

# Low Carbon Pulse - Edition 44

GLOBAL DEVELOPMENTS IN PROGRESS TOWARDS NET-ZERO EMISSIONS



Welcome to **Edition 44** of **Low Carbon Pulse** – sharing significant news on progress towards net-zero greenhouse gas (**GHG**) emissions (**NZE**) for the period from **Monday July 18, 2022** to **Sunday July 24, 2022**.

Click [here](#) for the **First Compendium of Low Carbon Pulse** (containing **Editions 1** to **28**, covering the period from October 6, 2020 to October 5, 2021), [here](#) for the **Second Compendium of Low Carbon Pulse** (containing **Editions 29** to **38**, covering the period from October 7, 2021 to March 31, 2022), and [here](#) for the **Third Compendium of Low Carbon Pulse** (containing **Editions 39, 40** and **41** covering **April, May** and **June, 2022**).

## Welcome to the weekly news-cycle Low Carbon Pulse:

During July 2022 we are trialling a weekly news-cycle for Low Carbon Pulse. As regular readers of Low Carbon Pulse will know, for April, May and June 2022 we trialled a monthly news-cycle, having previously used a two week news-cycle. Both the monthly and two weekly news-cycles resulted in long publications, not ideal for those seeking a "quick-read". It is hoped that the weekly news-cycle will provide the right balance / length, ideally between 8,000 and 10,000 words. In this **Edition 44** of Low Carbon Pulse, this ambition has been achieved.

## Climate consequences of hydrogen emissions:

Previous editions of Low Carbon Pulse reported on research in respect of the impact on the climate system of the release of hydrogen emissions as the production, and use, of hydrogen becomes everyday over the coming years. The headline was that hydrogen emissions need to be avoided because on release, hydrogen will compound with other elements, to produce **GHG** emissions.

On **July 20, 2022**, [copernicus.org](https://www.copernicus.org/) published [Climate consequences of hydrogen emissions](#). The article is compulsory reading for all. The abstract provides a clear sense of the need to understand and not to overlook or to underestimate the impact of hydrogen emissions, and part of it is quoted below:

"While zero- and low-carbon hydrogen hold great promise ... [hydrogen] is an indirect greenhouse gas whose warming impact is both widely overlooked and underestimated. This is largely because hydrogen's atmospheric warming effects are short-lived – lasting a couple of decades – but standard methods of characterising climate impacts of gases consider only the long-term effect from a one-time pulse of emissions. For gases whose impacts are short-lived, like hydrogen, the long-term framing masks a much stronger warming potency in the near- to medium term".

We live in a world of unintended consequences, but the mantra must be do no harm, and do it quickly.

## Publication very much worth a read:

The **American Bureau of Shipping (ABS)** has published [Setting the Course to Low Carbon Shipping – Zero Carbon Outlook](#). Whether your day job involves shipping or not, the publication is excellent and well-worth a read (see page 2 ).

## 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:

- **UK Net-Zero Strategy not sufficiently detailed:** On **July 18, 2022**, it was reported widely that **Justice Holgate** found that the UK Government had not complied with the UK **Climate Change Act** because its Net-Zero Strategy to achieve **NZE by 2050** was not sufficiently detailed and quantified. Justice Holgate ordered the UK Government to publish a revised Net-Zero Strategy compliant with the Climate Change Act by March 2023. A link to the case is [attached](#).
- **House of Lords Economic Affairs Committee warns of disorderly transition:** The judgment of **Justice Holgate** may be regarded as being consistent with the perspective of the **House of Lords Economic Affairs Committee**. On **July 21, 2022**, the **Committee** published [Investing in energy: price, security and the transition to net zero](#). At the core of the findings of the Committee is a lack of granularity, expressed in practical terms, providing a disconnect or gap between the ambitious targets and the practical plans to realise those targets. Also, the Committee notes the need to adopt a pragmatic medium term approach to natural gas to ensure energy security.
- **ABS Sets Course:** In the first couple of weeks of July the author finished reading the **American Bureau of Shipping (ABS)** published [Setting the Course to Low Carbon Shipping – Zero Carbon Outlook](#). As might be expected, the publication is data and information rich, and technology neutral, as to the transition in fuel use across the shipping industry.

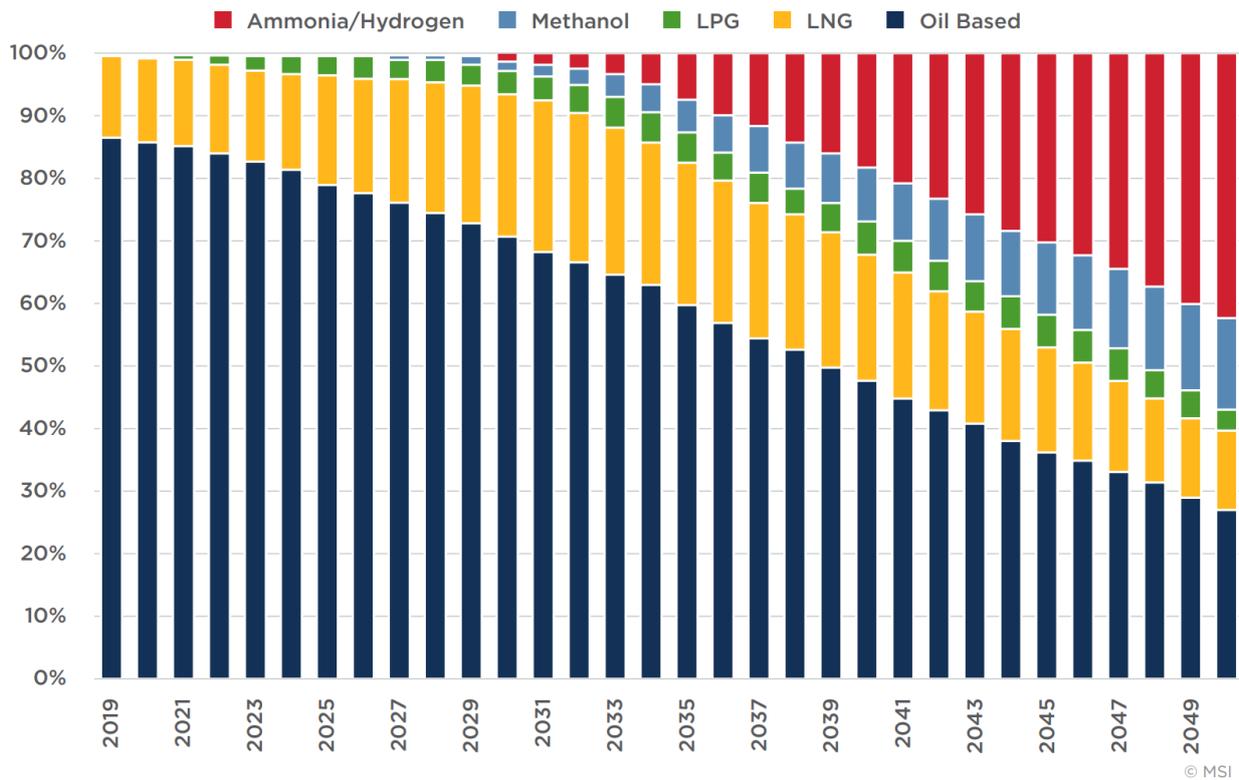


Figure 71: Fuel mix forecast.

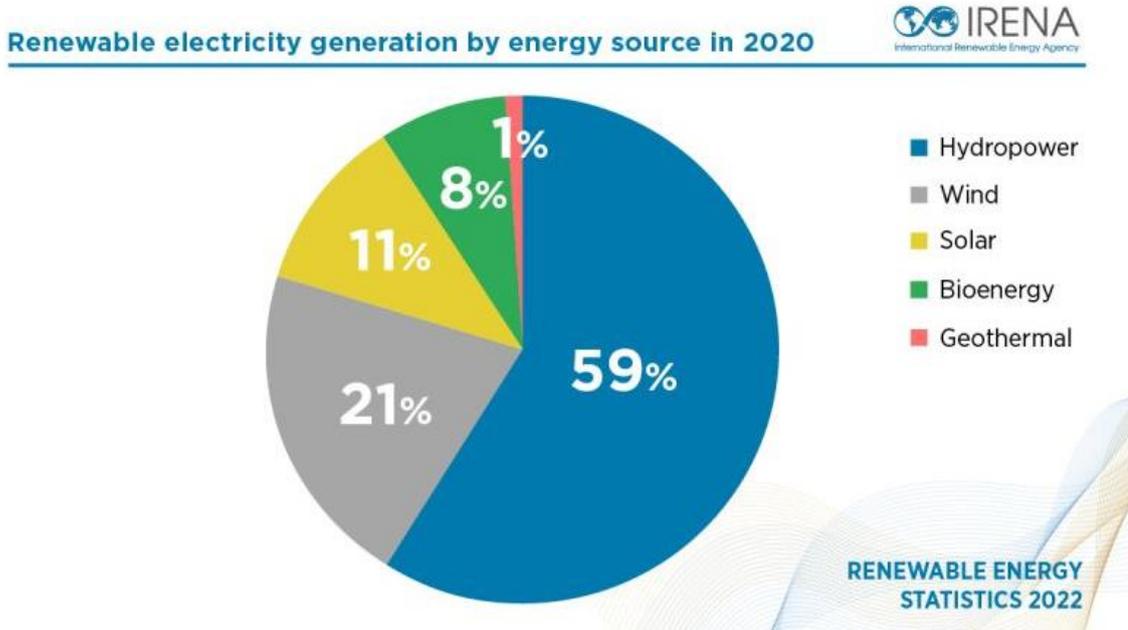
Source: [American Bureau of Shipping](#)

While the publication will be of considerable interest to those active (or interested) in the shipping industry, the report is to be commended in the same way that **Edition 43** commended **Mission Possible Partnership** publication [Making Net-Zero Aviation Possible – An industry-backed, 1.5°C aligned transition strategy](#). The quality of both publications is outstanding.

