frameworks to actualised, controlled implementation is slowed down by the imperative to maintain data quality. Generally speaking, this double injunction contributes to the prolonged timeline required for digitalising the industrial world compared to the (nimbler) consumer world.

In the power sector, it is important to make haste slowly. The "fail fast" or "move fast and break things" mentalities widely championed in some technological fields like IT and communications find little application in the energy systems landscape, due to the critical nature of the infrastructure involved – urging a more circumspect and considered mindset. Integrating cutting-edge technologies into existing complex systems is an inherently expensive process, fraught with uncertainties about the ultimate results; the prevailing strategy therefore pivots away from complete overhauls and toward a measured, small-to-large scaling approach, as it is paramount to retain control over the data all throughout the transition.

This approach aligns with the understanding that standards and Recommended Practices (RPs) are not just risk management tools; they enable controlled tech adoption, allowing industries to progress by building trust and efficiency. This, in turn, facilitates faster scaling for companies deploying proven processes, countering the criticism that standards stifle innovation. In fact, standards and RPs are intended to promote innovation by managing uncertainties – often in a technology-agnostic and methodology-oriented way.

Another common criticism is that players that adopt a less cautious approach are allowed to become first movers and gain an edge by advancing unconstrained – but recognised quality processes empower organisations to progress with confidence, offering a competitive advantage.

Ensuring the safe implementation of AI into operations is paramount, and necessitates a comprehensive systems approach, with a methodology covering both the whole system level and various digital building blocks, ensuring comprehensive guidance for the safe and reliable integration of AI into the sector. DNV's digital RPs, including DNV-RP-0671, support this holistic approach and focus on real-world consequences, ensuring AI-enabled systems are trustworthy and adhere to relevant requirements, playing a pivotal role in advancing the power sector's transition towards efficient and secure AI integration.

AI is a catalyst for change in the power sector, offering unprecedented opportunities to explore innovative approaches for efficiency and sustainability. Its strategic focus extends beyond immediate, low-risk applications, positioning it as an indispensable force to enable the sector to reach its objectives. While not a cure-all, advanced AI is emerging as a crucial tool to accelerate the global energy transition in line with emission reduction commitments. Effectively leveraging its potential for a more agile, safe, and affordable energy system demands strategic adoption, guided by comprehensive practices, dynamic partnerships, and informed regulatory engagement.

Navigating challenges such as technical unfamiliarity, resistance to change, a shortage of qualified personnel, outdated infrastructure, and potential cyber security risks is crucial to unlocking AI's full capacity. Industry leaders and policymakers must now lay the groundwork for a trusted and collaborative ecosystem, paving the way for a successful AI-enabled energy transition.

Kjell Eriksson is Vice President - Digital Partnering, Energy Systems at DNV.

WtE meets PtX: completing the sustainability cycle

Attitudes towards waste-to-energy vary significantly. In some regions, it is hailed as a beacon of sustainability, while in others there are concerns regarding airborne emissions. Afry's **Matthew Geraghty** explains how the technology, when combined with power-to-X, completes the sustainability cycle.

In the ever-evolving landscape of sustainable energy, waste-to-energy (WtE) stands as a pivotal player, offering a tangible solution to the burgeoning landfill problem. However, in some countries the environmental debate surrounding WtE is far from simple, with concerns regarding direct CO_2 emissions casting a shadow over its undeniable benefits.

The sustainability cycle is completed when WtE meets power-to-X (PtX). In fact, the synergy of the two technologies ensures minimal reliance on landfill for waste disposal, enables the decarbonisation of the waste sector and utilises waste materials as a feedstock.

WtE offers a ray of optimism in the fight against landfill overflow. The substantial global waste generated necessitates alternative solutions to traditional disposal methods.

However, from an international standpoint, attitudes towards WtE vary significantly. In some regions, it is hailed as a beacon of sustainability, while in others, scepticism prevails, largely due to concerns regarding airborne emissions.

As project consultants in the low carbon energy industry, we at AFRY have witnessed diverse approaches to WtE adoption. In certain countries, such as Finland, the urgency to reduce landfill dependence has led to enthusiastic acceptance, while others remain cautious due to concerns about direct CO_2 emissions.

WtE, with its ability to convert waste into energy, offers a compelling strategy to alleviate the strain on landfills. Finland stands out as an exemplary model in this regard, showcasing the successful integration of WtE practices to avoid overburdening landfills.

Balancing the scales between benefits and drawbacks, the industry grapples with a complex question: do the positives of WtE outweigh the negatives? The answer is not universal and often depends on the specific context of each region.

As the energy landscape evolves, PtX technology emerges as a transformative force. PtX involves converting surplus renewable energy into other forms, such as hydrogen or synthetic fuels. This technology opens new possibilities, offering a solution to store excess renewable energy for later use.

Potential users and producers of PtX span a broad spectrum, from industries seeking green alternatives to traditional fossil fuels to regions aiming to enhance energy security. PtX addresses a critical problem – the intermittent nature of renewable energy sources. By converting excess renewable energy into storable forms, PtX enables a more consistent and reliable energy supply.

