Low Carbon Pulse - Edition 46

GLOBAL DEVELOPMENTS IN PROGRESS TOWARDS NET-ZERO EMISSIONS

Welcome to **Edition 46** of **Low Carbon Pulse** – sharing significant news on progress towards net-zero greenhouse gas (***GHG***) emissions (***NZE***) for the period from **Monday August 1**, **2022** to **Sunday August 14**, **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 **45** covering **April**, **May**, **June**, and **July 2022**).

A change in approach:

Given changed circumstance, **Low Carbon Pulse** is going to take a different form. As currently planned, each Friday a summary of the key news items of the week will be published, more in the nature of a headline publication, with monthly articles going into further detail on decarbonisation and ***NZE*** initiatives, with the first such article to be on ***NZE*** **Waste**.

Two weeks of progress:

- **Week-beginning August 1**, **2022**:
  - **Inflation Reduction Act of 2022**: **Edition 45** of Low Carbon Pulse reported on the **Inflation Reduction Act of 2022**, commonly referred to as the **Manchin-Schumer Act**, noting that the **Act** had breathed life back into the decarbonisation agenda of the **Biden Administration**, and, that, if the **Act** became law, it would provide a clear pathway for the US to reduce its ***GHG*** emissions by 40% by 2030 (or 2.4 giga-tonnes reduction in CO_2-***e***).

    On **August 5**, **2022**, Senator Kyrsten Sinema (D-Arizona) was ready "to move forward" to support the **Manchin-Schumer Act** in the Senate. Following the "move forward signal" from Senator Sinema, over the weekend of August 6 and 7, 2022 the Senate debated the **Manchin-Schumer Act**.

    On **August 7**, **2022** (after an all-night sitting), the **US Senate** approved the **Act**. On **August 12**, **2022**, the **Act** was approved by the House of Representatives, and now goes to President Joe Biden for signature. A link to the Statement by President Biden is to be found at https://whitehouse.gov under **Statement by President Biden on Senate Passage of the Inflation Reduction Act**.

    The passing of the **Inflation Reduction Act** is good news for the US and globally.
  - **World Cities Summit**: Between **July 31**, **2022**, and **August 3**, **2022**, the **World Cities Summit** took place at the Marina Bay Sands, Singapore, under the theme of **Liveable and Sustainable Cities**: **Emerging Stronger**. For those in attendance, the conference was regarded as worthwhile in this increasingly important area.
- **Week-beginning August 8**, **2022**: In addition to the news articles covering the **Manchin-Schumer Act**, at the start of the week (and for a good portion of the week), India continued its progress its policy setting, with the Lower House of the Indian Parliament passing the **Energy Conservation (Amendment) Bill** on **August 8**, **2022**.

  This occurred five days after the Union Cabinet adopted a revised nationally determined contribution (**NDC**) (on **August 3**, **2022**) committing to reduce the emissions intensity of GDP by 45% by 2030 compared to 2005 (a 10%

increase on the previous commitment), a reduction of 1 giga-tonne of ***CO_2-e***, and that 50% of its cumulative installed electrical energy capacity will be from non-fossil fuel-based sources by 2030, or **500 GW** by 2030.

While India has yet to reach peak ***GHG*** emissions, ahead of **September 23**, **2022** (the date for revised **NDC**s to be reported to the United Nations Framework Convention on Climate Change) and ***COP-27***, the revised Indian **NDC** may be regarded as good news.

74 days to COP-27:

As of **August 17**, **2022**, there will be **74** days to go to the commencement of ***COP-27*** to be held in **Sharm El-Sheikh**, **Egypt** between **November 6/7** and **18**, **2022**. As was the case in 2021 (see **Editions** 23, 25, 26, 27 and 28) ahead of **COP-26** held in Glasgow, Scotland, ahead of ***COP-27*** Low Carbon Pulse will commence coverage of key themes and issues in respect of which progress needs to be made at ***COP-27***.

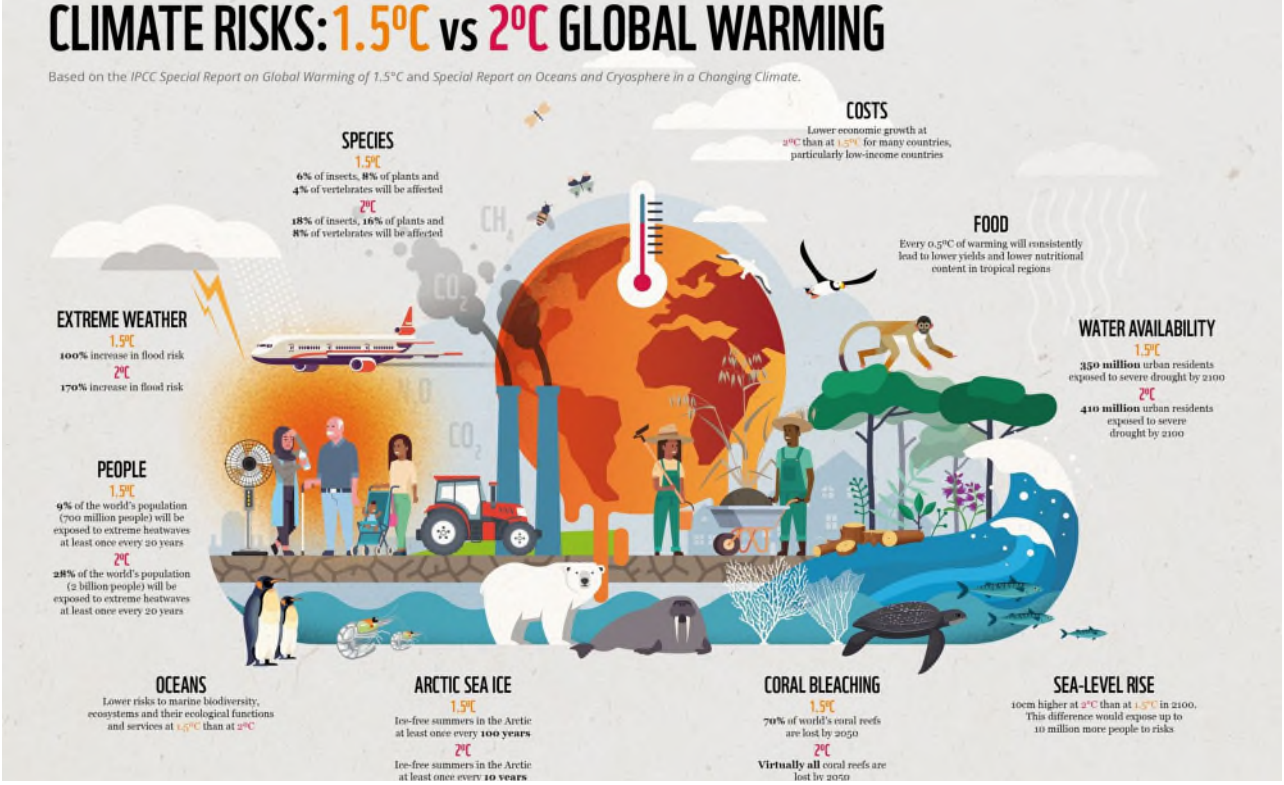
The overarching theme for ***COP-27*** is that Egypt will work to make ***COP-27***: "***a turning point in international efforts to coordinate with all parties, for the benefit of Africa and the entire world***".

In this context, it is noted that by **September 23**, **2022**, countries that are parties to the Paris Agreement are scheduled to submit their updated nationally determined contributions (**NDC**s). The **UN General Assembly** (**UNGA**) is meeting from **September 13**, **2022**, to **September 27**, **2022**, and **New York Climate Week** (**NYCW**) is taking place from **September 19**, **2022**, to **September 25**, **2022**. It might be expected that **NDC**s, and progress on them, will be a focus at both the **UNGA** and **NYCW**.

Progress at ***COP-27*** will be more likely, and more viable, if informed by updated **NDC**s. Continuing a theme identified some time ago, ***GHG*** emission reduction commitments are required at an increased, and at a faster, rate.

One of the themes that emerged ahead of ***COP-26***, and did not gather momentum (thankfully) during ***COP-26***, was whether it was necessary to continue commitment to the Paris Agreement stretch goal of limiting the increase in global average temperatures to a **1.5°C** or to move to a point somewhere between **1.5°C** and **2°C**.

It is hoped that this theme does not re-emerging ahead of ***COP-27***. The following infographic provides some sense of why it is important to foreclose on moving away from the stretch goal.



For a summary of the infographic in narrative form, the reader can click through to **The Urgency of 1.5°C** at https://wwf.panda.org.

