

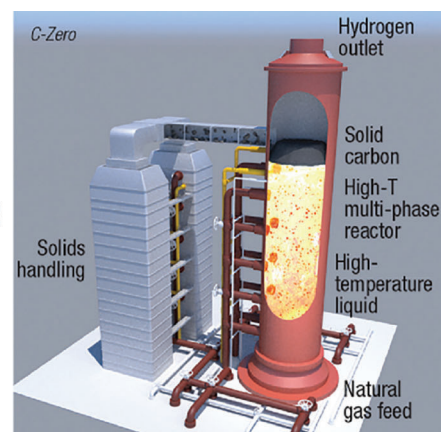
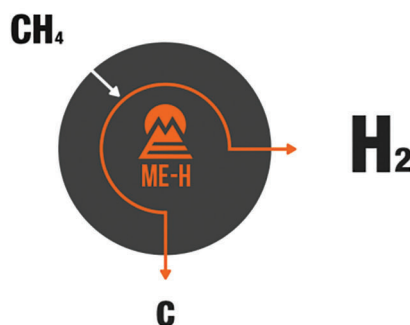


'Methane pyrolysis' turns natural gas into clean H₂ and solid carbon

Portland-based gas utility NW Natural has partnered with Modern Electron to create clean hydrogen (H₂) and solid carbon directly from natural gas and blend it into the local gas grid. The process – known as *concurrent combustion methane pyrolysis* – uses only methane and air as inputs. No electricity, water or consumable catalyst is needed. The pilot is due to go live in early 2023.

The technology, planned for a pilot project at NW Natural's Central Portland facility, is one of many solutions that the utility is pursuing as it aims to reach Net Zero emissions by 2050 for the energy it delivers to customers. For NW Natural, a local gas distribution company servicing about 2.5 million people in Oregon and Southwest Washington, the pilot with Modern Electron will be the first in a line of scheduled similar projects as it strives to decarbonise.

H₂, created by clean pyrolysis can potentially be used for industrial heating or power generation, if blended with natural gas. Solid carbon resulting from the process, meanwhile, could be turned into products such as asphalt, construction materials, automobile tires and soil amendments. This opens up a second revenue stream for early-adapters of combustion methane pyrolysis.



"This technology could provide an incredibly elegant and flexible way of producing clean hydrogen – and potentially at a very low cost whenever and wherever we need it on our system to help decarbonize," said Kim Heiting, senior Vice President of Operations for NW Natural.

Fast and economical way to decarbonize

Highlighting the potential of the novel combustion methane pyrolysis technology, Mothusi Pahl, Modern Electron's VP business development said: "The fastest and most economical way to reduce

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Exelon makes plans to spend \$29 billion on energy infrastructure by 2025

Exelon, one of the largest US utilities with more than 10 million customers, has announced plans to invest an \$29 billion in the years through to 2025 on energy infrastructure, in addition to the \$6.6 billion last year. These investments are "critical to bringing more renewables online," the company said, and for enabling the electrification of transport.

As the largest US energy transmission and distribution company, Exelon wants to "steward the clean energy transition and power the economic health and well-being of the large and diverse metropolitan areas that it serves," said Chris Crane, Exelon president and CEO.

"Our prudent, customer-focused investment in reliability continues to enhance the sustainable value Exelon delivers to all of its stakeholders (...) as the climate crisis, along with systemic inequity in our communities [will] shape what is imperative to our business and challenge us to do even more," he said.

Exelon focuses on electricity transmission, hav-



ing separated its power generation business to an independent business, Constellation in February 2022. The rapid build-out of inherently intermittent wind and solar power sources, hence directly impacts its business model.

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CO₂ emissions at a national scale is to effectively leverage existing infrastructure. By decarbonizing natural gas at the point of use, our modern hydrogen products help businesses reduce their carbon footprints without the cost and complexity of changing

their processes. We are all about decarbonization. And we are excited about our partnership with NW Natural."