However, the practical applications of PtX are still in their nascent stages. While the concept is promising, the industry is at a crucial juncture where implementation and scalability need to be proven.

Working in a global engineering and design firm, we see the promising potential of PtX for the future. However, key challenges lie in establishing a level playing field for PtX products compared to fossil-based alternatives, enhancing the energy efficiency of technical solutions, and ensuring the presence of supportive legislation and incentives during these early stages. To address these challenges, we need to work globally with governments, NGOs and companies to identify and implement novel solutions.

WtE and PtX are symbiotic sectors. WtE yields a trifecta of valuable resources: flue gases rich in CO_2, electricity, and heat. Enter PtX, a transformative force in the energy transition, demanding each of these outputs. Together, the synergistic combination of PtX and WtE, often referred to as waste-to-X (WtX), showcases a holistic approach to sustainable energy solutions.

PtX complements WtE by utilising these resources for the efficient production of synthetic fuels or other chemical feedstocks, contributing to a closed-loop system where waste carbon is repurposed rather than released into the atmosphere. The CO_2 is a chemical feedstock and the heat and electricity are used to improve the efficiency of the PtX processes.

This symbiosis extends beyond mere resource utilisation. By combining the strengths of WtE and PtX, a holistic and circular approach to waste management and energy production emerges. WtE not only addresses the immediate challenges of waste disposal but also provides the raw materials for PtX to contribute to carbon neutrality.

Geraghty: Nordics are well placed for WtX as there is an abundance of lower carbon electricity and biogenic CO_2

Many of the world's WtE plants make use of biogenic waste. Biogenic waste refers to organic waste materials that originate from living organisms or natural processes. This category of waste includes materials such as food scraps, yard waste, agricultural residues, and other organic matter derived from plants or animals. Biogenic waste is distinct from non-biogenic or fossil-based waste, which originates from non-living sources such as plastics, metals, and synthetic materials derived from fossil fuels.

As biogenic CO_2 is part of the natural carbon cycle, using it in PtX processes is environmentally beneficial compared to fossil-based CO_2. Utilising biogenic CO_2 decreases dependence on fossil-based carbon sources, aligning with a low-carbon or carbon-neutral economy.

AFRY, as an international engineering and design company extensively involved in projects worldwide, provides a unique lens to view the waste management industry.

AFRY is heavily involved in the WtX field as we recognise the inherent potential of this area to offer cost-effective and environmentally sustainable solutions. We are actively working with clients around the world to develop projects that seek to decarbonise WtE plants and create value by identifying cost-effective PtX products utilising the biogenic CO_2.

We are actively engaged with a European client poised to enter the PtX arena. With planned infrastructure encompassing renewable electricity and electrolysers for hydrogen production, the client is strategically seeking cost-effective CO_2 sources from WtE plants (and other biogenic sources), with a focus on identifying the most economically viable PtX processes to maximise value.

AFRY plays a pivotal role in guiding this venture by providing insights into the dynamic landscape of PtX markets, both present and future. Additionally, the firm is at the forefront of developing accurate techno-economic models tailored to diverse PtX production plants. This approach ensures that the client possesses a comprehensive understanding of market trends and engineering intricacies to make informed Final Investment Decisions (FIDs).

WtX faces different issues from country to country. In various major countries and regions, we have observed a spectrum of plans and outlooks regarding WtE and PtX. While some nations are actively investing in WtE infrastructure, others are cautiously exploring PtX as a means to enhance their renewable energy capacity. The international community's approach to these technologies is dynamic, reflecting the diverse priorities and challenges faced by different regions.

For example, the Nordics are well placed for WtX as there is an abundance of lower carbon electricity and biogenic CO_2, coupled with increasing government incentives for the sector.

However, in a number of countries in Africa and Southeast Asia, other issues take higher priority (e.g., grid stability and capacity). The transition to PtX demands a substantial and consistent supply of renewable energy, prompting nations to evaluate their existing infrastructure and assess future needs.

Concurrently, discussions around prioritisation emerge. Should renewable-sourced electricity be primarily directed towards consumption; powering homes and industries directly, or should it be further processed into WtX? This debate underscores the need for strategic decision-making in balancing immediate energy needs with long-term sustainability goals.

