Low Carbon Pulse - Edition 43

GLOBAL DEVELOPMENTS IN PROGRESS TOWARDS NET-ZERO EMISSIONS

Welcome to **Edition 43** of **Low Carbon Pulse** – sharing significant news on progress towards net-zero greenhouse gas (***GHG***) emissions (***NZE***) for the period from **Monday July 11**, **2022** to **Sunday July 17**, **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** to **42** 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 length, noting, however, that this **Edition 43** is around 11,500 words given the weight of news in the news-cycle.

Bigger news stories of the week, and the gem of the week:

- On **Tuesday July 12**, **2022**, the **European Union** (**EU**) committed **€1.8 billion** in funding support for **17 clean-tech projects** across the **EU**.

  On **Friday July 15**, **2022**, the **European Commission** (**EC**) approved **€5.4 billion** of funding support for an **EU**-wide hydrogen research and innovation project involving **15** of **27 Members States** of the **EU**. The approval from the **EC** permits **EU Member States** to provide up to **€5.4 billion** of funding support to **35 corporations** in one or more **Member State**, support that otherwise would have been proscribed as contrary to State Aid rules.

  The section of this **Edition 43** of Low Carbon Pulse headed **Europe and UK** (on pages 5 and 6) outlines the basis for, and the spread of, funding support across industry sectors and countries in the **EU**. The level of funding support and the spread of industry sectors is consistent with the **EU** policy settings, and is wonderful to see.
- During the last week the author of Low Carbon Pulse caught up on a back-log of reading. A key axiom re-emerged - all activities, and all goods and services, have a carbon impact / implication. While this is axiomatic and one knows this intuitively, it is helpful to be reminded, and to reflect on it, including that all activities are interconnected.

Publication very much worth a read:

On **July 14**, **2022**, the **Mission Impossible Partnership** published ***Making Net-Zero Aviation Possible – An industry-backed, 1.5℃ aligned transition strategy***. Whether your day job involves aviation or not, the publication is excellent and well-worth a read (see the ***Airports and Aviation*** section below on pages 18 and 19).

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:

- **Cities Climate Finance Leadership Alliance**: On **July 11**, **2022**, the ***Cities Climate Finance Leadership Alliance*** published ***Financing Net Zero Carbon Buildings – A background and scoping paper***. The publication provides an excellent overview of the dynamics of new building construction, driven by population growth, and increased urbanisation, and increased prosperity of a growing middle-class. The publication notes that achieving net-zero across the building sector will require changes to each element of every building, including materials, thermal envelopes, passive heating and cooling design, active heating and cooling, appliances, lighting and electrical energy generation. As might be expected, the publication notes that the: "*greatest opportunities lie in reducing embodied carbon in construction materials and clearer and more efficient heating and cooling, including through passive design*".
- **International Energy Agency** (***IEA***) publications:
  - On **July 12**, **2022**, the ***IEA*** published ***Securing Clean Energy Technology Supply Chains***. The publication was prepared for the **Sydney Energy Forum** that took place on **July 12** and **13**, **2022**. The forum was co-hosted by the **Australian Federal Government**, the **Business Council of Australia** and the ***IEA***.

    The publication is a pre-cursor to the 2023 edition of the ***IEA*** flagship publication, ***Energy Technology Perspectives***, which will provide a detailed analysis of what is needed to develop and to expand the required range of clean-energy technologies to achieve ***NZE***.
  - On **July 13**, **2022**, the ***IEA*** published its ***Oil Market Report July 2022***. While the oil and natural gas markets are not the focus of Low Carbon Pulse (sibling publications focus on those markets), this month's publication is well-worth a read, providing a good sense of the state of markets.
  - On **July 20 2022**, the ***IEA*** will publish its ***Electricity Market Report – July 2022 Update***, which will be covered in **Edition 44** of Low Carbon Pulse.
- **International Renewable Energy Agency** (***IRENA***) publications: On **July 13**, **2022**, ***IRENA*** published ***Renewable Power Costs in 2021*** and an ***Executive Summary***. The headlines from the publication are that: "*renewables are by far the cheapest form of power today*". As a result:

  "*Low cost renewables provide the most compelling pathway to decarbonisation in pursuit of climate-safe 1.5^{O}C target and the goals of the Paris Agreement*".

  For the author of Low Carbon Pulse, the following table provides a telling summary of the progress over the last ten years of so.

Table ES.1 Global weighted average total installed cost, capacity factor and levelised cost of electricity trends by technology, 2010 and 2021

	Total installed costs (2021 USD/kW)			Capacity factor (%)			Levelised cost of electricity (2021 USD/kWh)		
	2010	2021	Percent change	2010	2021	Percent change	2010	2021	Percent change
Bioenergy	2 714	2 353	-13%	72	68	-6%	0.078	0.067	-14%
Geothermal	2 714	3 991	47%	87	77	-11%	0.050	0.068	34%
Hydropower	1 315	2 135	62%	44	45	2%	0.039	0.048	24%
Solar PV	4 808	857	-82%	14	17	25%	0.417	0.048	-88%
CSP	9 422	9 091	-4%	30	80	167%	0.358	0.114	-68%
Onshore wind	2 042	1 325	-35%	27	39	44%	0.102	0.033	-68%
Offshore wind	4 876	2 858	-41%	38	39	3%	0.188	0.075	-60%

Source: ***IRENA***

While there is little to surprise in the publication, the publication provides a valuable up-to-date assessment of the levelized cost of electricity (**LCOE**) from renewable energy sources.

Climate change reported and explained:

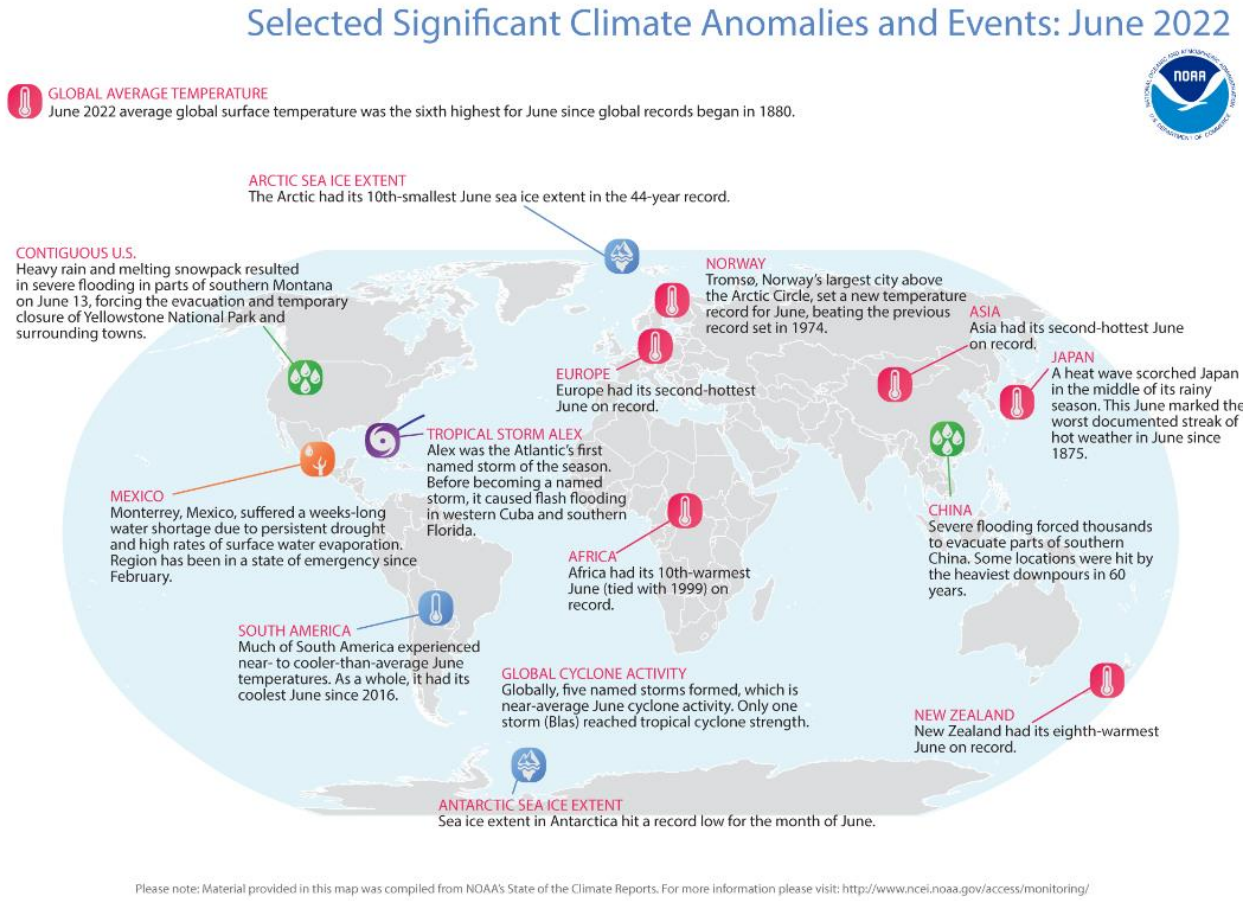
- **Extreme weather events**: Recent editions of Low Carbon Pulse have reported on the elevated levels of ***CO_2*** and ***CH_4*** in the climate system. **Edition 25** of Low Carbon Pulse reported on extreme weather events during the northern hemisphere summer of 2021.

  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**: 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*".



Middle East including GCC Countries:

UAE aligns with Linde: On **July 11**, **2022**, it was reported widely that the **UAE Ministry of Energy and Infrastructure** and **Linde** (one of the three global industrial gas giants) had signed a memorandum of understanding (**MOU**) under which the **UAE** and **Linde** are to work together to identify and to develop projects that will contribute to the achievement of the **Energy Strategy 2050** of the **Ministry of Energy and Infrastructure**.

UAE Undersecretary for Energy and Petroleum Affairs, **HE Sharif Al Olama** said: "*The UAE recognises Clean Energy as the main pillar of sustainability and a priority in the country. In line with our Net-Zero ambitions and the UAE Hydrogen Leadership roadmap, the UAE seeks to accelerate the adoption of the latest innovations to fact climate change and accelerate the energy transition. Partnerships with the private sector are key in helping us achieve this*".

Africa:

- **Green Hydrogen for sustainable growth and a low-carbon economy in Tunisia** (**h2Vert.TUN**) was launched published in late June 2022. The **h2Vert.TUN** was commissioned by the German Federal Ministry for Economic Cooperation and Development (**DMZ**). During the first couple of weeks of July, the author of Low Carbon Pulse spent time reading into **h2Vert.TUN**, and reading the publication ***Study on the opportunities of Power-to-X in Tunisia*** (published by **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH**). As with all **GIZ** publications, the publication is excellent, and well-worth a read, with supply and demand are assessed and dissected.
- **Egypt updates Nationally Determined Contribution**: In **June 2022**, it was reported widely that Egypt had submitted its updated **Nationally Determined Contribution** (**NDC**) for the purposes of the **Paris Agreement** – ***Egypt's First Updated Nationally Determined Contribution***. Over the last week or so, the author of Low Carbon Pulse has had the opportunity to read (and to re-read) the updated **NDC** for Egypt.