Vale those lost:

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

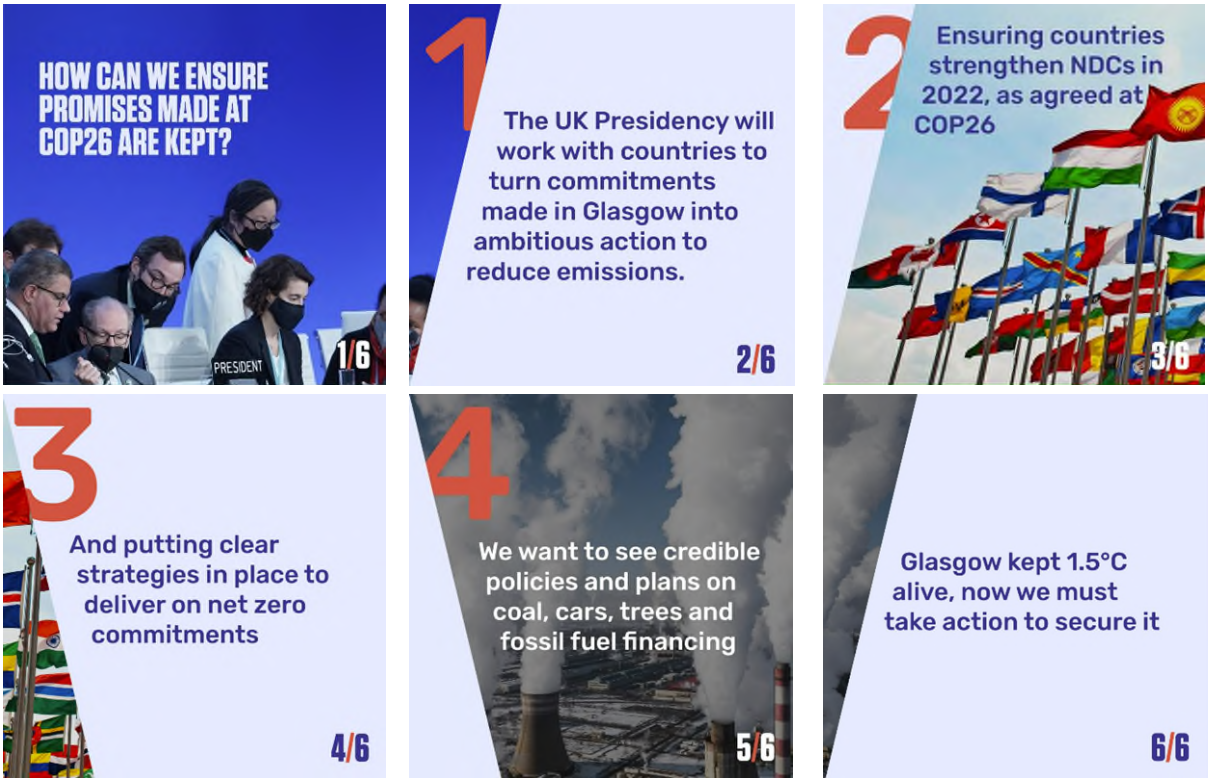
Legal, Policy Setting and Regulatory highlights, and Helpful Publications:

- **Through the portal, Green Hydrogen country by country**: On **August 5**, **2022**, the good folk at **GH_2 Green Hydrogen Organisation** published **The GH2 Green Hydrogen Portal** (https://gh2.org/countries) which provides an overview of announced policies, roadmaps and strategies (and accompanying targets) by country – two clicks and you are there!
- **Historic day for human rights and healthy planet**: On **July 28**, **2022**, the **UN General Assembly** adopted a resolution to recognise that everyone, everywhere, has a human right to live in an environment that is clean, healthy and sustainable. A link to the UN press release is attached. As at August 18, 2022, the text of the official resolution had not been uploaded.

- **World Economic Forum ask GH2 question**: On **August 10**, **2022**, the **World Economic Forum** asked **What's stopping the world from using more green hydrogen?** (at https://www.weforum.org). In answering the question, the good folk at the **World Economic Forum** note that while 45 countries are devising or have published hydrogen plans, roadmaps and strategies (and policies), the high production costs of Green Hydrogen (**GH2**) do not yet justify the demand side making investment decisions to shift to the use of **GH2** (sufficient supply of **GH2** at an appropriate price is needed). In this context, multi-faceted policy settings are needed to allow the development of sufficient supply at an appropriate price to encourage, to promote, and, in some cases, to force, a shift to the use of **GH2** is required.

  While cost of production, and resulting price, is at the core of the answer, it is important to add that a fleet of **GH2** carriers is required to allow the development of a global trade in **GH2**, and an increased fleet of ammonia carriers. None of these concepts are new, they are well-known and understood.

  On **August 12**, **2022**, the following six slides were published, and provide a helpful reminder of the resolution that emerged from ***COP-26***, and that continues to be required, critically, the need to realise the benefit of having kept **1.5°C** alive at Glasgow.



Climate change reported and explained:

- **Extreme weather events**: Extreme weather events have continued to be reported during the first two weeks of August, 2022.

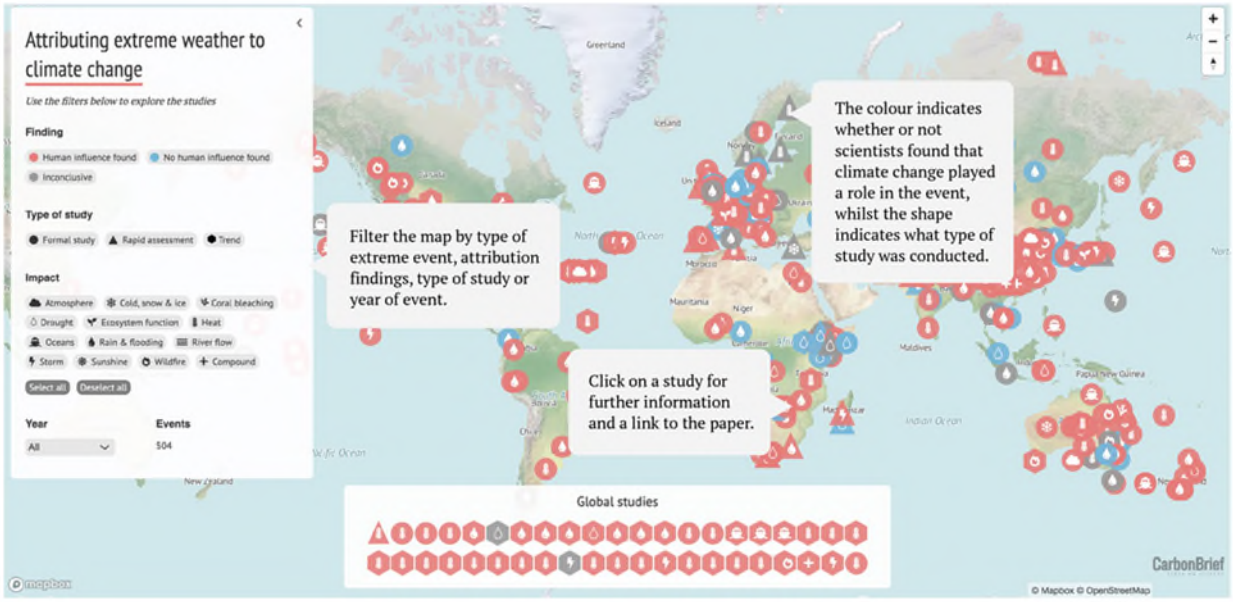
  The **International Panel on Climate Change** (**IPCC**) defines an extreme weather event as follows:

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

  It is fair to say that North America, North Africa, India and Europe, and the ***PRC***, have been experiencing **extreme weather events**, and in many instances those extreme weather events, having persisted, may be characterised as **extreme climate events**. The climate system has changed, and continues to change.
- **NOAA July Report**: On **August 10**, **2022**, the **US National Oceanic and Atmospheric Administration** (**NOAA**) published its **July Report**. The headline from the **July Report** is that average temperatures across the Lower 48 states of the US in July 2022 were 76.4°F, 2.8°F above the 20th century average, and ranking the third warmest July in 128 years.
- **NZ has a plan**: On **August 3**, **2022**, **The Guardian** (at https://www.theguardian.com, under **New Zealand releases its first national plan to protect against climate-driven disasters**) reported on the first national plan for New Zealand to prepare for fires, floods and rising sea-levels that are expected as a result of climate change. The plan was published on **August 3**, **2022**, and a link to it is **attached** (the **Climate Adaptation** plan). The **Climate Adaptation** plan is described by The Guardian as a sprawling document, providing a roadmap to seek to protect cities, cultural treasures, and infrastructure. It might be expected that climate adaptation plans will become the norm.

- **Too many Hot Spots**: On **August 4**, **2022**, **Carbon Brief** (at https://www.carbonbrief.org under **Mapped: How climate change affects extreme weather around the world**) reported on **extreme event attribution** and that it has mapped every **extreme weather attribution** study published to date. As interesting as the mapping are the following findings: **1**. **71%** of **504** extreme weather events and trends mapped were found to be made more likely or more severe by human induced climate change; **2**. **9%** of events and trends mapped were found to be made less likely or less severe by human induced climate change; **3**. Of the **153** extreme heat events assessed by scientists, 93% were found to be more likely or more severe by human induced climate change; and **4**. Of the **126** flooding or rainfall events studied, **56%** were fund to be more likely or more severe by human induced climate change.

