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# Low Carbon Pulse - Edition 21

# **GLOBAL DEVELOPMENTS IN PROGRESS TOWARDS NET-ZERO EMISSIONS**



Welcome to Edition 21 of Low Carbon Pulse – sharing significant current news on progress towards net-zero emissions globally. This edition covers the period from Monday June 28, 2021 to Sunday July 11, 2021 (inclusive of each day).

Please click <u>here</u> for the previous Edition of Low Carbon Pulse. Please also click <u>here</u> and <u>here</u> for the first two articles in the **Shift to Hydrogen Series** (**S2H2**): **Elemental Change** series: the *S2H2* series provides a narrative and perspective on hydrogen generally. Please **click** <u>here</u> for the first feature in the **Hydrogen for Industry** (**H24I**); the *H24I* features provide an industry by industry narrative and perspective.

Edition 21 will be posted again on July 16, 2021 to pick-up those reading later in the week.

# The week that was:

On July 5, 2021, the European Commission (*EC*) outlined a new green financial plan for the purpose of supporting the initiative to achieve the goal of reducing GHG emissions by 55% across European Union (*EU*) Member states by 2030. *EC* Vice President Mr. Valdis Dombrovskis is reported as having said that "natural gas and nuclear energy could be the "decarbonisation pathways" that start to replace heavily polluting coal-fired power stations". Consistent with a continuing narrative across Low Carbon Pulse, it would appear more than likely that natural gas will continue to be used as a fuel to allow progress towards net zero emissions (*NZE*) in the *EU* and globally using technologies that reduce and capture GHG emissions.

# **The Week Ahead:**

#### • EU and EC releases:

#### - CBAM:

On July 14, 2021, it is expected that the *EU* will release the developed policy settings for the Carbon Border Adjustment Mechanism (*CBAM*) (see Editions <u>12</u> and <u>19</u> of Low Carbon Pulse). If the July 14, 2021 timeline is achieved, Edition 22 or Edition 23 of Low Carbon Pulse will cover the form and substance of *CBAM*, and assess its likely implications. (Please click <u>here</u> for the link to the preliminary draft.)

#### - Climate Change Policy Proposals:

In addition to the release of **CBAM**, on July 14, 2021, the **EC** is scheduled to publish 2030 policy setting proposals in respect of **NZE**, including changes to the EU Emission Trading Scheme (**EU ETS**). The changes to **EU ETS** are expected to attract considerable attention and comment. The reason for this is that ahead of the publication much modelling appears to have been undertaken, including on the appropriate price point under the **EU ETS** will result in decarbonisation outcomes, critically, in the transport sector.

#### • Deadline for applications for ScotWind approaches:

There is expected to be considerable activity ahead of the deadline for applications for ScotWind Leasing Scheme on July 16, 2021. (Edition  $\underline{8}$  of Low Carbon Pulse reported on the ScotWind Leasing Scheme auction process.)

Given the outcomes achieved on February 8, 2021 in respect of the Round 4 leasing program auction process for sites off-shore of England and Wales (see Edition 9 of Low Carbon Pulse), the outcomes of the ScotWind Leasing Scheme auction process are eagerly awaited. It will be recalled that the original schedule for the ScotWind Leasing Scheme was delayed to avoid competing the Round 4 leasing program auction process.

#### **Report on reports:**

As noted in Edition <u>20</u> of Low Carbon Pulse, among other things, to manage the length of Low Carbon Pulse, rather than commenting on reports and publications in each edition of Low Carbon Pulse, links to them will be included in the text of and at the end of, each edition of Low Carbon Pulse. Short summaries of the reports and publications will then be developed every month or so, and published either as an appendix to Low Carbon Pulse or in a stand-alone publication.

# Ahead of the UKH2S:

Edition <u>20</u> of the Low Carbon Pulse noted that during the third week of July 2021, the UK Government is predicted to release its Hydrogen Strategy (**UKH2S**). Early indicators on the thinking that will inform the **UKH2S** are in plainsight as part of the <u>10-Point Plan for a Green Industrial Revolution</u> (**TPP**), including the aim of the development of 1 GW of low carbon hydrogen production capacity by 2025, and a firmer target of 5 GW by 2030.

Ahead of the release of the **UKH2S**, the All-Party Parliamentary Group (**APPG**) released a <u>report</u> urging the UK Government to set ambitious targets both under the **UKH2S**, and in the implementation of that strategy. While there are ten key recommendations from the **APPG**, the most compelling headline appears to be that the UK should expand beyond the 5 GW of low carbon hydrogen production capacity contemplated in the **TPP**, ("Aiming for 5 GW Hydrogen production capacity by 2030 in partnership with industry") including the use of nuclear technology to produce pink hydrogen. A short summary of the **APPG** report will be included in the Ashurst report on reports for July.

# **The Month Ahead:**

**Commencement of trading on PRC ETS imminent:** Towards the end of June, the Shanghai Environment and Energy Exchange (the first national carbon emissions trading platform, and which is understood will handle account openings for traders and operations until a formal national carbon emissions operator is set up in the PRC) provided clarity around emissions trading on the PRC emissions trading scheme (*PRC ETS*). On July 7, 2021, at an executive meeting of the State Council, Chinese Premier, Mr Li Keqiang, announced that trading on the *PRC ETS* would commence for power generation during July 2021. (See Editions <u>6</u>, <u>9</u> and <u>12</u> of Low Carbon Pulse for background on the *PRC ETS*.)

# **IRENA World Energy Transitions Outlook:**

Edition 13 of Low Carbon Pulse reported that the International Renewable Energy Agency (*IRENA*) had published its <u>Preview to World Energy Transition Outlook</u> (titled "Preview of World Energy – Transition Outlook – 1.5°C Pathway", and reprised the headlines and themes in Edition 20 of Low Carbon Pulse. On June 30, 2021, *IRENA*'s <u>World Energy Transitions Outlook</u> (*WETO*) was published. The <u>WETO</u> weighs in as a heavyweight, both in terms of number of pages, and the strength of its subject matter.

The **WETO** takes the same end point as its key term of reference: achieving the Stretch Goal under the Paris Agreement (i.e., to limit the increase in average global temperatures to  $1.5^{\circ}$ C above pre-industrial levels (what **WETO** refers to as the **1.5°C Scenario**)). As is the case with the International Energy Agency (**IEA**) **Net Zero by 2050 – A Roadmap for Global Energy Sector** (**IEA Roadmap**), the **WETO** provides a pathway to **NZE** by 2050, not the pathway.

Consistent with the intention not to report on reports in full in editions of Low Carbon Pulse, but to publish a report on reports in respect of each month, the report on reports for July will include a summary of the **WETO**.

To whet the appetite the following matters are key: 1. current progress and plans to decarbonise "fall woefully short of achieving" the Stretch Goal; 2. "time is of the essence, and a rapid decline in emissions must begin now to preserve a fighting chance of" achieving the Stretch Goal; 3. the pressure of time, requires "careful investment and policy [setting] choices" in the current decade, and for these purposes the **WETO** provides a helpful graphic (Figure <u>S.3</u>) to convey the concepts; 4. Hydrogen will account for 12% of final energy use by 2050 and bioenergy will represent 18% of total final energy consumption in 2050.

**Goals:** On November 4, 2016 the Paris Agreement entered into force. The Paris Agreement recognises that to respond to the effects of increased GHG in the atmosphere, it is necessary to commit to hold: "the increase in global average temperature to well below 2°C above pre-industrial levels [Stabilisation Goal] and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels [Stretch Goal] ..." (Article 2).

**WETO** is the second report from **IRENA** in short order: While the **WETO** was the second publication from **IRENA** in short order, it has long been expected. **WETO** and <u>Renewable Power Generation Costs in 2020</u> may be regarded as compulsory reading, along with the **IEA Roadmap** and the <u>Energy Prices: Overview –</u> <u>High-Ouality data on end-use energy prices</u>. All four reports are well tagged and thumbed by the author of Low Carbon Pulse.





#### FIGURE S.5 Evolution of emissions with phaseouts of coal and oil, 2021-2050

Note: RE = renewable energy; VRE = variable renewable energy; CBAM = carbon border adjustment mechanism; ICE = internal combustion engine; GW = gigawatt; Gt = gigatonne; CCS = carbon capture and storage; BECCS = bioenergy combined with carbon capture and storage; CCU = carbon capture and utilisation.