  Beyond the headlines, the **updated NDC** provides an excellent insight into the many factors that have to considered for the purposes of considering, and settling upon, an **NDC**. While these factors are known, they are different for each country. The **updated NDC** is well-worth a read because it covers all factors, critically, it covers what is needed, and the cost of what is needed, including the means, and the cost, of adaptation and mitigation.
- **Gabon and TotalEnergies partner**: On **July 13**, **2022**, **TotalEnergies** announced that it was to work together with **Compagnie des Bois du Gabon** to managed **600,000** hectares of forest in **Gabon**, to develop a new balance for these forest areas, by harvesting and local processing of sustainable wood and production of carbon credits through agroforestry, low-impact logging, and reforestation, so as to preserve natural forests.

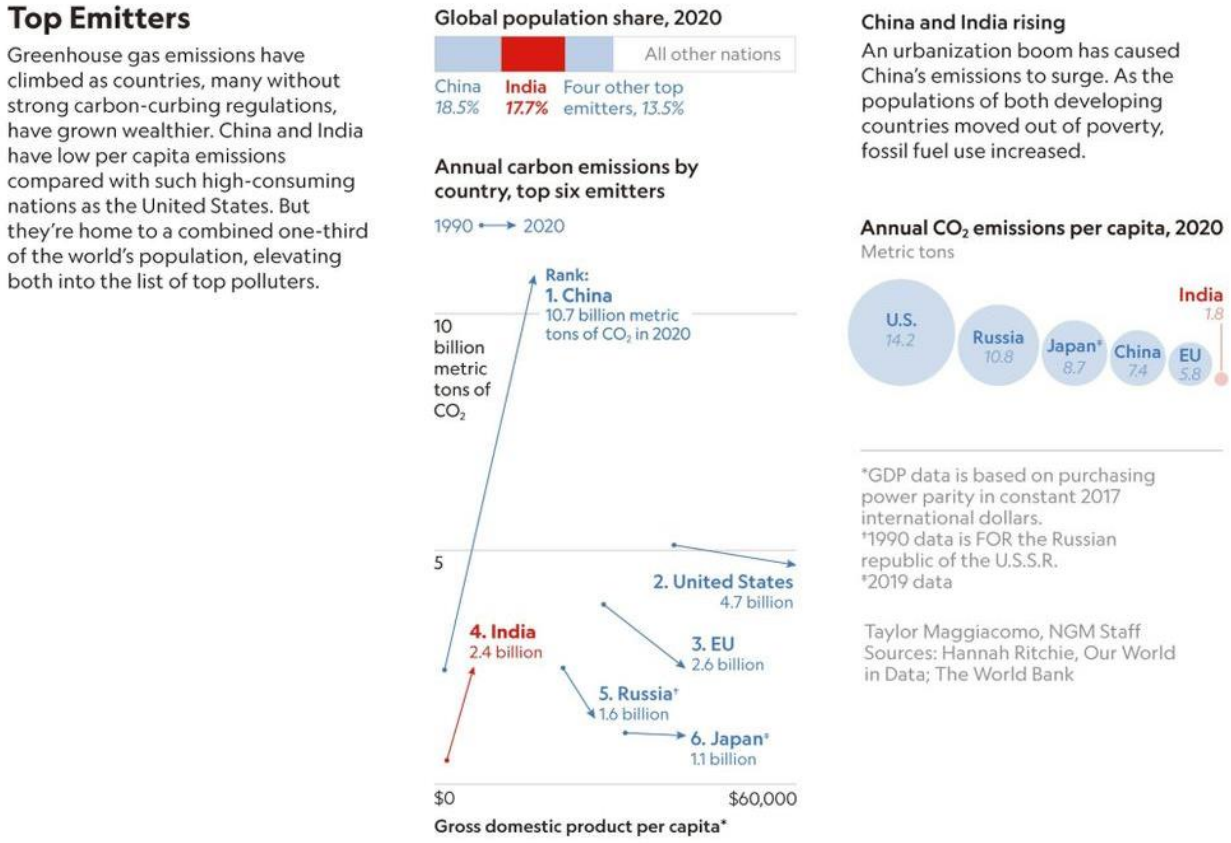
By way of reminder: **Edition** 42 of Low Carbon Pulse (under **Gabon to create 187 million carbon credits**) reported that: "**Gabon** (the second-most forested nation after Suriname) intends to create **187 million carbon credits**, almost half of which may be sold in voluntary carbon markets. As reported, the creation of **187 million carbon credits** (representing **187 million metric tonnes** of ***CO2*-e** emissions) would be the largest single creation of carbon credits to date. It is understood that the Government of Gabon is working with United Nations Framework Convention on Climate Change's **REDD+** mechanism to create the carbon credits".

India and Indonesia:

- **DNV and PIL blending project**: On **July 14**, **2022**, **DNV** announced that it was working with **Pipeline Infrastructure Limited** (**PIL**) on the integration of blending hydrogen with natural gas to be hauled across **PIL**'s gas network (including transmission, interconnectors, and spur-lines).

  In the context of hydrogen broadly, the **CEO** and **MD** of **PIL**, **Mr Akhil Mehrota**, said: "*The hydrogen industry in India is still in its infancy, and has a huge scope to supplement the growing energy needs while supporting the shift to a cleaner environment. Backed by strong governmental support for clean energy and significant renewable energy potential, India has the unique opportunity to become a major producer and exporter of hydrogen*".
- **National Geographic sets the scene**: On **July 14**, **2022**, **National Geographic Magazine** published ***India is reinventing its energy strategy – and the climate may depend on it***. The article is excellent, taking the reader through the everyday activities that need to be addressed by energy strategy, i.e., energy efficiency, the abundance of solar resources, abundance and the brilliance of the human capital resources, and the innovation that arises from them, all placed in the context of the continued growth and urbanisation of the population, and the attendant economic growth and prosperity, with the middle class in India expected to number 800 million people by 2030.

  As the author of Low Carbon Pulse has noted in many presentations (in response to questions about what might be the greatest challenge in progress to ***NZE***), the scale and scope of energy transition in India, and what needs to be done to decarbonise India, at the same time as the continued growth and urbanisation, and prosperity, of the population, is where the focus needs to be, both within India, and with the support from countries and economic blocs more progressed in ***GHG*** emission reduction than India. Even if the **EU** achieves ***NZE*** by 2050, or sooner, ***NZE*** in Europe will be for nought unless India is able to reduce its ***GHG*** emissions and progress to ***NZE***.



Source: National Geographic Magazine

The **National Geographic Magazine** article is well-worth a read. The scale and scope of the decarbonisation of India continues to be subject to comment. For example, on July 13, 2022, it was reported widely that if the pace of roll-out of renewable energy capacity continues at its current rate across India (recognising that the policy setting is to increase renewable energy capacity to 500 GW by 2030) this is likely to result in up to a 104 GW shortfall. This perspective is helpful, because it illustrates the need for policy settings that will ensure the achievement of the 500 GW target.

- **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*):

During the news-cycle covered by this **Edition 43** of Low Carbon Pulse no news items sufficiently material or significant arose to merit inclusion. This said, a number of new-items covered in this **Edition 43** of Low Carbon Pulse cover Japanese and South Korean corporations active around the globe.

STOP PRESS: On **July 18**, **2022**, asia.nikkei.com reported that leading Japanese steelmakers have unveiled a detailed timeline through fiscal 2030 for the development and deployment of investment of up to **USD 70 billion** to use **hydrogen** and **electric arc furnaces** (**EAF**) to decarbonise iron and steel production in Japan.

PRC and Russia:

- **Green Steel in *PRC***: On **July 14**, **2022**, greensteelworld.com published an article ***The positive reality of Chinese green steel*** providing a perspective on the ***GHG*** emissions arising from economic activity in the ***PRC***, including as a result of the production of iron and steel.

  The article notes that in 2021, the ***PRC*** produced around **1.033 billion metric tonnes** of iron and steel, representing around **53%** of total production globally, contributing around **15%** of ***GHG*** emissions arising from economic activity in the ***PRC***. The rate of growth in iron and steel production is said to be slowing, and the percentage of iron and steel production using scrap metal is stated as likely to increase. The level of production of iron and steel production is assessed as likely to stay at about **1 billion metric tonnes** a year, with increased use of scrap metal over time such that by 2060 around 70% of iron and steel produced will be sourced from scrap metal, up from around 20% in 2021.

  In addition to the dynamics outlined in the article, there is an increasing focus the need to decarbonise the iron and steel industry, recognising the importance of iron and steel to the economy of the ***PRC*** and the relatively short period of time available to reduce ***GHG*** emissions arising from the production of iron and steel. While the recycling of scrap metal is an element of this, so is the transition to electric arc furnace (**EAF**) technology, particularly for scrap metal, and the need to develop and to deploy low to no carbon technologies.

- ***PRC*** and ***IRENA*** - ***China's route to carbon neutrality: Perspectives and the role of renewables***: As noted in **Edition** 42 of Low Carbon Pulse, ***China's route to carbon neutrality: Perspectives and the role of renewables*** contains a **13-Point Plan** for the ***PRC*** (being recommendation for the ***PRC*** to consider and to explore), as the largest producer and consumer of energy, to reach **peak emissions by 2030**, and ***NZE*** **by 2060**.

  The **13-Point Plan** makes the following recommendations:

  1. Developing and implementing an integrated long-term energy plan; **2**. Maintaining energy efficiency improvements as a priority; **3**. Accelerating the phase-down of coal consumption; **4**. Accelerating the transition toward renewable power; **5**. Reforming power networks; **6**. Increasing the electrification of the end-use sector; **7**. Expanding the direct use of renewables, particularly biomass for energy purposes; **8**. Scaling up the production and use of hydrogen and synthetic fuels; **9**. Supporting cities as champions of low carbon living; **10**. Continuing progress in light-duty transport and broadening to heavy-duty and long-haul modes; **11**. Laying the groundwork for industrial sectors to achieve net-zero emissions; **12**. Continuing to support technology RD&D and broader systemic innovation; and **13**. Deepening global engagement. These recommendations (and sub-recommendations) are to be found on **pages 7** to **16** of the publication, and, along with the rest of the publication, are well-worth a read.

Europe and UK:

- **EU Innovation Fund awards**: On **July 12**, **2022**, the **European Union** awarded around **€1.8 billion** in funding support to **17** projects in the second round of large-scale funding for clean-tech projects under the **EU Innovation Fund** funding support initiative (and the third round of funding under the **EU Innovation Fund**).

  The **EU Innovation** Fund is intended to promote, and to scale-up, the development of renewable hydrogen projects.