Washington-based Modern Electron has a novel approach to creating H₂ which eliminates the logistics, costs, and emissions as-

sociated with traditional hydrogen generation, transportation, and storage. The company's proprietary Concurrent Combustion and Pyrolysis technology is built for continuous H₂ supply in process heat, power generation, and environmental/space /water heating. ■

Storengy chooses MAN to convert H₂ & CO₂ into synthetic methane

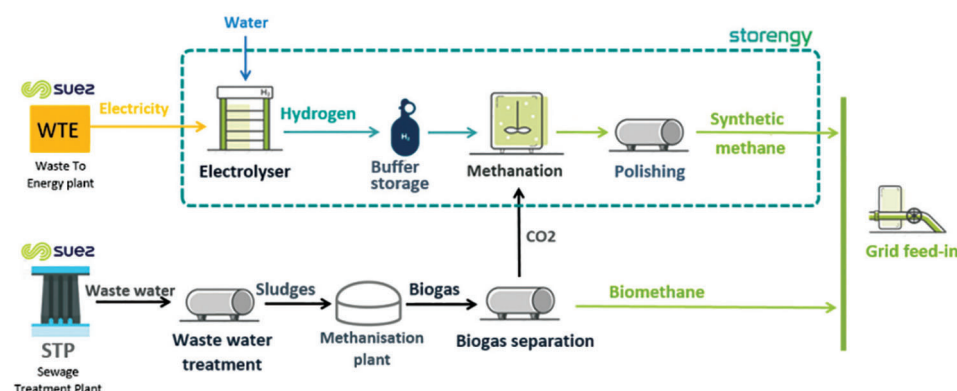
Storengy, part of the French utility ENGIE, has chosen MAN Energy Solutions to provide a methanisation unit for a wastewater treatment plant at Pau Bearn in the Pyrénées. The unit will convert renewable hydrogen (H₂) and biogenic carbon-dioxide (CO₂) – a co-product of anaerobic digestion of sludge – into synthetic methane via the so-called power-to-methane process.

A public call for tenders, related to the construction of a new sludge-treatment unit for a wastewater treatment plant, was won by a temporary consortium of companies led by Suez Eau. The consortium also includes the ENGIE affiliate Storengy, along with Camborde Architectes, SOGEA/Vinci and EGIS Eau.

Main functions of the sludge-treatment unit will be to produce a mixture of biomethane and biogenic CO₂ from sludge by anaerobic combustion, as well as the conversion of biogenic CO₂, a co-product of the anaerobic digestion, along with renewable hydrogen into synthetic methane via power-to-methane.

How methanation works

The site's performance is increased by producing synthetic methane from the methanation of green hydrogen (H₂) and carbon dioxide (CO₂). The latter, a product of anaerobic digestion (methanisation), is usually released into the atmosphere. The innovative catalytic methanation technology – introduced by Storengy for a world-first on the industrial stage for such an installation – allows the transformation of all the CO₂



emitted into synthetic methane, a green renewable gas.

This technology breakthrough has two advantages: the additional production in the long-term of 4,400 MWh of synthetic methane per year, and an unparalleled carbon-neutral footprint. The total bio- and synthetic methane produced by the site will, eventually, be 13,000 MWh per year – the energy equivalent of heating 1,200 homes.

"For MAN Energy Solutions, this project involves converting a mixture of biogenic CO₂ and green hydrogen into synthetic natural gas by catalytic methanation. The methanation unit makes it possible to increase the production capacity of the biogas plant by more than 50%. All of the bio-and synthetic

methane produced will be injected into the gas network," commented MAN ES France's President, Arnaud Filancia, President.

Storengy has entrusted MAN Energy Solutions France with the engineering, supply, transport, installation and on-site commissioning of the methanation unit. The methanation unit will be constructed at MAN Energy Solutions' site in Deggendorf, Germany, where the company's competence center for complex reactor systems for synthetic fuel production is situated. "MAN Energy Solutions offered the best technical solution and serious guarantees to carry out this project, which is why we chose this partner," said Storengy's project manager, Yan Figarol. ■

Continued from page 1

CEO Cranes said Exelon is striving to add renewable capacity while building up resilience. "Grid resilience is paramount to guarantee a stable supply of electricity – especially since US customers have to withstand more extreme weather and other disruptive events," he said, alluding to the global pandemic.