# New IEA Reports:

Edition  $\underline{20}$  of Low Carbon Pulse reported on the number of **IEA** reports and studies as mid-calendar year approached. Reports from the **IEA** have continued to drop ahead of the Northern Hemisphere summer holiday season:

- <u>Hydropower Special Market Report</u> (published on June 30, 2021), reminding us that one sixth of global electrical energy generation was derived from hydroelectric power in 2020, making it the single largest source of low-carbon power, that the quantity of hydroelectric power has increased by over 70% over the last two decades, but the rate of growth needs to be increased, and absent new and recalibrated policy settings the rate of growth will not be sufficient (in particular by reference to the *IEA Roadmap*) to achieve *NZE*;
- Trends and Developments in Electric Vehicle Markets emphasising that there is continued development of the use of battery electric vehicles (BEVs) (10,000,000 at the end of 2020), and that the rate of adoption of BEVs is increasing. As is the case with the Hydropower Special Market Report, the IEA notes the need for new policy settings to increase the rate of adoption of BEVs. One of the telling statistics from the IEA Roadmap is that the number of cars will increase from 1.2 billion to 2 billion by 2050. As ever, increased electrification requires increased renewable electrical energy, and the integrated policy settings must be in place to ensure supply of renewable electrical energy and recharging capacity is in place ahead of demand for it; and
- Gas 2021 Analysis and Forecast to 2024: On July 5, 2021, the IEA released its <u>Gas Market Report Q3-2-2021, including Gas 2021 Analysis and Forest to 2024</u> (Gas Report). As is to be expected, the Gas Report is consistent with the perspectives that inform the IEA Roadmap.



As a point of contrast, The Oxford Institute for Energy Studies (**OIES**) publication, <u>Energy Transition:</u> <u>Modelling the Impact of Natural Gas</u>, is worth consideration. The **OIES** report provides for the use of natural gas to a greater extent than the **Gas Report** and the **IEA Roadmap**. Given the timing of the release of the **IEA**'s **Gas Report**, the **OIES** report does not take account of the **IES**'s findings. The **OIES** report provides for two scenarios: one resulting in slightly higher use of natural gas than currently in 2050, the other with around 60% of current levels of natural gas use in 2050. Both scenarios are intended to achieve the Stabilisation Goal under the Paris Agreement, rather than the Stretch Goal (noting that the **IEA Roadmap** is based on achieving the Stretch Goal).

The report on reports for July will include a short form summaries of each report.

# India to introduce Green Hydrogen Consumption Obligations (GHCOs):

Edition 20 of Low Carbon Pulse anticipated that the Government of India (*GoI*) was likely to introduce mandatory purchase obligations for Green Hydrogen, similar to their Renewable Purchase Obligations (*RPOs*). On July 1, 2021, it was reported widely that the *GoI* is considering proposals to impose obligations on fertiliser producers and oil refineries to procure Green Hydrogen to satisfy a percentage of their demand for hydrogen. It is understood, that the Green Hydrogen Consumption Obligation (*GHCO*) will commence in 2023 / 24, requiring the procurement of 0.15% of demand (by class of hydrogen user) for hydrogen, with the *GHCO* increasing to 10% over a six year period.

The use of a policy setting of this kind allows the supply side of the hydrogen economy to develop in a controlled way, achieving economies of scale, while at the same time not providing a price shock to the demand side. Further, the displacement of grey hydrogen production has immediate GHG emission reduction outcomes.

#### Indonesia - Proposed Carbon Tax:

On June 29, 2021, it was reported that the Government of Indonesia intends to introduce a carbon tax of around USD 5 per tonne of  $CO_2$  or  $CO_2$ -e. The Nationally Determined Contribution of Indonesia is set to reduce GHG emissions by 29%, compared to the business as usual scenario, by 2030. To address the impact of COVID-19, the Government of Indonesia has had to reduce spending on net-zero and energy transition programs. In this context, the introduction of a carbon tax is fiscally prudent, and policy critical.

#### GoO on the move – Guarantee of Origin Schemes:

Edition <u>20</u> of Low Carbon Pulse reported on the discussion paper was released by the Federal Government in Australia, entitled "<u>A Hydrogen Guarantee of Origin scheme for Australia</u>". In the first week of July, 2021, Hydrogen Europe published, <u>H2ero Net Zero – Different energy carriers required separate systems of guarantees of origin</u> (H2 GoO).

The *H2 GoO* anticipates the review of the *EU*'s *Renewable Energy Directive*, and proposes that the existing GoO system should be re-worked to reflect five key principles: Traceability, Trackability, Tradability, Transparency and Trustworthiness. Key to the *H2 GoO* is distinct and separate GoOs for H<sub>2</sub> derived from the use 100% renewable resources and from mixed resources, thereby providing transparency and avoiding confusion, including in respect of hydrogen produced from mixed electrical energy sources and blending of natural gas and hydrogen.

As noted in Edition 20 of Low Carbon Pulse, globally, an effective and accepted assurance scheme to certify the origin, and carbon intensity, of hydrogen and hydrogen-based fuel production is essential both for bi-lateral export contracts (to support the development of projects) and to facilitate the development of a market for hydrogen and hydrogen-based fuels, including ammonia and methanol.

# Like minded giants:

On July 6, 2021, Shell Gas & Power Developments B.V (**Shell**) and Uniper Hydrogen GmbH (**Uniper**) announced that they had signed a memorandum of understanding (**MoU**) to explore how they may accelerate the development of the hydrogen economy in Europe, focusing on industrial demand and mobility demand.

It is reported that **Shell** and **Uniper** are going to work: "backwards from [identified] customer demand to identify key opportunities to develop [supply] as the foundation of a new hydrogen economy in Europe".

As noted in previous editions of Low Carbon Pulse, the development of supply and demand in tandem is key to the development of the hydrogen economy, with supply side needing to stay ahead of demand, so as to provide certainty of cost of supply and quantity of supply to enable demand side to develop, including to make key investment decisions to develop new infrastructure and acquire new assets (including fleets) to repurpose them.

As might be expected, the geographical focus of **Shell** and **Uniper** is going to be within the area from the Ports of Rotterdam and Wilhelmshaven to North Rhine Westphalia. As noted below (under **Mighty Refhyne Electrolyser**), Shell's Energy and Chemical Park is located in this region, being the location of the first industrial scale PEM (polymer electrolyte membrane) electrolyser.

The **Shell** and **Uniper** initiative is good news, and it follows other good news involving the private sector leading the way across Europe to develop supply and demand in tandem, including the infrastructure necessary to produce, store and deliver hydrogen to the ultimate point of use.

# More light than heat:

On July 6, 2021, the German Hydrogen Council released an <u>action plan</u> covering the period from 2021 to 2025. The action plan is aimed at facilitating the development of the hydrogen economy. The action plan is excellent, packed full of clear narratives and summaries, and clear recommendations arising from those summaries. The action plan will be reported upon in the report on reports for July.

July 8, 2021, was the first anniversary of <u>A hydrogen strategy for a climate neutral Europe</u> (**EUH2S**). In the report on reports for July, progress in the first year of the **EUH2S** in respect of each Key Action will be considered.



# More GHG, More Heat:

Edition 20 of Low Carbon Pulse, reported on the narrative that it is understood will emerge from the impending Intergovernmental Panel on Climate Change (*IPCC*), due in to be published. Key to the findings of the *IPCC* will be analysis of data from the Clouds and the Earth's Radiant Energy System (*CERES*) aboard NASA Earth-observation satellites: *CERES* data indicates the absorption of energy as sunlight and emission of that energy into space as infrared radiation – heat in, infrared radiation out - with the delta between the two being the energy imbalance. In a <u>study</u> of the *CERES* data from 2005 to 2019, it appears that energy imbalance has doubled in comparison to earlier years.

# Energy Storage round-up (including BESS):

• **BESS to synchronise and stabilise:** For some time global mining giants have been considering how best to progress to *NZE*, critically, how to generate electrical energy and deliver it across private grids (i.e., grids not connected to a regional or national interconnected grid) at remote mine sites using renewable sources. Iron ore mining giants, BHP, FMG and Rio Tinto, are all making progress.

