

Brief on Decarbonisation

Welcome to **Brief on Decarbonisation** – sharing significant news on progress towards net-zero greenhouse gas (**GHG**) emissions (**NZE**) for the period from **Saturday August 20, 2022** to **Thursday August 25, 2022**. The intention is to seek to limit the length of each edition, ideally to no more than 5,000 words (hence **Brief on Decarbonisation**).

The form of **Brief on Decarbonisation** will follow that of Low Carbon Pulse, but with no, or certainly fewer, info-graphics so as to limit the length of each edition.

As noted in **Edition 46** of **Low Carbon Pulse**, a different approach is going to be taken for a few months. As currently planned, each Friday a summary of the key news items from the week will be published, more a week-end "light read" or "highlight reel" (in the nature of a "headline publication"), with occasional articles going into further detail on decarbonisation and **NZE** initiatives, with the first article to be on **NZE Waste**.

A week of progress - highlights:

• Week-beginning August 20, 2022:

- **Canada and Germany:** Previous editions of Low Carbon Pulse have reported on the initiatives between Canada and Germany for the supply of Green Hydrogen. From Sunday **August 21, 2022** to **Tuesday 23, 2022**, Canadian Prime Minister, Mr Justin Trudeau, and German Chancellor, Mr Olaf Scholz, met to discuss energy security and progress of the energy transition. Ahead of the visit, Reuters reported that they would commit to the establishment of a hydrogen supply / value chain.

On Tuesday **August 23, 2022**, a number of announcements were made flowing from the **Canada** and **Germany Hydrogen Alliance**, including that the two countries had signed a **Joint Declaration of Intent** (under which each country commits to work with the other to develop a clean hydrogen supply chain). As would be expected, the **Joint Declaration** is not legally-binding, but provides a framework for each country to work closely together.

In addition, **EverWind Fuels** signed memorandums of understanding with **E.ON** and **Uniper** to supply 500,000 metric tonnes of Green Ammonia a year from **EverWind Fuels'** planned **Point Tupper** Green Hydrogen and Ammonia production facilities in Nova Scotia, Canada.

Further, Mercedes Benz and Volkswagen signed memorandums of understanding in respect of the supply of critical metals and minerals, Mercedes working with Rock Tech Lithium, and VW to invest in Canadian mines.

- **EU ETS hits all-time high:** On **August 20, 2022**, it was reported that on Friday **August 19, 2022**, the price of **EU ETS credits exceeded €99**, exceeding the previous all-time high of €98.14. To close of business on **August 19**, during August 2022, the **price of EU ETS credits had increased by 28%**. As reported, the surge in the price of **EU ETS** credits is the conclusion of gas contracts for delivery in 2023.
- **Record electricity prices across Europe:** On **August 23, 2022**, electricity prices across Europe and the UK reached record levels, with eight countries having prices in excess of **€600 MWh**, and only Spain and Turkey having prices at less than €200 MWh. It is to be expected that these prices will spur further development of renewables.

Ahead of COP-27:

COP-27 will be held in **Sharm El-Sheikh, Egypt** between **November 6/7** and **18, 2022**. As was the case in 2021, ahead of **COP-26** held in Glasgow, Scotland, ahead of **COP-27** Brief on Decarbonisation will commence coverage of key themes and issues in respect of which progress needs to be made at **COP-27**.

The overarching theme for **COP-27** is that Egypt will work to make **COP-27: "a turning point in international efforts to coordinate with all parties, for the benefit of Africa and the entire world"**.

As reported in Low Carbon Pulse, at, and as a result of, the Bonn Conference held in June 2022 it is clear that loss and damage caused by climate change will be a key theme at **COP-27**, with countries that have suffered loss and damage as a result of climate change seeking a basis to be compensated for that loss and damage. In addition, mitigation and adaptation will be key, and a new Mitigation Work Programme is to be launched at **COP-27**.

Further, there will be considerable coverage of the development of **National Adaptation Plans**, being plans that set out the actions that a country is to take in response to the impact of climate change, with actions to be taken on the basis of sound data and information, and embedded in policy settings address adaption action across medium and long term plans. Accompanying the **National Adaptation Plans** will be **Adaptation Communications** (ADCOMs) providing a clear basis of a country's commitment to adaptation action to be shared.