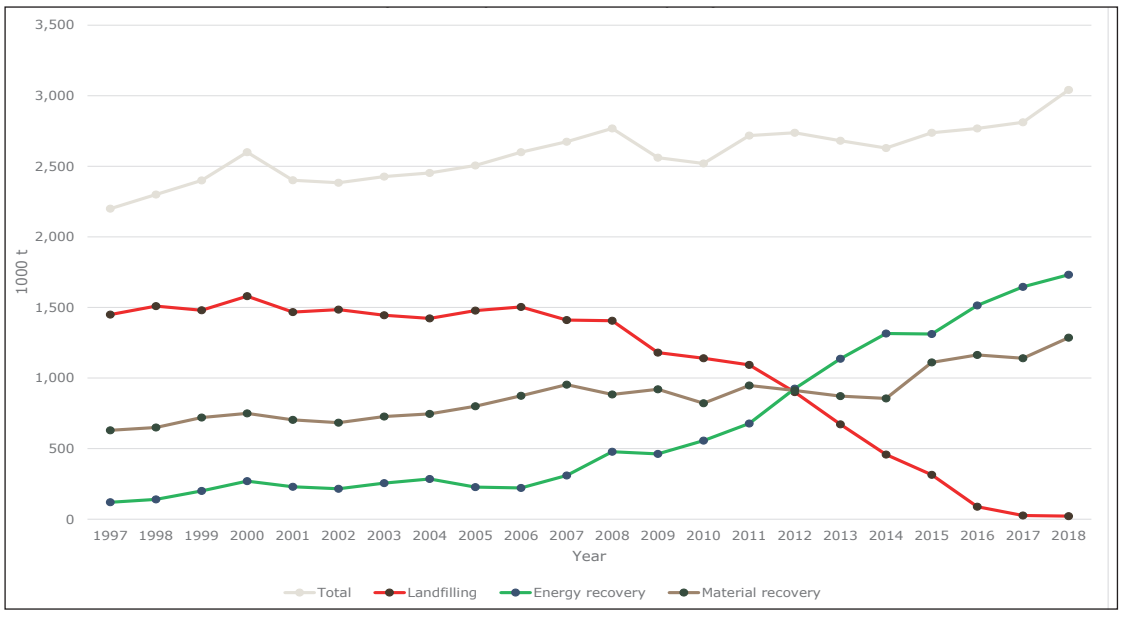
In conclusion, the sophisticated dance between WtE and PtX unfolds as a promising symphony in the global pursuit of sustainable energy solutions, which can be summarised with the following key takeaways:

- *Symbiotic WtE and PtX:* The synergy between waste-to-energy and power-to-X, encapsulated in the concept of waste-to-X, heralds a holistic approach to sustainability. By repurposing waste resources in closed-loop systems, this symbiosis manages waste and contributes significantly to carbon neutrality.
- *Global perspectives:* The global approach to WtX varies, with the Nordics positioned advantageously due to abundant resources, while other regions grapple with specific and unique challenges. The international discourse underscores the need for strategic decision-making that balances immediate energy needs with long-term sustainability goals.

In navigating the terrain of sustainable energy, the partnership between WtE and PtX emerges not merely as a technological integration but as a potential game-changer. WtX signifies a substantial step towards aligning numerous sectors to achieve sustainability and resilience in resource and energy practices. This collaborative journey underscores the transformative potential where energy is not just harnessed but harmonised with environmental stewardship, paving the way for a truly sustainable energy landscape.

Matthew Geraghty is a Senior Project Manager at Afry and leads the waste-to-X practice.

Finland's municipal waste by treatment method 1997-2017 (1000t by treatment and year)



Southeast Asia: brimming with net zero investment opportunities

Most of Southeast Asia's economies have set decarbonisation pathways. Their net zero policies are as different as their stages of economic development and socio-political systems, but the aims are the same. **Joseph Jacobelli** explains why the region's population size, GDP growth outlook and heavy reliance on fossil fuels offer massive opportunities for net zero asset investments.

Southeast Asia is uniquely positioned to benefit from carbon neutrality which in turn will profit the world as a whole. The Association of Southeast Asian Nations (ASEAN), the region's economic grouping, comprises ten nations with a fast-rising population, which the International Monetary Fund (IMF) estimates at about 680 million in 2023 compared to under 450 million for the EU. Their share of estimated global purchasing power parity (PPP)-based GDP in 2023 is about 6.4 per cent, according to the IMF, and has been growing at a fast rate; the IMF estimates 4.2 per cent in 2023 and 4.6 per cent in 2024. The largest six nations – Indonesia, Malaysia, Philippines, Singapore, Thailand, and Viet Nam – account for the bulk of ASEAN's GDP; the others are Brunei, Cambodia, Laos, and Myanmar.

Their energy consumption has excessively relied on fossil fuels. They consumed 29.5 exajoules in 2022, with coal, natural gas, and oil making up 89 per cent of the total. They used 26 per cent more oil than the global average and 13 per cent more coal, although they used 20 per cent less natural gas.