On July 2, 2021, it was announced that Rio Tinto is developing a 45 MW / 12 MWh BESS at its Tom Price iron ore mine in Western Australia: as will be deduced from 12 MWh of capacity, this BESS it is not a Big Battery, rather it is to be used as a "virtual synchronous machine" (**VSM**) to control and stabilize the electrical energy system (private grid) at Tom Price.

While the BESS **VSM** at Tom Price is not the first VSM developed, it is the largest so far: others include Mt Newman (WA) (35 MW / 12 MWh) and Dalrymple North (SA) (30 MW / 8 MWh). It is reported that FMG is developing BESS **VSM**s for use on its Pilbara network.

#### See: Rio Tinto <u>website</u>

Another Big Battery in Australia: On July 5, 2021, it was announced that Maoneng Australia is to develop a 225 MW / 450 MWh utility scale battery at Gould Creek, South Australia, 20 kms south of the South Australia State Capital, and largest city, Adelaide (in the State of South Australia). It is intended that the Gould Creek Big Battery will be completed during 2023.

See: Maoneng Australia Gould Creek BESS website

• And another BESS, this time a stand-alone BESS: On July, 2021, it was announced that TransGrid is to develop a BESS west of Melbourne, Victoria. The 300 MW BESS will be located at Deer Park, and will be used as an electrical energy storage source for metropolitan Melbourne. It is reported that financially the BESS is standalone in that it does not require any grant or other support initiative.

#### See: TransGrid website

In a previous edition of Low Carbon Pulse, it was noted that Edition 21 would include a brief explanation of Compressed Air Energy Storage (*CAES*). The use of *CAES* is not new: in concept *CAES* involves the use of electrical energy at times of low or lower cost, and possibly no cost, to electrical energy, to compress air, and to pump that compressed air underground where it is stored. The compression of any gas gives rise to heat. On release of compressed air the energy released is used to drive a turbine to generate electrical energy. The extent of storage is a function of available sub-surface storage with the right geology, and as such the available capacity for *CAES*. *CAES* is being considered in a number of contexts, and may be regarded as a possible alternative to BESS in some circumstances and settings. It has to be said, since the publication of the edition promising the brief explanation of *CAES*, the proposed projects prompting the promise seem less likely to proceed – pressure, heat and markets.

# **BECCS / BECCUS and CCS / CCUS round-up:**

- Singapore seeks to deepen partnerships: In Edition 20 of Low Carbon Pulse (under Singapore chilled about CCUS and hydrogen) it was reported that key agencies in Singapore are considering the findings of two reports, one on CCUS, the other on hydrogen. On June 29, 2021, it was reported that those key agencies are looking to build on these findings. It is expected that the emphasis will be on seeking technology partners to capture GHG emissions arising from industrial, chemical and petrochemical processes, and the use of hydrogen and hydrogen-based fuels, to achieve low to lower, and in some cases, no, GHG emission outcomes. This is seen as important to contributing to the achievement of Singapore's enhanced Nationally Determined Contribution and Long-Term Low Emission Development Strategy, and the Singapore Green Plan 2030.
- Equinor On Shore: On June 29, 2021, it was announced that Equinor (leading global international energy company), plans to develop a CCS hub with US Steel (leading global steel manufacturer) in the Appalachian region of the US. For these purposes, it is reported that Equinor and US Steel have signed a memorandum of understanding (*MoU*) to explore, jointly, the potential of the development of CCU in the US States of Ohio, Pennsylvania and West Virginia. The *MoU* is reported to contemplate the use of natural gas to produce Blue Hydrogen. Hydrogen and hydrogen-based fuels can displace the use of fossil fuel or other carbon intensive energy carriers used in high-heat temperature production processes, including the production of steel.

See: U.S. Steel to Work with Equinor to Assess Hydrogen, Carbon Capture and Storage Development

• **Petrofac and Storegga to fast track to net zero infrastructure:** On June 30, 2021, it was reported that Petrofac (leading service provider to the energy sector) and Storegga Geotechnologies (leading CCS technology corporation) entered into a Technical Delivery Alliance (*TDA*). Under the TDA, Petrofac will provide resources to allow Storegga Geotechnologies to accelerate its growing portfolio of low, lower and no carbon projects.

For Storegga Geotechnologies, this continues progress. As noted in Edition 20 of Low Carbon Pulse, Storegga and Carbon Engineering are to develop a direct air capture (**DAC**) and storage (**DACS**) project likely to be located in North East, Scotland, close to renewable electrical energy sources so as to allow storage of captured  $CO_2$  in subseabed structures. The **DACS** project is to be operational by 2026 and to capture up to 1 mtpa.



#### See: Petrofac and Storegga enter strategic Alliance to fast-track net zero infrastructure

 Baker Hughes and Samsung move to capture: On June 30, 2021, it was announced that Baker Hughes (leading energy technology company) and Samsung Engineering (leading engineering company) have combined "to capture" low to no emission projects, including CCUS and hydrogen production. As a team Baker Hughes and Samsung will work together to identify projects on which Baker Hughes' technologies and Samsung's engineering strengths will be leveraged.

See: Baker Hughes and Samsung Engineering to Collaborate on CCUS and Hydrogen Projects

Pertamina looks to maximise and to capture: On June 30, 2021, it was announced that Pertamina (with collaborators, Janus, JGC, J-Power and the Bandung Institute of Technology) is undertaking a feasibility study to assess CCUS and enhanced gas recovery (*EGR*, as a sibling of *EOR*) at its on-shore Gundih gas field, in Central Java, Indonesia. The fundamental element of the proposed project is using CO<sub>2</sub> to achieve *EGR*, and for the CO<sub>2</sub> stored to give rise to carbon credits.

See: Pertamina website

Sinopec developing CCUS: On July 5, 2021, China Petrochemical Corporation (*Sinopec*) announced the development of a CCUS project (reportedly the largest in the PRC, megaton-scale). The project is to use the Sinopec Qilu-Shengli Oilfield for CCUS, taking CO<sub>2</sub> arising and captured from Sinopec's Qil refinery, in Shandong province, and to inject that CO<sub>2</sub> into 73 wells to the Qilu-Shengli Oilfield as part of an enhanced oil recovery (*EOR*). It is understood the *Sinopec* is considering the development of further CCUS projects.

See: Sinopec launches China's first megaton scale carbon capture project

CCS + Initiative joined by "Big Plus": Edition <u>20</u> of Low Carbon Pulse (under From North Lights Project a CCS + Initiative) reported on the establishment of CCS + I. On July 5, 2021, it was reported that the World Business Council for Sustainable Development (WBCSD) has joined the CCS + I advisory group.

As reported in Edition 20, the objective of CCS + I is to leverage carbon markets, including through scaling-up decarbonisation and carbon dioxide removal. Given that the **WBSCD** is the umbrella organisation responsible for the Greenhouse Gas Protocol (**GHG Protocol**), the world's most widely used and accepted means of measuring and calculating GHG emissions, joining the **CCS + I** advisory group makes perfect sense, and may be expected to result in ongoing development of best practice measurement and calculation outcomes, which will feed into accounting and reporting outcomes.

See: World Business Council for Sustainable Development website

• Oaks and Acorns: On July 9, 2021, it was reported that INEOS (UK based international conglomerate) and Petroineos (a joint venture between PetroChina International and INEOS) had entered into a memorandum of understanding with the equity participants in the Acorn Project (see Editions <u>14</u> and <u>17</u>) for the provision of CCS services to INEOS and Petroineos.

As is the case with many if not all CCS projects, investment is required by the corporations that are contracting with the CCS project for the provision of CCS services (**CCS service off-takers**) to enable those **CCS service off-takers** to develop infrastructure or install new equipment, or both, to capture carbon from their existing processing and production activities. This is the case for INEOS and Petroineos in respect of their Grangemouth operations: investment is required to enable the capture of  $CO_2$  (with the capture 1 mtpa of  $CO_2$  to occur by 2027, and scope to capture additional  $CO_2$  after this time).

See: INEOS website

# E-fuel / Future fuel round-up:

- Equinor steps-in hydrogen production in UK: On June 29, 2021, it was announced that Equinor (leading global international energy company), is to increase its hydrogen production targets from [0.6 GW] to 1.8 GW by the addition of 1.2 GW of low-carbon hydrogen to supply Keadby Power Station, the world's first 100% hydrogen-fired power plant. See edition <u>14</u> of Low Carbon Pulse for more background information. See: Equinor website
- Empire State Building in Utah: On June 30, 2021 it was reported that Utah's largest coal-fired power plant is to transition to a hydrogen-fired power plant (*the Intermountain Power Project* or *IPP*). Key to the transition is the storage of hydrogen in salt domes before being extracted to be oxidised to produce electrical energy. The scale of the storage contemplated is demonstrated by a <u>graphic</u> placing the Empire State Building within a salt dome.