- **International Energy Agency (IEA)** publications: on **July 20 2022**, the **IEA** will publish its [Electricity Market Report – July 2022 Update](#). As with all **IEA** publications, this publication is well worth a read. The key findings of the report may be regarded as follows: **1.** Electricity demand growth is slowing significantly during 2022, slowing to 2.4%; **2.** Tight natural gas markets are favouring the use of coal-fired power plants in the near-term; **3.** The development and deployment of renewable energy capacity is growing at a faster rate than demand; **4.** The **GHG** emissions from the electricity sector are set to decline slightly; **5.** Wholesale electrical energy prices are skyrocketing in many countries; **6.** The **EU** is gearing up to reduce its reliance on Russian fossil fuel imports by accelerating its clean energy transition; and **7.** There remains uncertainty around estimates for 2023, both electrical energy demand and the supply side generation mix to match demand. Current forecasts are that electrical energy demand will increase by around 2.5% in 2023, with strong growth in the development and deployment of renewable electrical energy capacity.

On **July 19, 2022**, Ukraine joined the **IEA** as an Associate country.

- **International Renewable Energy Agency (IRENA)** publications:
  - On **July 18, 2022**, **IRENA** published [Renewable Energy Statistics 2022](#). The headline from the publication is that during 2020 "the amount of electricity generated from renewables reached 7,468 TWh". The publication provides details, country by country, of the renewable electrical energy generated, and as such is data and information rich. The following pie-chart provides a global view of the renewable sources from which electrical energy was generated.



Source: [IRENA](#)

Attached is a two page summary prepared by **IRENA** entitled [Renewable energy highlights](#) which will avoid the need to plough through the full report.

- On **July 20, 2022**, **IRENA** published [Scenarios for the Energy Transition – Experience and good practice in Latin America and the Caribbean](#). The publication is well-worth a read, providing great examples of long-term scenario and energy planning tools for the purposes of developing and implementing national energy planning and strategies.

### Climate change reported and explained:

- **Extreme weather events:** Extreme weather events have continued during the week commencing July 18, 2022. The **International Panel on Climate Change (IPCC)** defines an extreme weather event as follows:

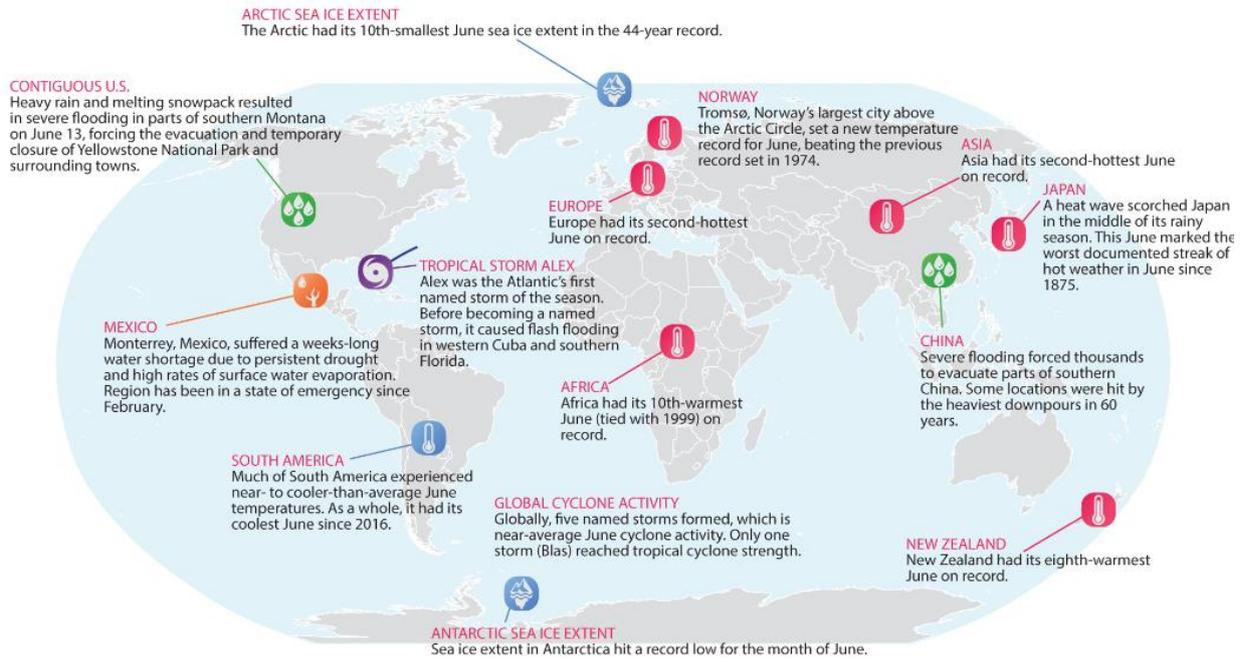
"An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare or rarer than the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics 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 increasingly 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 June Report:** As noted in **Edition 43** of Low Carbon Pulse, on **July 14, 2022**, the US National Oceanic and Atmospheric Administration (**NOAA**) published its June Report. The headline from the June Report is that: "June's average global temperature continued 2022's remarkably warm trend, as the both the month and the year so far ranked as the sixth warmest on record .... June 2022 marked that 46th consecutive June and the 450th consecutive month with temperatures above the 20th century average. The ten warmest Junes on record have all occurred since 2010". We have repeated the information and infographic from the **NOAA** June Report, reflecting the continued impact of climate change.

# Selected Significant Climate Anomalies and Events: June 2022

**GLOBAL AVERAGE TEMPERATURE**  
June 2022 average global surface temperature was the sixth highest for June since global records began in 1880.



Please note: Material provided in this map was compiled from NOAA's State of the Climate Reports. For more information please visit: <http://www.ncei.noaa.gov/access/monitoring/>

## Middle East including GCC Countries:

- **UAE aligns with France:** On **July 19, 2022**, it was reported widely that the **UAE** and **France** had signed a memorandum of understanding to establish a **Comprehensive Strategic Energy Partnership**. As reported, the partnership provides for the enhancement of energy security and affordability, decarbonisation and progressive action on climate change ahead of COP-28 to be held in the UAE in 2023. There has been considerable positive coverage of the **Comprehensive Strategic Energy Partnership** in both the UAE and France.
- **UAE aligns with France:** On **July 20, 2022**, it was reported widely that **ADNOC** (Abu Dhabi National Oil Company) and **TotalEnergies** had signed a **strategic partnership agreement** to ensure cooperation between the two energy giants, including in respect of CCS and natural gas (and product supply and trading). As with the **Comprehensive Strategic Energy Partnership**, this **strategic partnership agreement** has received positive coverage.

## Africa:

- **The importance of peat swamps and wetlands:** On **July 21, 2022**, [theconversation.com](https://www.theconversation.com) published [Congo peat swamps store three years of global carbon emissions – imminent oil drilling could release it](#), providing a link to the nature geoscience publication of [Mapping peat thickness and carbon stocks of the central Congo Basin using field data](#). Both the article and the report are well-worth a read, providing a data and information rich assessment of the carbon trapped within the peatlands of the **Congo Basin**, and the possible consequences for the release of carbon into the climate system – it is stated that the **Congo Basin** contains close to 30% of the world's tropical peat carbon. Globally, peatlands cover around 3% of the landmass, and yet store around 600 giga-tonnes of carbon (this may be regarded as a conservative estimate). As noted in previous editions of Low Carbon Pulse, peatlands (and wetlands) are vulnerable to drainage and drying given climate change. We live in a world of unintended carbon consequences, and as such the mantra of do no harm, and do it quickly, is a sound one.
- **Construction commences on El-Dabaa Nuclear Power Plant (ENNP):** On **July 22, 2022**, [energy-utilities.com](https://www.energy-utilities.com) reported that concrete has been poured for **Unit 1** of the **ENNP**, located 300 kms north-west of **Cairo, Egypt**. **Unit 1** is the first of four planned units, each with nameplate generating capacity of **1.2 GW**. The development agreement for **ENNP** was signed around five years ago, but it took time for approvals to be obtained. The developer of the **ENNP** is **Rosatom** (the Russian state-owned nuclear energy corporation).

## India and Indonesia:

- **REMC Limited procuring up to 2.6 GW of renewable electrical energy:** On **July 18, 2022**, it was reported widely that **REMC Limited** (a corporation within the Indian Railways group) has issued documents to procure up to **2.6 GW** of electrical energy from renewable sources, with the electrical energy to match the load across a number of areas of the Indian rail network. It is understood that the renewable energy projects will be developed using a build-own-operate development model.

- **Ola announces battery innovations centre in Bengaluru:** On **July 18, 2022**, [batteriesnews.com](https://www.batteriesnews.com) reported that it was to develop a **USD 500 million** battery innovations centre (**BIC**) in Bengaluru, India, providing an advanced cell research and development (**R&D**) facility.
- **Scale and size of hydrogen supply and demand in India:** On **July 18, 2022**, [energyworld.com](https://www.energyworld.com) (under [Green hydrogen demand in steel, mobility, natural gas sectors to require \\$78-bn funding in India](#)) reports on an interview with folk from the **Council on Energy, Environment, and Water (CEEW)**. For India to produce **5 million metric tonnes** of Green Hydrogen by 2030, this will require at least **100 GW** of installed renewable energy capacity and the development and deployment of **40 GW** of electrolyser capacity, at a cost of **USD 100 billion**. The perspective of the folk at **CEEW** is that Green Hydrogen can be used across the iron and steel and mobility sectors (using existing or repurposed natural gas pipelines), with the potential across these sectors equating to up to an **additional 3.5 million metric tonnes** of Green Hydrogen. The additional Green Hydrogen production will require at least **70 GW** of installed renewable energy capacity and the development and deployment of **28 GW** of electrolyser capacity, at a cost of **USD 78 billion**.  
The folk at **CEEW** see **two challenges** with the development of the Green Hydrogen sector, **first**, the experience of financial institutions in India in lending on projects of this kind, and **secondly**, the rate at which funding may be made available (both debt and equity). As in other markets around the world, the cost and the efficiency, and utilisation, of electrolysers are regarded as factors that may affect the cost of debt funding, certainly where the Green Hydrogen produced is to be used in the mobility sector. The report is well-worth a read, providing other insightful commentary on the Indian market.
- **GUNVL procuring up to 1.5 GW of photovoltaic solar:** On **July 19, 2022**, [pv-magazine-india.com](https://www.pv-magazine-india.com) reported that **Gujarat Urja Vikas Nigam Ltd (GUNVL)** has issued documents to procure up to **1.5 GW** of electrical energy from grid-connected photovoltaic solar projects located within the state of Gujarat.
- **Mumbai Climate Action Plan:** During the week-beginning **July 18, 2022**, the 240 page [Mumbai Climate Action Plan 2022, Towards A Climate Resilient Mumbai](#) was published (as part of the [C40 Cities](#) initiative) by **WRI India**. The publication is excellent, and may be regarded as compulsory reading. The publication identifies 24 action tracks under six priority areas. The following slides illustrate the six priority areas.