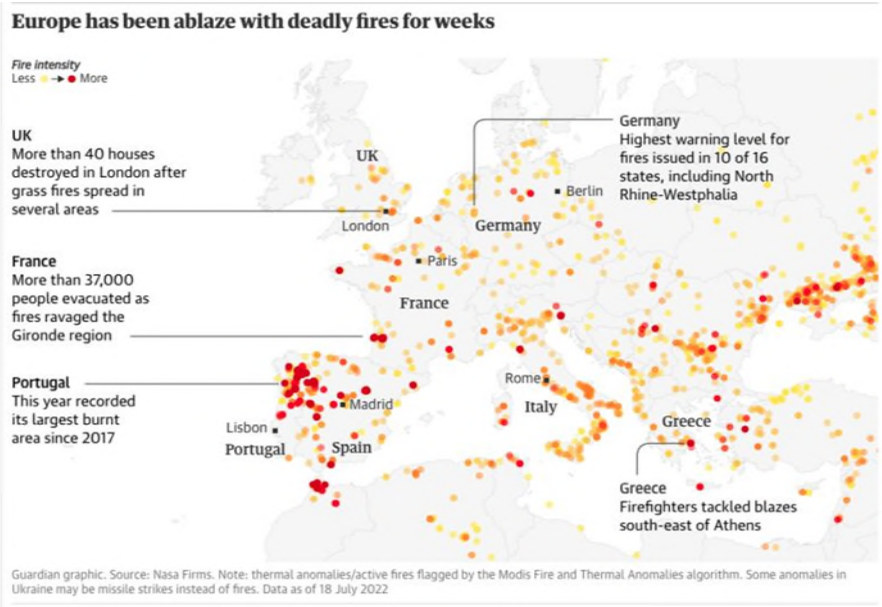
  The map is included below.



- **Too Hot to Handle**: On **August 5**, **2022**, the **UNFCCC** (at https://unfcc.int/blog/too-hot-to-handle) reported on the incidents of forest / wildfires across the northern hemisphere during this summer.

  In Europe, France, Greece, Italy, Portugal and Spain have all experienced record high temperatures, and the inevitable resulting forest / wildfires, to the end of July affecting affecting around **515,000 hectares** of land. As outlined in previous editions of Low Carbon Pulse, fires reduce ***CO_2*** absorption capacity and increase the mass of ***CO_2*** released to the climate system, each exacerbating climate change.

  The conditions experienced during extreme weather events involving high temperatures are invariably accompanied by rainfall deficit, and, if those events, persist they will give rise to soil moisture deficit and flora distress, from which recovery is necessary.



  In **Russia** more than 6,000 forest / wildfires had started by the end of June, covering **2 million acres** (or 810,000 hectares) of land, predominantly in the far east and in Siberia.

In the **US** multiple states have been fighting forest / wildfires, with upwards of **5.5 million acres** (or 2.225 million hectares) having been the subject of fire during 2022 to August 5, 2022 (with around **3 million acres** in the State of Alaska), which is 70% more than the 10 year average.

The article from the **UNFCCC** notes that while the forest / wildfires impact developed countries, forest / wildfires are more common and have a greater impact in developing countries. Forest / wildfires start due to a number of factors, including high-heat temperatures, and a lack of moisture in grasses and trees, and other flora. "*Add longer, warmer and drier summers and it is no surprise that we are seeing more frequent, and longer-lasting wildfires across the World*". The article ties back to a press release from the **UNFCCC** on February 23, 2022, ***Number of Wildfires to Rise by 50% by 2100 and Governments Are Not Prepared, Experts Warn***, outlining the findings from a report from the **UN Environmental Programme** (**UNEP**) and **GRID-Arendal** titled ***Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires***.

The focus during the summer months of 2022 has tended to be on forest / wildfires. Readers will recall that during the summer of 2021 the focus was on flooding, in particular flooding in Northern Europe arising from rainfall. One cause of flooding that does not receive the same level of focus is flooding that arises from rising sea-level, no doubt because it is not caused by an extreme weather event. By way of reminder, in February 2022 the **NOAA** published (at http://oceanservice.noaa.gov) an excellent publication entitled ***2022 Sea Level Rise Technical Report***, providing an excellent insight in to the nature of flooding that is likely to occur as sea-levels rise.

- **Sea ice cover for July 2022**: During the first week of August, **Copernicus – Europe's eyes on Earth**, **Climate Change Service** (at https://www.copernicus.eu) outlined the key findings from its observations during July 2022. The headlines being that:
  - Antarctic sea ice extent reached is lowest value for July in the 44-year satellite data record, at 7% below average;
  - The Southern Ocean had widespread areas of below-average sea ice; and
  - Arctic sea ice extent was 4% below average, and ranking as the 12th lowest for July in the satellite data record.

Middle East including GCC Countries:

- **Oracle Power Green Hydrogen green light**: On **August 4**, **2022**, it was reported widely that **Oracle Power Ltd** (listed on the AIM) had announced that the Directorate of Alternative Energy of the Government of Sindh, Pakistan, had confirmed that it was to issue a Letter of Intent to **Oracle Power** in respect of the development of a **1.2 GW photovoltaic solar** (700 MW) and **wind** (500 MW) project to provide renewable electrical energy to a **400 MW electrolyser** to up to **55,000** metric tonnes of Green Hydrogen a year.

  As reported, the **Oracle Power** is to develop the Green Hydrogen production facility in joint venture with Sheikh Ahmed Dalmook Al Maktoum, with the Sheikh participating as to 70% and Oracle Power as to 30% in the joint venture. (See **Editions** **29** and **35** of Low Carbon Pulse for earlier coverage of the Oracle Power project.)
- **UAE battery recycling centre to open**: On **August 4**, **2022**, the **Khaleej Times** (at https://khaleejtimes.com, under ***UAE's first used battery recycling centre to open in Ras Al Khaimah***) reported that **Royal Gulf Industries** is to add a state-of-the-art lead acid recycling unit to its industrial ecosystem, with the unit to be developed in **Ras Al Khaimah Economic Zone** (**RAKEZ**). The unit will have capacity to recycle up to **35,000 metric tonnes** of used lead batteries annually, from which **21,500 metric tonnes** of **lead ingots** and **2,400 metric tonnes** of **plastic granules** will be derived. With this capacity, the unit will recycle around **58%**, by mass, of **lead acid battery waste** arising in the **UAE**.
- **UAE plastic recycling facility progressing to FEED**: On **August 4**, **2022**, **Quantafuel** announced (at https://www.quantafuel.com, under **Quantafuel, DUBAI Holding and BASF sign FEED agreement for plastic recycling in Dubai**) that after a six month feasibility study, during which the main design parameters were settled, and the feedstock and site were secured, the chemical plastic recycling facility in Dubai, UAE, is now entering FEED. A final investment decision to proceed with the development of the chemical plastic recycling facility is expected during Q1 of 2023. The chemical plastic recycling facility will be a plastics-to-liquid (**PtL**) facility. It is hoped that the concept of **PtL** will be heard and written increasingly over the coming years.
- **Aramco and SABIC blue light**: On **August 5**, **2022**, it was reported widely that **Aramco** and **SABIC Agri-Nutrients Company** had obtained the first certification, globally, for Blue Hydrogen and Blue Ammonia, with each corporation having made announcements on **August 4**, **2022**. As reported and announced, **TÜV Rheinland** (see **Edition** **39** of Low Carbon Pulse, outlining the basis upon which **TÜV** provides certification) had provided certification for **37,800 metric tonnes** of **Blue Ammonia**, and **8,075 metric tonnes** of **Blue Hydrogen**, used to produce the Blue Ammonia.

  Vice-President for Chemicals for Aramco, Mr Olivier Thorel, is reported to have said: "*These certifications are the first of their kind in the world and signify a major milestone in our efforts to develop clean energy solutions, and advance our hydrogen and ammonia export capabilities*".

Africa:

- **Trans-Saharan Gas Pipeline**: On **August 1** and **2**, **2022**, there was increased reporting in respect of the signing of a memorandum of understanding by **Algeria**, **Niger** and **Nigeria**, under which it is planned to develop a **trans-Saharan Gas Pipeline** and **hub**, at Hassi R'Mel, to enable the export of natural gas from Africa to Europe via natural gas pipelines to Spain (Cordoba via a GME pipeline, and Almeria via a Medgaz pipeline) and Italy (via a TransMed pipeline).

  In addition, some of the natural gas will be liquified to produce liquified natural gas (**LNG**), with the LNG to be transported to northern Europe. While the trans-Saharan pipeline project has been talked about for many years, it appears more likely that previously to progress.
- **East Africa transmission connectivity**: On **August 3**, **2022**, **Green Building Africa** (at https://greenbuildingafrica.com, under **Construction of Tanzania Zambia Transmission Line to Begin Q1 2023**) reported that the construction of the 400 kW, 616 km, Tanzania Zambia transmission system would commence in January 2023, and will be completed in January 2025.