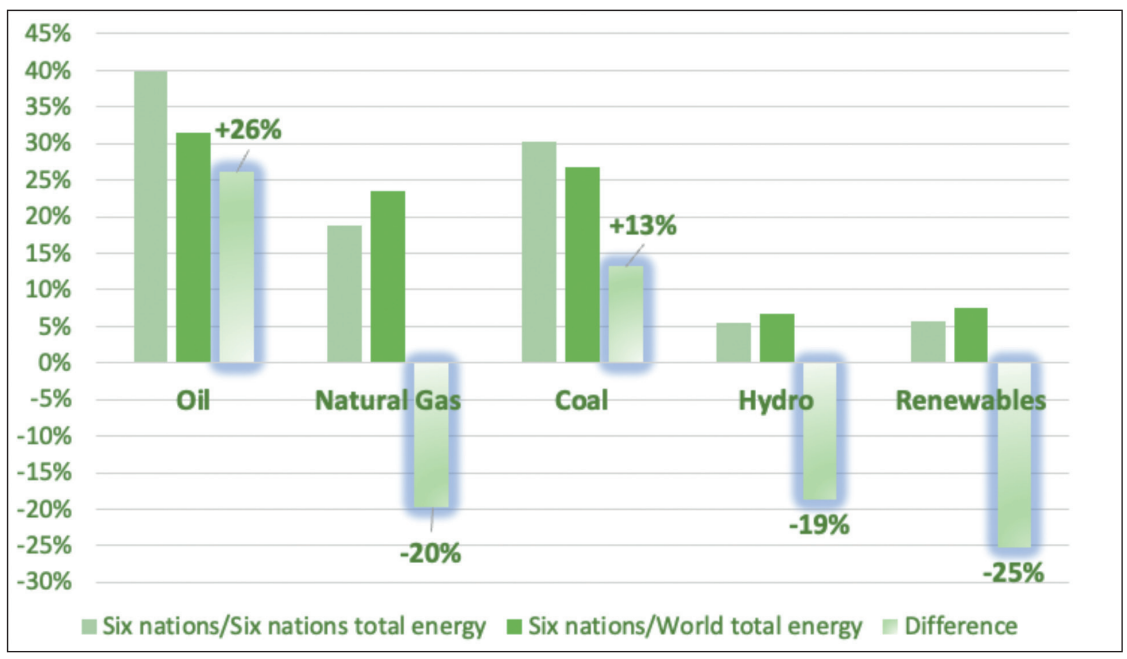
ASEAN nations have varying reasons for addressing climate change. Five members are among the world's 20 most at-risk nations, and climate change inaction could result in the displacement of nearly 90 million people in high-risk flood areas in Indonesia, Malaysia, Myanmar, Thailand and Viet Nam. Not addressing climate change could also cut ASEAN's GDP by 11 per cent by 2100, says the organisation.

ASEAN's ten members, including the big six, have highly different economic, religious, social, and political profiles; the latter ranging from one-party states to democracies. The group has stuck together for almost six decades. When it comes to decarbonisation, their policies, including their Nationally Determined Contributions (NDCs), or the work to cut domestic emissions and adapt to climate change impacts, are different but the aim is united. ASEAN concluded that pursuing decarbonisation more aggressively would deliver many benefits. They include as much as $5.3 trillion in GDP value add, $6.7 trillion in green investments, and 66 million additional jobs by 2050. So, the group adopted a common broad strategy in September 2023.

The strategy themes are not necessarily new, but it is important that they have been officially recognised by the group. They want to develop green industries, build up interoperability within ASEAN (such as exchanging green electricity), strive to achieve globally credible standards, and develop green capabilities in the form of green talent and expertise. The agreed green strategy comprises eight facets, according to a paper by the ASEAN Secretariat: (1) value chain integration acceleration; (2) circular economy supply chains promotion; (3) green infrastructure and markets connection; (4) boosting interoperable carbon markets; (5) advancing credible and common standards; (6) attracting and deploying green capital; (7) promoting green talent development and mobility; and (8) green best practice sharing. Further, they adopted 16 priority initiatives for the eight facets.

Perhaps the most important priority initiatives revolve around financing. They include adherence to an ASEAN sustainable finance taxonomy, adopting innovative sustainable finance instruments for de-risking, and developing local green funds while incentivising green fund managers to locate in ASEAN. These should be easier to realise and measure in terms of progress.

Several steps have already taken place. The ASEAN Sustainable Finance Board (ATB) was established under the auspices of the ASEAN Finance Ministers and Central Bank Governors in March 2021. The following November, it released the 87-page first version of the ASEAN Taxonomy for Sustainable Finance. In June 2023, it issued the 233-page second version. Now Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam are all developing national taxonomies, which will be aligned and consistent with that of ASEAN. These developments are absolutely pivotal to attracting capital from within and outside the region across various financing instruments such as equities and debt.



Six nations energy consumption by fuel type vs. global average
Data Source: https://www.energyinst.org/statistical-review. Table created by author.

Still on the financing front, ASEAN benefits from its sole developed economy, Singapore, which happens to be a major International financial centre – the top in Asia and the third highest ranked globally. The city state aspires, and actually has a good chance, of becoming Asia's renewable energy hub. This, coupled with its financing muscle will make a dramatic impact on the region's ability to raise and deploy capital for its energy transition ambitions.

Another feature of ASEAN's bright energy transition prospects is its geopolitical role. Specifically, its relationships with Australia, China, India, and Japan.

The region does face complex-to-navigate geopolitics, but it is likely to benefit from the relationship with these countries. In a speech launching the Sustainability Innovation Lab, which is dedicated to strengthening and advancing sustainability reporting by corporations, Deputy Prime Minister Heng Swee Keat reaffirmed Singapore's role by stating that "as a regional green finance hub, Singapore supports efforts to mobilise financing for Asia's net zero transition and regional decarbonisation activities".