- **BHP and Tata Steel align:** On **July 20, 2022**, **BHP** [announced](#) that it and **Tata Steel** had signed a memorandum of understanding (**MOU**) to undertake jointly the assessment and study of the use of lower and low carbon iron and steel making technologies. As announced, under the **MOU BHP and Tata Steel** intend to work together to reduce the **GHG** emissions intensity of blast furnace iron and steel making via two priority areas, first, the use of biomass as a source of bioenergy and secondly the use of CCU in iron and steel making.
- **RPO Order to apply through 2029-30:** On **July 22, 2022**, the **Ministry of Power Government of India** released [Renewable Purchase Obligation \(RPO\) and Energy Storage Obligation Trajectory till 2029-30](#).

Year	Wind RPO	HPO	Other RPO	Total RPO
2022-23	0.81%	0.35%	23.44%	24.61%
2023-24	1.60%	0.66%	24.81%	27.08%
2024-25	2.46%	1.08%	26.37%	29.91%
2025-26	3.36%	1.48%	28.17%	33.01%
2026-27	4.29%	1.80%	29.86%	35.95%
2027-28	5.23%	2.15%	31.43%	38.81%
2028-29	6.16%	2.51%	32.69%	41.36%
2029-30	6.94%	2.82%	33.57%	43.33%

Source: [Ministry of Power](#)

- **India Hydrogen Alliance- June 2022:** Attached is the link to the June edition of the [India H2 Monitor – June 2022](#). As noted in previous editions of Low Carbon Pulse, we intend to include the link to, rather than to repeat the content of, the **India H2 Monitor**.

## Japan and Republic of Korea (ROK):

- **ACWA and POSCO forge hydrogen tie-up:** On **July 19, 2022**, [renews.biz](#) reported that **ACWA Power** and **POSCO Holdings** had signed a Memorandum of Understanding under which the two leading corporations are to develop jointly Green Hydrogen, and Green Hydrogen derived-fuel, production capacity to decarbonise the activities of the **POSCO Group**. As reported, the Green Hydrogen, and Green Hydrogen derived-fuel, will be used across all activities undertaken by the **POSCO Group**, including the generation of electrical energy and the production of iron and steel, and will provide supply to other off-takers in the **ROK**.

The **CEO of ACWA Power, Mr Paddy Padmanathan** said: "*With tangible project commitments in Saudi Arabia and Oman, ACWA Power is at the forefront of scaling up green hydrogen – whose output – ammonia -will lead to the outcome of decarbonising entire industries, including hard to abate industrial activities like steel manufacturing*".

- **Hyundai Motor Group and Rolls-Royce up in the air:** On **July 19, 2022**, [hydrogen-central.com](#) reported that **Hyundai Motor Group** and **Rolls-Royce** have signed a memorandum of understanding under which they plan to work together to develop all-electric propulsion and hydrogen fuel cell technology to the **Advanced Air Mobility (AAM)** market, working to develop power and propulsion technology systems for **Hyundai's AAM** division, to commercialise / industrialise **Rolls-Royce** power and propulsion systems, to develop electric propulsion systems based on fuel-cells, to work together to bring to market a fuel-cell propulsion system to the wider **AAM** market, and to develop a fuel-cell electric demonstration aircraft by 2025.

As reported, both global leading corporations share a vision of leading the way in the **AAM** market, using battery electric and fuel-cell technology to develop the Urban Air Mobility and Regional Air Mobility markets.

## PRC and Russia:

- **Air Liquide to develop two hydrogen production units:** On **July 19, 2022**, it was reported widely that **Air Liquide** (one the three global industrial gas giants) is to develop two hydrogen production units within the **Shanghai Chemical Industry Park**, each equipment with **CO<sub>2</sub>** capture capacity. As reported, the development will require a capital investment of around **€200 million**. The return of, and return on capital, will be realised under long-term contracts with Covestro China and Shanghai Lianheng Isocyanate Company, both located within the **Shanghai Chemical Industry Park**.
- **PRC adds 30 GW of photovoltaic solar in the first half of 2022:** On **July 22, 2022**, [pv-magazine](#) reported that during the first six months of 2022, the **PRC** installed **30 GW** of photovoltaic solar capacity (the **PRC** now having **340 GW** of photovoltaic capacity installed cumulatively). The information is sourced from the **China Photovoltaic Industry Association**, which expects between **85** and **100 GW** of new photovoltaic solar capacity to be installed during 2022.

## Europe and UK:

- **UK launches electricity market reform:** On **July 18, 2022**, the UK Government (under [UK launches biggest electricity market reform in a generation](#)) announced a major review of the electricity market design to ensure that cost benefits of cheaper energy are realised for the benefit of consumers. The announcement from the Department for Business, Energy & Industrial Strategy is fulsome, providing a clear rationale for reform. The announcement is well-worth a read.
- **The Crown Estate green lighted in respect of six projects under derogation:** On **July 19, 2022**, **The Crown Estate** [announced](#) that the **Secretary of State for Business, Energy and Industrial Strategy** has agreed that **The Crown Estate** can proceed to enter into leases, thereby proceeding with the implementation of the **Offshore Wind Leasing Round 4** under a derogation: as reported in **Edition 33** of Low Carbon Pulse (early February 2022), a number of applicants in the **Offshore Wind Leasing Round 4** process were awarded preferred bidder status, providing a basis to undertake further work to allow progress towards development, at which time an agreement for lease would be entered into with **The Crown Estate**. The derogation allows **The Crown Estate** to enter into agreements to lease in respect of each of the lease areas comprising the **Offshore Wind Leasing Round 4** process. As reported in **Edition 42** of Low Carbon Pulse, on **July 5, 2022**, **The Crown Estate** has announced plans to develop floating off-shore wind fields in the Celtic Sea, with the potential to install a further 4 GW of off-shore wind field capacity.
- **UK launches first clean-hydrogen subsidy scheme:** On **July 20, 2022**, it was reported widely that the UK Government is seeking expressions of interest by September 7, 2022, from those wishing to participate in a funding support initiative to help fund an initial **1 GW** of **Green Hydrogen** and **1 GW** of **Blue Hydrogen** (consistent with

the dual track approach of the UK Government). On **July 20, 2022**, the **Department for Business, Energy and Industrial Strategy** published [UK public sector support for hydrogen research and innovation](#), providing an overview of the bodies supporting public sector hydrogen research and innovation in the UK, how this support can be accessed, and case studies to demonstrate the type of support that is available.

## Americas:

**Biden Administration Executive Action:** On **July 20, 2022**, **The White House, Briefing Room**, released **FACT Sheet: President Biden's Executive Actions on Climate to Address Extreme Heat and Boost Offshore Wind**. In respect of offshore wind, the release outlined that the Department of the Interior is proposing the first Wind Energy Areas in the Gulf of Mexico, covering 700,000 acres, and stated that President Biden had directed the Department to advance wind energy development in the waters offshore the mid and southern Atlantic Coast and Florida Coast.

## France and Germany:

- **Fifth FSRU for Germany:** Since March 2022, Low Carbon Pulse has reported on the procurement of four floating storage and regasification units (FSRUs) to be located in German ports. FSRUs allow the import of liquified natural gas (LNG), and its storage and regasification, and send out. The procurement of the FSRUs has been in response to providing energy security. On **July 18, 2022**, **TotalEnergies** announced plans to procure an FSRU to be located in the port of **Lubmin, Germany**, with operation planned to commence in December 2022. **TotalEnergies** is to procure the FSRU and **Deutsche ReGas** is designing the shoreside facilities (including top-sides and send out) and connection to the **EUGAL** natural gas network to allow the send-out of natural gas to ultimate users.
- **Germany's bi-lateral relationships:** Previous editions of Low Carbon Pulse have reported on the bi-lateral relationships that Germany has established to develop hydrogen supply / value chains. The 23 bi-lateral relationships include 11 within the carriage of **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)**, GmbH for the German Federal Government. **GIZ** has published [Hydrogen Business Guide – Bilateral energy partnerships in development countries and emerging markets](#).
- **Electrolysers mapped: Edition 43** of Low Carbon Pulse noted that **Dr Thomas Hillig** had posted a map of the [Green Hydrogen electrolysers across Germany](#). We have retained this link for those who may have missed it. The post from **Dr Hillig** promises maps on hydrogen pilot projects in the iron and steel industry, hydrogen projects in the mining industry, Green Hydrogen in fertiliser, Electrolysers in Europe and in the World.

## Australia:

- **Queensland Launches Skills Development Roadmap:** On **July 20, 2022**, the Government of Queensland, Australia, launched the first dedicated workforce development plan for the hydrogen industry – [The Hydrogen Industry Workforce Development Roadmap 2022-2023](#). The initiative was flagged by the Government of Queensland nearly three years ago, and demonstrates the progressive thinking of the Government.
- **Renewable natural gas on its way:** On **July 20, 2022**, [pv-magazine-australia](#) reported that Sydney is progressing to the first flow of renewable natural gas with biogas from wastewater upgraded to produce biomethane for injection into the pipeline network. The biogas is to be derived from the Sydney Water Wastewater Resource Recovery Facility with the biogas then ungraded to produce up to 95,000 GJ of biomethane. It is to be hoped that this project will blaze a trail along the East Coast of Australia.