- **Masdar and Tanesco create JV**: As reported widely, on August 3, 2022 (including detailed reporting on **August 9, 2022**, from **Energy Utilities** (at https://energy-utilities.com, under **Tanzania welcomes Masdar to help develop renewable resources**)) **Masdar** (the Abu Dhabi Future Energy Company) and the **Tanzania Electric Supply Company Ltd** (**TANESCO**) signed a joint development agreement (**JDA**) to develop up to **2 GW** of renewable electrical energy projects within Tanzania. The **JDA** contemplates the establishment of a joint venture corporation to develop projects, with the first phase involving the development of 600 MW of photovoltaic solar and onshore wind capacity.

India and Indonesia:

- **Hydrogen Mission document drafted**: On **August 2 2022**, it was reported widely that the Minister for State of New and Renewable Energy (**MNRE**), Mr Bhagwanth Khuba had indicated that the National Hydrogen Mission document for India had been developed (foreshadowed by Indian Prime Minister, Mr Narendra Modi, during his Independence Day speech – see **Edition 25** of Low Carbon Pulse). According to Minister Khuba the draft National Hydrogen Mission document provides a framework for both supply and demand side creation, focusing on the production and use of Green Hydrogen within India. Critical elements of the framework include research and development programs, proposals for pilot projects, and policy settings, and implementing laws and regulations, intended to promote and to enable capacity development.
- **Energy Conservation (Amendment) Bill 2022 introduced, and NDC revised**: On **August 3, 2022**, it was reported widely that **Government of India** (**GoI**) had introduced **The Energy Conservation (Amendment) Bill 2022**. As reported, the **Bill** is intended to provide the framework to allow India to progress to the use of non-fossil fuel sources, including to facilitate the development of Green Hydrogen and Green Ammonia, and ethanol, production capacity, and the development of the use biomass and bioenergy. The framework includes mandating designated users of energy to source energy from non-fossil fuel sources, thereby providing the basis for a known demand to provide a market for which the supply side can produce Future Fuels.

  As outlined on a number of occasions by the **GoI** (and as reported in Low Carbon Pulse), the framework will reduce the dependence of India on fossil-fuel sources of energy, and provide for energy security for India. While the main thrust of the **Bill** is the development of Future Fuel production capacity, the **Bill** promotes energy conservation in the building sector and provides for the establishment of a carbon market, with the establishment of a carbon market considered as being key to increased investment in clean energy and energy efficiency.

  Also on **August 3, 2022**, it was reported that the Union Cabinet, chaired by Prime Minister, Narendra Modi, and that on **August 4, 2022**, had approved India's revised **NDC** to be communicated to the United Nations Framework Convention on Climate Change for the purposes of the **Paris Agreement**. As reported, India will commit to reduce emissions intensity of its GDP by 45% by 2030, compared to 2005, and to source 50% of its electrical energy from non-fossil fuel sources by 2030.

  On **August 8, 2022**, it was reported by **Money Control News** (at https://moneycontrol-com, under **Lok Sabha passes Energy Conservation (Amendment) Bill**) that the lower house of the India Parliament passed the **Bill** (also visit https://moneycontrol-com, under **MC Explains Proposed changes in Energy Conservation regulations: Why they are important for India**).
- **India to stop carbon credit exports**: On **August 8, 2022**, **The Business Times** (at https://www.businesstimes-com, under **India to stope carbon credit exports until climate goals are met**) reported that India is to ban the export of carbon credits from India until India meets its climate goals. The Power and Renewable Energy Minister, Mr Raj Kumar Singh, made this clear as the Lok Sabha passed the **Energy Conservation** (**Amendment**) **Bill**. While the detail of the ban is yet to take shape, the logic and the accompanying narrative it clear: "*Carbon credits are not going to be exported. No question. These credits will have to be generated by domestic companies, bought by domestic companies*". As noted above, the **Energy Conservation** (**Amendment**) **Bill** provides the framework for the development of a national carbon credit trading market in India.
- **India Hydrogen Alliance - July 2022**: Attached is the link to the June edition of the ***India H2 Monitor – July 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*):

KOGAS and Matrix align: On **August 8, 2022**, **H2 View** (at https://h2-view.com, under **MOU looks to develop large-scale liquid hydrogen storage in South Korea**) reported that **Matrix Service Company** (leading cryogenic containment and storage tank corporation) and **Korea Gas Corporation** (**KOGAS**) had signed a memorandum of understanding to provide a framework for **Matrix** and **KOGAS** to work together to develop liquid hydrogen storage technology, with scope to work together on containment and storage systems on board liquid hydrogen carriers.

PRC and Russia:

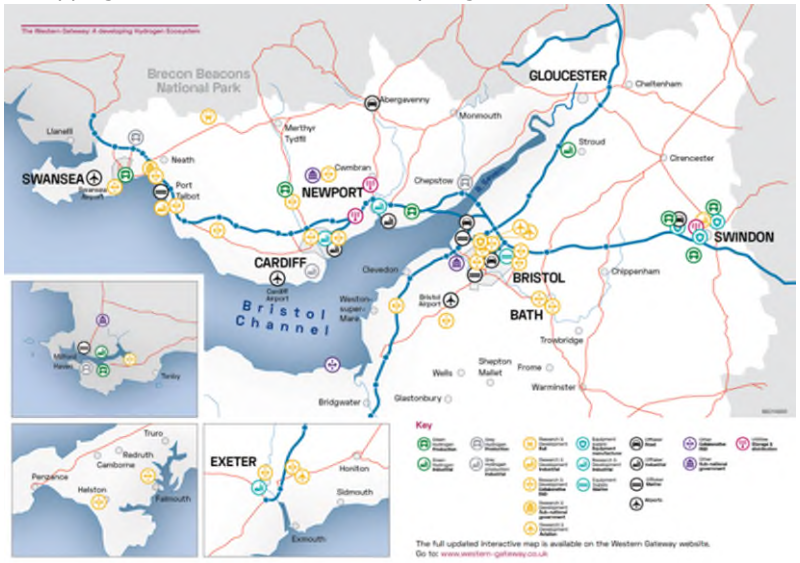
- **Ganfeng developing 10 GWh giga-factory**: On **August 3, 2022**, **Battery News** (at https://batterynews.com, under **Ganfeng Lithium Plans to Build China's Largest Solid-State Battery Production Base**) reported that Ganfeng Lithium is to develop the largest solid-state manufacturing plant in Liangjiang New Area, Chongqing, in the south west of the ***PRC***. As reported, construction commenced on July 30, 2022. The manufacturing plant will have 10 GWh of battery production capacity and 10 GWh of pack production capacity.
- **NIO and Shell open**: On **August 2, 2022**, **NIO** (at https://www.nio.com, under **NIO and Shell introduce the First Integrated Power and Swap Station**) announced that on **August 1, 2022**, the first **NIO** and **Shell** integrated **Power Charger and Swap Station** had been opened officially. The **Power Swap Station** is located in **Tongan, Xiamen**. As announced by **NIO**, this is the first of **100 Power Swap Stations** that **NIO** and **Shell** plan to install across the ***PRC*** by 2025. In addition, **NIO** and **Shell** plan to commence the development and deployment of **Power Swap Stations** across **Europe** later in 2022. The first Power Swap Station with Shell, is NIO's 1,048th swap station, and its 1,777th charger station, across the ***PRC***.

- **Johnson Matthey and Sinopec MOU**: On **August 3**, **2022**, it was reported widely the **Johnson Matthey** and **Sinopec** had signed a memorandum of understanding to allow them to assess opportunities for them to work together to produce Blue and Green Hydrogen, and to develop decarbonisation and fuel-cell technologies.

Europe and UK:

- **North Sea Transition Authority provides more thinking on CCS sites**: On **August 1**, **2022**, the **North Sea Transition Authority** published ***Measurement, Monitoring and Verification (MMV) of Carbon Capture and Storage (CCS) Projects and Co-location considerations***. The publication is a technical report, and the key themes from it are: **1**. There is not a one-size-fits-all solution to the monitoring of activities at off-shore CCS facilities; **2**. Seismic surveying of carbon storage sites that are located in and around off-shore wind field sites has challenges, and that the use of areas with large overlap between carbon storage sites and off-shore wind fields are not considered feasible, and to the extent of any overlap cooperation is required; and **3**. There is an expectation that first-of-a-kind monitoring approaches may be over-engineered as different approaches to ***MMV*** are tested and certified.