The Chicago-based company in August 2021 announced its Path to Clean commitment to reduce operations-driven emissions 50% by 2030 and achieve net-zero operations by 2050, while also supporting customers and communities in achieving their clean energy goals. On the demand side,

Exelon's six local energy delivery companies last year saved 22.8 million MWh through energy efficiency programs.

Spending with diversity-certified suppliers reached \$2.4 billion in 2021, accounting for 40% of Exelon's sourced spending. Moreover, the company invested more than \$14 million last year to support 65 workforce development programs across its six utilities – Atlantic City Electric (ACE), Baltimore Gas and Electric (BGE), Commonwealth Edison (ComEd), Delmarva Power & Light (DPL), PECO Energy Company (PECO), and Potomac Electric Power Company (Pepco). ■

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Berlin allows restart of 1.8 GW lignite power to pre-empt energy crisis

The German coalition government has given the green light to take 1.8 GW of lignite-fired power generation capacity back into operation from a reserve scheme, as of October 1. It requested for more gas to be held in storage as overall filling levels are at 65.1%, while the large Rehden storage is just 34.4% full as of today.

The activation of lignite-fired reserve power plants is designed to reduce gas consumption. The German economy and climate minister Robert Habeck explained “these lignite-fired power plants can then also return to the electricity market and replace natural gas power plant.” But critics doubt this will be enough to meet demand, as the coal-to-gas switch in power generation can replace only a fraction of Germany’s overall gas use, notably the huge demand from energy-intensive industry and for space heating during the winter.

Habeck announced the move to restart these moth-balled lignite power stations on Thursday, when presenting a wider plan as to how industry and household customers could reduce their consumption of natural gas in the upcoming autumn and winter season. Having triggered Phase-2 of a “Gas Emergency Plan” some weeks ago, the government is on high alert to pre-empt the risk of a full-blown energy crisis and a subsequent recession.

As for gas storage, the targets for filling facilities up quicker envisage them to be 85% full as of October 1, and 95% by November 1. These new rules also prevent utilities from selling the gas that they have already stored at times of high prices, Habeck explained.

Low flows through Nord Stream, hamper storage in-feed

Gazprom, the Russian state-owned gas export monopoly, has resumed flows through the Nord Stream 1 interconnector to Germany as of Thursday this week – albeit at low levels. Having returned from its annual maintenance, Nord Stream 1 currently runs at just 40% of its full capacity.

This complicated the in-feed of natural gas into Rehden, one of Germany’s largest gas storage facilities that used to be managed by Gazprom Germania but is now in the hands of Kassel-based Astora GmbH, one of Eu-

rope’s largest gas storage operators. Astora also own the large cavern storage unit at Jemgum as well as the Austrian storage unit in Haidach, together with Wingas, RAG Austria and Gazprom Export.

To ensure gas storages are full before winter, the government set a new target to fill them to 75% by 1 September, as the reduced deliveries through Nord Stream “speak a clear political language,” Habeck commented. The more stringent targets for filling up gas storages envisage them to be filled to a level of 85% by 1 October, and 95% by November 1.



Garzweiler open-cast mine with RWE's lignite power stations in the background

Expiry of US coal tax credit lowers coal-burn for power gen from Q1

Refined coal, created by removing impurities from thermal coal, is less and less used in the U.S. due to the recent expiry of a ‘coal tax credit scheme’. Burning refined coal to generate electricity peaked in 2021, and production of the fuel almost fell to zero during the first quarter of 2022 as utilities prefer renewables combined with gas peaking plants.

Consumption of refined coal in the US peaked in 2021 at 162 million short tons. That year, refined coal accounted for 31% of coal-fired electricity generation. During the first quarter of 2022, refined coal held a share of U.S. coal-fired electricity generation below 10%, which we mostly attribute to the expiration of the refined coal production tax credit.