#### See: IPP website

• **Mighty** *Refhyne Electrolyser*: Edition <u>18</u> of Low Carbon Pulse reported on the development of a 10 MW PEM (polymer electrolyte membrane) electrolyser at Shell's Energy and Chemicals Park Rhineland, Cologne, Germany (*Refhyne Electrolyser*).

On July 2, 2021, it was announced by Shell that the **Refhyne Electrolyser** had commenced production of Green Hydrogen. The **Refhyne Electrolyser** has capacity to produce up to 1,300 tpa of Green Hydrogen. It is planned to increase capacity to 100 MW by the end of 2024.

The **Refhyne Electrolyser** is a PEM electrolyser manufactured by ITM Power (leading electrolyser technology corporation). Shell and ITM Power are part of the **Refhyne** Consortium, including SINTEF (one of Europe's largest energy research organisations), and consultants Sphera and Element Energy. The consortium was provided with funding from the **EC** (through the Fuel Cells and Hydrogen Joint Undertaking).

In addition to Green Hydrogen, it is understood that there are plans to produced sustainable aviation fuel, and that a plant is in development to produce bio-LNG from biomass feedstock.



**See:** <u>Shell starts up Europe's largest PEM green hydrogen electrolyser;</u> <u>REFHYNE I - Building Europe's largest</u> <u>PEM electrolyser at the Shell oil refinery at Wesseling, Germany</u>

- KHNP completes Fuel Cell Power Plant: On July 5, 2021, it was reported that Korea Hydro and Nuclear Power had completed development of a 39.6 MW power plant at Dong-gu, South Korea. The power plant comprises 90 fuel cells (each a Doosan 440 kw design). Editions <u>12</u> and <u>17</u> reported on the development of FC projects to allow the production of electrical energy and heat in an industrial urbanised context.
- See: <u>KHNP completes 39.6MW hydrogen fuel cell power plant in South Korea</u>
- Bio-energy not all biomass is good biomass: During the week beginning July 5, 2021, the Energy Transitions Commission (*ETC*) published a report entitled <u>Bioresources within a Net-Zero Emissions Economy:</u> <u>Making a Sustainable Approach Possible</u>.

For those active in the bio-energy / bio-resources sector, the report provides a reminder of what is already known and that: "while bioresources are in principle renewable, not all forms of biomass use are beneficial from an environmental perspective: not all biomass is good biomass. To be sustainable, biomass production should have low lifecycle GHG emissions, its production should take into account the 'opportunity cost' related to carbon that could be sequestered without intervention [i.e., if the biomass were to remain in situ], and must not compete with use of land for food production, trigger any land use change that could release carbon stocks into the atmosphere (especially deforestation) and negatively impact biodiversity". The report is excellent, and will be covered in the July report on reports.

BioLNG best studied: On July 5, 2021, it was reported that CMA CGM Group (leading global shipping and logistics company), EveRe (provider of the waste methanization technology) and TotalEnergies (leading global international energy company) are studying the development of a BioLNG production facility at the Port of Marseille using waste from households as a feedstock to produce liquefied biomethane (*BioLNG*). It appears that the intention is for CMA CGM Group to use the *BioLNG* to power its vessels. It is reported that: "BioLNG, combined with the dual-fuel gas engine technology developed by CMA CGM Group reduces greenhouse emissions (including carbon dioxide) by at least 67% relative to well-to-wake VLSFO [across the complete supply chain] ... On the basis of tank-to-wake measurement (at vessel level), greenhouse gas emissions are reduced by 88%".

See: From Trash to Fuel: BioLNG Production Project Takes Shape in France

Hydrogen economy developing in Egypt: Edition 20 of Low Carbon Pulse reported that the Ministry of Electricity and Renewable Energy in Egypt is committed to sourcing 42% of total energy produced in Egypt from renewable sources by 2035. In addition, Egypt's Minister of Electricity and Renewable Energy, Mr Mohamed Shaker, announced that Egypt is planning to invest up to USD 4 billion in a Green Hydrogen Project (*EGHP*). While still at feasibility stage, it is understood that the project is likely to progress.

On July 8, 2021, it was widely reported that Eni (leading global international energy company) has entered into an agreement with the Egyptian Electricity Holding Company (*EEHC*) and the Egyptian Natural Gas Holding Company (*EGAS*) to assess feasibility of the development of hydrogen production projects.

It is understood that both Green Hydrogen production projects and Blue Hydrogen production projects are being considered, with  $CO_2$  arising from the production of Blue Hydrogen to be captured and stored in depleted natural gas fields. For Eni, the development of projects to produce Green and Blue Hydrogen is part of its strategy to achieve **NZE**: as is the case for other international energy companies, Eni needs to reduce, and then remove, GHG emissions from the life-cycle of the energy carriers that it produces (Scopes 1, 2 and 3). For Egypt, this is a continuation of its strategy for progress to **NZE**.

Edition 20 of Low Carbon Pulse noted the key role that Italy (and Spain) were likely to play in the export of hydrogen from North Africa into Europe.

See: Eni signs an agreement to produce hydrogen in Egypt

• Self-fulfilling dynamics in UAE: Edition 20 reported on the dynamics across the Gulf Cooperation Countries (*GCC*) in the Middle East. Edition 18 reported on four Blue and Green Hydrogen projects in Abu Dhabi, including a proposed Green Hydrogen Project at the Khalifa Industrial Zone Abu Dhabi (*KIZAD*).

On July 7, 2021, it was reported that the Abu Dhabi National Energy Company (**TAQA**) and Abu Dhabi Ports are planning to develop a Green Hydrogen to Green Ammonia export project, the **Abu Dhabi TAQA-Abu Dhabi Ports** project. The planning is said to involve the installation of 2 GW of solar photovoltaic capacity to produce renewable electrical energy. The Green Ammonia produced would be used for bunkers at Abu Dhabi Ports and as the feedstock for the production of Green Ammonia for export.

See: TAQA Group and Abu Dhabi Ports Planning 2 GW Green Hydrogen to Ammonia Project

**Chile continues to speed up progress:** On July 07, 2021, it was announced that MAN Energy Solutions (**MANES**) is to supply a methanol reactor to allow the development of an E-Fuel pilot project being developed by the Highly Innovative Fuels consortium, led by AME (a corporation based in Chile), with participation from Porsche AG and Siemens Energy (**Haru Oni**). The project is located close to the evocatively named Punta Arenas, Magallanes, in Southern Chile. (**Haru Oni** was approved by the Magallanes regional environmental agency on May 11, 2021.)

The E-Fuels production project will use Green Hydrogen as a feedstock to produce synthetic fuels: the Green Hydrogen will be combined with  $CO_2$  captured / filtered from the air to produce Green Methanol in the **MANES** reactor. The plan is to scale-up production at **Haru Oni** from 130,000 litres a year by the end of 2022, 55,000,000 litres a year by 2024, and 550,000,000 litres a year by 2026. Porsche intends to use the synthetic E-Fuels.

See: <u>MAN Energy Solutions to supply methanol reactor for Porsche AG eFuels pilot plant in Chile</u>



Common sense from Fitch, including a KAS pitch: Edition 20 of Low Carbon Pulse included a narrative around the highly prospective, world-class resources that exist in the GCCs (see under Black Gold and Blue and Green Gold, and Oman's aim is true and New petroleum), and continued above under Self-fulfilling dynamics in UAE. On June 28, 2021, Fitch Solutions Country Risk & Industry Research published some themes that have emerged or are emerging.

The <u>publication</u> covers 4.5 pages or so, but packs a fair punch, providing cogent perspectives and clarity around emerging themes. Building on one of the themes noted in recent editions of Low Carbon Pulse is viewing  $CO_2$  as a resource, and in this context looking to accelerate CCS / CCUS technology as having long term benefits.