## Blue and Green Carbon Initiatives and Biodiversity

- **Global Mangrove Alliance and Wetlands International report on mangroves:** On **July 20, 2022**, **Global Mangrove Alliance**, **Save Our Mangroves Now!** and **Wetlands International** published [The State of Mangroves in the West Indian Ocean](#). The publication considers the state of the mangroves along the east coast of Africa, in particular Kenya, Madagascar, Mozambique and Tanzania. For those interested in Blue Carbon, the publication is rich in data and information, with a strong focus on the opportunities for restoration of mangrove forests and swamps within the West Indian Ocean region.
- **Nature Based Solutions:** During the first part of July, the author of Low Carbon Pulse read the **European Commission** publication [The Vital Role of Nature-Based Solutions In a Nature Positive World](#), which was released by the **Directorate-General for Research and Innovation**. The publication is an excellent primer for **Nature-Based Solutions (NBS)** and **Nature-Based Enterprises (NBE)**. It is hoped the resources and time are devoted to the development of the thinking contained in the publication in the near term.

The author also read the **Asian Development Bank (ADB)** publication [Integrating Nature-Based Solutions for Climate Change Adaptation and Disaster Risk Management – A Practitioner's Guide](#). The **ADB** publication, authored by John Matthews and Ernesto Ocampo Dela Cruz provides a wonderful addition to those active (or those interested) in the area of **NBS**. **NBS** are at the core of both Blue and Green Carbon Initiatives. One of the many good things about the **ADB** publication is that it applies a broader perspective as to what is an **NBS**.

- **UN Biodiversity Conference:** As reported in **Edition 41** of Low Carbon Pulse, **Part 2 of the UN Diversity Conference** (fifteenth meeting of the Conference of Parties (COP-15) to the Convention on Biological Diversity) is to take place between **December 5 and 17, 2022**, in **Montreal, Canada**.

**COP-15** is intended to adopt the **post-2000 global biodiversity framework**, which provides a strategic vision and global roadmap for the conservation, protection, preservation, restoration and sustainable management of biodiversity and ecosystems for the next decade. [Draft 1](#) of the **post-2000 global biodiversity framework** was released in July 2021.

## BIODIVERSITY

In the broadest sense, **biodiversity** describes the variety of the fauna and flora globally, and in any particular area. The preservation of **biodiversity** is a key policy setting. In this context, human activities and the clearing of land to undertake agricultural, forestry or other land use (**AFOLU**) is a key focus of policy settings. Desertification and

deforestation are key concerns (both as a result of **AFOLU**), as is the broader impact of climate change on habitats, critically, the impact on change in temperature on land and in the ocean.

**There is a balance in habitats**, with eco-systems that have developed overtime, and that continue to develop. The balance of habitats and their eco-systems are impacted by **AFOLU** and climate change. There are many examples, but a consistent example (that many will recognise) is the need to preserve the habitats of bees and other pollinators, and to avoid loss of bees and other pollinators. As a policy setting, the rewilding of habitats is one element of preservation, and, in some cases, restoration of eco-systems. As a broad statement, preserving wilderness areas, and rewilding of areas, and reducing old growth forestry, and afforestation and reforestation, are key to the preservation and restoration of **biodiversity**. These are policy settings over which we have control in the near, medium and long term. In addition, overtime, policy settings may extend to addressing optimal use of land, optimal in the sense of preserving or restoring **biodiversity** while at the same time addressing climate change. As always, what is needed is known. As always, the challenge is acting upon it.

**Climate change will impact** the effectiveness of these policy settings (in particular coastal habitats, and areas of increased drought and desertification, driven by rising sea-levels and changes in weather patterns, as a result of climate change), but they are policy settings that are necessary and need to be progressed in the near term. In addition, acting to preserve and to restore **biodiversity** is likely to yield benefits, economic and social.

## Bioenergy and heat-recovery:

- **Biogas reading for those taking a vacation:** On **July 20, 2022**, the ever-excellent [biogasworld.com](http://biogasworld.com) 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**. To the surprise of the author of Low Carbon Pulse, a number of the publications sit in the "read-pile", with an equal number in the "to-read pile".

- **A Gas for Climate report: Edition 42** of Low Carbon Pulse reported that the **Gas for Climate** consortium published an update **Biomethane production potentials in the EU**. The updated publication builds on the previous publication from **Gas for Climate**, to take into account the acceleration of the use of biomethane now contemplated by the **EU**. The key findings of the publication are: **1.** There is enough sustainable feedstock in the **EU** to achieve the **EU REPowerEU** target of **35 bcm by 2030**, with up to **41 bcm by 2030** and **151 bcm by 2050**; **2. Anaerobic digestion** is regarded as having the potential to derive up to **38 bcm by 2030**, and up to **91 bcm by 2050**. In the **EU** context, France, Germany, Italy, Poland and Spain will be the top five producers of **biogas** derived **biomethane** using anaerobic digestion technologies. The **key feedstocks** for these purposes **to 2030** being **manure** (33%), **agricultural residues** (25%) and **sequential cropping** (21%); and **3. Thermal gasification** is regarded as having the potential to derive up to **2.9 bcm by 2030**, and **60 bcm by 2050**. In the **EU** context, France, Germany, Italy, Spain and Sweden will be the top five producers of biomethane using thermal gasification. The **key feedstocks** for these purposes **to 2030** are **forestry residues** and **wood waste**, together having 60% of the feedstock source.

## 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 **CO<sub>2</sub>**, and other compounds and elements, such that the gas hauled through the pipeline is **CH<sub>4</sub>**). **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 H<sub>2</sub> derived from a renewable source that is then combined with N to produce the compound NH<sub>3</sub>;
- **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 CO<sub>2</sub> (captured or derived) and H<sub>2</sub> 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):

- **Iberdrola inaugurates 40 GWh pumped hydro-electric plant on July 18:** On **July 19, 2022**, [energy-storage.news](#) reported that **Iberdrola** had inaugurated its **Tâmega Giga-battery** in northern Portugal, as part of its renewable energy complex. As reported, **Iberdrola** has invested **€1.5 billion** in the renewable energy complex which combines **two run-of-river hydroelectric plants** and a **880 MW** pumped hydro energy storage (**PHES**) unit (Gouvães), with combined electrical energy output of 1.158 GW.

**By way of reminder:** **Edition 35** of Low Carbon Pulse reported on the renewable energy complex as follows:

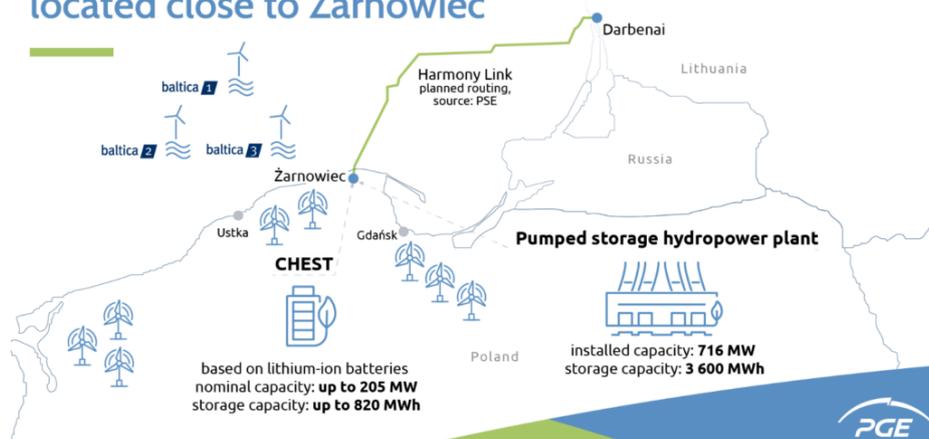
**Iberdrola pumps-up scale:** On February 8, 2022, it was reported widely that Spanish renewable energy giant, Iberdrola is developing a MW hydro-electric power complex in northern Portugal, using water from three reservoirs: Alto Tâmega, Daivões and Gouvães.

The hydro-electric power complex will deploy a 880 MW reversible storage facility (pumped-storage), which is able to store water from the Daivões reservoir delivered into the Gouvães reservoir. There is a 650 metre differential between the two reservoirs, use of the differential will generate renewable electrical energy, with the water in the Gouvães reservoir pumped into the Alto Tâmega reservoir. The pumped storage is being described as the "Alto Tâmega giga battery": on operation the energy storage of Portugal will increase by 30%.

- **PGE Group to develop Big BESS:** On **July 21, 2022**, [energy-storage.com](#) reported that **PGE Group** (state-owned energy corporation) had obtained approval to develop and to deploy a **200 MW / 820 MWh BESS** in Poland – named **CHEST (Commercial Hybrid Energy Storage)**. As reported, **CHEST** will be integrated with the existing **716 MW / 3,300 MWh** pumped hydro-electric storage (**PHES**) plant at Żarnowiec, and with wind farm generation capacity (**PGE Group** is permitted to install up to **3.5 GW** of wind farm capacity).

The development is part of a broader plan to provide energy market and grid flexibility, and the planned synchronisation of Estonian, Latvian and Lithuanian power grids under the Harmony Link project (see **Edition 34** of Low Carbon Pulse).