The reason for the subsequent rapid decline in coal-burn was that at the end of 2021, the refined coal production tax credit – created by the American Jobs Creation Act of 2004 – expired. Before that producers of refined coal used to be able to claim the tax credit for up to 10 years, if they met certain conditions, including: Begin service by December 2011, certify that they had reduced

nitrogen oxide emissions by 20% and reduced either sulphur dioxide or mercury emissions by 40% compared with feedstock coal, and sell the refined coal to an unrelated entity.

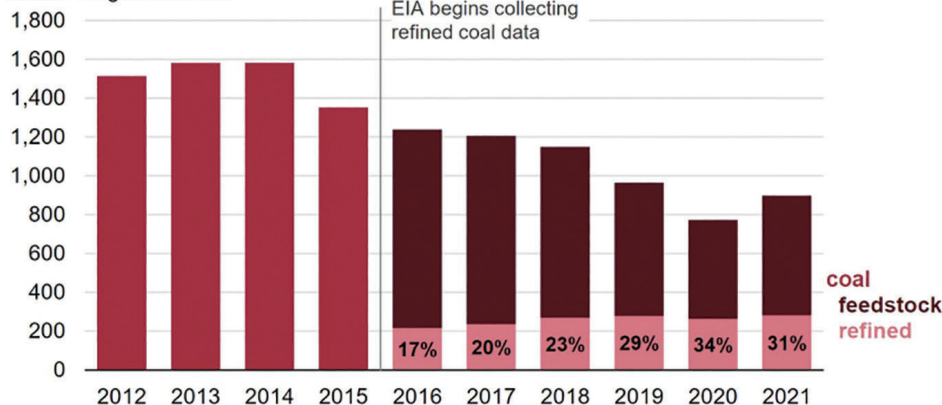
Technically speaking, refined coal is most commonly made by mixing proprietary additives to feedstock coal with the aim of helping capture emissions when the coal is burned. For example, these additives increase mercury oxides, which technologies – such as flue gas desulfurization scrubbers and particulate matter control systems – can then capture.

The tax credit was designed to increase with inflation. In 2021, the tax credit value was \$7.38 per short ton, an increase from \$4.38 per short ton in 2012.

By comparison, the IRS’s reference price of feedstock coal was \$45.64 per short ton during 2021, a decrease from \$55.80 per short ton during 2012. According to a U.S. Government Accountability Office audit report, refined coal producers claimed approximately \$8.9 billion in tax credits between 2010 and 2020.

U.S. coal-fired electricity generation (2012–2021)

million megawatthours



Data source: U.S. Energy Information Administration, [Power Plant Operations Report](#)

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Energy storage market to top 500GW by 2031 driven by US and China

Deployments of energy storage are expected to reach 500 GW or more worldwide by 2031, with the US and China making up three-quarters of demand while Europe lags behind. "Europe's grid-scale market struggles to stabilise," WoodMac says, with only 159 GWh forecasted for the region by 2031, compared to 422 GWh for China and 600 GWh for the United States.

Regulatory barriers in Europe undermine the economics of energy storage project. In addition, limited access to power markets and little revenue stacking opportunities, combined with a lack of capacity market auctions, has lowered investment for grid-scale storage assets in Europe, said WoodMac's Global Head of Energy Storage, Dan Shreve.

Despite this, Germany's energy storage market continues to grow and is set to become the third biggest energy storage market by 2030, following US and China. Analysts forecast the German market will top 32 GWh installed capacity, including 61% from the residential segment.

REPowerEU boosts European market

Europe's energy storage market as a whole is boosted by the Commission's recent REPowerEU which pushes for a higher share of renewable energy supply in EU member states. Since the plan was launched in May 2022, Europe already saw a 12 GWh increase – but this is still far below the targeted 600GW target for the solar PV market, hence the Commission pledged to ease permitting processes for both solar and energy storage projects

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

US keeps leading the way

The US remains the energy storage market leader, with average annual installations of 54 GWh through 2031, 83% of that volume will be grid-scale. But Wood Mackenzie's US outlook shows 2022 and 2023 demand downgrades of 34% and 27%, respectively.