The publication provides real clarity in noting that in the context of the use of CCS:

- for *EOR* (and *EGR*): "On a net basis, the overall CO<sub>2</sub> released both from production and consumption) is less, assuming the additional oil recovered would have been recovered and consumed regardless of the injection of CO<sub>2</sub>"; and
- has one key challenge, and that is the need for favourable local geology, and that in this context emphasising the development of CCUS technology was critical so as to make use of CO<sub>2</sub> as a resource, and have the means of doing so.

Continuing the theme around the role of *GCC*s, in answer to a question about the role of Kingdom of Saudi Arabia (*KAS*) as a hydrogen and hydrogen-based fuel producer, the folk at Fitch provide the following pitch: "... [KAS is] in a strong position to develop and to expand its hydrogen footprint. Its vast experience in the upstream sector along with consistent delivery of industrial and infrastructure projects gives [KAS] additional advantages in developing and operating blue hydrogen projects".

• More Green Hydrogen for the Green Isle: Editions <u>18</u> and <u>20</u> of Low Carbon Pulse reported on the development of the EI-H2 green hydrogen facility in Aghada, Co Cork, Ireland. On July 6, 2021, it was reported that EI-H2 and Zenith Energy are planning to develop a 3.2 GW green energy facility at Bantry Bay (*GEF*) to produce Green Hydrogen and Green Ammonia. The *GEF* would be co-located with the Whiddy Island Terminal of Zenith Energy (which is within Bantry Bay, County Cork, Republic of Ireland). The *GEF* would be developed in two stages, first, a 2.7 GW Green Hydrogen facility, and secondly, a 500 MW Green Ammonia facility.

See: <u>Zenith Energy and EI-H2 announce joint venture for green energy facility at Bantry Bay</u>

• **ADNOC continues advance**: On July 8, 2021, the Abu National Oil Company (**ADNOC**) announced that it had entered into a joint study agreement (**JSA**) with Japanese giants, INPEX, Japan Oil, Gas and Metals National Corporation, and JERA to explore the potential for the development of Blue Hydrogen and Blue Ammonia trade, and to explore possible new opportunities more broadly on climate change initiatives, including renewable energy projects.

As noted above, and reported in Editions 5 and 18 of Low Carbon Pulse, **ADNOC** is one the key players in the development of hydrogen and hydrogen-based fuel market.

See: ADNOC and Three Japanese Companies to Explore Hydrogen and Blue Ammonia Opportunities

# Green Metals and Minerals, and the Mining Industry:

- In the last week of June, 2021, McKinsey & Co released two publications, one on mining, the other on use of negative GHG emission initiatives. Both publications are well-worth a read:
  - Decarbonisation of mining: In Edition <u>17</u> of Low Carbon Pulse (under *Increased focus on the mining sector*), the decarbonisation of the mining industry was outlined. In an article entitled <u>Creating the -zero</u> <u>carbon mine</u> published on June 29, 2021, McKinsey & Company, Metals and Mining, provide an overview of the activities undertaken at mine sites, and the means of decarbonising them. The publication notes that BHP and Vale are targeting 30% reductions in Scope 1 and 2 emissions by 2030, with Rio Tinto targeting a 15% reduction, and that the means to the decarbonisation of mining activities (giving rise to Scope 1 and 2 emissions) will arise ahead of 2030. The greening of the iron and steel industry is noted as a positive development in respect of Scope 3 GHG emissions (see Edition <u>20</u> of Low Carbon Pulse, under *First fossil fuel free iron and steel production*). See below under *Rio Tinto and POSCO forge alliance to address Scope 3 emissions*.
  - Negative GHG emission initiatives: In Edition 9 of Low Carbon Pulse (under Negative GHG Emissions...not new, but higher profile likely), the concept of negative GHG emission initiatives were outlined. On June 30, 2021, McKinsey, Sustainability, in a publication entitled <u>How negative emissions can help organizations meet their climate goals</u>, provides a clear outline of how negative GHG emission initiatives can be used, and the required scale.

Amongst other things, the publication outlines the three principal purposes for negative GHG emission initiatives: **1.** to off-set residual, hard-to-abate emissions (including from cement and iron and steel industries); **2.** to lessen atmospheric GHG emissions if GHG emission reductions do not occur quickly enough; and **3.** to remove historical GHG emissions from the atmosphere to provide long term assurance around a stable climate.

To these three principal purposes might be added the net reduction of GHG emissions arising from the Agricultural, Forestry and other Land Use sector.

As is the case with the number of pathways and scenarios around achievement of the Stretch Goal, McKinsey point out that it will be necessary to scale-up substantially negative GHG emission initiatives.

• **Rio Tinto and POSCO forge alliance to address Scope 3 emissions:** Edition <u>19</u> of Low Carbon Pulse reported on the use of natural gas in the calcination process inherent in much alumina refining, and how it may be replaced. Edition <u>20</u> reported on Rio Tinto's study in respect of the use of hydrogen in alumina refining at its Yarwun refinery, Gladstone, Queensland, and that Rio Tinto and Schneider Electric have entered into an



agreement for Schneider to purchase aluminium, borates, copper and iron ore mined and produced by Rio Tinto, using renewable electrical energy, and other low carbon technologies.

On July 8, 2021, it was reported that Rio Tinto (global mining giant, and leading iron ore producer) and POSCO (leading global and innovative South Korean steel producer) have entered into a memorandum of understanding (**MoU**) to develop, explore, demonstrate and deploy technologies to accelerate the transition of the iron and steel sector to low, lower and no carbon. Rio Tinto's Chief Commercial Officer, Mr Alf Barros, noted that "The [**MoU**] ... complements Rio Tinto's partnerships with other customers as the industry focus" on Scope 3 emissions. For Rio Tinto, the **MoU** is a clear demonstration of its commitment to **NZE** (including in respect of Scope 3 emissions).

As noted in Edition <u>17</u> of Low Carbon Pulse (under *Increased focus on the mining sector*) the mining sector is a quiet achiever.

See: Rio Tinto and POSCO sign climate MOU

### Hydrogen Cities, Councils, Hubs, Infrastructure and Valleys:

- **TX to Power-to-X:** Recent editions of Low Carbon Pulse have reported on a number of proposed CCS / CCUS projects in Texas, and that the Gulf Coast Region is highly prospective for off-shore wind field development. In addition, TX has high quality on-shore renewable energy resources, and a considerable amount of built-infrastructure that might be augmented and repurposed over time. As such, it appears that TX will continue to develop as a hydrogen hub. In a <u>report</u> from the Center for Houston's Future and the University of Houston, these dynamics are considered. This is well-worth a read.
- Gen2 Energy and Port of Hirtshals Hubub: On 30 June, 2021, Gen2 Energy (a Norwegian corporation committed to the development of Green Hydrogen production and supply) and the Port of Hirtshals signed a memorandum of understanding to develop a Green Hydrogen hub in the Hirtshals region of Norway.
   The stated aim is to make the Port of Hirtshals a hub for Gen2 Energy's logistics activities and an export port for Green Hydrogen, and to supply Green Hydrogen and oxygen to users at, or in the vicinity of, the Port.

See: Gen2 Energy and Port of Hirtshals signs Memorandum of Understanding on Green Hydrogen

• **Uniper and Eni exploration:** Edition <u>19</u> and <u>20</u> of Low Carbon Pulse outlined the scope of the development of infrastructure necessary to proceed with the carbon capture and storage project in Liverpool Bay using depleted natural gas fields operated by Eni UK Ltd.

On June 30, 2021, Uniper and Eni UK Limited announced that they had signed an memorandum of understanding to allow exploration of opportunities on a joint basis for the production of low carbon hydrogen at the site of Connah's Quay Power Station in North Wales.

As reported in Edition <u>19</u> of Low Carbon Pulse, Eni UK Limited owns and operates depleted fields in Liverpool Bay, suitable for CCS. Uniper owns Connah's Quay, which is reported to be ideally located for the production of low carbon hydrogen (using natural gas otherwise used to generate electrical energy).

This may be regarded as a continuation of the broader decarbonisation initiatives underway in North Wales and the North West of England under the HyNet North West initiative.

See: Eni UK and Uniper partnering for the decarbonisation of the North Wales energy sector

• **Everfuel and Greenstat evergreen:** On July 5, 2021, it was announced that Everfuel (see Edition <u>18</u> of Low Carbon Pulse) and Greenstat (energy and technology corporation based in Norway) have agreed to combine their efforts to develop hydrogen refuelling infrastructure projects across Norway (reported as 15 in the first instance) so as to accelerate the development of the use hydrogen as fuel.