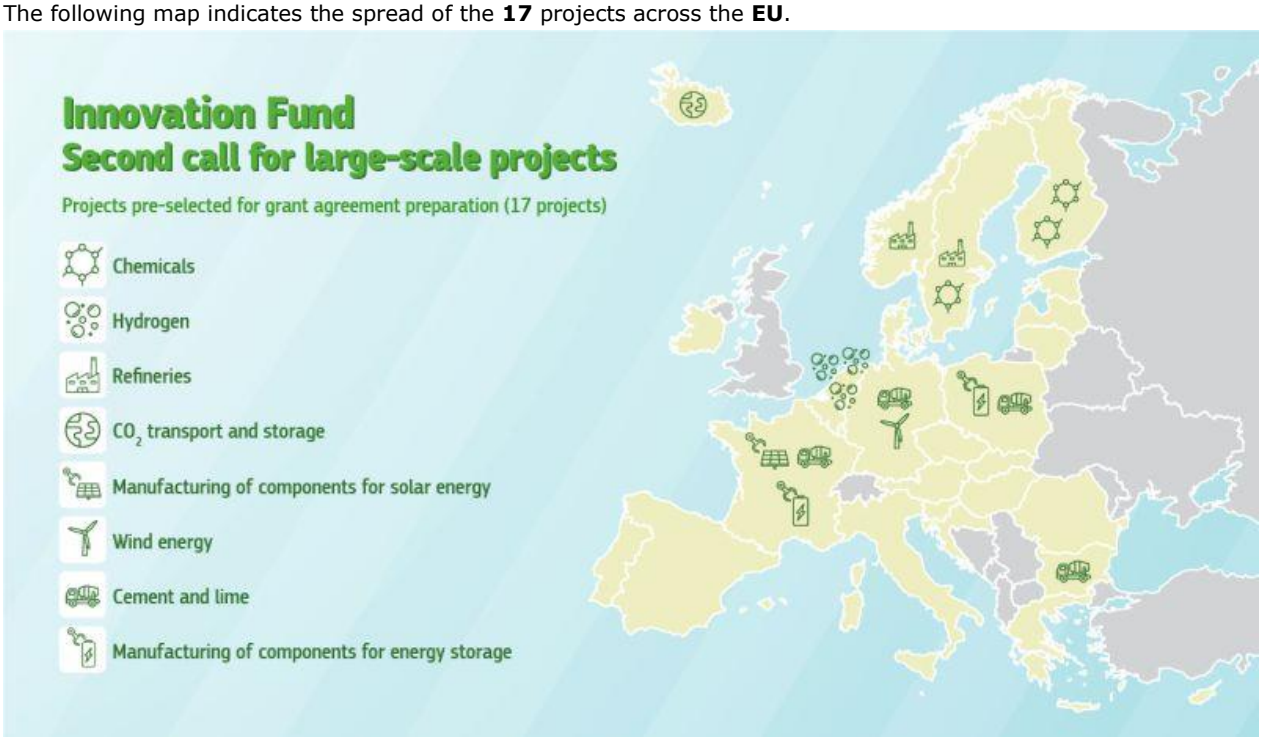
  As reported on the europa.eu.com link **12** of the **17** projects awarded funding support are for energy intensive projects: four cement projects, three chemical projects, three hydrogen projects, and two refinery projects. In addition, three projects providing clean tech solutions were awarded funding for energy storage and renewable energy. The final two projects involve an off-shore wind field with innovative solutions for wind turbines and the production of hydrogen, and a carbon capture and storage project deploying a highly scalable on-shore carbon capture mineral storage terminal (with an estimated storage capacity of 880 million metric tonnes)

  A link detailing each of the **17** projects successful in the second round of large-scale funding for clean tech projects is attached, and are summarised below.

  1. **Holland Hydrogen** - covered in **Edition** 42 of Low Carbon Pulse; **2**. **Project Pulse** - covered in previous editions of Low Carbon Pulse, and at ***E-fuels & feedstocks / Future Fuels & Feedstocks / Now Fuels & Feedstocks*** below; **3**. **Nordsee Two Offshore Windfield Innovation Project** - a 450 MW off-shore wind field and 4 MW electrolyser project; **4**. **FUREC** - covered in previous editions of Low Carbon Pulse and at ***E-fuels & feedstocks / Future Fuels & Feedstocks / Now Fuels & Feedstocks*** below; **5**. **ReLieVe** - ERAMET SA's battery recycling project; **6**. **Carbon2Business** - the Holcim Deutschland GmbH project deploying oxyfuel carbon capture at Holcim's **Lägerdorf**, **Germany**, cement plant; **7**. **BIOZIN** - the Biozin Holding AS, Bergene Holm AS and Norske Shell AS commercial-scale drop-in biofuel production facility in **Åmli**, **Norway**; **8**. **RISE** - a 2 GW a year photovoltaic solar module manufacturing plant developed by REC Solar Pte. Ltd; **9**. **ANRAV** - a full-chain CCS project linking ***CO_2*** capture facilities at **Denya**, **Bulgaria**, cement plant, though an on-shore and off-shore pipeline system with off-shore storage; **10**. **Coda Terminal** - covered in previous editions of Low Carbon Pulse and at ***Carbon Accounting, Carbon Capture and Carbon Capture and Use and CDR*** below; **11**. **Project Air** - first-of-a-kind large-scale methanol plant using CCS processes to derive ***CO_2*** from residue streams to derive renewable hydrogen and biogas to methanol, being developed by Fortum Sverige AB, Perstrop Oxo AB and Sydkraft AB; **12**. **HySkies** - a large-scale synthetic sustainable aviation fuel production facility in Sweden, being developed by Lanzatech Inc, Shell New Energies, and Vattenfall AB; **13**. **ELYGATOR** - a 200 MW electrolyser project in **Terneuzen**, **the Netherlands**, to produce up to **15,500 metric tonnes** of Green Hydrogen a year using its "flexible electrolyser dispatch" concept, being developed by Air Liquide NL; **14**. **NorthSTOR Plus** - covered in previous editions of Low Carbon Pulse, and at ***BESS and HESS (and energy storage)*** below; **15**. **IONFibre** - Metsa Spring OY will produce a new fibre substitute for existing textile fibres; **16**.

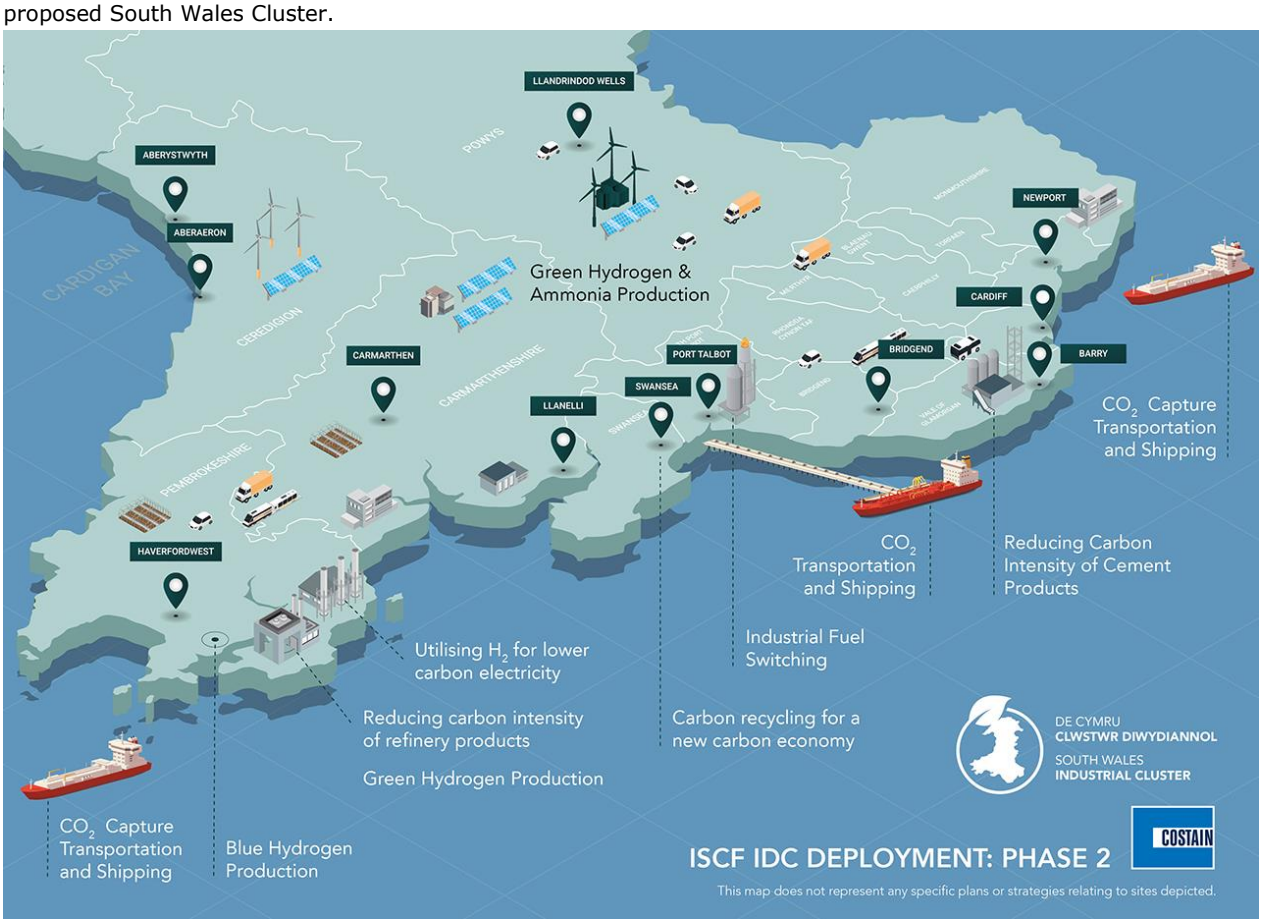
GO4ECOPLANT - is a Lafarge Cement SA project, creating an end-to-end ***CO_2*** capture and liquefaction facility at its **Kujaway**, **Poland**, cement plant, transporting the liquefied ***CO_2*** to **Gdansk**, **Poland**, for shipping into off-shore storage; and **17**. **CalCC** is a ***CO_2*** capture project, capturing exhaust gases arising during lime production, using Air Liquide Cryocap technology, and storing the ***CO_2***, being developed by Air Liquide France Industrie and Chaux et Dolomies du Boulonnais).

The following map indicates the spread of the **17** projects across the **EU**.



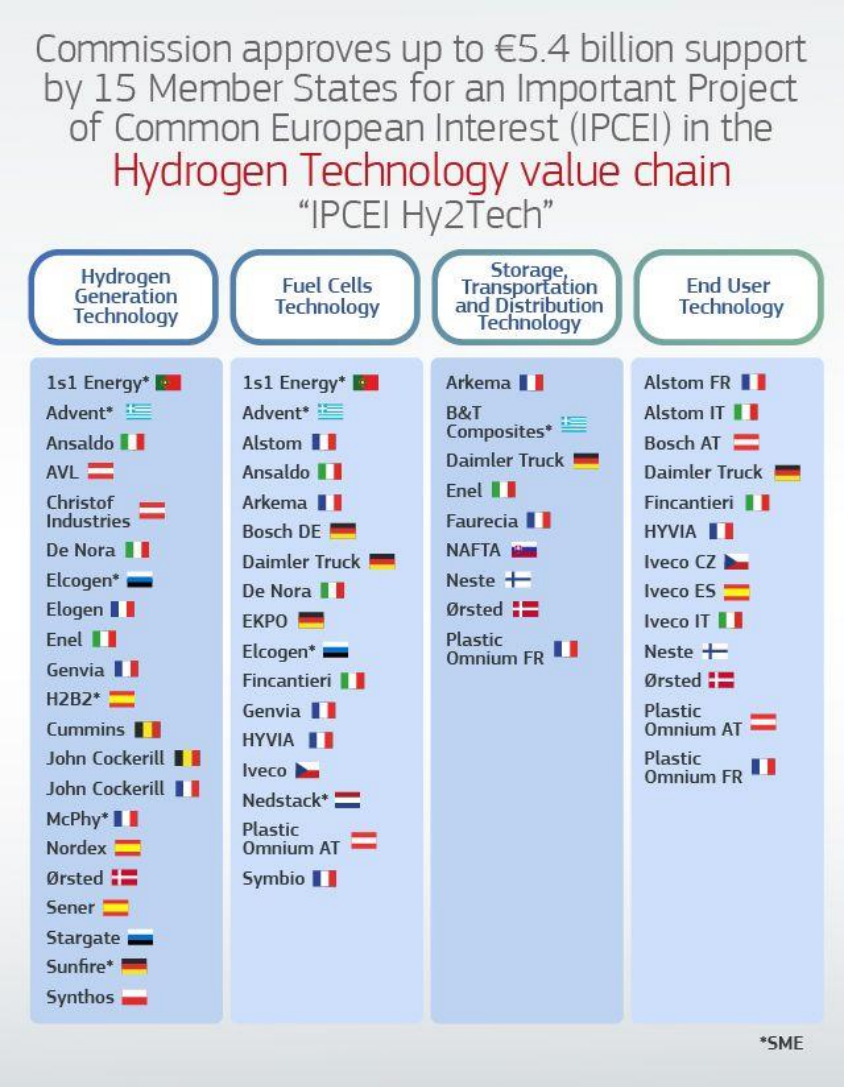
Source: European Commission

- **South Wales Cluster**: On **July 14**, **2022**, the following infographic was shared providing an overview of the proposed South Wales Cluster.