## Commercial Hybrid Energy Storage (CHEST) located close to Żarnowiec



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

- **DNV and Petronas Southeast Asian focus:** On **July 19, 2022**, [upstreamonline.com](#) reported that **Petronas** (Malaysia's natural energy corporation) and **DNV** are to work together on CCS and CCUS initiatives, in particular to address the business, regulatory and technical challenges of the development and deployment of CCS and CCUS within Southeast Asia. As reported, **Petronas** and **DNV** will work together on environmental and safety, risk generally, including technology, and identify and assess sites for storage, and the legislation and regulatory matters that are required.
- **"First of its kind" CCS project in North Dakota:** On **July 19, 2022**, [politicopro.com](#) reported that **Red Trail Energy LLC** (which operates an ethanol production facility in western North Dakota) had announced that the US's "first carbon capture and storage project allowed under state primacy" started operating during June 2022. As reported, in 2018 North Dakota became the first state to secure primacy over Class VI injection wells, being wells used to inject **CO<sub>2</sub>** deep into rock formations for long-term (permanent) storage. **Red Trail Energy LLC** has announced that it is capturing **100%** of **CO<sub>2</sub>** arising from its ethanol production facility.
- **WoodMac Energy Super Basins:** The **July Edition of Wood McKenzie's Horizon** publication [Energy super basins: Where the renewable CCS and upstream stars align](#). The publication is excellent, and compulsory

reading for those in the upstream oil and gas industry working towards energy transition and **NZE**. As is an emerging theme, Scope 3 emissions are critical, and CCS is critical to sequestration of Scope 3 emissions, but CCS is not feasible in many oil and gas basins globally.

- **The Week in Carbon Dioxide Removal:** On **July 22, 2022** Mr Wil Burns published his [Week 1 Edition](#). The **Week 1 Edition** is great and is commended to anyone interested in CCS / CCUS.

### Carbon Credits and Hydrogen Markets and Trading:

**REDD+ Framework:** On **July 22, 2022**, the good folk at **Sylvera** published [Our Carbon Credit Ratings Framework for REDD+ Projects Reducing Emissions from Deforestation and Forest Degradation Project \(REDD+\)](#). The purpose of the publication is to provide a bottom-up approach to assess and to produce accurate ratings and analyses for carbon projects from which carbon credits are to be sourced for the voluntary carbon market.

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

**Portugal to the Netherlands supply chain:** On **July 18, 2022**, the **Port of Rotterdam Authority** announced that **Engie, Shell New Energies NL BV, Anthony Veder** and **Vopak** had signed an agreement to study jointly the feasibility of producing and liquifying (in the precincts of the Sines Port) and transporting Green Hydrogen from the Sines Port in Portugal to the Port of Rotterdam in the Netherlands. Assuming that the feasibility of the Green Hydrogen supply chain is proved-up, the plan is for the first cargoes of liquified Green Hydrogen to be shipped from Sines Port to the Port of Rotterdam in 2027.

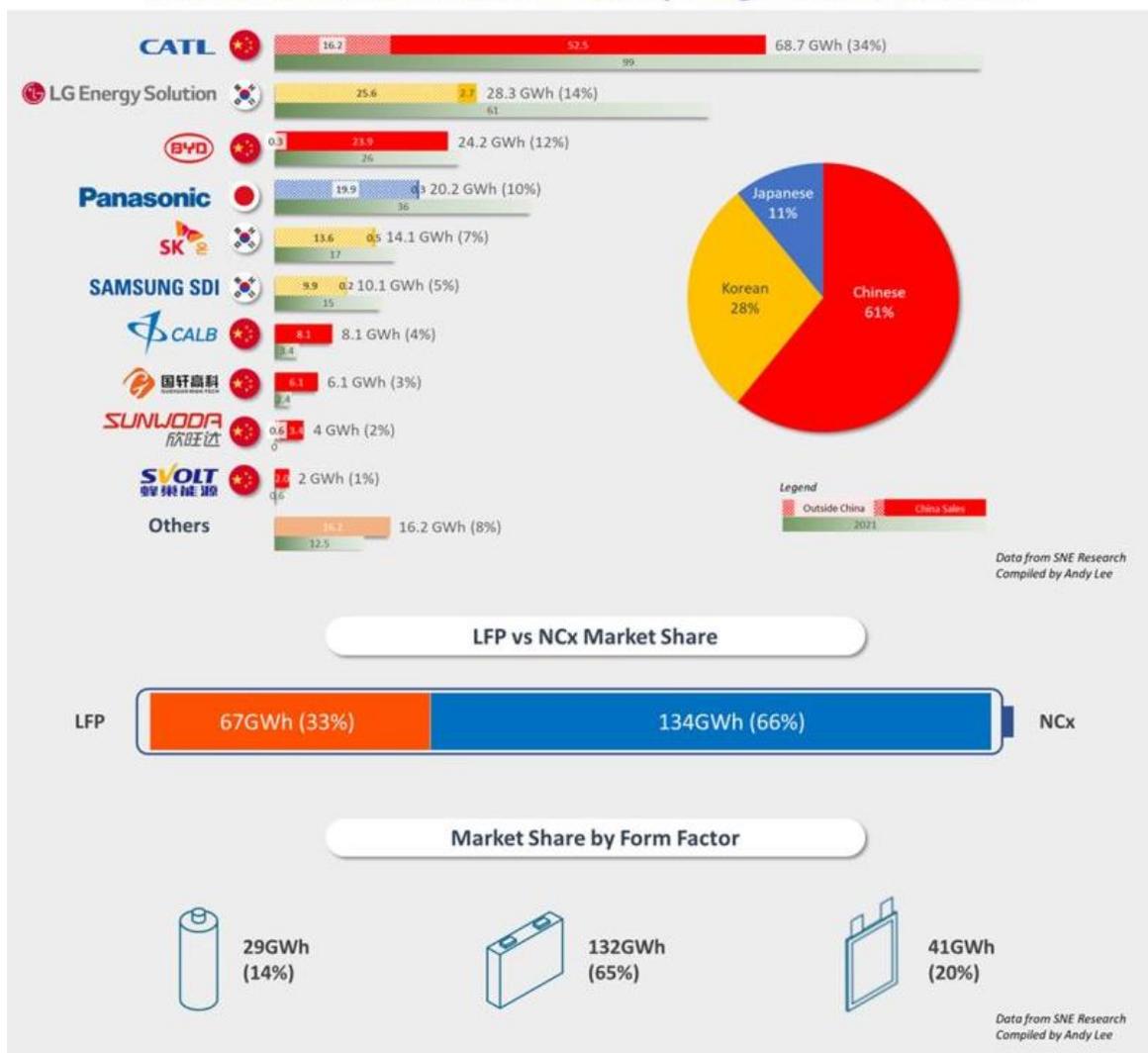
In passing, the author of Low Carbon Pulse notes that after a bumper news week covered by **Edition 43** of Low Carbon Pulse, there was a drop-off in reported activity and projects during the week July 18 to July 24, 2022.

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

- **CATL down Mexico way:** On **July 19, 2022**, it was reported widely that the world leading battery manufacturer, **Contemporary Amperex Technology Co (CATL)** is considering the development of two giga-factories to be located in Mexico – one in Ciudad Juarez, Chihuahua, and other in Saltillo, Coahuila. As reported, the two giga-factories will manufacture batteries for the **Ford Motor Company** and for **Tesla**.

On **July 19, 2022** the market share of battery manufacturers were released for the first half of 2022. The bar-chart below provides an overview of the market leaders, and their market shares.

#### 1H2022 Global EV Lithium-ion Battery Usage and Market Share



- **Envision and Spain have clear vision:** On **July 20, 2022**, it was reported widely that **Envision** and the **Government of Spain** had signed a Strategic Partnership Agreement (General Protocol for Collaboration) under which Envision and the Government are to work together to develop the first net-zero industrial cluster / park in Europe (**Net Zero Industrial Park**), with the first stage of the **Net Zero Industrial Park** including the development of a giga-factory for the manufacture of batteries for electric vehicles.

**NeuConnect achieves financial close:** On **July 21, 2022**, the **European Investment Bank (EIB)** [announced](#) that **NeuConnect** (the **730 km, 1.4 GW** subsea interconnector between Germany and the UK) had achieved financial close, with construction of **NeuConnect** to commence during 2022, and operation planned to commence in 2028. **NeuConnect** will traverse Dutch, German and UK waters, running from the converter station at **Fedderwarden**, close to **Bremerhaven, Germany** (operated by Tennet) to the converter station at the **Isle of Grain** (operated by the National Grid) in the **UK**. The converter stations will step-up and step-down the high voltage current to be conveyed by **NeuConnect**, a 525 kV high voltage direct current (HVDC) interconnector. The **EIB** is providing **€400 million** in debt funding for the **€2.8 billion project**. The **EIB** led a consortium of 20 lenders. The equity investors are reported to be Allianz Capital Partners, Kansai Electric Power Company and Meridiam ACP. The Japan Bank for International Corporation (JBIC) and the UK Infrastructure Bank policy banks provided funding along with the **EIB**.

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

- **H2 Green Steel and Hitachi Energy partner:** On **July 20, 2022**, it was reported widely that **H2 Green Steel** and **Hitachi Energy** are to work together to develop an industrial steel start-up plant located in **Boden, Sweden**. For these purposes, **H2 Green Steel** and **Hitachi Energy** have entered into a memorandum of understanding, under which they will work together with **Hitachi** being a customer for green steel, developing and optimising a supply / value chain to provide distribution channels for green steel, and providing the development and operation of power infrastructure.
- **Size and scale of greening iron and steel:** On **July 22, 2022**, the good folk at [rechargenews.com](https://rechargenews.com) published an excellent piece in the greening of iron and steel - "[Average EU steel plant would need a whopping 1.2 GW of electrolyzers and 4.5 GW of solar to decarbonise](#)". As the title of the piece suggests, the size and scale of the greening of the iron and steel industry should not be underestimated. The piece is informed by a report from **Hydrogen Europe** [Steel from Solar Energy: A Techno-Economic Assessment of Green Steel Manufacturing](#).
- **EC Technical Report on iron and steel:** In the first week of July, the author of Low Carbon Pulse read the **European Commission Joint Research Centre (JRC)** published **JRC Technical Report – Technologies to Decarbonise the EU Steel Industry**. The technical report is excellent, outlining the challenges with the decarbonisation of the iron and steel industry, the current size and scale of the iron and steel industry, the means of achieving decarbonisation (including hydrogen direct reduced iron, **CCS** and **CCUS**, and iron ore electrolysis) and the cost of achieving decarbonisation, all placed in the context of current levels of **GHG** emissions and commitment to reduce them.