Vale those lost:

Our continued condolences for those lost in the conflict in Ukraine, and safe-haven for those displaced.

Legal, Policy Setting and Regulatory highlights, and Helpful Publications:

- **Joint Research Centre Technical Report on Hydrogen Emissions:** The **JRC Technical Report – Hydrogen emissions from a hydrogen economy and their potential warming impact** is well-worth a read. The impact of hydrogen emissions has been flagged in Low Carbon Pulse. For ease of reference the key conclusions of the **JRC Technical Report** are as follows: **1.** Hydrogen in the climate system impacts the lifetime of methane, ozone and water vapour, indirectly increasing the earth's surface temperature; **2.** Hydrogen emissions to the climate system are expected to arise from hydrogen supply / value chain equalling 1 to 2% of the mass of hydrogen delivered; **3.** While not climate neutral, low-carbon, in particular renewable, hydrogen would reduce significantly the impact of climate change compared to fossil-fuel; **4.** To reach climate neutrality, the additional global warming arising from the hydrogen economy needs to be minimised and emissions to be modelled and compensated for. There are other conclusions, but they relate to the characteristics of hydrogen, and there are recommendations, critically, including the need for the impact of hydrogen emissions to be taken into account in the models used by the Intergovernmental Panel on Climate Change (**IPCC**).
- **Data Tools from the IEA:**
 - **ETP Clean Energy Technology Guide:** On **August 19, 2022**, the **International Energy Agency (IEA)** released an interactive database to over 400 technologies contributing to achieving net-zero: <https://www.iea.org>, under **ETP Clean Energy Technology Guide**. The Guide allows the reader to choose a sector from: Buildings, CO₂, Energy Transformation, Industry and Transport, and drill down. This is a great tool.
 - **Electricity market tool from the IEA:** On **August 20, 2022** the **IEA** promoted its new interactive tool providing real-time data on how electricity markets around the world are developing, including demand and supply, and prices at a county and regional level: <https://iea.li/3KkXtwl>.
- **Hydrogen Project Visualisation Platform:** On **August 24, 2022**, the author became aware of a very helpful platform: **Hydrogen Project Visualisation Platform – Overview of hydrogen projects along the emerging value-chain in Europe** (at <https://linkd.in/eXU9cCUP>).

Climate change reported and explained:

- **Climate change impact on energy generation:** On **August 21, 2022**, the ever excellent Alessandro Blassi (Special Advisor to the IEA Executive Director) made following points: **1.** Energy production and use is the main cause of climate change, contributing up to 80% of anthropogenic **GHG** emissions; **2.** Climate change driven heatwaves are reducing water availability (including because extreme weather events boost the need for electrical energy); and **3.** Lower water availability and droughts impact the energy sector, reducing the capacity from hydro-electric and nuclear generation power stations.

The dynamic described by Mr Blassi has been seen across the world during the northern hemisphere summer. At the start of the week beginning August 22, 2022, it has been reported that the Yangtze River had "dried up", sparking a shortage in hydro-electric power. On August 19, 2022, a nationwide drought alert was issued in the **PRC**. As noted in Low Carbon Pulse, the **PRC** as had a long-running extreme weather event in the form of sustained high temperatures this summer. As reported, cloud seeding has been undertaken to seek to address the lack of rain.

During the week covered by this Brief on Decarbonisation, it was reported widely that two-thirds of Europe is under drought restrictions, with some reporting suggesting that the drought events across Europe are the worst in around 500 years.

- **Greenhouse Effect explained:** On **August 21, 2022** (at <https://rappler.com/science>, under **How the "greenhouse effect" works**), the following by-line captures the reader's attention "The problem is not the Greenhouse Effect; it's that we are upsetting it by adding huge amounts of carbon dioxide and other industrial gases to the air ... the planet keeps itself warm enough for life with this energetic, actively balanced atmospheric system". The Greenhouse Effect keeps earth warmer than it would otherwise be, and as such allows for life. The article is a timely reminder of one of the key elements of the Paris Agreement.
- **Extreme weather events:** Extreme weather events have continued to be reported during the first two weeks of August, 2022.