- **Best prepared countries to achieve net-zero emissions**: On **July 14**, **2022**, futurenetzero.com reported on new analysis by **Utility Bidder** (an energy advisory corporation) which found that the five best prepared countries to achieve net-zero emissions are Norway, the UK, Sweden, Denmark and Germany.
- **Important Project of Common European Interest across the EU**: On **July 15**, **2022** the **European Commission** (**EC**) approved a hydrogen research and innovation project, involving **15** of the **27 EU Member States** (Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, the Netherlands, Poland, Portugal, Slovakia and Spain) as an **Important Project of Common European Interest** (**IPCEI**) under the name "**IPCEI HyTech**", with 41 projects to be undertaken across the **EU**.

  The approval of a project as an **IPCEI** means that the project will have access to funding support (and regulatory benefits, critically in respect of State-Aid rules). The approval for the hydrogen research and innovation project as an **IPCEI** brings with it up to **€5.4 billion** in funding support for project development (to be provided by EU Member States), with an estimated **€8.8 billion** of accompanying private sector funding: effectively the **HyTech-programme** will promote investment of **€14.2 billion** across the **EU**.



Source: European Commission

For full coverage of this news item please click on the following link europa.eu, titled ***State Aid: Commission approves up to €5.4 billion of public support by fifteen Member States for an Important Project of Common European Interest in the hydrogen technology value chain***.

Americas:

- **Canada and US (and Russia) leads in trees gained (and lost)**: On **July 11**, **2022**, the **University of Maryland** and the **World Resources Institute** published ***The Global 2000-2020 Land Cover and Land Use Change Dataset Derived From the Landsat Archive: First Results***. The publication analyses data on tree growth and loss, concluding that the world gained nearly 131 million hectares of new growth from 2020 to 2020, with 36 countries gaining more trees than they lost.

  The critical point from the publication (and noted in Low Carbon Pulse previously) is that new growth does not make-up for the loss of carbon rich "old growth", with "old growth" areas providing ideal ecosystems for other flora and for fauna to thrive.

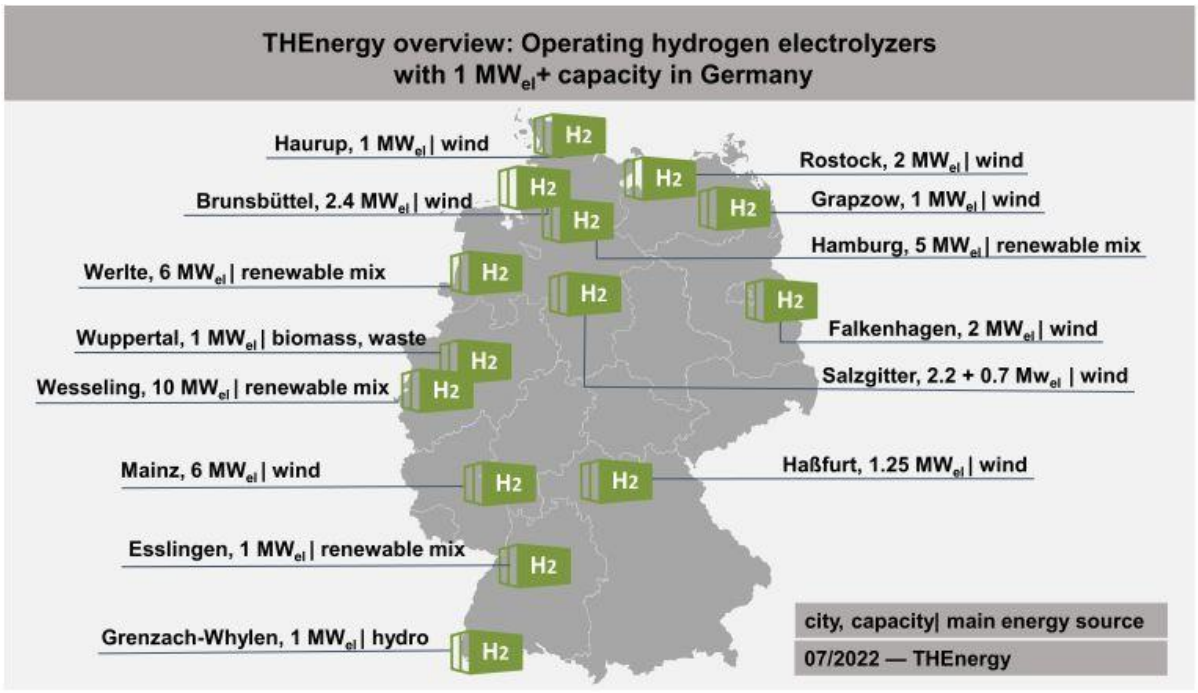
- **Methane reduction funding**: On **July 12**, **2022**, the US **Department of Energy** (**DOE**) announced its intent to issue a funding notice for research and development projects to help to reduce methane emissions across the US. The announcement notes that: "*After carbon dioxide, methane is the most abundant … GHG warming our planet, and methane emissions contribute significantly to the GHG intensity of natural gas*".

  The funding for methane reduction research and development supports the Biden Administration ***US Methane Emission Reduction Action Plan***, which in turn reflects the ***Global Methane Pledge*** to reduce methane emissions by 30% from 2020 levels by 2030.
- **Biden Administration opens USD 2.6 billion CCS funding**: On **July 13**, **2022**, the US **DOE** issued notices of intent to fund two programs to advance carbon capture demonstration projects, and to expand regional pipeline networks for the haulage of ***CO_2*** for storage permanently or for use.

  The two programs are the ***Carbon Capture Demonstration Projects Program*** and the ***Carbon Dioxide Transport / Front-End Engineering Design (FEED) Program***. As announced, the two programs build on the Biden Administration actions to catalyse investments in clean energy any industrial innovation and advance the goal of a net-zero ***GHG*** emissions economy by 2050.
- **Ceres and Clean Air Task Force report published**: On **July 14**, **2022**, the **Clean Air Task Force** announced the publication of ***Benchmarking Methane and other GHG Emissions of Oil and Natural Gas Production in the United States***. The publication provides analysis from **Ceres** and **Clean Air Task Force** benchmarking the relative emissions intensity and total reported carbon dioxide (***CO_2***), methane (***CH_4***) and nitrous oxide (***N_2O***) emissions of more than 300 US oil and gas producers. As noted in previous editions of Low Carbon Pulse, ***CO_2***, ***CH_4*** and ***N_2O*** (the three well-mixed ***GHG***s) emitted to the climate system are responsible for the majority of the increase in average global temperature, and as such climate change. The publication is well-worth a read.
- **Wyoming hydrogen roadmap**: During the first week of July the **Wyoming Energy Authority** and **Cheyenne-Laramie County Corporation for Economic Development** published the ***Roadmap to Build a Hydrogen Economy***. The principle purpose of the implementation of the Roadmap is for the State of Wyoming to commence the production of hydrogen, both Blue Hydrogen and Green Hydrogen. At the moment, the States of California, Louisiana and Texas lead the way in hydrogen production in the US.

France and Germany:

Electrolysers mapped: On **July 14**, **2022**, **Dr Thomas Hillig** posted a map of the Green Hydrogen electrolysers across Germany. 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:

- **Prime Minister Albanese sets out Australian stall**: On **July 12**, **2022**, the **Prime Minister of Australia**, **Mr Anthony Albanese** spoke at the **Sydney Energy Forum** (as noted above co-hosted by the **Australian Federal Government**, the **Business Council of Australia**, and ***IRENA***). **Prime Minister Albanese** stated that investment in clean energy projects had stalled previously, but there was a "*once-in-a-generation opportunity, and .. government policies are designed to seize that opportunity …*".
- **South Australia closing in on 100% renewable dispatch**: On **July 15**, **2022**, pv-magazine.com reported that the latest **OpenNEM** (National Energy Market) report shows that during financial year 1 July 2020 to 30 June 2021 more than two-thirds of the dispatched electrical energy in South Australia was from a renewable energy source. The report shows that on average 68.3% of the daily load across the State of South Australia were matched by electrical energy dispatched from renewable energy sources.

Blue and Green Carbon Initiatives and Biodiversity

- **Nature Based Solutions**: During the first week of July, the author of Low Carbon Pulse read 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.

  During the second week of July the author read the **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** publications is that it applies a broader perspective as to what is an **NBS**.
- **Land-Based Climate Solutions for the United States**: On **July 11**, **2022**, carbon.direct.com published an article that introduced ***Land-Based Climate Solutions for the United States*** by Messrs Robertson, Hamilton, Paustian and Smith. The article and the publication are both excellent, with a key point being that **NBS** are constrained by the time taken for carbon accrual in forest biomass and soils.
- **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:

- **Air Liquide *PRC* biomethane project**: On **July 12**, **2022**, **Air Liquide** (one of the three industrial gas giants globally) announced that its first **biomethane production facility** in the ***PRC*** is to open by the end of 2022. The **biomethane production facility** is located in **Huai'an City**, **Jiangsu Province**. **Air Liquide** has deep expertise across the **biomethane** supply / value chain, including deriving **biogas**, upgrading **biogas** to produce **biomethane**, and the storage and transportation of **biomethane** in compressed or liquified form. **Air Liquide** has **21 biomethane** projects globally.

  The **biomethane production facility** will derive **biogas** from agricultural and livestock waste from local farms and upgrade that **biogas** to produce **biomethane**. The digestate arising from deriving **biogas** will be processed and pasteurised to produce **bio-fertilisers** that will be used by local farms. It is apparent that **biomethane** production is highly prospective across the ***PRC***.
- **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** previous, 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_2***, and other compounds and elements, such that the gas hauled through the pipeline is ***CH_4***). **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_2 derived from a renewable source that is then combined with N to produce the compound NH_3;
- **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_2 (captured or derived) and H_2 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):

- **Wärtsilä and Clearway Energy Group contract for BESS**: On **July 11**, **2022**, **Wärtsilä** announced that it had contracted with **Clearway Energy Group** for the supply of a **500 MW** / **2 GW** portfolio of ***BESS***s. The portfolio of ***BESS***s will be located in the US States of **California** and **Hawaii**, and will include one of the world's largest combined ***BESS*** and photovoltaic solar facilities.
- **Northvolt energy storage system plant is a winner**: One of the successful applicants for funding support under **€1.8 billion** second round of large-scale funding for clean-tech projects under the **EU Innovation Fund** was the **Northvolt** (Swedish headquartered technology corporation) **NorthSTOR PLUS** energy storage system (**ESS**) assembly plant located in **Gdańsk**, **Poland**. The **ESS** will use **high-nickel**, **nickel-manganese-cobalt** (**NMC**) cells, having a higher energy density than other technologies.