  On **August 10**, **2022**, **Hydrogen East** (at https://www.hydrogeneast.uk, under **NSTA explores monitoring offshore carbon storage sites**), picks up on the key themes of the publication. The article is worth a read.
- **Full-house for Round 4 contract for difference scheme**: On **August 3**, **2022** **4coffshore** (at https://4coffshore.com, under **All contracts signed for UK governments Round 4 CfD scheme**) reported that all 99 contracts for difference offered in the fourth allocation round had been signed and returned to the Low Carbon Contracts Company (**LCCC**). What this means on the ground is that 93 projects across the UK will now proceed, working with the **LCCC**, to meet the milestones in their contract for difference, with the 93 projects to result in the installation of **11 GW** of renewable electrical energy capacity.
- **UK Government on the benefits of LDES**: On **August 3**, **2022**, the UK Government (Department of Business, Energy and Industrial Strategy) published ***Benefits of long duration electricity storage*** (with an accompanying ***methodological annex***), providing an outline of the role and requirements for LDES and associated system impacts.
- **UK Government awards funding for BECCS**: On **August 4**, **2022**, the UK Government (Department of Business, Energy and Industrial Strategy) announced the results of its **Bioenergy with Carbon Capture and Storage** (**BECCS**) programme (more formally Hydrogen BECCS Innovation Programme Phase 1 – see https://www.gov.uk, under **Hydrogen BECCS Innovation Programme Phase 1: successful projects**), awarding funding for 22 applicants to promote the use of technologies using **BECCS** to derive or to produce hydrogen from biomass and waste, all of which are listed in the announcement. As structured the innovation programme awarded in respect of three categories: Category 1: Feedstock pre-processing; Category 2: Gasification components, and Category 3: Novel biohydrogen technologies.
- **Greece establishes 2 GW off-shore wind field target**: On **August 4**, **2022**, it was reported widely that the **Greek Parliament** had passed a law that establishes a target for Greece to develop at least **2 GW** of offshore wind field capacity by 2030. To implement this policy setting, the Green Ministry for the Environment and Energy will arrange for environmental impact assessments to be undertaken in areas that may be regarded as appropriate areas for development. As reported, the first round of applications will be sought within the coming 12 to 18 months.
- **Decommissioning cost estimate revised downward**: On **August 4**, **2022**, the **North Sea Transition Authority** (at https://www.nstauthority.co.uk, under **UK decommissioning cost estimate drops 25% to £44.5 bn**) announced a reduction in the cost estimate of GBP 15 billion, with the revised cost estimate expected to maintain industry focus on cost-efficiency. A link to the ***Decommissioning Cost Estimate Report 2022*** of the North Sea Transition Authority is attached.
- **European Battery Atlas**: During the week beginning **August 8**, **2022**, through the combined efforts of **VDMA**, **PEM** and **RWTH Aachen University**, the first edition of the www.battery-atlas.eu was published, edited by Heiner Heimes. The **Battery Atlas** provides a summary of the current state of the battery industry across Europe.
- **Hydrogen Ecosystem Map launched in the UK**: On **August 9**, **2022**, **Hydrogen Central** (at https://hydrogen-central.com, under **Launch of UK First Hydrogen Ecosystem Map for South West and South Wales**) reported on the **Hydrogen Ecosystem Map**, the work of the **GW4 Alliance** and the **Western Gateway** in producing an interactive on-line tool mapping lower, low and no carbon hydrogen activities.



- **INTOG offshore wind leasing opens**: On **August 10**, **2022**, **The Crown Estate Scotland** (at https://www.crownestatescotland.com, under **INTOG of offshore leasing opens, aiming to encourage innovation and decarbonise North Sea**) opened registration for the Innovation and Targeted Oil and Gas (**INTOG**) offshore wind leasing process, under which off-shore wind field developers are being invited to make proposals for the leasing of seabed to reduce the ***GHG*** emissions arising from activities in the North Sea, and to boost innovation. Registration closes on **August 24**, **2022**, and on **November 18**, **2022**, the application submission process will close.
- **Another 20 projects on progress**: On **August 12**, **2022**, the **UK Government** (Department of for Business, Energy and Industrial Strategy (at https://www.gov.uk, under **20 projects shortlisted for next stage of carbon capture, usage and storage (CCUS) cluster proces**s) announced that **20** innovative projects had been shortlisted for the next stage of the **Phase-2 CCUS cluster** process.

  In **November 2021**, the **HyNet** cluster, and the **East Coast** cluster were selected as **Track 1 Clusters** (with the Scottish Cluster in reserve). On **March 22**, **2022** the UK Government issued a notice (entitled **Cluster sequencing Phase-2: eligible projects (power CCUS, hydrogen and ICC)** detailing projects that had satisfied the eligibility criteria for **Phase-2 CCS cluster** process – see **Edition 37** of Low Carbon Pulse, with each eligible project located within the **HyNet** cluster and the **East Coast** cluster (and the Scottish cluster).

  It is understood that each of the **20** shortlisted projects will be considered for funding support to allow development by the mid-2020s.

CLUSTER	POWER CCUS	HYDROGEN	INDUSTRIAL CARBON CAPTURE
East Coast	Net Zero Teesside Power; Whitetail Clean Energy; and Keadby 3 Carbon Capture Power Station	bpH2 Teesside; H2NorthEast; Hydrogen to Humber (H2H) Saltend	CF Fertilisers; Tees Valley Energy Recovery; Norsea Carbon Capture; Redcar Energy Centre; Teesside Hydrogen CO2 capture; Humber Zero – Phillips 66 Refinery; Prax Lindsey Oil Refinery and ZerCal 250
HyNet	No project to progress	HyNet Hydrogen Production Project	Hanson Padeswood Cement Works; Viridor Runcorn Energy Recovery Facility; Protos Energy Recovery Facility; Buxton Lime Net Zero; and EssarOil UK CO2 capture

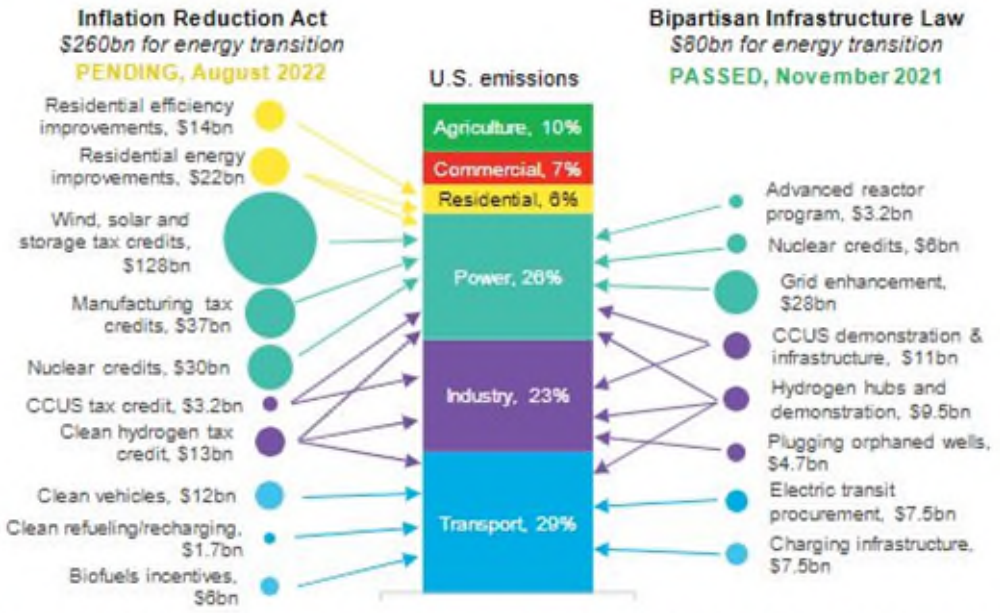
Americas:

- **Inflation Reduction Act heads to Congress**: On **August 7**, **2022**, the US Senate passed the **Manchin-Schumer Act** the ***Inflation Reduction Act of 2022*** was published in revised form. **Edition 45** of Low Carbon Pulse included the following short form summary, which remains correct.

SHORT FORM SUMMARY OF THE MANCHIN-SCHUMER ACT	
USD 369 billion for Energy Security and Climate Change over 10 years	**"**investing in domestic energy production and manufacturing and reduce carbon emissions by roughly 40 percent by 2030**"**
USD 9 billion consumer home energy rebate programs and 10 years of tax credits	This initiative is focused on lower-income customers to electrify home appliances and energy efficient retrofits
USD 4,000 tax credit (used) and USD 7,500 tax credit (new) clean vehicles	This initiative is focused on lower and middle income folk to buy used and new clean vehicles
USD 1 billion grant program	This initiative is to make affordable housing more energy efficient
Production tax credit scheme	This initiative is to accelerate US manufacturing of batteries, solar panels, and wind turbines, and extraction of critical materials, modelled to result in USD 30 billion investment
USD 10 billion investment tax credit scheme	This initiative is to accelerate the development of clean technology manufacturing facilities for batteries, solar panels, and wind turbines
USD 2 billion in grants to retool	This initiative is to accelerate the retooling of existing manufacturing facilities to manufacture clean vehicles
USD 20 billion in loans	This initiative is to accelerate the development of new clean vehicle manufacturing
USD 2 billion in funding	This initiative is to accelerate the development of breakthrough technologies

  A fuller summary of the Energy Security and Climate Change provisions is **attached**.
- **Infographic representation as to the implications of the Manchin-Schumer Act**: During the week beginning August 8, 2022, the good folk at BNEF published the following infographic.