Australia and Japan are keen to support ASEAN's energy transition journey. They help, for example, with policy formulation, financing, and technology. The three will meet to develop a zero carbon emissions framework in Tokyo in December, reported the *Kyodo* news agency. Technical cooperation on the development of green hydrogen and other technologies as well as the supply chains for minerals are among the topics to be discussed. Japan's Prime Minister Fumio Kishida even proposed creating an Asia Zero Emission Community (AZEC).

ASEAN nations have neutral to positive economic and political relations with India. The south Asian giant may not be a major source of capital for ASEAN's energy transition, but it could contribute some technologies, including digital ones. At a forum between the two in 2022, they sought to create a cooperation framework in areas such as renewable energy development and electric mobility as well as smart grids.

China, the undisputed global clean energy leader, has a tenuous relationship with ASEAN. On the political front there are several types of relationships including territorial disputes with Brunei, Malaysia, and the Philippines, and Viet Nam. At the same time, the two are each other's largest trading partners and China's investments in ASEAN surged to $15.4 billion in 2022, according to the Asia Society Policy Institute. On the clean energy front, China is a major investor in clean energy generation projects as well as a primary technology provider, such as solar PV energy equipment.

ASEAN's need to shift to green and clean sources dramatically to meet the 2050 or 2060 carbon-neutral targets set by most states in the region offers a vast pool of investment opportunities. At the same time, the market will be boosted by strong GDP growth as well as a growing population.

The growth in net zero investments will be boosted by recent strategic directives by the group. This will be enhanced by a harmonised approach in the setting of parameters around aspects of sustainable finance, especially those driven by the Asian sustainable finance taxonomy.

As one of the world's largest capital markets, Singapore will serve to attract and channel capital for the energy transition.

Lastly, the region will also benefit from its relationships with Australia, Japan, India, and China.

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Carbon Neutral Target Year	2060	2050	2060	2050	2050	2050
Energy-related CO_2 emission reduction target from 2017	50%	50%	100%	100%	50%	70%

Six nations' carbon neutral target year
Data Source: International Energy Agency, Decarbonisation Pathways for Southeast Asia, Paris April 2023, page 16. Table created by author.

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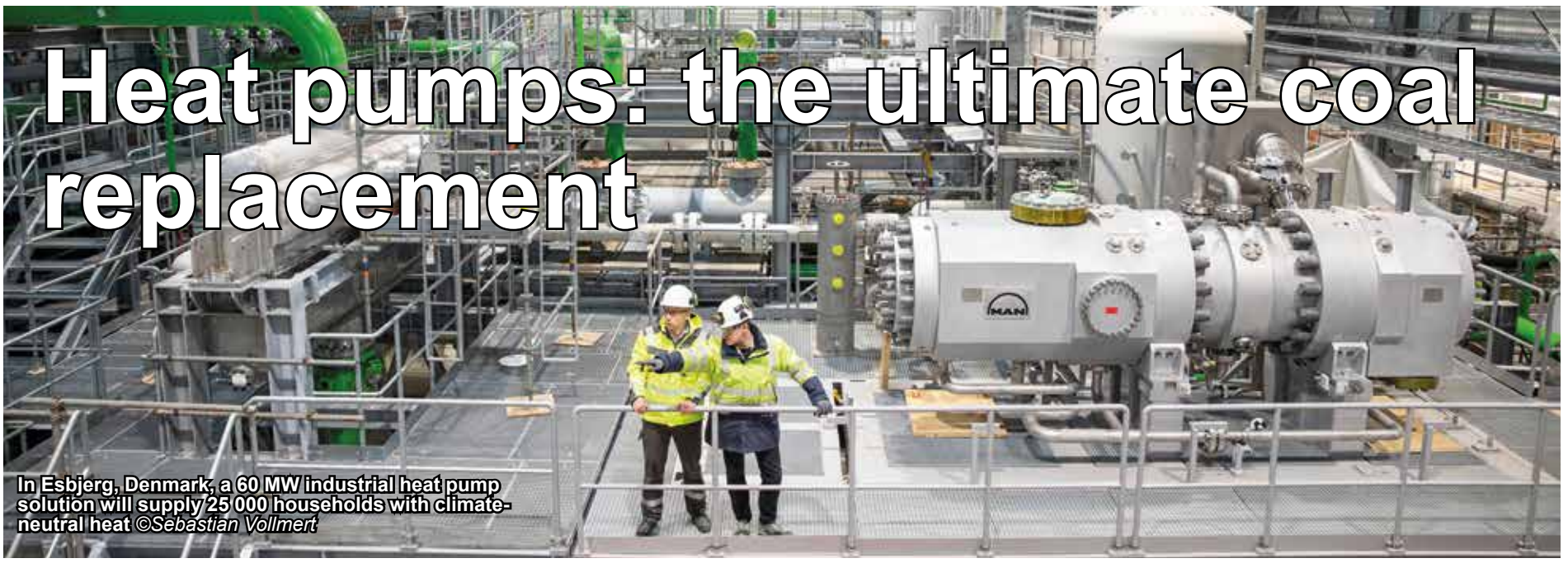
Heat pumps: the ultimate coal replacement



In Esbjerg, Denmark, a 60 MW industrial heat pump solution will supply 25 000 households with climate-neutral heat ©Sebastian Vollmert

The unique capabilities of heat pumps are seeing deployments in sectors that have previously been hard to penetrate with renewables. MAN Energy Solutions' **Raymond C. Decorvet** explains how they are displacing coal fired capacity at a project in Esbjerg, Denmark.