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

- **DAC for Microsoft**: On **July 13**, **2022**, **Climeworks** announced that it had signed a 10 year carbon removal offtake agreement with **Microsoft Corporation**. (See **Editions** **25**, **26**, **36** and **41** for coverage of **Climeworks**.)

  By way of a reminder: **Edition 25** of Low Carbon Pulse (under **Microsoft founded but not forgetting**) noted that: "**Microsoft Corporation** was founded in 1975 by Mr Bill Gates and, the late, Mr Paul Allen. As noted in **Editions** **11** and **13** of Low Carbon Pulse, **Microsoft** is committed to achieving ***NZE*** by 2030 and, as noted in **Edition** **2** of Low Carbon Pulse, to removing from the climate system a mass of ***CO_2-e*** equal to the mass of ***GHG*** emissions that it has emitted since it was founded (zero historical ***GHG*** emissions or ***ZHE***) by 2050".
- **Coda Terminal funding support from European Innovation Fund**: On **July 12**, **2022**, **Carbfix** announced that it and **Dan-Unity** had been awarded grant funding support from the **EU Innovation Fund** for the development of the **Coda Terminal**, a large-scale ***CO_2*** transport and storage hub at **Straumsvik**, **Iceland**. As announced, operation of the **Coda Terminal** will commence in mid-2026, with full capacity of **3 million metric tonnes** a year of ***CO_2*** storage to be achieved during 2031. (See **Edition** **18** of Low Carbon Pulse for previous reporting.)
- **ExxonMobil – seven things to know about CCS**: On **July 13**, **2022**, **ExxonMobil** published ***Seven Things to know about carbon capture and storage technology***. **1**. **CCS** is proven technology; **2**. **CCS** could capture more than 90% of ***CO_2*** emissions; **3**. **CCS** is crucial to mitigating climate change; **4**. Natural gas with **CCS** ensures a more stable and cost-effective energy supply than renewables alone; **5**. There is more than one way to capture ***CO_2***; **6**. ***CO_2*** can be stored permanently and safely underground; and **7**. ExxonMobil is responsible for capturing 40% of all the ***CO_2*** captured to date.
- **Peterhead Carbon Capture project awards FEED contract**: On **July 13**, **2022**, **SSE plc** and **Equinor** announced that **Mitsubishi Heavy Industries**, **Tecnicas Reunides** and **Worley** had been appointed to deliver carbon capture

for the Peterhead Power Station. The **Peterhead Carbon Capture Project** is intended to capture **1.5 million metric tonnes** of ***CO_2*** a year. As announced and reported, the **Peterhead Carbon Capture Project** involves the replacement of carbon-intensive generation capacity with renewable electrical energy, with the ***CO_2*** capture units to be integrated into a power turbine with generating capacity of 910 MW.

- **Timor-Leste project awards FEED contract**: On **July 13**, **2022**, it was reported widely that **Santos Ltd** had appointed **Worley** to undertake **FEED** on the **Timor-Leste CCS** project.
- **CDR required, lots of it**: It is well-known and understood that **carbon dioxide removal** (**CDR**) is critical to achieving ***NZE*** by 2050 (see **Edition** 38 of Low Carbon Pulse) – **165 billion metric tonnes** (or **165 giga-tonnes**) of it. The rate of development of mechanical carbon capture and storage (**CCS**) solutions and direct air capture (**DAC**) solutions is increasing, and deployment of both **CCS** and **DAC** accelerating (with **CCS** having been used for around 50 years, with around **300 million metric tonnes** injected into storage, currently with around 30 projects globally injecting into storage around 40 million metric tonnes a year of ***CO_2***).

  In addition, there is increasing focus on nature based solutions (**NBS**), at the core of which is the absorption or sequestration of ***CO_2*** in biomass, i.e., negative ***GHG*** emission solutions. The need for negative GHG emission solutions is known, and the means of implementing the solution is known, in particular in areas of the world impacted by climate change, including Africa.
- On **July 14**, **2022**, illuminem.com published ***COP27 Why Africa Needs to be at the Forefront of the Climate Change Conversation***, by **Adetayo Adetuyi** and **Nnanke Williams**, which provides an overview of the current dynamics for Africa, critically, that while Africa is not responsible for the level of ***GHG*** emissions in the climate system, it is one of the most, if not the most, susceptible regions to the resulting climate change, and the resulting impact, including the adaptation and mitigation. The article is well-worth a read.

Carbon Credits and Hydrogen Markets and Trading:

- **Climate Impact X**: As reported previously, **Climate Impact X** is working with Nasdaq. (See **Editions** 18, 27 and 37 for coverage of **Climate Impact X**.). On **July 13**, **2022**, digfingroup.com included a feature on **Climate Impact X**, in particular the distribution channels to market for high-quality carbon credits, being an auction venue for new projects, a corporate sustainability market, and a spot market. As stated in the feature, the voluntary carbon market for carbon credits represents around **360 million metric tonnes** of ***CO_2-e*** emissions that have been captured and stored by mechanical means or sequestrated by natural means.

  As part of multi-facetted progress towards ***NZE***, carbon credits have a role to play, but to play a meaningful role ***CO_2-e*** emissions need to be removed at a rate of **10** to **20 billon metric tonnes** if ***NZE*** is to be achieved. In scaling-up **CDR** on this level of removal, carbon credits and the voluntary carbon markets need to scale-up. As carbon credits and the voluntary carbon markets scale up, to provide functioning distribution channels, investment in **CDR** projects can be expected to increase. As Head of Product, at Climate Impact X, Mr Tom Enger says: "*The carbon market needs integrated solutions, including money, project development, credit analysis, product design, contract definition, and platforms for trading, matching and settlement. It needs buyers and sellers*".

  Voluntary carbon markets allow buyers to purchase carbon credits that match the ***GHG*** emissions arising from the activities undertaken by the buyer. A carbon credit arises from an activity or project that avoids, reduces or removes ***CO_2-e*** emissions. From a policy setting perspective, the idea is that over time the cost of the carbon credits increases forcing the buyers of carbon credits to decarbonise the activities that give rise to ***CO_2-e*** emissions. As such the carbon markets do not effect decarbonisation, but with appropriate policy settings can buy time and overtime drive decarbonisation.
- **Climate Impact X and Puro.earth align**: As reported previously, in **June 2022**, **Climate Impact X** announced that it and **Puro.earth** are to work together to address the growing imbalance in supply and demand in the voluntary carbon markets, by making it easier for businesses and financial institutions globally to access new and emerging carbon credit types. The CEO of **Climate Impact X**, Mr Mikkel Larsen, said that: "*Our partnership with Puro.earth helps to unlock new supply by sending a clear demand signal. It is a unique collaboration that will help drive the creation of a science-aligned solution that reduces frictions for businesses and institutions looking to incorporate a blend of curated credits in their carbon portfolios*". (See **Edition** 19 of Low Carbon Pulse for previous coverage of **Puro.earth**.)
- **Carbon markets can drive revenue**: On **July 13**, **2022**, the **Environmental Defense Fund** published an article entitled ***Carbon Markets Can Drive Revenue, Ambition for Tropical Forest Countries, New Studies Show***. The article references publication ***Financial Opportunities for Brazil form reducing Deforestation in the Amazon***. Both the article and the publication are worth a read, providing an outline of how opportunities may be realised, in particular in the context of voluntary carbon markets.

  This follows the new items covered in **Edition 42** of Low Carbon Pulse (under **Impact of VCM on Tropical Rainforests**) as follows: "During the first week of **July**, **2022**, an **Environmental Defense Fund** funded study was published ***Impact of the Voluntary Carbon Market on Tropical Forest Countries – Implications for Corresponding Adjustments***. The study estimates the capacity of the tropical rain forests to match the demand for carbon credits. The study uses three scenarios for carbon credit demand covering two periods – 2021 to 2030 and 2021 to 2050. The study is excellent and well-worth a read".

  The perspective of Climate Impact X is supported by these articles and studies.
- **Plastic Credits**: On **July 12**, **2022**, the author of Low Carbon Pulse was introduced to the concept of a plastic credit in a paper from the good-folk at **South Pole**. At the outset, a plastic credit is not a carbon credit (because there is no carbon to off-set), rather a plastic credit is a credit to which value may be attached in the context of an appropriate policy setting framework.

  The premise of a plastic credit is that there is environmental benefit / value in the collection of plastic that is at large in the climate system, and a means of encouraging collection may be the issue of plastic credits which will have value, and which will support projects to collect plastic that is at large.

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

- **Neste Porvoo refinery funding support from the EU Innovation Fund**: On **July 12**, **2022**, **Neste** announced that it had been awarded grant funding from the **EU Innovation Fund** for the development of chemical recycling facilities at its Porvoo refinery – **Project Pulse** (see **Editions 31** and **39** of Low Carbon Pulse for previous coverage). The recycling facilities will pre-treat and upgrade plastic waste, with the resulting fluid being used to produce Future Fuels or as feedstock for chemicals.
- **Sunfire on target**: On **July 13**, **2022**, **Sunfire GmbH** announced that it was the "first" Green Hydrogen corporation headquartered in the **EU** to receive funding from the **USD 2 billion Climate Pledge Fund** established by the good folk at **Amazon**.

  The CEO of Sunfire, Mr Nils Aldag, said:

  "*We are proud to welcome on to the most successful companies in the world as our investor. It's great recognition to the first EU-based green hydrogen company to receive investment from Amazon*".
- **Shell invests in plastic circular economy**: On **July 13**, **2022**, **Shell** announced its ambition to recycle more than **1 million metric tonnes** a year of **plastic waste** at its chemical plants **by 2025**. For these purposes, **Shell** is to invest to develop a **new pyrolysis oil upgrader** at the **Shell Chemicals Park** at Moerdijk, the Netherlands.

  The **new pyrolysis oil upgrader** will improve the quality of the **pyrolysis oil**, being the liquid derived from the chemical recycling if plastic waste. The **pyrolysis oil** is suitable for the production of new chemical products at the facilities of **Shell** in the Netherlands and Germany.

  As announced, the **new pyrolysis oil upgrader** will have capacity to produce **50,000 metric tonnes** of **pyrolysis oil** a year. With other international energy corporations, **Shell** is progressing towards convergence in the recycling of plastics – long hypothesised, now with us, with chemical recycling of plastic waste (in contrast with mechanical recycling), increasingly seen as economic and sustainable.
- **HyCC launches Project H2era project**: On **July 13**, **2022**, it was reported widely that the **Hydrogen Chemistry Company** (**HyCC**) launched **Project H2era**, a **500 MW Green Hydrogen** production facility, to be developed within the Port of Amsterdam. **HyCC** is a joint venture between **Green Investment Group** and **Nobian**.