Figure 1: Estimated 2022-31 energy transition spending in Inflation Reduction Act and Bipartisan Infrastructure Law



Source: EIA, EPA, Joint Committee on Taxation, BloombergNEF. Note: Chart only captures tax credits and incentives, not grant programs or loans. Bn is billion. CCUS is carbon capture, utilization and storage.

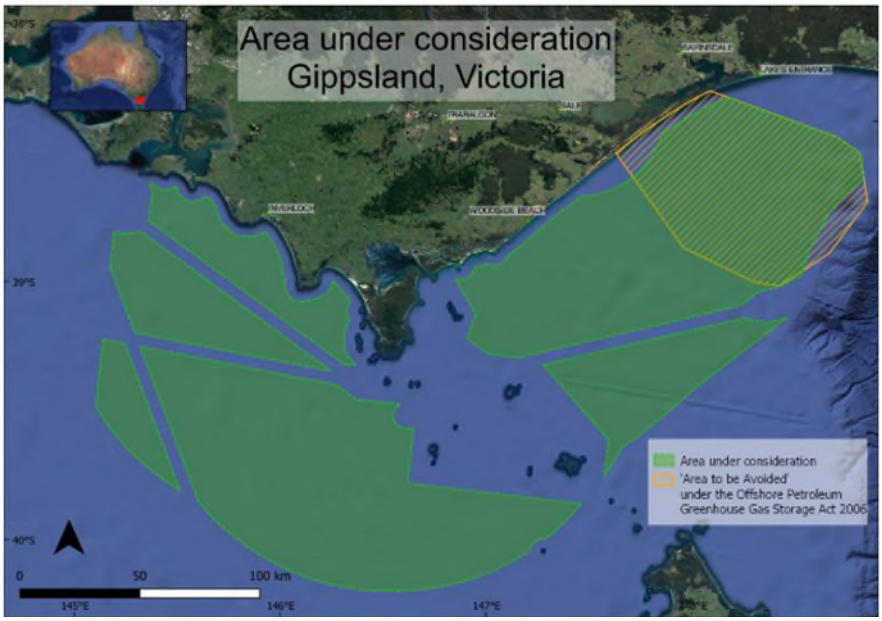
France and Germany:

- **Germany supports Hyundai imports**: On **August 2** and **3**, **2022**, it was reported widely that the German Federal Government, Ministry for Digital and Transport (**BMDV**), had provided funding support to enable seven German corporations to acquire **27 Hyundai XCIENT** trucks (using fuel-cell technology), now a well-proven FCT truck.
- **European Commission approves German Federal Government's heating program**: On **August 2**, **2022**, it was reported widely that the European Commission had approved the **€3 billion** district heating program (using renewable energy and waste heat). Under the program, the German Federal Government will promote and enable the development of district heating capacity by providing funding support, in the form of grants, through 2028, in respect of capacity that uses not less than 75% renewable and waste heat derived energy. As reported, it is expected that the program will result in the installation of around 680 MW of renewable energy capacity year on year.
- **France shortlists bidders**: On **August 2**, **2022**, it was reported widely that 13 proponents had been pre-selected in respect of the **1.5 GW AO6 Mediterranean Floating Off-shore** wind tender being run by France. The 13 shortlisted proponents (comprising consortiums and single corporations) are to bid for two off-shore floating wind field projects, each of 250 MW, but with the ability to expand to up to 750 MW. The pre-selected shortlisted proponents is part of the tender process, and marks the commencement of the competitive dialogue phase which is scheduled to continue until the end of 2022, with the preferred proponents to be selected by the end of 2023.

  The 13 shortlisted proponents is a veritable who's who of the off-shore wind field industry, including BlueFloat Energy, Sumitomo and Akuo; EDF Renewables and Maple Power; Iberdrola; Marine Energy Archipelago involving TotalEnergies, Qair and Corio Generation; Ocean Winds; Oceole partnership of Equinor, Q Energy and Green Giraffe; RWE and Bourbon; Shell and EnBW's Les Moulin du Leonis partnership; and Vattenfall.
- **France new FiTs**: On **August 3**, **2022**, it was reported widely that France's energy regulator (Commission de régulation de l'énergie) had released feed-in tariffs (**FiTs**) for roof-top photovoltaic solar installations of up to 500 kW to apply during the **Q3** of **2022**. The **FiT**s have been increased, and range between **€0.1951 kWh** in respect of installations of less than **3 kW** to **€0.1068** kWh in respect of installations in the **100 kW** to **500 kW range**. The increase in the **FiTs** is consistent with the policy setting from the French Government to encourage increased installation of roof-top solar.
- **France mandates use of rooftops**: Also during the first week of August 2022, the President of France, Mr Emmanuel Macron approved a new law requiring all new buildings in commercial zones to be covered with photovoltaic solar panels or plants. A number of news-items covered the new law, and in doing so noted the benefits expected to be realised, including, in respect of plants, that they can absorb between 50 and 80% of annual rainfall, create habitats for flora biodiversity, reduce temperatures and the heat effect of urban islands, and to allow the use of rooftops as amenities, for example, parks and vegetable gardens.
- **German power sector climate-neutral by 2035**: During the week beginning **August 8**, **2022**, **Agora Engiewende** (at https://www.agora-energiewende.com, under **Climate-neutral power system 2035 – How the German power sector can become climate neutral by 2035**) published a **paper** providing a roadmap for how Germany can achieve its policy objective of a renewable energy electricity system by 2030. The paper is well-worth a read.

Australia:

- **Australia pegs out off-shore wind field areas off Victoria**: On **August 5**, **2022**, it was reported widely that the Australian Federal Government had commenced the process to develop off-shore wind field areas off the coast of Gippsland, Victoria. The Federal Government has indicated that the public consultation process will start immediately, with a map detailing areas off Gippsland released for consultation. Submissions have been invited by October 7, 2022.



As reported in previous edition of Low Carbon Pulse, there is considerable interest in the development of off-shore wind fields off the coast of Gippsland, in the Bass Strait, including the **BlueFloat Energy** and **Energy Estate 1.3 GW Greater Gippsland Project** (see **Edition 33** of Low Carbon Pulse), the **Copenhagen Infrastructure Partners 2.2 GW Star of the South Project** (see **Editions 13**, **14**, **16**, **31** and **39** of Low Carbon Pulse), the **Corio Generation** (part of the **Green Investment Group**) **2.5 GW Great Southern Wind Project** (see **Edition 41** of Low Carbon Pulse), the **Flotation Energy 1.5 GW Seadragon Project** (see **Edition 31** of Low Carbon Pulse), and **Alinta Energy**'s long-anticipated Spinifex Offshore Wind Project (see **Editions 29** and **32** of Low Carbon Pulse). The Star of the South Project was the first, and is the most progressed, of the off-shore wind field projects, being in development phase.

After the consultation in respect of the Gippsland areas, consultation will commence in respect of the Pacific Ocean region of Portland in Victoria, the Bass Strait region off northern Tasmania and the Indian Ocean region off the Perth and Bunbury regions of Western Australia.

The good folk at **RenewEconomy** have long established an ***Offshore Wind Farm Map of Australia***.

- **Frontier Energy reports positive PFS**: On **August 5**, **2022** pv-magazine.com (under ***Australian solar park could generate hydrogen for less than $2/kg***) reported that a pre-feasibility study (**PFS**) for the **Frontier Energy Bristol Springs Solar** project in Western Australia indicated that the project would be able to produce Green Hydrogen at AUD 2.83 / kg or at sub-USD 2 / kg. Low Carbon Pulse will report on the **Bristol Springs Solar** project as it progresses.
- **PHES project progresses in QLD**: On **August 5**, **2022**, it was reported widely that **Bechtel Corporation** had been appointed by **BE Power** and **GE Renewable Energy** for the **Big-T** (large scale pumped-hydro-energy storage (**PHES**) project at **Lake Cressbrook**, south east Queensland). The **PHES** is a **10 hour**, **400 MW** / **4,000 MWh** facility, that will work with a **200 MW** / **200 MWh** ***BESS***. If a final investment decision is taken to develop **Big-T Bechtel Corporation** will be the EPC contractor.
- **Australia formalises its NDC at 43%**: On **July 27**, **2022**, Australia's Energy and Climate Minister, Mr Chris Bowen introduced legislation to the Australian Federal Parliament to formalise Australia's new nationally determined contribution (**NDC**) of a 43% reduction by 2030 compared to 2005, and ***NZE*** by 2050.