The **International Panel on Climate Change (IPCC)** defines an extreme weather event as follows:

"An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare or rarer than the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme".

It is fair to say that North America, North Africa, India and Europe, and the **PRC**, have been experiencing **extreme weather events**, and in many instances those extreme weather events, having persisted, may be characterised as **extreme climate events**. The climate system has changed, and continues to change.

- **NOAA July Report:** On **August 10, 2022**, the **US National Oceanic and Atmospheric Administration (NOAA)** published its **July Report**. The headline from the **July Report** was that average temperatures across the Lower 48 states of the US in July 2022 were 76.4°F, 2.8°F above the 20th century average, and ranking the third warmest July in 128 years.

African and Middle East including GCC Countries:

During the week covered by this edition of Brief on Decarbonisation, there were no news items of sufficient materiality or significance to merit inclusion, it was, however, noteworthy that the seven Fuel Fuels projects in Egypt that have been covered extensively by Low Carbon Pulse during 2022, are progressing with formal signing ceremonies on August 24, 2022.

India and Indonesia:

- **Avaada progress reported:** On **August 25, 2022**, **PV Magazine** (at <https://www.pv-magazine-india.com>, under **Avaada to invest \$5 billion in green hydrogen, ammonia plant with 6 GW captive renewables in Rajasthan**) reported that Avaada, Senior Executive Vice-President, Mr Ravi Verma, announced that the Avaada Group intends to invest USD 5 billion to develop an integrated Green Hydrogen and Ammonia production facility in Rajasthan with the renewable energy required to power the electrolyzers to be supplied from 6 GW of captive renewable electrical energy. As reported, the capacity of the production facilities will be around 1 million metric tonnes of Green Ammonia a year.
- **India Hydrogen Alliance - July 2022:** Attached is the link to the June edition of the **[India H2 Monitor – July 2022](#)**. We intend to include the link to, rather than to repeat the content of, the **India H2 Monitor**.

Japan and Republic of Korea (ROK):

- **Hydrogen and ammonia to fuel power plants:** On **August 22, 2022**, **H2 View** (at <https://www.h2-view.com>, under **Agreement could see green hydrogen and ammonia fuelling South Korean power plants**) reported that **Korea Southeast Power Generation (KOEN)** and **SK Plug Hyverse** (a joint venture between SK E&S and Plug Power reported on in Low Carbon Pulse) had signed a memorandum of understanding under which **SK Plug** is to supply PEM electrolyzers to produce Green Hydrogen for combination with nitrogen to produce Green Ammonia as part of **KOEN** initiatives to reduce its **GHG** emissions by 48% by 2034.
- **Pyeongtaek hydrogen production facility opens:** On **August 22, 2022**, it was reported widely that a hydrogen production facility had opened at the port town of Pyeongtaek, Gyeonggi Province. As reported, the hydrogen production facility is the largest in the **ROK** to date. The hydrogen is produced from reforming natural gas: the port of **Pyeongtaek** imports liquified natural gas (LNG), and on regasification natural gas derived will be used.

PRC and Russia:

China Merchants and COSCO Shipping perspective on methanol: On **August 24, 2022**, it was reported by the CEO of the Methanol Institute, Mr Gregory Dolan, that China Merchants Energy Shipping Co. Ltd and COSCO Shipping Bulk Co. Ltd view methanol as their main alternative fuel. In this context, Mr Dolan notes that both major shipping corporations intend to focus their main research efforts on methanol as a future clean ship fuel.

Europe and UK:

- **Crown Estate Scotland – any more for any more?** On **August 21, 2022**, **Crown Estate Scotland** announced that three floating off-shore wind field projects will be offered ScotWind option agreements. ScotWind applicants that met the required standards for the **ScotWind** process (concluded in early 2022), but were not successful in that process, were given the opportunity to apply in the clearing round in respect of three leases in the **NE1** area east of Shetland. The three successful applicants in the clearing round are **Ocean Winds** (500 MW), **Mainstream Renewable Power** (1.8 GW) and **ESB Asset Development** (500 MW). Each will deploy floating wind technology.
- **BECCS projects called for:** On **August 24, 2022**, the **UK Government**, Department for Business, Energy and Industrial Strategy (at <https://www.gov.uk>, under **Cluster sequencing for carbon capture, usage and storage (CCUS), deployment: power bioenergy with CCS (BECCS)**) called for submissions from power BECCS projects wanting to take part in Track-1 of the CCS Cluster Sequencing Process. This is the next step in the sequenced process being undertaken by the UK Government aimed at the removal 5 million metric tonnes of **GHG** by 2030.