The **JRC Technical Report** follows the publication of [The Sustainable STEEL Principles](#) (in late June, 2022), which comprises "a set of bank-led commitments to adopt a common measurement and disclosure framework to support the steel industry in forging a pathway to net-zero carbon emissions". There are five **STEEL Principles** reflecting: 1. **Standardised assessment**; 2. **Transparent reporting**; 3. **Enactment**; 4. **Engagement**; and 5. **Leadership**. The **STEEL Principles** were developed within **RMI** (Independent non-profit clean energy development consultant) and five working group banks, **Citi**, **ING**, **Societe Generale**, **Standard Chartered** and **UniCredit**.

It is estimated that greening the iron and steel industry in the **EU** will require **25.4 GWh** of renewable energy to produce sufficient Green Hydrogen. Stated another way, this is more than half of the increase in wind power capacity contemplated by the **EU REPowerEU** initiatives. As noted in a number of news items, the **EU** iron and steel sector is lobbying for **31 GW** of renewable electrical energy capacity to be developed and deployed by 2030.

### Wind round-up, on-shore and off-shore:

Other than as reported elsewhere in this **Edition 44** of Low Carbon Pulse (under **Americas** and **Europe and UK**), during the week July 18 to July 24, 2022, the author of Low Carbon Pulse did not come across any news items sufficiently material and significant to merit inclusion in this **Edition 44**.

### Solar and Sustainability (including NZE Waste):

- **Scatec and H1 Holdings gets to financial close of South African solar portfolio:** On **July 19, 2022**, [renews.biz](https://renews.biz) reported that **Scatec** (51% owner) and **H1 Holdings** (49% owner) had reached financial close in respect of their **540 MW photovoltaic solar** and **BESS** portfolio in **South Africa**: the portfolio to be developed comprises three photovoltaic wind farms and a **225 MW BESS**. The investment is the largest single project investment in the history of Scatec, with a total capex of USD 962 million, including USD 727 million of non-resource project finance debt. The debt providers include The Standard Bank Group as arranger.

On development the portfolio will be able to dispatch 150 MW under a 20 year power purchase agreement. The portfolio is being developed under the auspices of the [Risk Mitigation Independent Power Producer Procurement Programme](#).

- **RWE looks for hybrid off-shore fields:** On **July 19, 2022**, [offshorewind.biz](https://offshorewind.biz) reported that **RWE** is working with **SolarDuck** at its exclusive provider of off-shore floating photovoltaic solar as part of **RWE's** bid for the **Hollande Kust (west) VII** area (see **Edition 40** (Long Form Version) of Low Carbon Pulse for detail). See **Edition 16** of Low Carbon Pulse for reporting on **SolarDuck**.
- **Worthy of note:** While Low Carbon Pulse does not report on investment activity (including merger and acquisition activity) in the ordinary course, it does when a particular transaction is material and significant in a particular market. On **July 18, 2022**, the **Green Investment Group** [announced](#) that it has completed its investment in **Galehead Development**. **Galehead** is stated to have **5 GW** of photovoltaic solar and wind capacity, with co-located energy storage projects, and is developing a further **4 GW** of renewable energy generation (and storage) capacity.
- **HSBC Reports on Scope 3 emissions:** On **July 11, 2022**, **HSBC** published [Scope 3 emissions: The largest piece in the net zero jigsaw](#), authored by **Wai-Shin Chan** and **Polo Heung** on **Scope 3 emissions** (being those

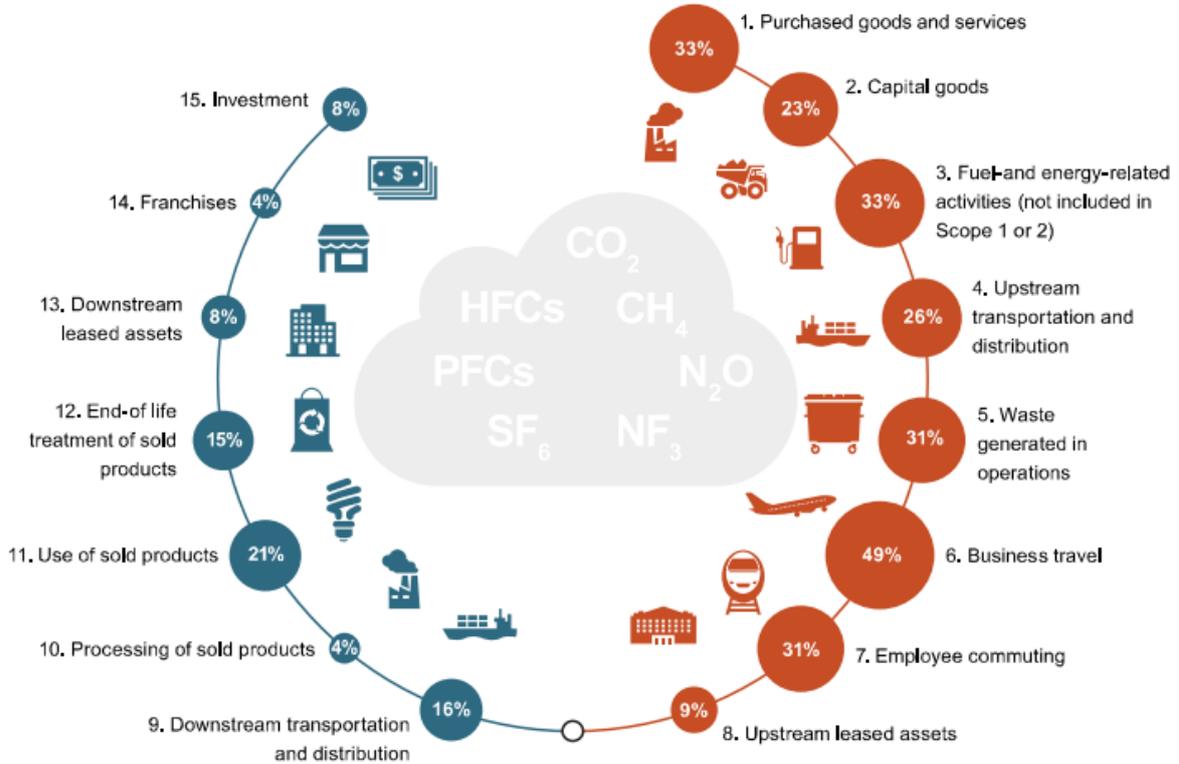
that "occur from sources owned or controlled by other entities in the value chain") – being emissions that provide most pieces in the 8 billion three dimensional jigsaw puzzle that we are seeking to finish by 2050. The following infographic gives a sense of the one dimensional jigsaw puzzle at it relates to Scope 3 emissions.

# Scope 3 emissions in a nutshell

## Scope 3 emissions come from a company's value chain ...

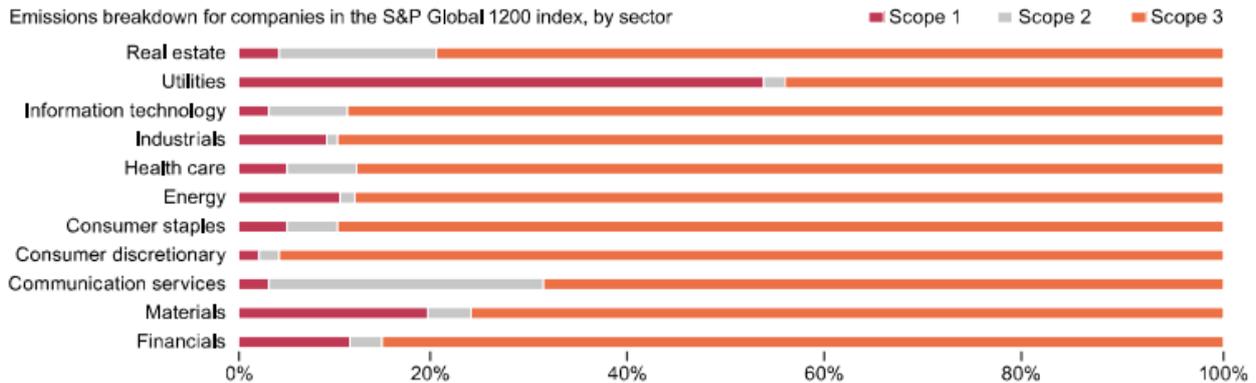
Disclosure rate by each of Scope 3's fifteen categories (FY2020, S&P Global 1200 index)

● Downstream activities | ● Upstream activities



## ... and often represent the greatest share of corporate-related emissions

Emissions breakdown for companies in the S&P Global 1200 index, by sector



Source: HSBC

- **What a life-time of fossil-fuel consumption looks like:** On **July 22, 2022**, the good folk at the [visualcapitalist.com](https://visualcapitalist.com) published **Fossil Fuels**. The infographic provides a perspective as to the mass of fossil fuels consumed by folk, on average:

# FOSSIL FUELS

## How Much Do You Consume in a Lifetime?

We consume fossil fuels every day for transportation, heating, and manufacturing, but over a lifetime of 80 years how much does the average American consume?

119.3 tonnes (131.5 tons)

### COAL

5.2m  
17.1ft

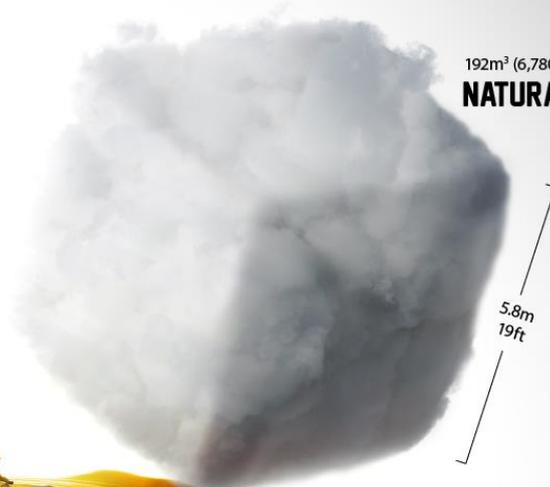


Coal is primarily used to generate electricity, but it is also used to manufacture steel, cement, and other industrial materials.