  In addition to **Project H2era**, **HyCC** is to develop **Project H2ermes** at the Port of Amsterdam in combination with the Port and Tata Steel. (See **Edition 32** of Low Carbon Pulse for earlier reporting on the **Project H2era project**.)
- **Waste-to-*SAF***: On **July 14**, **2022** it was reported widely that a **GBP 1 billion Lighthouse Green Fuels** plant is planned to be developed in the North East of England, as part of the **Net Zero Teesside** industrial cluster, itself part of the **East Coast Cluster**.

  The **Lighthouse Green Fuels** project is being developed by **alfanar** (Saudi Arabian engineering group).

  The Chief Investment Officer of **alfanar** said:

  "*With the third largest aviation network on the world, and with one of the world's largest potential off-shore CO2 stores, the UK has the industrial and geological advantages to become a global leader in developing green aviation fuel with the lowest possible emissions using CCS technology. This is why we want to build our first ever SAF plant in the UK by 2027 and two further plants by 2035*".

  The **Lighthouse Green Fuels** project entered front end engineering design (**FEED**) during June 2022.
- **Project Air**: On **July 13**, **2022**, **Uniper** announced that **Project Air**, a project involving **Fortum**, **Perstorp** and **Uniper** had been successful in its application in the second round of large-scale funding for clean-tech projects under the **EU Innovation Fund**. **Project Air** seeks to move the chemical industry from the use of raw fossil fuels and feedstocks to the use of bio-based fuels and feedstocks, to allow the production of chemicals without the use of fossil fuels and feedstocks.

  For these purposes, **Project Air** uses existing technology innovatively, with large-scale industrial application, to produce sustainable methanol, using ***CO_2*** (and other residual emissions) from **Perstrop**'s operations and biogas derived from new facilities, and an electrolyser facility, with the water for electrolysis sourced from wastewater, and the electrical energy to power the electrolysers from renewable sources.
- **Enagas fully committed to hydrogen**: On **July 13**, **2022**, the Hydrogen Economist (pemedianetwork.com) reported that **Enagas** (Spanish natural gas network operator) has earmarked **€800 million** for the development of hydrogen projects by 2030 as part of its plan to position itself as a "reference hydrogen network operator" by 2030.
- **RWE FUREC waste-to-H2 project** gets **EU** funding support: On **July 14**, **2022**, **RWE** announced that it had been successful in its application in the second round of large-scale funding for clean-tech projects under the **EU Innovation Fund** in respect of its **Fuse Reuse Recycle** (**FUREC**) project.

  The **FUREC** project involves the production for renewable hydrogen from waste arising to displace the use of natural gas. The **FUREC** project is being developed in in **Limburg**, the **Netherlands**, and will process and treat residual waste into raw material pellets, with the pellets converted in renewable hydrogen **Limburg**'s Chemelot industrial park, with the renewable hydrogen to be supplied to OCI for use in its fertiliser production plants.

  The **FUREC** project is designed to produce up to **54,000 metric tonnes** of renewable hydrogen a year.
- **Green Hydrogen Taskforce**: On **July 14**, **2022**, ammoniaenergy.org published an article entitled ***New roadmap for ammonia imports into Germany***. The article touches on the 10 point plan (see **Edition 41** of Low Carbon Pulse). The article reminds us of the 10 point plan as follows:
- **Hy2Gen plans €500 million Green Hydrogen project**: On **July 15**, **2022**, fuelcellsworks.com reported that **Hy2Gen** (headquartered in Wiesbaden, Germany and specialising in the development of future fuel facilities) plans to develop **Green Hydrogen** and ***SAF* production facilities**, named the **JANGADA project**, with the intention for the **JANGADA project** to be in operation by 2027. The **JANGADA project** is to be located in the municipality of Jänschwalde, Germany, with **Hy2Gen** working with **Euromovement Industriepark GmbH**.

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

- **Panasonic Energy Co., Ltd** (the battery business division of the Japanese technology conglomerate) and the **Governor of Kansas**, **Ms Laura Kelly** had announced jointly that the US State of Kansas had approved the application from **Panasonic Energy** under the State's Attracting Powerful Economic Expansion incentive scheme.

  With the approval of the application, it appears likely that **De Soto**, **Kansas** will be the location for a **USD 4 billion giga-factory** to manufacture **lithium-ion batteries** for use in the Battery Electric Vehicle (**BEV**) market.

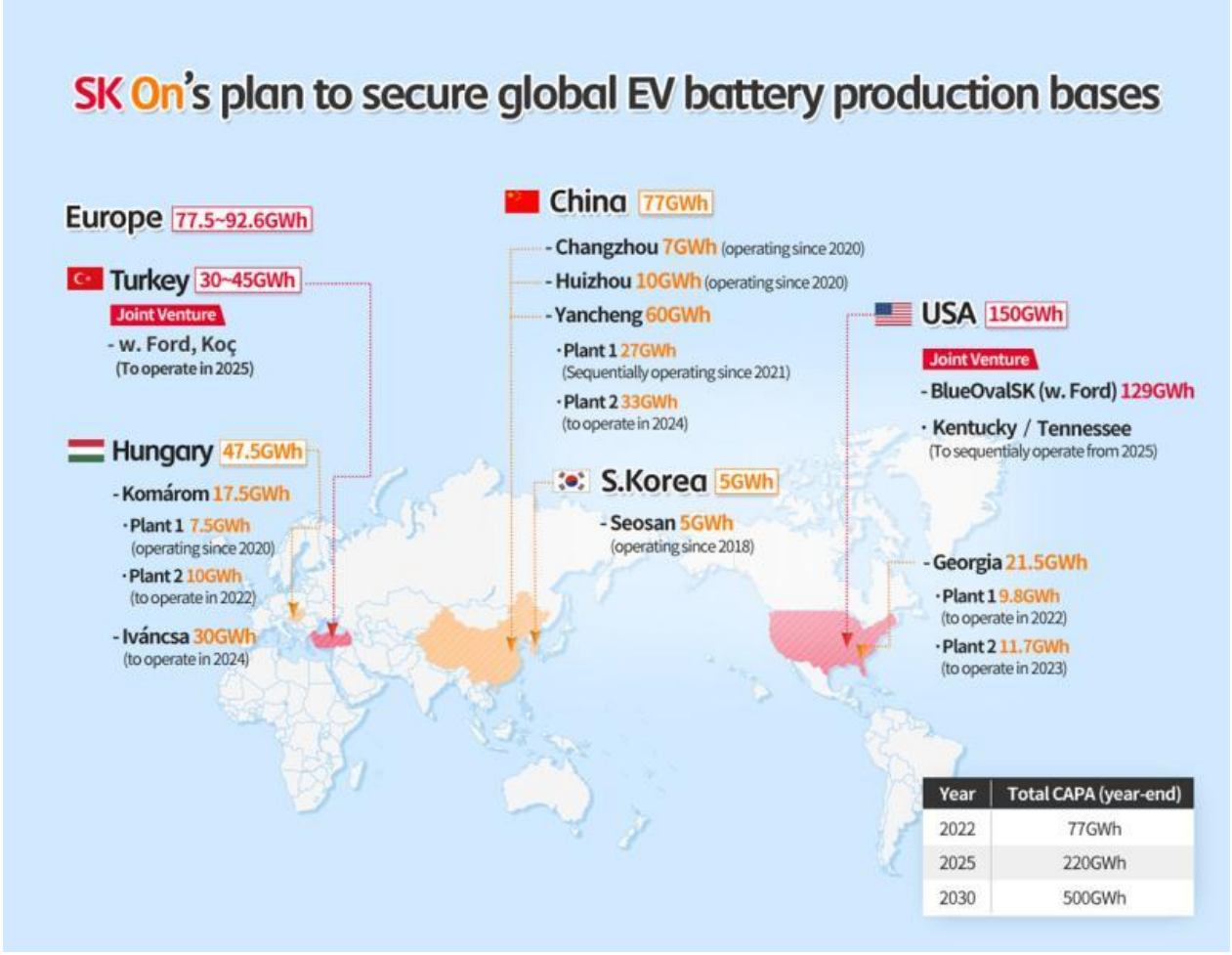
  President and CEO of Panasonic Energy, Mr Kazup Tadanobu, said:

  "*With the increased electrification of the automotive market, expanding battery production to the US is critical to help meet demand*".

- **SK On and Ford good to go**: On **July 13**, **2022**, it was reported widely **Ford Motor Company** and **SK On** had progressed to establish **BlueOval SK**.

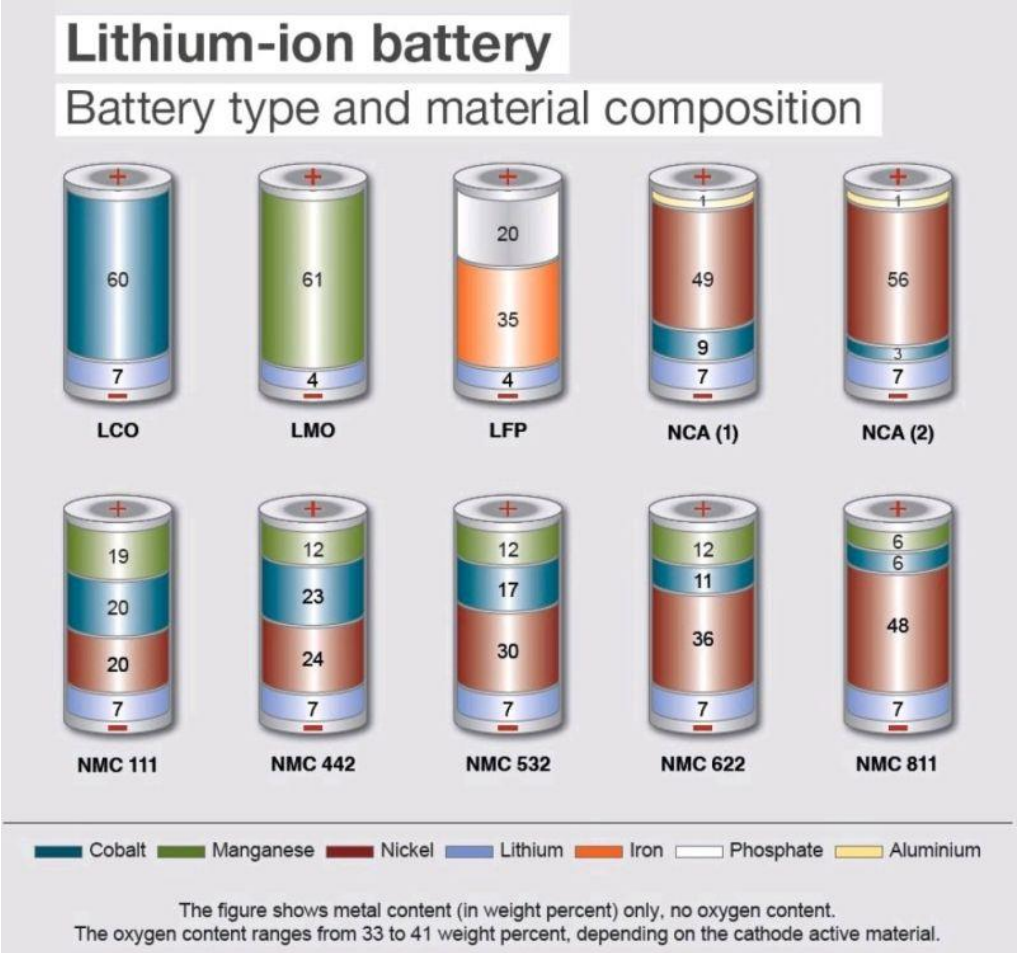
  BlueOval SK, currently headquartered in the US State of Georgia, is to be headquartered in **BlueOval City** which Ford is developing in **Stanton**, **Tennessee**, at which **BlueOval SK**'s **Tennessee EV battery giga-factory** will be developed, with **two further giga-factories** planned for the **US State of Kentucky**.