Americas:

Other than as covered elsewhere in this edition of Brief on Decarbonisation, no news items have come to the attention of the author of sufficient materially or significance to merit inclusion, but noting, however, that the author could have written 20 pages to cover the continued expressions of enthusiasm about the **[Inflation Reduction Act of 2022](#)**.

Australia and New Zealand:

- **5 GW plan for NZ:** On **August 23, 2022**, **RenewBiz** (at <https://renewbiz.com>, under **BlueFloat team unveils 5 GW NZ offshore wind vision**) reported that **BlueFloat**, **Energy Estate** and **Elemental Group** have plans to develop four offshore wind field projects. The stated focus of the consortium is providing renewable energy to displace existing electrical energy sources, and to provide renewable electrical energy for the production of Green Hydrogen.
- **2.8 GW Provaris Energy project proceeding:** On **August 23, 2022**, **H2 View** (at <https://www.h2.view.com>, under **Green hydrogen project on Tiwi Islands awarded Major Project Status**) reported that the Northern Territory Government, Australia, had awarded the **Provaris Energy Tiwi Islands 2.8 GW Green Hydrogen** production facility project (**Tiwi H2 Project**) Major Project Status. Major Project Status will provide an integrated approvals pathway for the **Tiwi H2 Project**. In addition, as reported, **Provaris Energy** and the Northern Territory Government have entered into a Project Facilitation Agreement under which they will work in a spirit of co-operation to seek to achieve the effective and timely development of the **Tiwi H2 Project**.
- **100% renewable grid with 5 hours storage:** On **August 24, 2022**, **RENEW ECONOMY** (at <https://reneweconomy.com.au>, under **A near 100% renewables grid is well within reach, and with little storage**) reported on the findings of ground-breaking studies from Beyond Zero Emissions, the University of New South Wales, and the Australian National University, with the headline conclusion being that Australia's east coast electricity grid can get very close to 100% renewable electricity with approximately five hours storage across the grid – 24 GW / 120 GWh. The article in RENEW ECONOMY is well-worth a read.
- **Real Nous:** On **August 25, 2022**, interim findings of **The Net Zero Australia** (Nous Group, University of Melbourne, University of Queensland, Princeton University) report were issued, with the headline being that Australia's north could have up to half a dozen photovoltaic and green hydrogen hubs, providing a decarbonisation pathway for Australia that stresses comprehension.

Blue and Green Carbon, Biodiversity, Bioenergy and heat-recovery:

- **WoodMac on bio-liquid gold:** The team at Wood Mackenzie has released **Bi-liquid gold: How biofuel circularity could unlock the energy transition**. The publication is part of the Horizons series from Wood Mackenzie (see <https://www.woodmac.com/horizons>). The headline is that "Bio-based diesel and aviation fuels from plant-based feedstock could emit 80% less carbon than crude oil-based products that dominate today's global market. The question is how to make it happen". In this context, it is noted that agricultural residue, municipal solid waste, and waste plastics could be game changers, noting that these feedstocks are little used today to produce liquid biofuels. The startling estimate from Wood Mackenzie is that by 2050 up to 20 million barrels a day of liquid biofuel could be produced or up to 25% of the liquid fuel demand (applying the Wood Mackenzie **Energy Transition Outlook** model).
- **Biogas reading for those taking a vacation:** The ever-excellent biogasworld.com has published [Top 10 Biogas Reports To Add To Your Summer Reading List](#). The Top Ten Biogas reads listed are: **1. [Best Practices for Reducing Costs of Anaerobic Digestion of Organic Waste](#); 2. [Biomethane Production Potentials in the EU](#) – see below; **3. [Renewable Natural Gas as a Complementary Solution to Decarbonizing Transport](#); 4. [Fuelling Clean Mobility with Bio-LNG](#); **5. [Hitting Canada's Climate Targets with Biogas and RNG](#); 6. [Bioenergy Europe Statistical Report 2022](#); **7. [Green Gas: The Green Economy under our Feet](#); **8. [Turning Circle: How Bioenergy can Supercharge Australia's Circular Economy](#); **9. [The Landscape of Methane Abatement Finance](#); and **10. [Anaerobic Digestion Deployment in the UK](#).**************