**See:** <u>Everfuel and Greenstat to collaborate on zero-emission mobility in Norway;</u> <u>Everfuel and Greenstat to collaborate on commercially competitive hydrogen supply for zero-emission mobility</u>

Polish Hydrogen Valleys: While progress towards hydrogen valleys within Poland has been apparent for some time (with Hydrogen Valleys in Pomorze and Podkarpacie), for some reason the declaration establishing the Wielkpolska Hydrogen Valley appears to have captured broad attention, possibly because of the signatories to the declaration (including the region's largest cities and prestigious universities), as well as industry participants.

See: <u>'Hydrogen' Valley under development in Wielkopolska region</u>

East Coast Cluster – Zero Carbon Humber and Net-Zero Teesside: On July 9, 2021, it was widely reported
that the Northern Endurance Partnership had made a submission to the UK Government seeking support for
decarbonisation initiatives in the Humber and Teesside regions focussed around the Humber and Tees rivers on
England's eastern seaboard. It is understood that the submission includes the deployment of CCUS and more
broadly hydrogen technologies.

See: Northern Endurance Partnership website

# Sustainable Energy Round-up:

• **Denmark continues on shore procurement:** On June 28, 2021, the Danish Energy Agency (**DEA**) issued a technology neutral tender for the development by the private sector of a further 429 MW of renewable energy capacity. Proponents have until October 22, 2021, to submit proposals, with decisions on the procurement scheduled for the end of 2021. The successful proponents will be entitled to a feed-in premium (pegged to the wholesale price of electrical energy) for 20 years.

**See:** <u>The Danish Energy Agency releases the time schedule and tender documents for the forthcoming Danish technology neutral tender</u>

Poland continues on-shore procurement: On June 30, 2021, the Polish Energy Regulatory Office (*ERO*) announced the result of its solar and wind auctions held on June 8 and June 11, 2021. In the first and second auctions, around 1.2 GW and 1 GW of solar photovoltaic capacity was awarded. While around 300 MW of capacity



was set aside for on-shore wind projects, it would seem that the Polish market is developing using solar onshore, and wind off-shore.

• See: ERO <u>website</u>

**Fortescue Metals Group (FMG) increasing the global pace:** On July 8, 2021 it was reported that Fortescue Future Industries Pty Ltd (**FFI**) had signed a memorandum of understanding with the State Government of Ceara to develop a Green Hydrogen Project within the Pecem Port complex and industrial precinct (**Pecem Project**). The USD 6 billion **Pecem Project** will produced up to 15 mtpa of Green Hydrogen.

It is reported that the **MoU** is the fourth arrangement concluded by Ceara in respect of the Pecem Port complex and industrial precinct. **FFI** is a subsidiary of Fortescue Metals Group Limited, founded by Dr Andrew Forrest, AO. **See:** FMG website

#### Wind round-up:

• Sailing in offshore Greece: On June 29, 2021, it was announced that Copenhagen Infrastructure Partners (leading global renewable energy developer and investor), through CU New Markets Fund I and Mytilineos (major Greek conglomerate) and through its power and gas business, Protergia, are to develop off-shore wind projects off Greece.

See: <u>MYTILINEOS partners with CIP for the development of offshore wind</u>; Copenhagen Infrastructure Partners <u>website</u>

 Japan first floating off-shore wind field to progress: Edition 20 of Low Carbon Pulse reported that the Ministry of Economy, Trade and Industry (*METI*) and Ministry of Land, Infrastructure and Tourism (*MLIT*) had appointed a consortium to develop the 16.8 MW floating off-shore wind field project, off Goto City, Nagasaki Prefecture. The consortium (called *Goto City Offshore Wind Power Generation LLC*) comprises Chubu Electric Power, ENEOS Corporation, INPEX, Kansai Electric Power, Osaka Gas, and Toda Corporation (the leader of the consortium).

On July 7, 2021, it was reported that ENEOS Corporation (a member of the **Goto City Offshore Wind Power Generation LLC**, and the largest refiner, and largest distributor, of petroleum products in Japan) has signed a joint development agreement with BW Ideol (leading floating wind technology corporation) to develop a floating off-shore wind field project using BW Ideol technology.

**See:** <u>ENEOS Signs Agreement with BW Ideol for Joint Development of Floating Offshore Wind Power Generation</u> <u>Project in Japan</u>

 Polish sector of the Baltic Sea maintains heat: Editions 8, 14, 18 and 20 of Low Carbon Pulse have reported on the development of off-shore wind-field projects in the Baltic, with the development underpinned by the use of contracts for differences (CFDs).

On June 30, 2021, it was reported that Ocean Winds (a 50 / 50 joint venture between EDP Renewables (a Polish based oil refiner and petroleum retailer) and Engie (world leading energy company)) had been awarded a *CFD* in respect of the 369.6 MW B&C-Wind off-shore wind field (*OWP*). The *OWP* is located around 21 kms off-shore.

As with other off-shore wind field projects awarded *CFDs*, the award of the *CFD* is a critical milestone in progress to a final investment decision for *OWP*.

This is the fourth *CFD* awarded in 2021 under the Polish Offshore Act (see Editions 8, <u>14</u> and <u>20</u> of Low Carbon Pulse). As noted in Edition <u>18</u> of Low Carbon Pulse, the award of *CFD*s is seen as a key to enabling Poland to achieve its target of develop up to 10.9 GW of off-shore wind capacity by 2027: with auctions for 5.9 GW by the end of by 2021, with two further tranches to be auctioned by 2025 and 2027.

See: <u>Ocean Winds, the 50/50 JV owned by EDPR and ENGIE, has been awarded a CfD for the `B&C-Wind'</u> offshore wind farm in Poland

• Ocean Wind and Atlantic Wind - Off-shore the Garden State: Edition 20 of Low Carbon Pulse reported that the Bureau of Ocean Energy Management (*BOEM*) was to conduct an environmental review of the BP and Equinor Empire Wind off-shore wind field project off the coastlines of that US states of New Jersey (17 miles east of Long Branch) and New York (12 miles south of Long Island).

On July 1, 2021, following a tender process run by the Board of Public Utilities, in New Jersey's second round of off-shore wind solicitation, it was announced that New Jersey had agreed to the development of around 2.66 GW off-shore wind field capacity:

- Ocean Wind II: the Ocean Wind II (OCII) off-shore wind fields are to be developed by Ørsted (global leading off-shore wind corporation) and PSE&G (Public Service Electric and Gas, New Jersey's major power utility). The Ocean Wind fields are reported as to be sited to the east of Cape May, in the southern part of New Jersey. It is reported that the OCII off-shore wind-field project will be developed in three stages, starting in 2024, with completion to occur in 2028 and 2029; and
- Atlantic Shores: a 1.5 GW project to be developed by EDF Renewables (a subsidiary of Electricite de France) and Shell New Energies (a division of the Royal Dutch Shell Group). It is reported that the Atlantic Shores offshore wind-field will be developed in two stages, starting in 2024, with completion to occur in 2027 and 2028.

As has been noted before in Low Carbon Pulse, among others, the off-shore areas of the east coast of the US are highly prospective, having the benefit of being close to load. The development of **OCII** and Atlantic Shores (at over 2.6 GW), together with Ocean Wind I (1.1 GW off-shore wind field project), means that New Jersey will be well-on the way to achieving its target of 7.5 GW of installed off-shore wind field capacity by 2035.

It is reported that the consortia appointed to develop the off-shore wind field projects were the only bidders in the second round of the off-shore wind solicitation process.



As noted in previous editions of Low Carbon Pulse, each project will need to be approved at a Federal level (as was the case for the Vineyard Wind 1 off-shore wind field project (see editions 13 and 17 of Low Carbon Pulse)).

**See:** Ørsted awarded 1,148 MW offshore wind contract in New Jersey, fully utilizing its Ocean Wind lease area; Atlantic Shores Offshore Wind Awarded N.J. Board of Public Utilities Contract to Develop 1,510 MW in Offshore Wind Energy, Largest Single Project in New Jersey

#### • BOEM starts COP on Vineyard Wind South:

As noted in previous editions of Low Carbon Pulse, including Edition 20 in respect of Empire Wind, each project will need to be approved at a Federal level (as was the case for the Vineyard Wind 1 off-shore wind field project, see Edition 17 of Low Carbon Pulse).