  To regular readers of Low Carbon Pulse will know, **SK** is a leading corporation across all aspects of the energy transition. In respect of **EV** batteries, the map-info-graphic provides a snap-shot of the activities of **SK On** globally.



Source: Batteriesnews.com

- **A infographic for this age**: On **July 15**, **2022**, the good folk at the **visualcapitalist** (elements.visualcapitalist.com) published one of their sensational infographic providing a side by side comparison of lithium-ion battery and fuel-cell technologies.
- **And another ...** : On **July 15**, **2022**, the author came across the following infographic from **Thermofisher** indicating the critical materials (metals and minerals) used in difference battery technologies.



Source: Thermofisher

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

- **Lower cases align**: On **July 11**, **2022**, **bp** announced that it is to work with **thyssenkrupp** to advance the decarbonisation of iron and steel production. As announced, **bp** and **thyssenkrupp** are to work together to promote jointly policy setting to support the development of low carbon hydrogen (both Blue and Green Hydrogen) production and green steel production across Europe.

  The alignment of **bp** and **thyssenkrupp** is framed in a memorandum of understanding signed by each of them on July 11, 2022. The production of iron and steel by **thyssenkrupp** gives rise to around 2.5% of ***GHG*** emissions arising from economic activity across Germany. Overtime **thyssenkrupp** (and other producers of iron and steel) will replace blast furnace technology with direct reduced iron or sponge iron produced using direct reduced iron technology and electric arc technology.

- **Salzgitter ironing out decarbonisation**: On **July 15**, **2022**, the ever-excellent rechargenews.com published an excellent piece on the plans of leading Germany iron and steel producer, **Salzgitter**, to develop the **€723 million** first phase of its iron and steel decarbonisation project which will use Green Hydrogen as the high-heat temperature source for the production of iron and steel. As reported, the intention is to have developed the first phase by the end of 2023, with two further phases, 2 and 3, with direct reduction plants and electric arc furnaces to be developed to replace blast furnaces. (See **Editions** **23**, **34** and **36** for previous reporting about Salzgitter.)

  In operation, the first phase will reduce total ***GHG*** emissions arising from economic activity across Germany by 1%. The iron and steel decarbonisation project is called **Salcos** (**Salzgitter Low CO_2 Steelmaking**), which uses Green Hydrogen to displace the use of coking coal in blast furnaces (which produce pig iron).

  As reported in previous editions of Low Carbon Pulse (and this **Edition 43** of Low Carbon Pulse), the use of Green Hydrogen will allow the production of direct reduced iron / sponge iron (in contrast to pig iron).

- **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 **S**tandardised assessment; **2**. **T**ransparent reporting; **3**. **E**nactment; **4**. **E**ngagement; and **5**. **L**eadership. 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**.

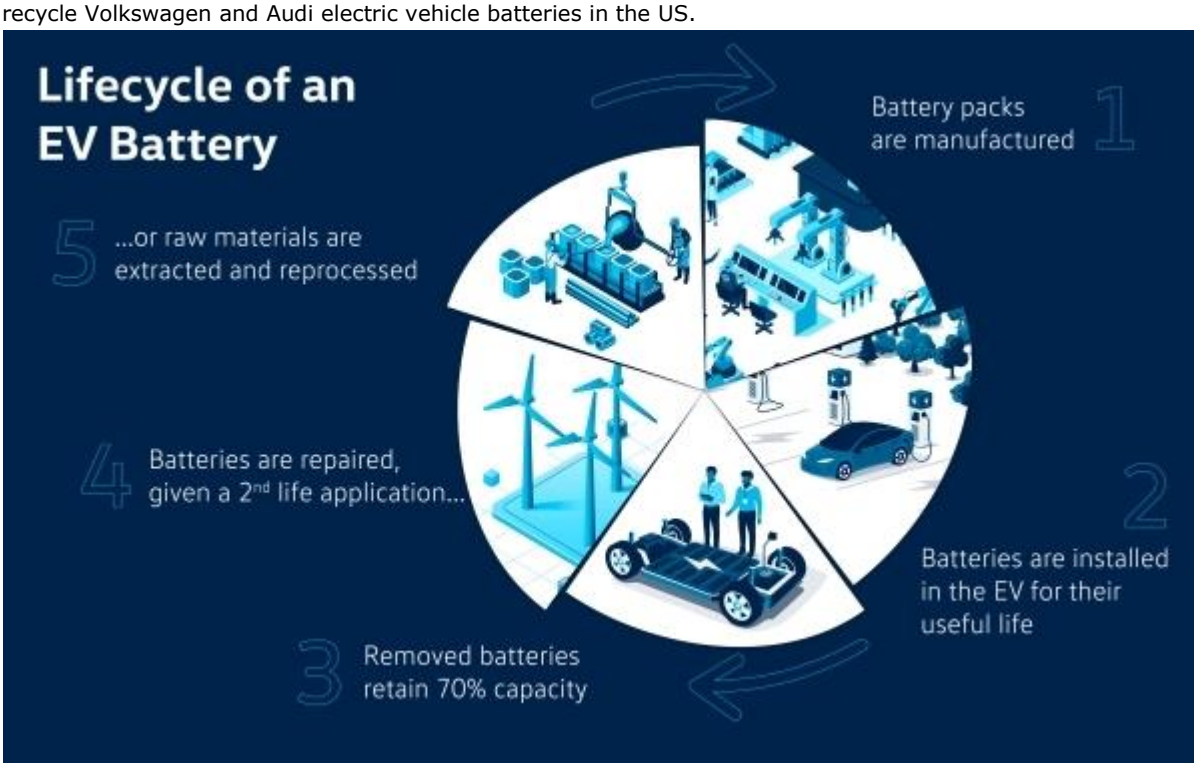
It is estimated that greening the iron and steel industry in the **EU** will require **25.4 GWh** of renewable energy to produce sufficient Green Hydrogen. Stated another way, this is more than half of the increase in wind power capacity contemplated by the **EU REPowerEU** initiatives. As noted in a 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:

- **DP Energy and Iberdrola proceed with Inis Ealga Marine Energy Park**: On **July 14**, **2022**, 4coffshore.com reported that **DP Energy** and **Iberdrola** had published an **EIAR Scoping Report** for their proposed **1 GW Inis Ealga Marine Energy Park** off the south coast of the Republic of Ireland. Consultation on the **EIAR Scoping Report EIAR Scoping Report** is open until **September 21**, **2022**. The **EIAR Scoping Report** is a said to be a significant milestone on the path to the preparation of a Development Permission for the off-shore wind field development application in due course.
- **Finnish Government approves permits**: On **July 15**, **2022**, renews.biz reported that the Finnish Government had approved permits to lease state-owned sea area for Suomen Hyotytuuli's 500 MW Tahkoluoto 2 off-shore wind field and the 1.3 GW Korsnas project under development by Metsahallitus (a state-owned corporation). The State of Finland will receive rental income under the leases, and the municipalities of Korsnas and Pori will receive payment in the form of property taxes.

Solar and Sustainability (including *NZE* Waste):

VWG and Redwood to develop recycling supply chain: On **July 13**, **2022**, batteriesnews.com reported that **Volkswagen Group North America, Inc**. and **Redwood Materials**, **Inc**. are to work together to create a supply chain to recycle Volkswagen and Audi electric vehicle batteries in the US.



Source: Volkswagen

Land Mobility / Transport:

- **Buses and coaches:**

  Electric buses:

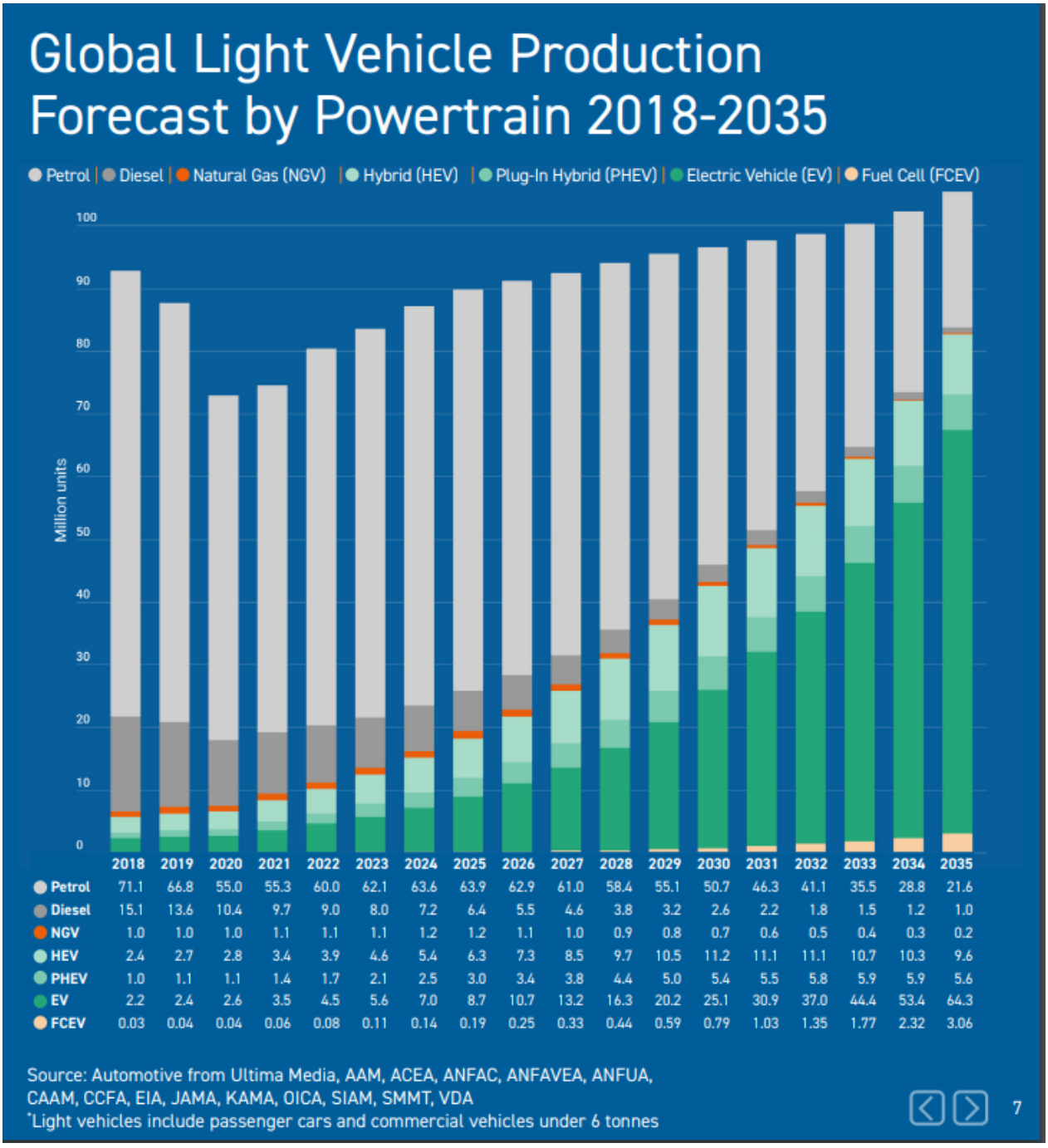
  - **Austria to procure 289 electric buses**: On **July 11**, **2022**, it was reported that the Austrian government had committed **€122 million** to support the procurement of **289 electric buses**. Among the procurement are 16 double-articulated trolleybuses and 70 electric battery buses for Vienna. It is understood that Austria has a fleet of 184 electric batter buses, with the aim to have 682 e-buses in operation by 2026.
  - **16 Mercedes eCitaro electric buses head for Trento**: On **July 12**, **2022**, it was reported that **Evobus Italia** and **Enel X Italia** had won a tender for **16 Mercedes eCitaro** to be operated in the **Province of Trento**, **Italy**.
  - **Ebusco to go**: On **July 12**, **2022**, it was reported that **Ebusco** had contracted with **Nobina** for the supply of 19 **Ebusco 3.0 12 metre** buses for delivery during 2023.
  - **Agrale MT17.0LE sails for Buenos Aires**: On **July 13**, **2022**, it was reported that the **Agrale MT17.0LE** was being shipped to Buenos Aires, Argentina, to commence in service trials for 12 months. The 70 PAX, 12 metre, single deck **Agrale MT17.0LE** is powered and propelled by an **Equipmake** powertrain.