When the Danish port city of Esbjerg wanted to become net zero and retire its coal fired district heating system, the spotlight turned to industrial-scale heat pumps. With a population across Esbjerg municipality of 116 000 people, DIN Forsyning – the Danish multi-utility company that operates the district heating network across the city, nearby Varde and part of the island of Fanø – is set to deploy two large-scale heat pump units that are collectively rated at around 60 MW. They will supply DIN Forsyning's 100 000 domestic heating customers with approximately 280 000 MWh of carbon-free heat annually.

Although DIN Forsyning currently delivers around 1 million MWh to its district heating network, the heat pump system, along with other measures such as a wood chip boiler, will largely replace an existing coal fired thermal plant that is scheduled for decommissioning shortly after the heat pumps become operational.

The unique feature of the heat pump system, which has been developed by MAN Energy Solutions, is that it will be powered by renewable energy with the electricity coming from nearby wind farms. However, the system allows several other heat sources to be recovered as usable energy.

The city of Esbjerg is located on the Bay of Ho (Ho Bugt) in the Wadden Sea and the MAN Energy Solutions system will extract heat energy from the seawater of the bay by fractionally cooling it, allowing a UNESCO World Heritage Site to be deployed as an energy resource for a major city.

Claus Nielsen, Business Development Director at DIN Forsyning, explained: "Because we are close to the coast, we have a big heat sink. It's at a low temperature but it's stable and with 8 million m^3 of new water each tide, there is a huge and stable heat source accessible from the ocean."

The MAN Energy Solutions heat pump system is built around a highly efficient multi-stage radial turbocompressor HOFIM® with an integrated expander. Originally developed for gas compression in the oil and gas sector, this compressor has been tried and tested in the harshest possible environments.

When deployed at the heart of a heat pump it compresses and then expands CO_2 in a closed loop heat cycle to generate heat and cold simultaneously. This heat can be used to raise the temperature of water in a nearby hot store or to directly supply hot water into the district heating network. Once the heat has been extracted, the still pressurised CO_2 is expanded in the expander where it cools down immediately. Even below zero degrees if the application demands it. In this way the now liquid CO_2 could be used for chilling water, for example in a cooling network or for cooling down another process or facility such as a datacentre. Next, the cold, liquid CO_2 is transferred into another heat exchanger, called an evaporator. The heat source, in the case of Esbjerg the seawater, is warmer than the CO_2 and the heat energy is extracted from the heat source and transferred to the CO_2. The CO_2 is then forwarded to the HOFIM® compressor again, where it is pressurised to the desired temperature. The heating/cooling cycle is repeated.

Using CO_2 as the working fluid – also known as refrigerant (R744) – is an environmentally safe and non-toxic option while the outputs are equally environmentally friendly, comprising of hot and chilled water, green electricity or any combination desired thereof. If required, the heat or cold may be stored in insulated water tanks for future usage. Alongside the options for heating and cooling at any temperature levels from -20°C to 150+°C the flexibility of the heat pump system gives ample scope to supply different process heating and cooling applications in the industry as well as deployment in district heating, as in Esbjerg.

Deploying a heat pump powered by renewables and using water as a heat source allows heating and cooling to be distributed according to demand.

"What we see from the major global trend is that renewable electrical power will be the basis of the whole energy system in some way. We see the heat pump as part of a transition," said Nielsen, adding: "If we are to bring in more renewable energy into the district energy system in Esbjerg then we have to find a smart way to integrate the network with the electricity system. The best method that we have seen is the electrically-driven heat pump."

Indeed, the heat pump delivers a route to replace coal fired capacity with wind or solar and supply appropriate energy resources to previously tough to reach sectors. But perhaps of more fundamental interest is the capability to become a key enabler for further expansion of renewables. The flexibility of the system and the capacity for energy to be cheaply stored in a simple and scalable water tank is a major breakthrough. When deployed as part of a district heating system, the heat network itself may be used as a substantial energy store by temporarily adjusting the energy flows into the network. For example, reducing heat production to perhaps free up more electrical energy if desired.

"A heat network is much better prepared for variability than the electricity system that has to balance consumption and production at all times. With the heat system in Esbjerg we can have up to 10 hours without any inputs and still meet demand using residual heat in the network, accumulated heat and moving around consumption at the consumer end. Even on the coldest day we can supply heat to all customers for several hours without any production," said Nielsen.

This flexibility also offers substantial benefits for grid management too, helping to balance potential variations between supply and demand and supporting important grid stability characteristics. Knock-on effects like reduced grid congestion and improved load factors across the network add to the positive balance.