192m<sup>3</sup> (6,780 ft<sup>3</sup>)

### NATURAL GAS

5.8m  
19ft



The primary use for natural gas is heating and electricity generation, but it is also used as a raw material in the manufacturing of anhydrous ammonia fertilizer.

6.7m  
22ft

236.8 tonnes (261 tons)

### PETROLEUM PRODUCTS



Along with automotive fuels, petroleum products are also used to manufacture pharmaceuticals, textiles, plastics, and wax.

1.7m  
5.6ft

### AVG. PERSON



Methodology: To visualize the average American's fossil fuel consumption, we took petroleum product, coal, and natural gas yearly consumption per capita data and multiplied it by 80 to calculate a "lifetime consumption" figure. The natural gas figure was already in cubic meters/feet, however the figures for coal and petroleum were still a weight (kgs/lbs). Using the density of these materials (833kg/m<sup>3</sup> for bulk bituminous coal and 800kg/m<sup>3</sup> for petroleum products) and the weight of a lifetime's worth of consumption we calculated the total volume the materials would make up.



Source: National Mining Association, Worldometer

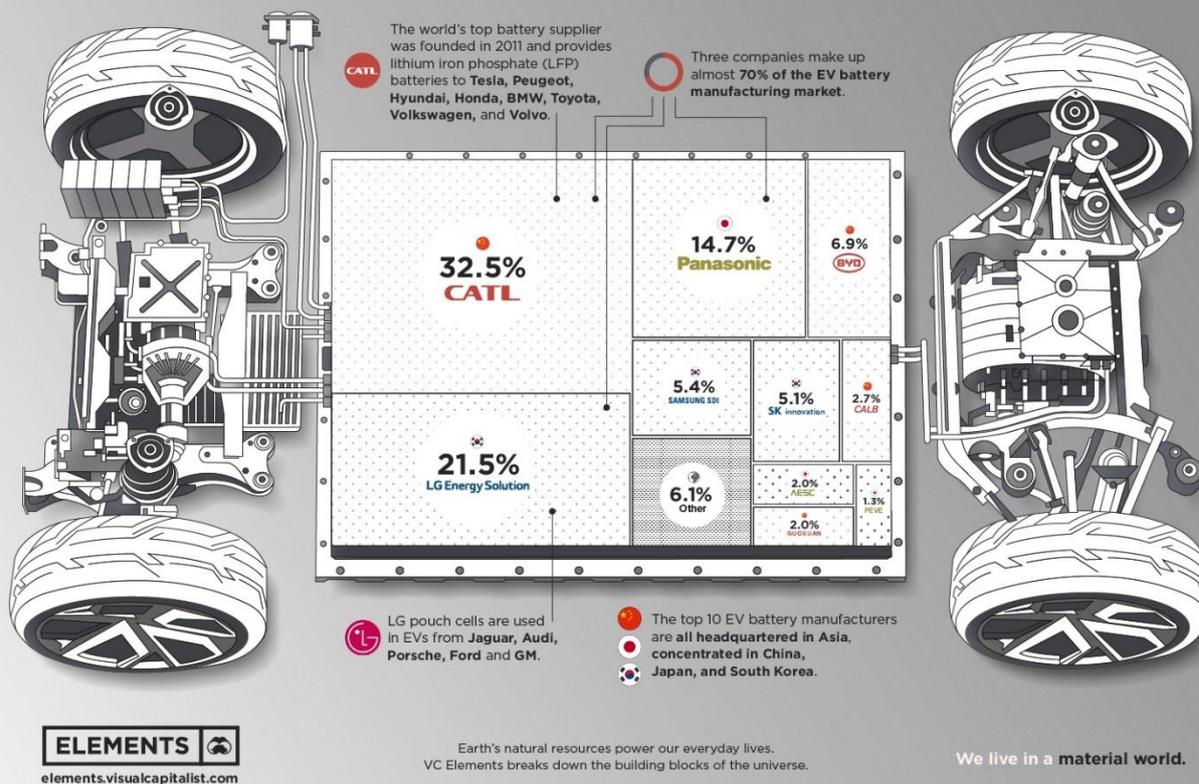
ELEMENTS.VISUALCAPITALIST.COM

## Land Mobility / Transport:

- **Buses and coaches:** While there continued to be news items in respect for orders for electric battery and fuel cell technology buses during the period July 18 to 24, 2022, for the purposes of this **Edition 44** of Low Carbon Pulse the author has decided not to include, so as to manage the length of this **Edition 44**.  
**Cars:** During the news cycle of this **Edition 44** of Low Carbon Pulse, the author has not come across any news items sufficiently material or significant to merit inclusion.
- **Battery, Fuel Cell and ICE Technology:**
  - **Batteries from biomass:** On **July 22, 2022**, [cnn.com](https://www.cnn.com) reported (under **Volkswagen-backed Northvolt to develop wood-based batteries for EVs**) that **Northvolt** is to work with **Stora Enso** (one of the largest forest owners in the world) to develop batteries (under a joint development agreement) with an anode made from lignin-based hard carbon: as described by **Northvolt** and **Stora Enso**, the lignin is "a plant-derived polymer found in the cell walls of dry-land plants". The feedstock for the plant-derived polymer will be lignin derived from managed forestry. The development of this technology is both exciting and timely.
  - **Another graphic on market share:** On **July 24, 2022**, the author of Low Carbon Pulse came across another excellent infographic from the good folk at [element.visualcapitalist.com](https://element.visualcapitalist.com) entitled **Big Battery The Top 10 EV Battery Manufacturers**.

# BIG BATTERY: THE TOP 10 EV BATTERY MANUFACTURERS

With an increased interest in EVs, the electric car battery market is now a \$27 billion per year business.



## • Industrial Vehicles and Trucks:

- **H2Accelerate new Whitepaper:** On July 18, 2022, H2Accelerate (see Edition 26 of Low Carbon Pulse for background) published **Whitepaper – The need for hydrogen trucking**. The Whitepaper is balanced and insightful, and as such well-worth a read.

While the author of Low Carbon Pulse finds it difficult to sift to the core of publications, there is one piece in the Whitepaper that is balanced and compelling:

*"There are three potential solutions to achieve zero emissions long-haul trucks, which result in zero CO2 tailpipe emissions: 1. Hydrogen fuel cell trucks, 2. Battery trucks with stationary charging, and 3. Battery trucks with catenary charging.*

*While biofuels, power-to-x type fuels, ... may be able to reduce CO2 emissions from trucking in the short term, these solutions do not mitigate the NOx and particulate emissions associated with internal combustion engines. Hydrogen fuel cell or battery-based solutions will therefore be required in the long term".*

- **Toyota plans to roll-out fuel-cell trucks by 2023:** On July 21, 2022, [cnbc.com](https://www.cnbc.com) reported that the Toyota Motor Company, with Hino Motors and Isuzu, and Commercial Japan Partnership Technologies Corporation, is working to roll-out light-duty fuel-cell technology trucks in Japan during 2023.
- **Daimler Truck eEonic production commences:** On July 22, 2022, Daimler Truck announced that production of the Mercedes Benz eEonic had commenced at its Wörth plant, the second battery electric truck from Daimler Truck, the first being the eActros. The eEonic is designed and built for inner-city municipal use.
- **Amazon delivering with Rivian:** On July 21, 2022, it was reported widely that Amazon had commenced the use of Rivian battery electric vehicles to make deliveries. The Rivian delivery vans are being used in Baltimore, Chicago, Phoenix and Seattle. By way of reminder: In 2019, Amazon committed to purchase 100,000 Rivian delivery vans.
- **Recharging and refuelling infrastructure:**
  - **H2 Energy Europe and Phillips 66 announce JV:** On July 20, 2022, [esqnews.com](https://www.esqnews.com) reported that H2 Energy Europe and Phillips 66 had established a 50:50 joint venture (Jet H2 Austria GmbH) to develop and to deploy a network of fuelling / refuelling stations across Austria, Denmark and Germany. Jet H2 Austria GmbH will combine the fuel retail expertise of Phillips 66 and the hydrogen expertise for H2 Energy, with the plan to roll-out around 250 fuelling / refuelling stations by the end of 2026.
  - **Element 2 and Exelby Services on the road:** On July 21, 2022, [H2-view.com](https://www.h2-view.com) reported that Element 2 and Exelby Services are to work together to develop and to deploy the UK's first public hydrogen fuelling / refuelling stations for heavy-goods vehicle / truck fleets. As reported, stations are to be deployed at Exelby Services' existing Coneygarth and Golden Fleece service station locations along the A1 (M) (in Yorkshire) and the M6 (in Cumbria) motorways / freeways.