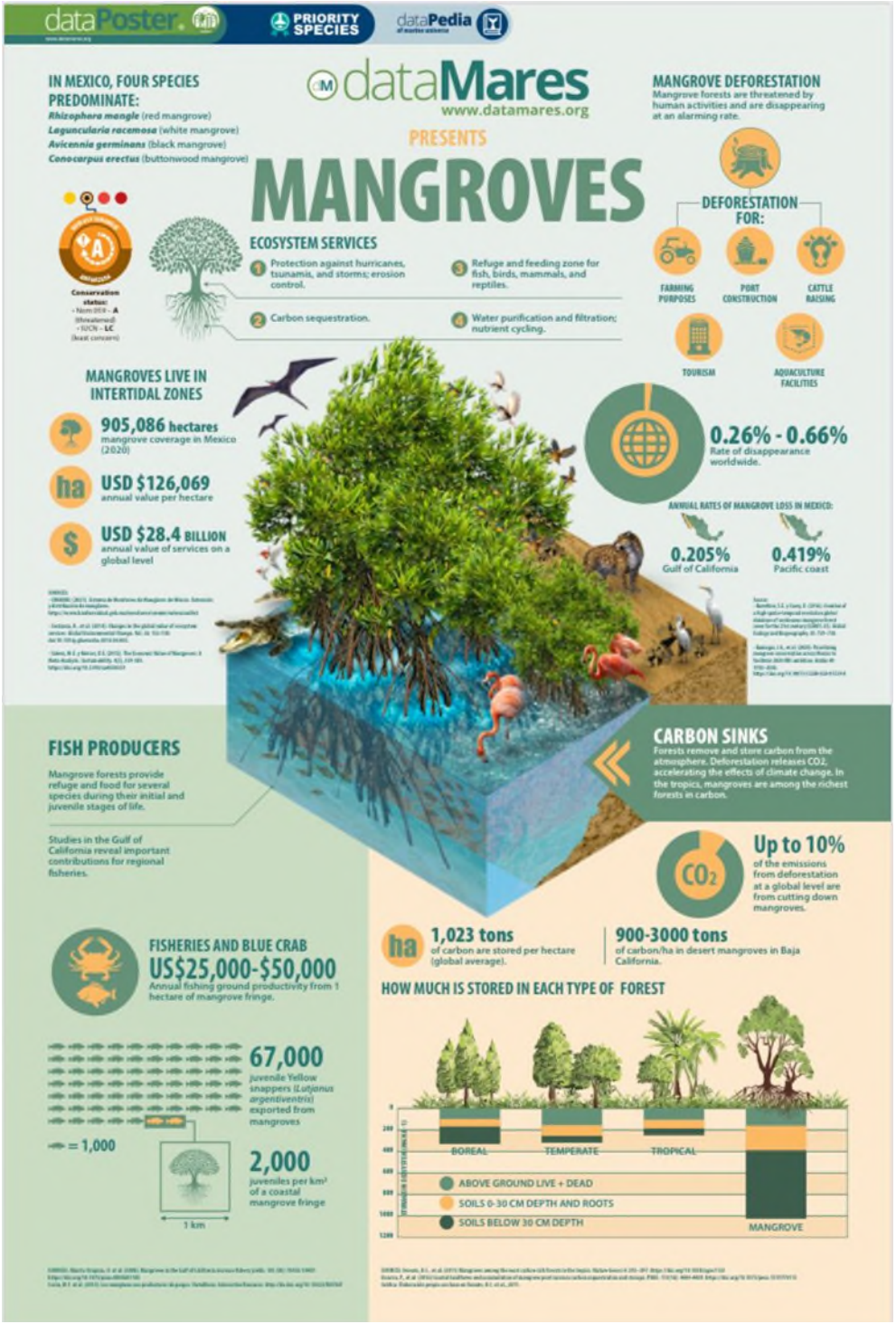
  In addition to increasing the **NDC** and committing to ***NZE***, the legislation provides for the establishment of a new independent agency, the **Climate Change Authority**, requires the Minister of Climate Change and Energy to issue an annual report to the Australian Federal Parliament, and incorporates the **NDC** and ***NZE*** targets into the objectives of key agencies, including the Australian Renewable Energy Agency (**ARENA**), the Clean Energy Finance Corporation (**CEFC**), Export Finance Australia, Infrastructure Australia, and the Northern Australia Infrastructure Facility (**NAIF**).

  On **August 6**, **2022**, the House of Representatives (the Lower House of the Australian Federal Parliament) passed the Climate Change Bill 2022. The **Bill** now goes to the Senate of the Australian Federal Parliament in September 2022 at the next sitting of the Senate.

Blue and Green Carbon Initiatives and Biodiversity

- **More about mangroves ecosystems**: **Edition 45** of Low Carbon Pulse reported on the **International Day for the Conservation of the Mangrove Ecosystem** (on July 26, 2022) and in so doing recapped on the fact that the author of Low Carbon Pulse has long included background on the role that mangrove forests and swamps play, and the increased role that they can play, as a nature based solution to mitigate the impact of climate change (see **Editions** **29**, **31**, **32**, **33** and **44** of Low Carbon Pulse).

During the first week of **August 2022**, the author came across the **dataMares** website (at www.datamares.org), which provides an excellent source of data and information, including the following infographic providing key information and insights into the mangrove ecosystem. As will be apparent from the bottom right hand side of the infographic, mangrove ecosystems have the ability to store more ***CO_2*** than other nature based solutions.

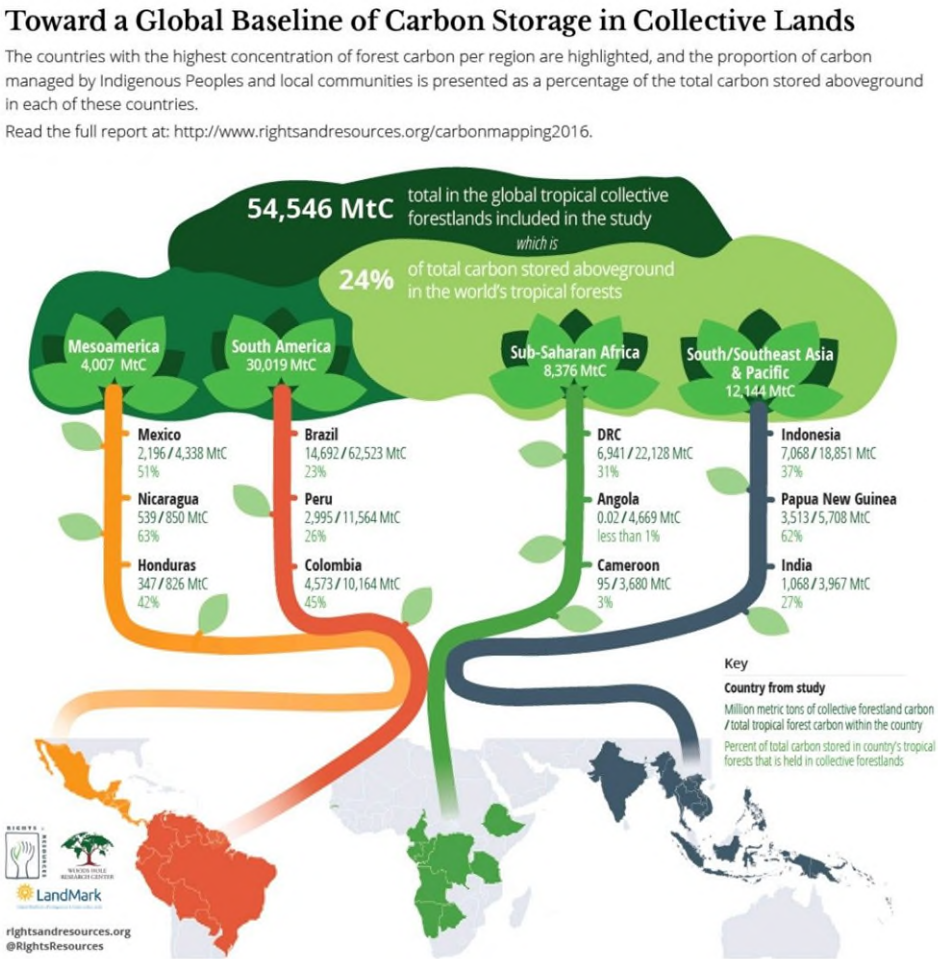


- **Missing links**: During July the author came across the following news items on Blue Carbon, which missed the final cut in editing of **Edition 45** of Low Carbon Pulse, but squeezed into to this **Edition 46**.
  - **UK to map Blue Carbon Stores**: In mid-July a report on **BBC** news (under ***The UK will become the first nation to create a full map of its blue carbon stores***) reported that two thirds of the UK is underwater! The **BBC** report provides an overview (explaining Blue Carbon, i.e., that it comprises mangroves, saltmarshes and wetlands, and seagrass). The mapping of Blue Carbon is important for conservation, preservation and restoration purposes.
  - **Carbon Capture at sea**: A week or so after the BBC news report, **DNV** (https://dnv.com under ***Commencing carbon capture with seaweed***), announced that it is to establish, together with **Equinor**, **Lundin** and **Sintef**, the "world's first pilot project for active, nature-based carbon capture at sea". As announced the objective, is to develop methodologies and technologies "to enable the capture of millions of tonnes of CO2 through the cultivation

of seaweed [in the form of sugar kelp]". The announcement from **DNV** explains the methodology to be used, and the harvesting and use of the seaweed.