The Esbjerg project is being deployed to deliver heat and cooling and so brings the concept of city-wide energy management one step closer to reality.

Nielsen explained: "City-wide energy management helps the whole region move towards the clean transition, by having that flexibility and being able to pull energy from different parts at different times to suit supply and demand characteristics. Most of western Europe and some parts of the US like many university campuses have a district energy network. In these district energy networks you can achieve this transformation to decarbonise heat and integrate more renewables because you can add flexibility to renewable electricity production."

The heat pump system also raises the possibility of effective sector coupling, a concept in which energy demands across multiple industries and sectors are matched. Heat pump systems like the one deployed in Esbjerg could, for example, match the cooling requirements of a data centre with the heat needed for food and beverage production and the whole system powered with renewables rather than coal or other fossil fuels. It is clear that sector coupling will be essential to meet the pressing need for a rapid low-carbon transition.

Given the wealth of benefits a heat pump system offers, it is no surprise that as the Esbjerg system nears full commissioning, another Danish utility, Aalborg Forsyning, has contracted for an even larger turnkey heat system. The Aalborg project will feature three MAN heat pumps and have a capacity of 132 MW, and the system will supply around 550 000 MWh of heat annually. This project will also supply a district heating system, providing almost one-third of the heat needed in Denmark's third-largest municipality. Again, the heat pump system will allow an existing coal fired power plant to be shut down.

The district heating plant is located on the northern bank of the Limfjord strait and, like the Esbjerg development, will use the sea as a heat source as well as renewable electricity. It will reduce carbon emissions by around 160 000 t annually while raising the temperature of the water in the district heating system from 1-15°C up to 98°C, a relatively high temperature for a district heating network and unique for a heat pump system.

Each heat pump unit has a capacity of 44 MW, making them the largest units to be installed in a district heating plant to date. Construction of the plant is scheduled to begin in August 2024 with Aalborg Forsyning expected to begin operations by 2027. The coal plant is scheduled for closure in in 2028.

Commenting on the project in a statement, Jesper Høstgaard-Jensen, Technical Director at Aalborg Forsyning, said: "These seawater heat pumps will play an important role in our transition from coal-based to climate-friendly district heating."

With full-scale deployment now underway at Esbjerg and a second project underway in Aalborg, heat pumps are already proving they can displace coal while still balancing the diverse energy needs of a large city with renewables. The economic case for greater heat pump deployment is set to strengthen further, given they have a high efficiency. Their Coefficient of Performance (COP), the ratio between electricity consumption converted into thermal energy, is typically >3. An electric boiler by comparison would have a COP of >1.

As a cost-effective, efficient and climate-neutral alternative to conventional fossil-fuelled heating and cooling technologies, heat pumps are already a central part of city plans to become carbon neutral. There is no other sustainable, long lasting and robust technology that can provide heat and cold simultaneously more efficiently, helping store thermal energy, integrating renewables and balancing the grid. The 21st century is the age of the heat pump.

Raymond C. Decorvet is Senior Account Executive CO_2 Heat-Pumps at MAN Energy Solutions, responsible for business development for heat pump technology.

Decorvet: heat pumps are a central part of city plans to become carbon-neutral

Junior Isles

Bridging the emissions canyon

World leaders at COP28 are facing a monumental task – how to bridge the increasing gap between the current carbon emissions trajectory and what is needed to stay within the limit needed to avoid irreversible climate change. Just 10 days before the meeting kicked off in Dubai, the UNEP Emissions Gap Report showed that if nothing changes, in 2030 emissions will be 22 Gt higher than the 1.5 degree-limit will allow.

Giving some context to the scale of the challenge, the UN noted that this is roughly the total present annual carbon emissions of the USA, China, and the EU combined.

Commenting on the report's findings, UN Secretary General António Guterres, said: "It shows greenhouse [gas] emissions reaching all-time highs – a 1.2 per cent increase on last year – when those levels should be shooting down. And those emissions are shattering temperature records. June, July, August, September and October were all the hottest on record. Present trends are racing our planet down a dead-end three-degree temperature rise.

"In short, the report shows that the emissions gap is more like an emissions canyon. A canyon littered with broken promises, broken lives, and broken records."

Damning words. Hopefully still echoing in the minds of world leaders who are now entering negotiations.

Notably, this COP summit will respond to the first Global Stocktake – an inventory of each country's climate plans, which will show just how far the world is from meeting the goals of the Paris Agreement.

According to the Gap Report, climate change pledges for 2030 put the world on track for limiting the global temperature rise to between 2.5 and 2.9°C above pre-industrial levels in this century. The cuts required to 2030 greenhouse gas emissions are 28 and 42 per cent for the Paris Agreement's 2°C pathway and 1.5°C pathway, respectively. "We are already at the outer limits of the possibility for 1.5°C, with only a 14 per cent chance of avoiding overshoot in even the most optimistic scenario," stressed Guterres.