BIOENERGY

Biomethane: is **Biogas** that has been processed and scrubbed (referred to as "upgrading") so that it can be used as pipeline gas (i.e., complying with the specification for hauling through the applicable natural gas pipeline, including the removal of **CO₂**, and other compounds and elements, such that the gas hauled through the pipeline is **CH₄**). **Biomethane** is a **Biofuel**.

Biogas and **Biomethane** can be used as a fuel (typically, as a gas that is combusted / oxidised to produce electrical energy or heat energy or both) or as a feedstock. Also, either may be referred to as **Renewable Natural Gas** (or **RNG**), or in compressed form, as compressed natural gas (or **CNG**) and in liquified form as **Bio-LNG** or, less frequently, **Renewable LNG**.

Biofuel is a fuel derived or produced from **Biomass**, whether in gaseous, liquid or solid form. In addition to **Biogas** and **Biomethane**, for example, wood products (gaseous and solid biofuels), the following may be regarded as the most prevalent **liquid biofuels**:

- **Bio-ammonia:** being ammonia that is derived or produced using H₂ derived from a renewable source that is then combined with N to produce the compound NH₃;
- **Bio-butanol:** being butanol (i.e., a synthetic alcohol) that is derived or produced from the microbial fermentation of carbohydrates (typically from corn and from agricultural waste), and is similar to motor spirit, and as such may be used as a fuel for internal combustion engines. (It is a drop-in fuel.)
- **Bio-diesel:** being diesel (i.e., synthetic paraffinic compound) that is produced typically using transesterification of animal fats and vegetable oils;
- **Bio-ethanol:** being ethanol (i.e., synthetic alcohol) that is derived or produced the microbial fermentation of carbohydrates (including from corn and sugarcane, and lignocellulosic biomass);
- **Bio-kerosene:** being kerosene (i.e., synthetic paraffinic compound and another kind of methyl ester) that is derived or produced from animal and vegetable oils (containing fatty acids);
- **Sustainable or Synthetic Aviation Fuel (SAF),** is a synthetic paraffinic kerosene. Currently, most SAF is derived or produced from used animal fats and cooking oil and from the gasification of other organic waste streams (typically using some natural gas). As noted below, typically fatty acids and hydrogenated acids are used to produce synthetic paraffinic kerosene. If the feedstock is sourced from Biomass it is a Bio-kerosene;
- **Bio-LNG:** being Bio-methane that is liquified at a temperature of -161°C, with the liquified Bio-methane 1/600th the volume of gaseous Bio-methane; and
- **Bio-methanol:** being methanol (i.e., produced from CO₂ (captured or derived) and H₂ derived from Biomass) that is derived or produced from biochemical (fermentation) or thermochemical (including gasification and pyrolysis) technologies.

A **Biofuel** is an **E-Fuel** (an **electro-fuel**) if the electrical energy used to produce it is sourced from a renewable source. Hence the use of **E-Diesel, E-Ethanol, E-Kerosene, E-LNG** and **E-Methanol**.

BESS and HESS (and energy storage):

Other than as covered elsewhere in this edition of Brief on Decarbonisation, no news items have come to the attention of the author of sufficient materiality or significance to merit inclusion.

Carbon Accounting, Carbon Capture and Carbon Capture and Use and CDR:

- **Mitsubishi Heavy Industries no solvent for point-source capture:** As noted in Low Carbon Pulse, as a general statement carbon capture may be point-source capture (capturing carbon at the point at, or near to the point at, which it arises to prevent **CO₂** being emitted to the climate system), or direct air capture (capturing **CO₂** from the climate system, being **CO₂** emitted historically). While point-source capture exists, it is continuing to develop. On **August 20, 2022, Mitsubishi Heavy Industries** announced a new solvent (KS-21™) for **CO₂** point-source capture, achieving 99.8% capture rates. In technologies working to fine margins, this is a material advance.
- **Major CCS in Australia:** On **August 24, 2022, TotalEnergies** (at <https://totalenergies.com>, under **Australia: Total Energies, INPEX and Woodside Join Forces to Develop a Major Offshore CO₂ Sequestration Project**) announced that the **Bonaparte CCC Assessment** joint venture between **INPEX** (53%, as operator), **TotalEnergies** (26%) and **Woodside** (21%) had been awarded a Greenhouse Gas Storage Assessment Permit off the northwest coast of Australia, allowing evaluation and appraisal work on block G-7-AP. In the Australian context, this is significant. As announced, on development the CCS project contemplated would be able to store up 10 million metric tonnes of **CO₂** a year by 2030.

- **DAC in Permian Basin:** On **August 25, 2022**, **Hart Energy** (at <https://www.hartenergy.com>, under **Occidental to Begin Construction of Direct Air Capture Plant in Texas Permian Basin**) reported that **Occidental Petroleum Corporation** is to commence development of its first direct air capture (DAC) project in Ector County, Texas, in the Permian Basin. This is a significant development in a global context, and is consistent with increased recognition of the role of DAC.

Carbon Credits and Hydrogen Markets and Trading:

Other than as covered elsewhere in this edition of Brief on Decarbonisation, no news items have come to the attention of the author of sufficient materiality or significance to merit inclusion.

E-fuels & feedstocks / Future Fuels & Feedstocks / Now Fuels & Feedstocks:

- **A.P. Moller – Maersk continues to secure supply chains:** Low Carbon Pulse reported on the arrangements that **A.P. Moller – Maersk** has been putting in place to provide it with sufficient supply of low to no carbon methanol for its dual fuel container vessels.
On **August 20, 2022**, it was reported widely that **A.P. Moller – Maersk** had signed a letter of intent with Chinese bio-energy corporation, **Debo**, for the purposes of the development a bio-methanol production facility producing up to 200,000 metric tonnes of bio-methanol a year by 2024. It is understood that the bio-methanol will use agricultural residue as the feedstock, and that **A.P. Moller – Maersk** will off-take all production. The announcement from **A. P Moller - Maersk** (at <https://www.maersk.com>, under **A.P. Moller – Maersk engages green bio-ethanol partnership**) provides further details and summarises the supply arrangements that **A.P. Moller – Maersk** has put in place so far.
- **Port of Belledune H2 production facility:** On **August 20, 2022** it was reported that the **Port of Belledune, New Brunswick, Canada**, intends to develop a hydrogen production facility using electrical energy from the New Brunswick grid to produced hydrogen and then combine that hydrogen with nitrogen to produce ammonia, primarily for export. While at pre-feasibility stage, the Port is reported to have engaged Cross River Infrastructure Partners to work with it to formulate the scope and scale of the proposed development.
- **Amazon plugged in:** On **August 25, 2022**, **Amazon** (at <https://www.aboutamazon.com>, under **Amazon adopts green hydrogen to help decarbonize its operations**) announced that it had signed an agreement with **Plug Power** for the supply of 10,950 tons of Green Hydrogen a year to power and to propel vehicles and for building operations, supply to start in 2025. The Green Hydrogen will replace diesel and grey hydrogen, and other fossil fuels.

Cities, Clusters, and Hubs and Corridors and Valleys, and Giga-Factories:

Other than as covered elsewhere in this edition of Brief on Decarbonisation, no news items have come to the attention of the author of sufficient materiality or significance to merit inclusion.

Green Metals / Minerals, Mining and Difficult to Decarbonise Industries:

BMW Group and H2 Green Steel have steel the deal: On **August 20, 2022**, it was reported widely that **BMW Group** and **H2 Green Steel** had signed a contract for the delivery of **CO₂** reduced steel. As reported, the contract addresses upstream Scope 3 emissions of **BMW Group**, including end-of-life and recycling initiatives. It is understood that the **CO₂** reduced steel gives rise to up to 90% fewer **CO₂** emissions than steel produced using blast furnace technology.