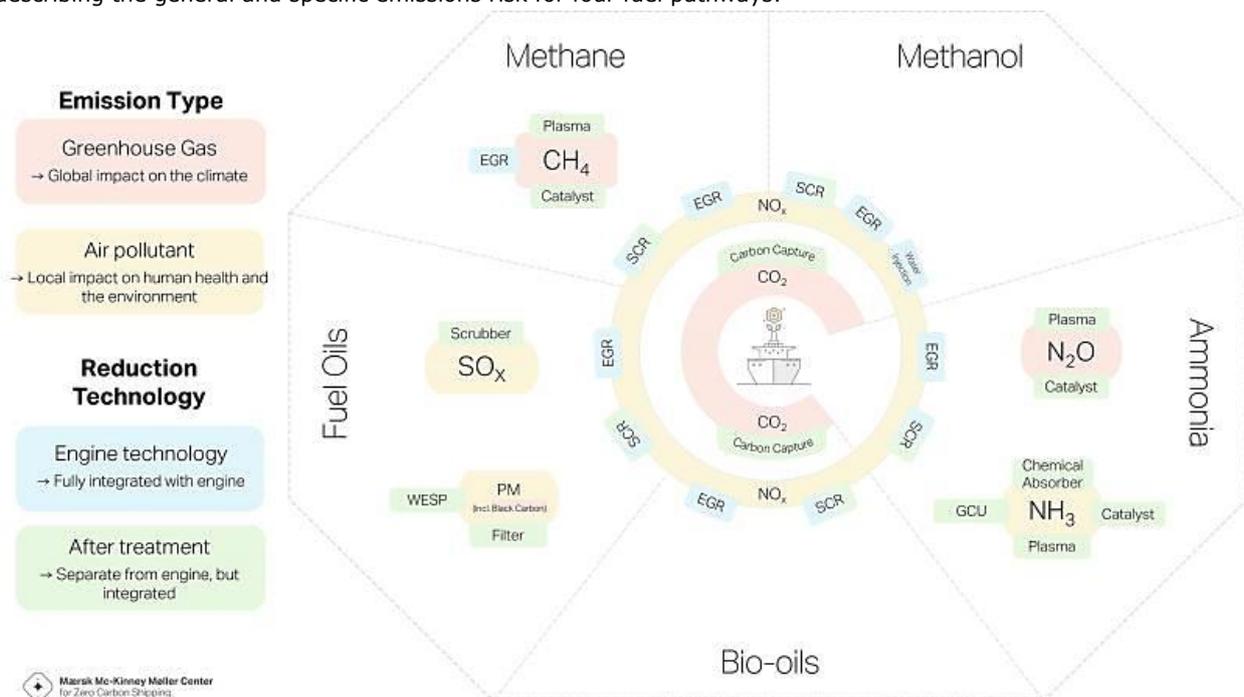
- **Trains: Stadler Flirts:** On **July 21, 2022**, [hydrogen-central.com](https://hydrogen-central.com) reported that **Stadler Rail** (Swiss headquartered manufacturer of rolling-stock) had unveiled its hydrogen powered and propelled **FLIRT H2** multiple unit for use for rail passenger transport in the US. In addition to reporting on the **FLIRT H2**, the report recounts that **Stadler Rail** has developed the battery electric powered and fuel cell train FLIRT train, the EURO9000 model, which is the most powerful hybrid locomotive in Europe.

## Ports Progress and Shipping Forecast:

**Ferries and other craft: Norled AS takes delivery of second Ro-Pax Ferry:** On **July 22, 2022**, **Sembcorp Marine Ltd** [announced](#) that its wholly owned subsidiary, **LMG Marine AS**, had delivered the **Dragsvik**, the second of three battery electric operated **roll-on-roll-off passenger (Ro-Pax) ferries** to **Norled AS**. The **Dragsvik** joins the **Hella** in the **Norled AS** fleet, both **Ro-Pax** ferries have an in service speed of 10 knots, powered and propelled by lithium-ion electric batteries, which are charged / recharged using electrical energy from renewable energy sources. The **Hella** started operating on the **Hella-Vangsnes-Dragsvik** run in May 2022.

### By way of reminder:

- **Editions 23** and **34** of Low Carbon Pulse reported that: "In late July 2021, the **MF Hydra** (styled as the first liquid hydrogen powered ferry) had been delivered. As reported, the **MF Hydra** is 82.4 metres in length, with capacity for 300 passengers and 80 motor cars. On February 2, 2022, it was reported widely that Ballard Power Systems is to supply two of its 200KW FCwave fuel cell modules to Norled A/S, the owner of the **MF Hydra**. As will be apparent from the previous news items, during 2022 the **MF Hydra** will start to serve the Hjelmeland-Skipavik-Nesvik route in Rogaland."
- **Edition 37** of Low Carbon Pulse reported that: "On **March 16, 2022**, Sembcorp Marine announced that it had completed the fabrication of the first of three zero-emission battery powered Ropax Ferries for Norled AS. The design of each of the Ropax Ferries has been optimised for the requirements of Norled A/S, with each ferry to be powered and propelled by lithium-ion batteries, and having a back-up battery-diesel hybrid mode. Each battery is to be charged / recharged using renewable electrical energy from hydroelectric sources."
- **Green Shipping: Wonderfully clear perspective from Maersk Mc-Kinney Moller Center for Zero Carbon (MMMCOC):** On **July 21, 2022**, the good folk at **MMMCOC** shared an info-graphic providing an Emissions Web, describing the general and specific emissions risk for four fuel pathways.



## Airports and Aviation:

- **DAC and carbon credits:** On **July 18, 2022**, **Airbus** [announced](#) that it and a number of major airlines (Air Canada, Air France-KLM, easyJet, International Airlines Group, LATAM Airlines Group, Lufthansa Group and Virgin Atlantic) had signed letter of intention to assess opportunities for the future supply of carbon removal credits that may arise from the use of direct air capture (DAC) technology. **DAC** and **Direct Air Capture and Storage (DACCS)** are regarded as high-potential technologies. Airbus explains that: "As the aviation industry cannot capture CO<sub>2</sub> emission releases into the atmosphere at source, a direct air capture and storage solution would allow the sector to extract the equivalent amount of emissions from its operations directly from the atmospheric air". The continued embrace of **SAF** and the prospective embrace of **DAC** and **DACCS** by the aviation sector, combined with continued development of hydrogen technology to power and to propel aircraft, illustrates that the aviation sector provides a large and ready market for **NZE** initiatives.
- **Airbus joins hydrogen infrastructure fund:** On **July 21, 2022**, **Airbus** [announced](#) that it had joined the "world's largest" hydrogen infrastructure investment fund (the **Hy24 Fund**). The move by **Airbus** underlines its commitment to the greening of aviation, and the attendant need for the development of infrastructure and supply from Green Hydrogen production facilities globally.

**By way of reminder:** To provide context and further understanding to the **Airbus** decision, **Edition 43** of **Low Carbon Pulse** reported as follows (under **Making Net-Zero Aviation Possible**): "

**By way of reminder:** On **July 14, 2022**, the **Mission Possible Partnership** (sponsored by Energy Transition Commission, RMI, We mean Business Coalition, and World Economic Forum, supported by knowledge partner McKinsey & Corporation), published [\*\*Making Net-Zero Aviation Possible – An industry-backed, 1.5°C aligned transition strategy.\*\*](#)

The publication notes that it builds on others as follows: [\*\*Waypoint 2050\*\*](#) by the **Air Transport Action Group** and its accompanying **ICF report [\*\*Fuelling Net Zero; Report on the Feasibility of a Long-Term Aspirational Goal for the International Civil Aviation CO2 Emission Reductions\*\*](#)** by the **International Civil Aviation Organization**; [\*\*Decarbonising Air Transport\*\*](#) by the **International Transport Forum** and the **Organisation for Economic Co-operation and Development**; [\*\*Horizon 2050: A Flight Plan for the Future of Sustainable Aviation\*\*](#) by the **Aerospace Industries Association** and **Accenture**; [\*\*2021 Aviation Climate Action Plan\*\*](#) by the **US Federal Aviation Administration**; [\*\*PtL Roadmap\*\*](#) by the **German Federal Government**; [\*\*Decarbonisation Road-Map\*\*](#) by **Sustainable Aviation for the United Kingdom**; and [\*\*Roadmap to Climate Neutral Aviation in Europe\*\*](#) by **Transport and Environment**. All are excellent publications, and links to all are included for ease of reference.

The [\*\*Making Net-Zero Aviation Possible – An industry-backed, 1.5°C aligned transition strategy\*\*](#) provides **11 critical insights**, as follows: **1.** Bringing aviation on a path to net-zero emissions by 2050 requires a doubling of historical fuel efficiency gains for aircraft, a rapid roll-out of **SAF**, and market development of novel propulsion aircraft by 2030; **2.** Aviation can comply with a sectoral 1.5°C carbon budget if all levers are pulled. Achieving net-zero by mid-century avoids cumulative **GHG** emissions of **25 to 26 Gt CO<sub>2</sub>-e**; **3.** The average annual investments between 2022 and 2050 to get global aviation to net zero is estimated at about USD 175 billion, about 95% of which would be required for fuel production and upstream assets; **4.** Current project pipelines for **SAF** production are insufficient and need to be scaled-up by a factor of 5 to 6 until 2030; **5.** The faster the cost decline in renewable electrical energy generation, the higher the expected market share of Power-to-Liquids (PtL). In contrast, if electrical energy costs do not drop as rapidly, biofuels are likely to dominate the market; **6.** Hydrogen and battery-electric aircraft can make global aviation more efficient starting in the late 2030s and supply up to a third of the final energy demand by 2050; **7.** By 2050, net-zero emission aviation could require an additional **5,850 TWh** of renewable electrical energy, **95 million metric tonnes** of hydrogen, and **12 EJ** of **sustainable biomass**; **8.** Aircraft fuel efficiency gains and operational measures could avoid over 15 Gt CO<sub>2</sub>-e of cumulative **GHG** emissions at zero or even negative abatement costs; **9.** Although average fuel costs are increasing in the net-zero scenarios, the cost of flying could remain stable, being counterbalanced by efficiency gains; **10.** Carbon dioxide removal (**CDR**) solutions are needed to remove residual emissions from renewable fuels, but are not a replacement for deep and rapid sector decarbonisation; and **11.** Policy makers must create a level playing field between fossil fuel jet fuel and **SAF**, industry collaboration across the value chain can ramp up **SAF** demand and supply, as well as trigger technological innovation.

- **AA purchases SAF from Gevo, Inc:** On **July 22, 2022**, [stattimes.com](#) reported that **American Airlines** and **Gevo, Inc.** (a biofuels production corporation) had signed an agreement under which **Gevo, Inc.** is to sell **500 million gallons** for **SAF** to **American Airlines** over five years.

## Key Contacts

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