On June 28, 2021, it was reported that **BOEM** has started conducting a Construction and Operations Plan in respect of the proposed 2 GW to 2.3 GW capacity Vineyard Wind South off-shore wind field project (**VWS**). **VWS** is to be developed in stages off Rhode Island.

• **Off-shore wind, not the Maine game:** On July 2, 2021, it was reported that the US State of Maine has placed a moratorium on the development of off-shore wind fields within its state waters for 10 years: the moratorium is reported to be in place until March 1, 2021. The moratorium does not affect the development of off-shore wind fields in Federal waters, indeed the State is working with Aqua Ventus on a demonstration project using floating off-shore wind technology.

**See:** <u>BOEM Announces Environmental Review of Wind Energy Project Proposed for Offshore Rhode Island and</u> <u>Massachusetts</u>

Giants with a following wind: In 2020, India state-owned corporations, NTPC Limited (*NTPC*) (India's largest power generation company) and Oil and Natural Gas Corporation (*ONGC*), signed a memorandum of understanding contemplating the acceleration of renewable energy business development. At the end of June 2021, *NTPC* announced plans to raise funds to allow it to develop up to 60 GW of clean energy capacity by 2032. Key to achieving the business development objectives of both corporations is said to be the roll-out of an off-shore wind field program, critically using scale to realise higher efficiency levels than is possible with on-shore wind farms.

The Ministry of New and Renewable Energy (**MNRE**) has set policy settings targeting the development of 5 GW of installed off-shore wind capacity by 2022, and 30 GW by 2030. It is reported that the coastlines off Andhra Pradesh (south-eastern coastal region of India), Gujarat (western coast of India), Karnataka (south-western India, with Arabinan Sea and Indian Ocean coastlines), Maharashtra (western coast of India) and Tamil Nadu (south coast of India) offer the most prospective off-shore wind resources.

• Listing in the wind: NTPC Limited's plans to develop its renewable energy business are estimated as likely to cost up to USD 35 billion. To assist in funding these costs, NTPC Limited intends to list its subsidiary, NTPC Renewable Energy Ltd during 2022. As India's largest power generation company (with the vast majority of electrical energy produced from coal-fired power stations), the scale and scope of NTPC Limited's plans are key to the decarbonisation of electrical energy generation in India.

See: NTPC Limited website

• Taiwan Teams for Two Wind Fields: On July 6, 2021, Swancor Renewable Energy is reported to have partnered with Tien Li Offshore Wind Technology, Yeong Guan Energy and J&V Energy Technology to establish the *Taiwan Team*. The *Taiwan Team* is to develop the Formosa 4 (fixed-bottom) and Formosa 5 (floating) offshore wind fields. The establishment of the *Taiwan Team* means that the renewable electrical energy will be Taiwan made.

See: Swancor & Co. Set Up 'Taiwan Team' to Develop Two New Offshore Wind Farms

BlueFloat Energy, Falck Renewables and Ørsted combine for ScotWind off-shore wind lease: On July 8, 2021, it was reported that Ørsted (global renewable energy giant), BlueFloat Energy (pioneering off-shore wind field project corporation) and Falck Renewables (a leading renewable energy corporation based in Milan, Italy) have combined to bid in the SccotWind Leasing Scheme auction, with bids due on July 16, 2021.

**See:** Ørsted announces partnership with Falck Renewables and BlueFloat Energy to unlock floating wind potential in Scotland

Swift off-shore wind mark: On June 30, 2021, the Republic of Ireland National Marine Planning Framework (*NMPF*) was updated (see Edition <u>16</u> of Low Carbon Pulse), providing further detail of the plans to facilitate off-shore wind field development off the Republic. On July 8, 2021, it was reported that RWE (leading German international energy company) had announced its intention to develop a 900 MW off-shore wind field under the new Maritime Area Planning (*MAP*) following the establishment of *MAP*.

See: <u>RWE joins forces with Polish maritime industry to strengthen the offshore wind sector in Poland</u>

• **Off-shore wind-to-hydrogen:** On July 9, 2021, it was widely reported that the H-Wind Project is considering a development of off-shore wind fields off the Republic of Ireland: the Republic has world class off-shore wind resources, and the concept under consideration is the use of electrical energy derived from them for the purposes of the production of Green Hydrogen on a large scale at a number of hydrogen hubs.

The H-Wind Project is being co-funded by the Science Foundation and the H-Wind Consortium. The H-Wind Consortium comprises Equinor (leading global international energy company) and Gas Networks Ireland (see Edition <u>14</u> of Low Carbon Pulse), Electricity Supply Board (*ESB*), and DP Energy (worldwide renewable energy company). The involvement of Gas Networks Ireland and *ESB* reflects that the H-Wind Project is consistent with *EU* policy settings encouraging the integration of energy systems.

• World Largest On-shore Wind Farm Complete: On July 9, 2021, SCMP (the South China Morning Post) reported that the 10 GW Jiuquan on-shore wind-farm (in the Gobi Desert, in the province of Gansu) had been



completed. In the words of one local official, the completion of the project had turned: "the lifeless Gobi Desert into an unlimited chamber of treasure". To benefit from this "chamber of treasure", the provincial government is planning to expand the capacity of the wind-farm to 20 GW by 2025.

#### Solar round up:

Providence and Smartest combine for world first: On June 6, 2021, it was announced that Marubeni Corporation (leading Japanese trading house) subsidiary SmartestEnergy (*Smartest*) has contracted with Providence Asset Group (*PAG*) to develop of 30 community-based solar photovoltaic solar farms in combination with BESS to allow Green Hydrogen production. Under the agreement between *Smartest* and *PAG*, *PAG* will develop solar farms having 300 MW of installed capacity, generating up to 500 GWh a year. This is may be regarded as world first project, and is likely a model for the incremental development of Green Hydrogen supply.

See: <u>New multi-year contract to deliver 500GWH of solar energy into the national electricity market;</u> Smartest <u>website</u>

Skies the limit:

 On July 2, 2021, it was reported that the Solar Energy Corporation of India (*SECI*) running procurement for 1.785 GW of solar photovoltaic projects in Rajasthan is over-subscribed by 9.3 GW. This is Tranche IV of the Rajasthan procurement process, with *SECI* 4.355 GW of installed capacity being procured across the Tranches.

See: SECI website

 Also on July 2, 2021, it was reported that NTPC Limited has gone to market seeking EPC contractors for 500 MW of grid-connected solar photovoltaic projects across India.

See: NTPC Limited website

Solar in Burkina Faso: On June 28, 2021 it was reported that the World Bank has agreed to support the Sustainable Renewables Risk Mitigation Initiative (SRMI) in Burkina Faso, West Africa: USD 168 million is committed, with USD 75 from the International Development Association (IDA) and USD 93 million from the Clean Technology Fund (CTF). Among other things, it is reported that the funding support will be applied to develop Large Scale Solar and Rural Electrification, including in the context of an upcoming tender to procure solar photovoltaic capacity and BESS. IRENA reported that as of 2020, Burkina Faso had 62 MW of installed solar photovoltaic capacity, with Axpo Group and Engie developing further solar photovoltaic capacity.

See: Scaled Up Support for Solar Energy Production and Rural Electrification in Burkina Faso

# **Port News and Shipping Forecasts:**

- **Wallenius and Alfa Laval combine:** In mid-2020, Wallenius Marine announced that it would develop a windpowered vessel – Oceanbird. As reported, the dimensions of Oceanbird were world scale with capacity to carry 7,000 cars, and to cross the Atlantic in 12 days, at 10 knots. On June 30, 2021, it was announced that Wallenius and Alfa Laval have combined with the principal objective of developing a revolutionary wind power and propulsion system for the Oceanbird.
- **Maersk to methanol:** On July 1, 2021, Maersk announced that it had signed a shipbuilding contract with Hyundai Mipo Dockyards to build the world's first containership powered and propelled by carbon neutral methanol, with Maersk and Hyundai Mipo to work in collaboration. It is reported that the power and propulsion system is being developed by MAN Energy Solutions with Hyundai Engine and Machinery (the main engine) and Himsen (providing the auxiliary engine), and that the classification society will be American Bureau of Shipping.