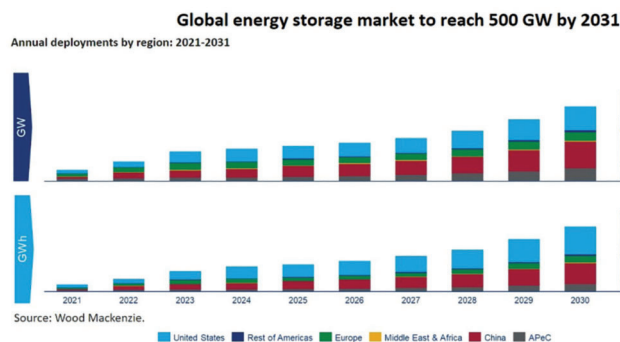
This is largely due to disruptions within the grid-scale and distributed segments from an antidumping and countervailing duties (AD/CVD) tariff suit from Q2 of this year. According to Shreve, "the US solar and storage market was hit hard by the AD/CVD tar-

iff petition, with approximately 35% of 2022 hybrid grid-scale installations delayed."

Rapid growth in China

China continues to dominate the Asia Pacific market, with over 400 GWh of demand forecasted through to 2031. Analysts reckon this has mainly been driven by China's Fourteenth Five-Year New Energy Storage Development Implementation Plan which reiterated the central importance of energy storage in the country's earlier overarching plan for decarbonisation. This wider plan proposes that by 2025 energy storage will enter the large-scale development stage, given that system costs are anticipated to fall by more than 30% through improved technology performance.

Central planning and rapid project implementation are trademarks of the Chinese economy. In fact, since the decarbonisation plan was released, 12 provinces and cities in China have announced 2025 cumulative energy storage deployment targets, totalling around 40 GW.



NGK to install 1.2 MWh battery plus solar PV at its factory in Japan

NGK Insulators will install a NAS battery with 200 kW electricity output and 1.2 MWh capacity, and solar PV with 2,600 kW/2.6 MW capacity at its Ishikawa plant and Ceramic Device plant in Nomi City, Japan. Start of operation is due in January 2024, as the manufacturer wants to slash emissions by making use of all renewable energy generated nearby.

The battery-based energy storage will be the largest in the Hokuriku region, and can serve as a backup power source in times of emergency or disaster. The 200 kW / 1,200 kWh battery will

empower NGK Insulators to better cope with unforeseen shortages in electricity supply or rolling blackouts, due in part to intensifying natural disasters in recent years.

"Combining the NAS battery with the PV system will enable electricity to be supplied to important equipment at the plant for up to 10 hours when power from the grid is interrupted," the company said, explaining the hybrid battery & solar PV solution will be used as a "countermeasure against instantaneous voltage drops caused by lightning strikes and so forth."



View of NGK Insulators' Ishikawa plant in Nomi City, Japan

Onsite power generation and energy storage lowers the risk of power cuts with subsequent shut-

downs of production lines, which can incur major losses. Looking ahead, NGK said it will quantitatively assess the NAS battery's effects, especially with regards to preventing production losses but also with a view to promote the adoption of such batteries in Japan and overseas.

Under its "Environmental Vision" set up in April 2021, NGK aims to reduce its CO2 emissions by 50% compared with fiscal 2013 by fiscal 2030 and achieve net zero emissions by 2050. The company hence works on "expanded use of renewable energy" as one strategy to achieve those targets, including by installing PV systems utilizing NAS batteries but it will also buy more clean energy and carbon-neutral fuels from third parties.



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Rolls-Royce invests in Germany to boost MTU's engine making capacity

Britain's Rolls-Royce Power System has announced it is "proactively investing in Germany" to meet rising demand for MTU engines, both for military application and for emergency power supply. To expand manufacturing capacity at its Augsburg site, RRPS will hire up to 450 additional employees over the next ten years.

Beyond the supply of existing propulsion and energy solutions, Rolls-Royce Power Systems is active in developing climate-neutral technologies such as hybrid drives, microgrids and fuel cells. Already today, many mtu engines can run on sustainable fuels, the production of which binds as much CO₂ as is

released during combustion.

That way, even existing combustion engines can be operated in an "almost climate-neutral manner," the manufacturer stressed. MTU's efforts on clean fuels and Power-to-X are part of the company's "Net Zero at Power Systems" strategy as Rolls-Royce Power Systems aims to become climate-neutral by 2050.