Solar and Sustainability (including NZE Waste) Wind round-up, on-shore and off-shore:

Solar Philippines expansion: On **August 22, 2022**, **pv-magazine-australia** (at <https://www.pv-magazine.com>, under **Solar Philippines to build 4 GW solar farm in Nueva Ecija Bulacan provinces**) reported that **Solar Philippines Nueva Ecija Corp** plans to expand its **500 MW** photovoltaic project on the island of Luzon to **4 GW**. The expansion will require a further 2,500 hectares of land.

Land Mobility / Transport:

- **Buses and coaches, Battery, Fuel Cell and ICE Technology, Industrial Vehicles and Trucks and Recharging and refuelling infrastructure:** No news items have come to the attention of the author of sufficient materiality or significance to merit inclusion in this edition of Brief on Decarbonisation.
- **Cars and taxis (and light-vehicles generally):** On **August 24, 2022**, **Channel News Asia** (at <https://www.channelnewsasia.com>, under **California to ban fossil fuel cars by 2035**) reported on proposals being debated by the California Air Resources Board (CARB) to formalise the policy settings being sought by California Governor, Mr Gavin Newsom to phase out the use of fossil fuel cars by 2035. It is understood that the proposals include incremental steps to progress to one third of the cars sold in California to be zero emission by 2026, and over two thirds by 2030.
- **Trains:** On **August 24, 2022**, **Alstom** (at <https://alstom.com>, under **World premiere: 14 Coradia iLint to start passenger service on first 100% hydrogen operated route**) announced its **Coradia iLint** was being used on the world' first 100% hydrogen train route, the **Cuxhaven, Bremerhaven, Bremerforde, Buxtehude**, route in **Lower Saxony**, Germany. The 14 trains provided by Alstom will replace diesel locomotive trains on the 100 km (60 mile) route.

Ports Progress and Shipping Forecast:

- **Ferries and other craft and Green Corridors:** No news items have come to the attention of the author of sufficient materiality or significance to merit inclusion in this edition of Brief on Decarbonisation.
- **Green Ports:**
 - **Ammonia floating storage and regasification barge:** On **August 22, 2022**, **LNG Prime** (at <https://lngprime.com>, under **Japan's NYK inks deal for FSRB**) reported that **NYK Line** had signed a research and development agreement with **Nihon Shipyard, ClassNK** and **IHI** for the development and commercialisation

of an **ammonia floating storage and regasification barge (FSRB)**. The development and commercialisation of FSRBs may be regarded as key to the development of the international trade in Green Ammonia.

- **Mitsui O.S.K Lines progresses L-CO₂ carrier:** On **August 23, 2022, Offshore Energy** (at <https://www.offshore-energy.biz>, under **MOL gets AiP for large-scale LCO₂ carrier**) reported that **Mitsui O.S.K Lines** had been granted Approval in Principle (**AiP**) from **Nippon Kaiji Kyokai** (ClassNK), classification society, for its large-scale liquified carbon dioxide carrier. The process in respect of the large-scale **L-CO₂** carrier is part of the **CCUS R&D and Demonstration Related Project / Large-scale CCUS Demonstration Project in Tomakomai / Demonstration Project on CO₂ Transportation**, which in turn is one of the initiatives of Japan's New Energy and Industrial Technology Development Organization (**NEDO**).
- **Azane Fuel Solutions progresses ammonia bunkering:** On **August 23, 2022, Arena Pro – Ocean Hyway Cluster** (at <https://www.oceanhywaycluster.com>, under **Major milestone for Azane's ammonia bunkering terminals**) announced that approval in principle (**AiP**) had been obtained by **Azane Fuel Solutions** from **DNV** for its floating ammonia bunkering terminal.
- **Longship to get sails:** Low Carbon Pulse reported on a number of occasions on the procurement of two **CO₂ carriers** from the **PRC** for use to transport **CO₂** as part of the **Longship Project**, with the **CO₂** to be injected and stored as part of the **Equinor, Shell and TotalEnergies Northern Lights Project**. Over the last week or so it has been reported widely that the two **CO₂ carriers** are to be fitted with auxiliary wind propulsion capacity in the form of rotary sails.

Airports and Aviation:

Other than as covered elsewhere in this edition of Brief on Decarbonisation, no news items have come to the attention of the author of sufficient materiality or significance to merit inclusion.

The author of Brief on Decarbonisation is Michael Harrison