In February 2021, Maersk announced its intention to operate the first carbon neutral liner vessel by 2023, wellahead of previous plans to do so by 2030, and consistent with having a carbon neutral fleet by 2050.

See: Maersk signs shipbuilding contract for world's first container vessel fueled by carbon neutral methanol

# Land Transport (automobiles, buses, trains and trucks) round-up:

LOHC for Trains: As reported in previous editions of Low Carbon Pulse, battery technology (*BET*) and fuel cell (*FCT*) technology continues to be developed across the transport sector, including to power and propel trains. One if the issues with *FCT* is the source and carriage of hydrogen, whether in compressed or liquified form. Hydrogen can be carried in absorbed organic form in a Liquid Organic Hydrogen Carrier (*LOHC*): a *LOHC* absorbs hydrogen, hydrogen is then released when required. This means of carriage negates the need for compression or liquefaction, both of which are energy intensive, liquefaction in particular.

Alstom's Coradia iLint train uses *FCT* and carries hydrogen in compressed gas form in tanks. Alstom's Coradia iLint train is being tested in a number of European countries, including most recently in Poland (being tested at the Railway Research Institute).

On July 1, 2021, it was announced that Siemens Mobility is testing its Mireo Plus H train using **LOHC** technology, working with Helmholtz Institute Erlangen-Nuremburg. Many countries have high levels of electrification across their rail networks. High levels of electrification allow decarbonisation by the completion of electrification and development, and use, of renewable electrical energy, and on some part of the rail network to use **BET** or **FCT** or both. In countries with lower and low levels of electrification (in the US less than 1% of rail miles are electrified), it is likely that **BET** and **FCT** will be used.

See: Cooperation on the use of LOHC technology in rail transport planned

- On the high road and on overhead:
  - Sweden over our heads: On July 1, 2021, it was announced that Sweden has progressed with its first
    overhead electrification system to power and to propel heavy good vehicles / trucks in hauling freight by road.
    As noted in Edition <u>19</u> of Low Carbon Pulse, logistics routes in many countries are known and understood, and



in the context of use of *FCT* this will allow the location of hydrogen refuelling infrastructure and stations along those routes. Likewise, it is likely to make increasing sense to develop overhead electrification systems at the core of, and along, known logistics routes. The use of overhead electrification has been considered for some time, and while not as efficient as the use of electrified trains to haul freight, may be regarded as the next best thing.

#### - Hyzon Motor Inc keeps trucking to deliver:

- On July 2, 2021, it was announced that Hyzon is to deliver a 150 tonne *FCT* powered and propelled heavy goods vehicle / truck (*HHT*) to an EU customer: the *HHT* is reported to have a range of 400 to 600 km, and has 480 kW (or 644 horse power).
- On July 6, 2021, it was announced that Hyzon is to develop a liquid hydrogen *FCT* powered and propelled heavy goods vehicle / truck with a range of up to 1,000 km (*HPHDT* or *hydrogen-powered heavy-duty truck*). As reported in Edition <u>18</u> of Low Carbon Pulse (under *Air Liquide to refuel Daimler trucks*), Daimler is working with Air Liquide to use liquified hydrogen gas.

As noted in Edition 20 of Low Carbon Pulse, in addition to goods movers, Hyzon produces people movers, with Fortescue Metals Group (leading iron ore company founded by Dr Andrew Forrest, AO) having ordered up to 10 Hyzon coaches.

See: Hyzon Motors, Chart Industries to develop liquid hydrogen fuel cell-powered truck, targeting 1,000-mile range

 Hyundai finding a home in the US: In August 2020, use of the Hyundai Xcient truck commenced in Switzerland. By the end of June 2021 the 46 trucks deployed to Switzerland had ticked (and tocked) to over 1,000,000 kilometres (621,500 miles) travelled. On July 2, 2021, it was announced that Hyundai is to turn its focus to the US market, and the design of a FCEV best suited for the US. The Hyundai Xcient is a rigid-body.

See: Fleet of Hyundai XCIENT Fuel Cell trucks surpass million-kilometre benchmark

# **Carbon credits and Carbon off-sets, Insurance and Negative Emissions Initiatives:**

- Quote of 2021 (so far): As has been reported previously in Low Carbon Pulse, the insurance and re-insurance
  industry is ceasing to provide insurance for some industries, and activities within those industries. In this
  context, Swiss Re has released a paper on <u>The Insurance Rationale for Carbon Removal Solutions</u>. The
  paper is helpful in framing perspectives, but the most memorable part of the paper is the following:
  - "The science is clear, the challenge is massive: Do our best, remove the rest! In other words: we all need to reduce, reduce, reduce, and in parallel start balancing the emissions through carbon removal"

Senior Environmental Management Specialist, Corporate Real Estate and Services, Swiss Re – Mischa Repmann

In the next article in **The Shift to Hydrogen (S2H2): Elemental Change** series, the use of carbon credits and negative GHG emission initiatives (see Edition 9 of Low Carbon Pulse under **Negative GHG Emissions ... not new, but higher profile likely**) will be considered in the context of a broad analysis of the means and tools available to capture carbon and storage of it.

# **NZE** reports:

As noted above, at the end of future editions of Low Carbon Pulse reports that have been reviewed for the purpose of that edition of Low Carbon Pulse will be listed, by title and link.

ORGANIZATION	TITLE / SUBJECT BATTER
All-Party Parliamentary Group (APPG)	The role of hydrogen in powering industry
Energy Transition Commission	Bioresources within a Net-Zero Emissions Economy: Making a Sustainable Approach Possible
European Commission	A hydrogen strategy for a climate neutral Europe
Hydrogen Europe	<u>H2ero Net Zero – Different energy carriers required separate systems of guarantees of origin</u>
International Energy Agency (IEA)	Energy Prices: Overview – High-Quality data on end-use energy prices
International Energy Agency (IEA)	Hydropower Special Market Report
International Energy Agency (IEA)	Trends and Developments in Electric Vehicle Markets.
International Renewable Energy Agency (IRENA)	World Energy Transitions Outlook
International Renewable Energy Agency (IRENA)	Renewable Power Generation Costs in 2020.
McKinsey & Company	Creating the -zero carbon mine
McKinsey & Company	How negative emissions can help organizations meet their climate goals
NASA and NOAA	Satellite and Ocean Data Reveal Marked Increase in Earth's Heating Rate
Swiss Re Group	The Insurance Rationale for Carbon Removal Solutions
The Oxford Institute for Energy Studies	Energy Transition: Modelling the Impact of Natural Gas).
University of Houston and the Center for Houston's Future	Houston: The Low Carbon Energy Capital
Zickfeld, K., Azevedo, D., Mathesius, S. et al.	Asymmetry in climate – carbon cycle response to positive and negative $CO_2$ emissions

The author of Low Carbon Pulse is Michael Harrison.

# **Key Contacts**

We bring together lawyers of the highest calibre with the technical knowledge, industry experience and regional know-how to provide the incisive advice our clients need.



Michael Harrison Senior Partner, Energy, Resources and Infrastructure

M +65 9728 8562 /+61 439 512 384/ +61 414 968 707 michael.x.harrison@ashurst.com



Daniel Reinbott Partner

T +65 6416 9529 M +65 9728 8672 daniel.reinbott@ashurst.com



**Dan Brown** Partner

T +61 7 3259 7149 M +61 401 564 654 dan.brown@ashurst.com



Michael Burns Partner

T +44 20 7859 2089 M +44 7717 840 646 michael.burns@ashurst.com



**Antony Skinner** Partner

T +44 20 7859 1360 M +44 7917 635 974 antony.skinner@ashurst.com



Global Co-Head, International Projects T+65 6602 9153

M+65 9728 7943 richard.auit@ashurst.com



Peter Vaughan Partner

**Richard Guit** 

T +61 8 9366 8173 M +61 412 909 489 peter.vaughan@ashurst.com



Paul Curnow Partner

T +61 2 9258 5738 M +61 434 074 591 paul.curnow@ashurst.com

Anna-Marie Slot Global Environmental, Social and Governance Partner

T +44 20 7859 3724 M +44 7788 710 892 anna-marie.slot@ashurst.com

David Wadham Office Managing Partner, Tokyo

T +81 3 5405 6203 M +81 90 4828 5191 david.wadham@ashurst.com

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Low Carbon Pulse – Edition 21 – 13 July 2021