First test bench for mtu H2 engines

In Augsburg, the main manufacturing site for mtu engines in Germany, Rolls-Royce Power Systems CEO Andreas Schell recently commissioned the company's first in-house test stand for hydrogen-ready engines. Over the past 16 months, mtu spent €10 million on modernising test

benches and H₂ infrastructure.

Based on MTU's fuel cell system, the company has launched gas gensets capable of co-firing sustainable fuels like HVO (hydro-treated vegetable oils). It is also developing electrolyzers to produce green hydrogen, while the mtu gas engine portfolio is being prepared for hydrogen as a fuel.

"We see hydrogen as an essential energy carrier of the future, in conjunction with renewable, often decentralized, energy sources," said Dr. Otto Preiss, Rolls-Royce Power Systems chief technology officer (CTO) and chief operating officer (COO). "That is why we are doing everything we can to gradually bring our mtu gensets and CHP units based on the Series 500 and 4000 gas engines to market for operation with a hydrogen blending of 25% by volume (H₂) and more and for operation with up to 100% by volume."



View into MTU's aero engine manufacturing site at Munich

GE get \$4.2 million in ARPA-E funding for decarbonisation tech

GE Gas Power has secured \$4.2 million in funding from the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) that will go towards research on "Lifted-flame combustion for high-hydrogen reheat gas turbines" and "Manufacturing high-yield investment castings with minimal energy." Researchers at Greenville, South Carolina, aim to reach combined-cycle gas turbine efficiency of 67%, or beyond.

With the first project, GE Gas Power will investigate a novel lifted-flame combustion approach for advanced gas turbine engines powered by mixtures of natural gas and hydrogen. H₂ does not produce CO₂ emissions, when burned in a gas turbine, hence it is widely seen as a way to decarbonise mature combined-cycle gas combustion technology.

Targeting 67% net efficiency

The lifted-flame combustion technology aims to break the current, materials-limited upper bound efficiency barrier for new gas turbines and installed base retrofits and create a new gas turbine combined-cycle growth trajectory. GE said it is targeting net plant efficiencies of 67% or greater on a wide range of fuel compositions, all while meeting strict emissions standards.

"Our goal of increasing gas turbine combined cycle plant efficiency by 5 or more percentage points in the next decade will position GE's technology to help lead the energy transition," said Jeffrey Goldmeier, Emergent Technologies Director for Decar-

bonization at GE Gas Power. "The proposed technology offers transformative value for both high-hydrogen and post-combustion carbon capture applications, ensuring dispatchable power with significantly reduced carbon emissions via highly efficient gas turbine-driven power generation."

This project will be executed at GE's Gas Turbine Technology Center in Greenville, South Carolina, home to the world's largest gas turbine manufacturing facility and full-scale combustion test facility. The foundational testing of the technology will be conducted at the Atlanta-based Georgia Institute of Technology, a leading research university in the field of engineering and gas turbine combustion.

"As home to the largest university-based hydrogen research and development effort in the country, we are delighted to be collaborating with ARPA-E and GE Gas Power on this effort," said Tim Lieuwen, Regents' Professor and Executive Director of the Strategic Energy Institute at Georgia Tech. "We will be deploying state-of-the-art diagnostics and modeling tools to predict key hydrogen.

Manufacturing castings with minimal energy

This project will combine key elements of casting technology such as furnace development, and 3D printed additive ceramic mold tech to change the production of high-value metal components for gas turbines. The new system could produce cast parts using up to 90% less energy than traditional methods, as well as provide improved quality, consistency, and yield – all at lower cost.

"The proposed system of technologies, combining digital tooling, cutting edge additive ceramic mold printing, and lean flow casting technology, will enable us to respond rapidly while reducing our energy usage and carbon footprint," said Tom Amond, Emerging Technology Incubator at GE Gas Power.

On this project, GE engineers at Greenville are working with DDM Systems, a company known for the precision investment castings of complex engineered components, and gets support from the GE Global Research Center in Niskayuna, New York.



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