Fuel cell buses:

- **Ile-de-France Mobilités to procure 47 hydrogen buses**: On **July 12**, **2022**, is was reported widely that **Ile-de-France Mobilités** is to procure 47 hydrogen powered and propelled fuel-cell technology buses. This is a departure for **Ile-de-France Mobilités** which currently has a mixed fleet of electric battery buses and bio-natural gas vehicles.
- **Liverpool City Region to get yellow bus**: On **July 12**, **2022**, hydrogen-central.com reported that the **Liverpool City Region** is to get 20 state-of-the-art hydrogen powered and propelled fuel-cell technology buses, the procurement of the buses being funded through the Liverpool City Region **Transforming Cities Fund**.

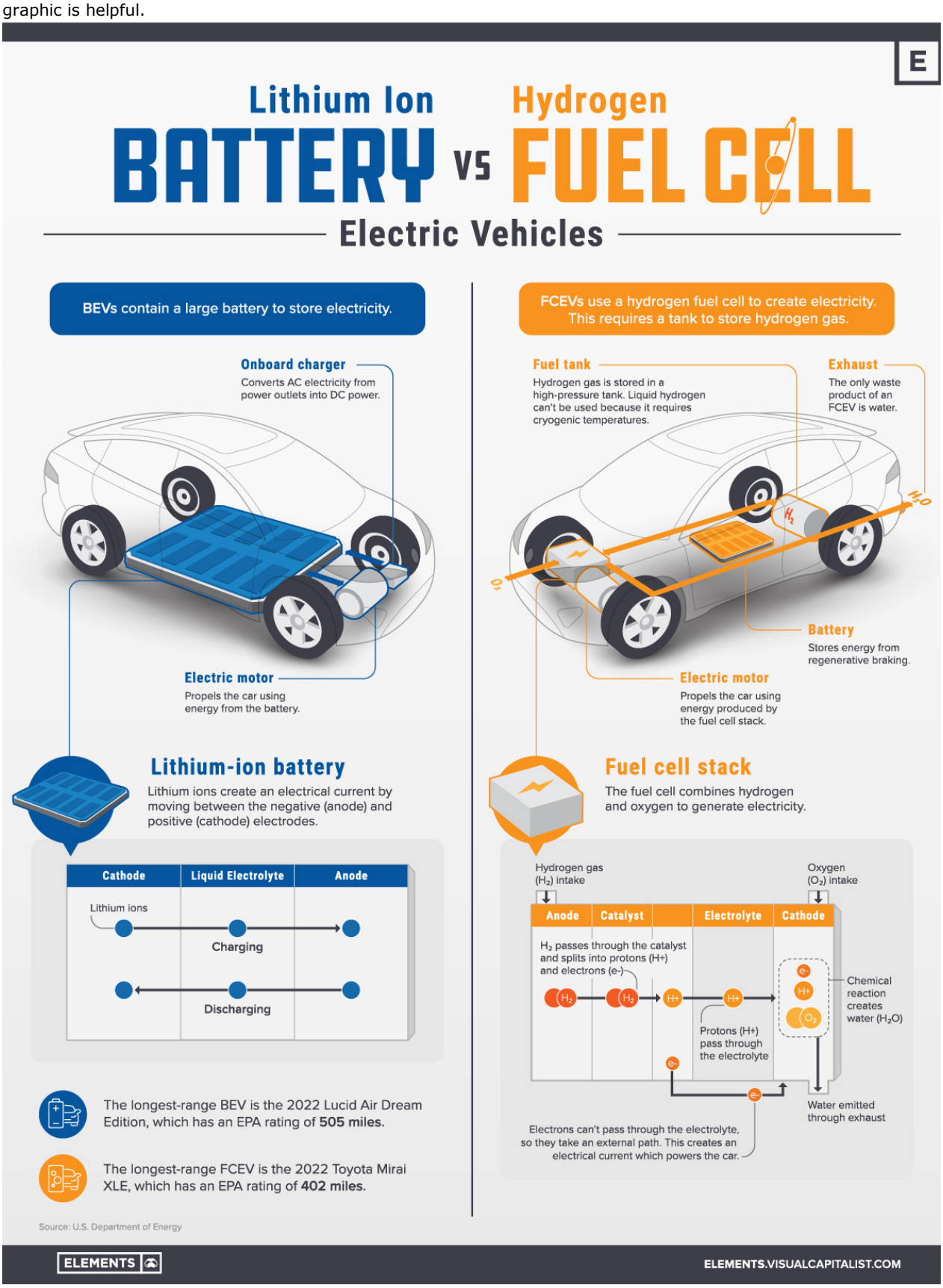
Cars:

- During the week beginning **July 11**, **2022**, **A.P. Moller – Maersk** published ***Regional powerhouses – How logistics will charge EV battery localisation***. The publication is excellent, providing an economically literate perspective on the shift in technologies used to power and to propel vehicle. The publication is well-worth a read, containing many useful facts and stats, but the high-light for the author of Low Carbon Pulse is the following bar-chart.



Source: A.P. Moller – Maersk

- **Battery, Fuel Cell and ICE Technology**: During the news-cycle covered by this **Edition 43** of Low Carbon Pulse, no news items sufficiently material or significant arose to merit inclusion. This said, it is hoped that the following info-graphic is helpful.



- **Industrial Vehicles and Trucks**: During the news-cycle covered by this **Edition 43** of Low Carbon Pulse, no news items sufficiently material or significant arose to merit inclusion.

- **Recharging and refuelling infrastructure**:
  - **BOC and BP on the road**: On **July 14**, **2022**, h2-view.com reported that **BOC** (part of the Linde Group) and **bp** (leading international energy corporation) had announced that they have agreed to develop and to deploy a hydrogen refuelling station at a bp truck-stop at **Lytton**, **Queensland**.

    BOC will supply and install the state-of-the-art Linde designed and developed hydrogen refuelling station, and **BOC** will supply Green Hydrogen produced at its **Bulwer Island** production facility.

    As reported, this will be the first service station in Australia with hydrogen refuelling capacity, and will open later in 2022.
  - **Hynion to install two hydrogen refuelling stations**: On **July 15**, **2022**, h2-view.com reported that **Hynion** (hydrogen refuelling station designed, developer and operator) is to develop and to deploy two high-capacity hydrogen fuelling / refuelling stations at **Västerås** and **Jönköping**, Sweden. The two stations are to be developed with funding support from the Swedish Energy Agency. Each station is reported to have capacity of 1,500 kgs a day.
- **Trains**: During the news-cycle covered by this **Edition 43** of Low Carbon Pulse, no news items sufficiently material or significant arose to merit inclusion.

Ports Progress and Shipping Forecast:

- **Ferries and other craft:**
  - **Saronic Ferries to procure 800 pax Ro-Pax ferry**: On **July 12**, **2022**, it was reported that **Sarconic Ferries** (Greek ferry operator) had appointed **C-Job Naval Architects** (the Netherlands based design and engineering corporation) to develop the design for a **Ro-Pax ferry** with capacity for 800 pax, and that is to have a fully electric propulsion system. The home port of the **Ro-Pax ferry** will be **Piraeus** (where the batteries for its propulsion system will be recharged), and will ferry vehicles and pax between **Piraeus** and the islands of **Aegina** and **Agistri**.
  - **MS Medstraum voyage**: On **July 14**, **2022**, offshore-energy.biz reported that **MS Medstraum** had embarked on its maiden voyage from the Norwegian Fjellstrand shipyard to its home port of Stavanger. From late summer 2022, the **MS Medstraum** is to ferry passengers between Stavanger and Hommersåk.

    As reported, the 30 metre **MS Medstraum** is the "*world's first fully electric and zero emission fast ferry classed as a high-speed craft*".
- **Green Shipping: Berge Bulk to install Anemoi rotor sails**: On **July 13**, **2022**, offshore-energy.biz reported that **Berge Bulk** had agreed with the assisted propulsion provider **Anemoi Marine Technologies** (UK headquartered technology corporation) to for the supply and installation of **rotor sails** on two of its bulkers, the **Berge Neblina** (a 388,000 dwt Valemax) and the **Berge Mulhacen** (a 210,00 dwt Newcastlemax).

Airports and Aviation:

- **Neste delivers CORSIA certified SAF to AA**: On **July 12**, **2022**, **Neste** announced that: "*For the first time in aviation history a CORSIA batch of sustainable aviation fuel (SAF) was delivered to a commercial airline. Neste, the world's leading SAF producer, delivered a batch of its Neste MV Sustainable Aviation Fuel TM to American Airlines at San Francisco International Airport*".

  CORSIA stands for **Carbon Offsetting and Reduction Scheme for International Aviation**, being a carbon offset and carbon reduction scheme to lower ***CO_2*** emissions arising from international flights. **CORSIA** was developed by the International Civil Aviation Organization.
- ***SAF* continues to find, and to expand, market**: On **July 14**, **2022**, it was reported **Alaska Air Group Inc.**, **Microsoft Corporation**, and **Twelve**, had signed a memorandum of understanding to work together to develop the market for sustainable aviation fuel (***SAF***), including derived from re-captured ***CO_2***, to work towards the first commercial demonstration flight in the US powered and propelled using **Twelve E-Jet®** fuel.
- **Making Net-Zero Aviation Possible**: 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℃ 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℃ 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^{O}C carbon budget if all levers area pulled. Achieving net-zero by mid-century avoids cumulative ***GHG*** emissions of **25** to **26 Gt CO_2-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_2-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.

The ***Making Net-Zero Aviation Possible – An industry-backed, 1.5℃ aligned transition strategy*** is outstanding, and is worth-repeated reading and reflection.

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

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The researcher and author of each edition of Low Carbon Pulse is Michael Harrison.