"Specifically, in their response to the Global Stocktake, countries must commit to triple renewables capacity, double energy efficiency and bring clean power to all, by 2030. And they must also commit to phasing out fossil fuels, with a clear time frame aligned to the 1.5° limit. Otherwise, we're simply inflating the lifeboats while breaking the oars."

World leaders, however, are faced with more than rowing their way out of trouble in a dinghy. Bridging the emissions gap is a challenge of titanic proportions and now is the time to put every shoulder to the wheel.

Last month McKinsey launched its 'Global Energy Perspective 2023' report, which models the outlook for demand and supply of energy commodities across a 1.5°C pathway, and four bottom-up energy transition scenarios. The energy transition scenarios examine outcomes ranging from warming of 1.6°C to 2.9°C by 2100.

Bram Smeets, Partner at McKinsey, said: "The analysis of these bottom-up scenarios shows that the world requires a major course correction to reach the goals aligned with the Paris Agreement.

"While we see a strong increase in low-carbon technologies such as solar, wind and electric heat pumps, urgent global momentum and collaboration across the energy value chain is needed to resolve bottlenecks and fulfil critical prerequisites for accelerated decarbonisation."

Smeets also points out that the debate around the energy transition has shifted over the last two years. There has been renewed focus on security of supply, affordability and industrial competitiveness triggered by the Ukraine war. He said there has also been an increasing notion that the shift towards a low carbon energy system might not be just about a transition to renewables, but will actually be more volatile with a broader base of solutions.

"Other low carbon solutions such as nuclear power, carbon capture utilisation and storage (CCUS) and blue hydrogen are considered as part of that options space," he said. "There is also increased awareness of bottlenecks triggered by certain developments and the price volatility spikes that we've seen – all the way from increased investment challenges in a high interest rate environment, to supply chain crunches and labour shortages."

In parallel to the shift in the debate, there have also been other factors that could potentially cause a slowdown in the transition, such as an increase in the cost of renewables for the first time in over two decades.

Although renewables are predicted to continue to grow strongly, the current rate of growth is not enough. According to McKinsey, today's share of renewables, including hydropower, in the generation mix is about 35 per cent. By 2030 it is projected to reach 45 per cent and 65-85 per cent by 2050.

The International Energy Agency has said that renewable power capacity must triple by 2030 to keep the 1.5°C goal within reach.

Indeed there must be an immediate and accelerated ramp up of all low carbon technologies and even deployment of carbon removal technologies to reach net zero by 2050 in order to keep 1.5 alive. In a recent report DNV set out a pathway, which it says makes this possible.

In its 'Energy Transition Outlook' launched in October, the company forecast that global temperature will rise 2.2°C by the end of the century. Last month it followed this up with its 'Pathway to net zero', a "backcast" detailing a carefully constructed pathway to net zero emissions using technologies that already exist.

DNV Group President and CEO, Remi Eriksen commented: "Emissions must fall very fast for us to reach net zero in just 27 years. In fact we don't think it's possible for the world to eliminate emissions until after 2050. There will have to be a large carbon capture and removal effort to deal with excess emissions beyond the carbon budget for 1.5°C of warming."

While the pathway calls for a tripling of renewables in final energy demand, a total exit from coal and a reduction of oil and gas by two-thirds each, it also says there will still be some emitting sources in the energy mix. This means technologies like CCUS and direct air capture (DAC) must expand considerably in the 2040s.

Sverrer Alvik, Director of Energy Transitions Outlook at DNV explained: "With this backcast, we start with the 1.5°C we want to achieve and then put into our models – in the different sectors and countries – what it takes to reach the 1.5°C. This decade we will empty the budget to achieve 1.5°C, and in the period between 2030 and 2050 we will emit around 300 billion t of CO_2, which needs to be removed by carbon removal technologies, or negative emissions, in the latter half of the century."

While stressing that cutting fossil fuel use is the biggest lever we can pull in reducing emissions, Alvik says CCS is the technology with the "largest gap between current pace and the needed pace". CCS will have to be 40 times higher within 20 years, according to DNV. DAC, which today is capturing around 5000 t globally will have to remove around 1 billion t by 2050, i.e. about 200 000 times more than today.

This is unimaginable. Yet Ditlev Engel, CEO at DNV's Energy Systems business, remains optimistic, adding that there are two or three drivers that will make this COP meeting different from others.

"The first is that 2023 will be the hottest year on record; the whole aspect of energy security is also new into the discussions at COP. And also the cost of the technologies are also very promising," he said.

To bridge the emissions canyon world leaders will need to adopt a can do mind-set and set a target for the end of fossil fuel use, at least in sectors like power where there are mature and lower cost alternatives. At the same time there should be a realisation that higher income regions must move faster and achieve net zero before 2050. This will offer the headroom that middle- and low-income regions need. It is important to accept that some countries are simply not capable of achieving net zero emissions by 2050.

As Guterres put it: "Leaders can't kick the can any further. We're out of road." It was a realisation Robbie Knievel no doubt had to accept moments before jumping the Grand Canyon.

Cartoon: jemsoar.com