- **Clear lines of sight to green**: During the first week of **August 2022**, the good folk at **South Pole** and the **WWF** published ***Commons success factors for bankable nature-based solutions*** projects (see https://www.southpole.com, under **Common success factors for bankable nature-based solutions**). For the purposes of scoping the publication, nature based solution (**NbS**) is defined as "*actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefit*".

  Four key themes emerge from the publication: **1**. There isn't one-size-fits-all "blueprint to bankability of a **NbS**; **2**. While some success factors have a high potential for improving the bankability of a **NbS**, implementing them remains a challenge for most projects; **3**. Projects must be designed in close collaboration with potential investors; and **4**. A success factor for one project can be a hindrance for another, and understanding the local context is key. While none of these themes is revelatory, they are confirmatory.
- **A strait view**: On **August 2**, **2022**, **The Straits Times** (at https://www.straitstimes.com, under **Cities can tap nature for solutions as they seek to develop without harming the environment**) published an excellent article (in the context of the World Cities Summit) on the use of nature based solutions in an urban context. The article starts with: "In China, Hainan province built interlocking fingers of land that channel sea tides into the island's 10 ha mangrove park", and the article only gets better! The article is well-worth a read, and well-worth sharing.
- **Pictures and Stories**: Low Carbon Pulse has provided considerable background on the importance of biodiversity, and in this context of the importance of ceasing deforestation and promoting afforestation and reforestation. To help illustrate the point the author returned to a World Resources Institute source to provide a perspective, and in doing so came across a post from my Omar AL-Ajaji, who had posted the following infographic (noting that the 13% in now 16%).



- **World Resources Institute (WRI) Five Reasons for Cities to include tress in climate action**: In the context of the World Cities Summit, on **July 29**, **2022**, the **WRI** (under ***5 Reasons Cities Should Include Trees in Climate Action***) noted that while cities and communities around the world are focusing on ***GHG*** emissions from the building, energy, industrial, transportation and waste sectors a number of overlooking the benefits of forestry and trees. The **WRI** introduces its publication, ***Global Protocol for Community Scale Greenhouse Gas Inventories: Supplemental Guidance for Forests and Trees***, and guides us to the ***GHG Protocol for Cities – An Accounting and Reporting Standard for Cities***, which has been piloted in Jakarta, Mexico City, Mumbai and Salvador, and in respect of multiple US communities (through the **process of estimating annual emissions and removals by forests and trees**).

The **WRI** outlines the five reasons as follows: **1**. Forests and trees both emit (on degradation or removal) and remove carbon (on growth); **2**. Protecting urban forests is low-hanging fruit, even if the mitigation potential is small (in a global context, and in the context of other means and solutions); **3**. Urban forests and trees are important for climate adaptation; **4**. Expanding forest and tree coverage can address inequities; and **5**. The benefits of forests and trees go well beyond climate. The **WRI** publication is well-worth a read, providing links to many helpful sources of data and information, and providing a number of case studies. More worthwhile still is to spend an afternoon or evening with all of the materials to which links are provided, and the article itself.

Bioenergy and heat-recovery:

- **Coëvrons biomethane plant opens in France**: On **August 4**, **2022**, **Biogas Channel** reported the opening of the Coëvrons biomethane plant, designed by **ENGIE BIOZ**, which will take agricultural and food waste to derive biogas, and then upgrade that biogas to produce biomethane to be sent out across the natural gas pipeline system.

  It is clear that biogas and biomethane derivation and production is becoming increasingly viewed as a part of the solution to ***GHG*** emissions reduction. By way of background, the **European Biogas Association** (at https://www.europeanbiogas.eu, under **Record-breaking year for biomethane production – shows EBA / GIE Biomethane Map 2021**), has recently provided an article providing an overview of the levels of biogas and biomethane derivation and production across Europe. The article provides a map that can be downloaded and with an on-demand function that provides for printing and shipping. The map is detailed, and as such reproduction in Low Carbon Pulse would not do it justice.
- **World Biofuel Day**: Each **August 10** is **World Biofuel Day**, among other things, commemorating the work of **Sir Rudolf Diesel**, which in **1893** ran an engine on **peanut oil**, as legend relates, the first non-fossil fuel liquid biofuel.
- **UK Government seeks to improve diversity of energy supply**: On **August 11**, **2022**, the **UK Government** (Department of Business, Energy and Industrial Strategy) announced (at https://www.gov.uk, under **Government seek to further improve diversity of energy supply by boosting biomass**) the launch of a consultation process on how it might support the development of biomass energy generation (with associated BECCS and BECCUS) in the UK with the basis of consultation outlined in **Business model for power bioenergy with carbon capture and storage (power BECCS)** to be found at https://www.gov.uk. The consultation process is scheduled to close at 11.45 pm on October 7, 2022.
- **Biogas reading for those taking a vacation**: In **July 2022**, the ever-excellent **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***.

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):

- **Ameresco working around the clock**: On **August 3**, **2022**, Energy Storage News (at https://energy-storage.news, under **Ameresco South California Edison "working around the clock" on 2.1 GWh BESS portfolio**) reported that Ameresco and Southern California Edison teams are working around the clock to deploy **2.1 GWh** of ***BESS*** capacity over three sites by the end of 2022 - see **Edition 35** of Low Carbon Pulse.
- **Greenspot green-lighted**: On **August 5**, **2022**, **Greenspot** announced (https://greenspot.com.au under **Wallerawang 9 Battery Approved for development**) that the development of its **AUD 400 million 500 MW** / **1 GWh** grid-scale ***BESS*** had been approved by the New South Wales Department of Planning and Environment for development at the site of the decommissioned coal-fired Wallerawang Power Station near the town of Lithgow, New South Wales. (See **Editions 17** and **32** Low Carbon Pulse for previous news about the **Wallerawang 9 BESS**.)
- **BESS map for Australia**: During the week beginning August 1, 2022, the good folk at **Maoneng** published their **Big Battery Storage Map – Australia**.

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

- **Drilling of injection wells commences**: On **August 5**, **2022**, **Northern Lights** announced that the joint venturers had started a drilling campaign in the southern North Sea (within the area of its storage licence Exploitation Licence 001), being an important milestone in the preparation by the joint venture for the injection, and storage, in the Johansen Formation (with the overlaying Drake Formation of shale providing an effective seal), of **1.5 million metric tonnes** a year of ***CO_2*** from **2024**. Further information can be found at http://linkd.in/dMKPe2_X.
- **Eramet Norway and Northern Lights combine efforts**: On **August 9**, **2022**, **Northern Lights** (at https://norlights.com, under **Eramet Norway and Northern Lights announce collaboration**) announced that it and **Eramet Norway** had signed a memorandum of understanding which provides a framework for **Northern Lights** and **Eramet Norway** to work together to capture and to store 70% of the ***CO_2*** emissions arising from the operation of the **Eramet Norway** manganese smelter located in **Sauda**, **Norway**.
- **Another useful CCS and CCUS resource**: On **August 12**, **2022**, the author of Low Carbon Pulse came across a great resource for keeping track of CCS / CCUS projects globally – **The CCUS Hub** (at https://www.ccushubogci.com), covering Aramis, Antwerp@C, HyNet North West, Net Zero Teesside, Northern Lights / Longship, Porthos, China Northwest, Ravenna and Louisiana.
- **The Week in Carbon Dioxide Removal**: On **August 8, 2022** Mr Wil Burns published his **Week 3 Edition**. Links to the Week 1 Edition and **Week 2 Edition**, are attached.

Carbon Credits and Hydrogen Markets and Trading:

- **BNEF analyses carbon credit buy and sell sides**: During the week beginning **August 1**, **2022**, the good folk at **BNEF** published a report analysing the buying and selling trends. The coverage of the **BNEF report** is well-informed: nearly 98% of carbon credits used to off-set carbon emissions in 2021 came from projects in Africa, Asia and Latin America, predominantly (83.7%) bought by corporations in Europe and North America.

The informed conclusion is that while carbon credits are arising from projects in Africa, Asian and Latin America, the buy / sell side dynamics are such that the value realised for the carbon credits does not provide a benefit that is sustainable for the countries hosting the activities giving rise to the carbon credits, and the sale of carbon credits is not allowing host countries realise their own decarbonisation and reduction targets.

It may or may not be the case that the **BNEF Report** informed the decision of India (see above **India to stop carbon credit exports**), but it is clear that there is a strong emerging logic, and narrative.

- **Carbon Direct and Eco-Engineers**: On **August 2**, **2022**, **Carbon Direct** (at https://carbon-direct.com under **A New Proto-Protocol of Bio-oil Sequestration**) announced that it and **Eco-Engineers** had developed a prototype protocol on bio-oil sequestration, working with **Charm Industrial**. As announced, the protocol provides for carbon accounting, life-cycle analysis, and monitoring, reporting and verification (**MRV**). A link to the protocol is attached.
- **Variety the spice of life**: On **August 3**, **2022**, the good folk at **Ecosystem Marketplace** (https://ecosystemmarketplace.com) published ***The State of the Voluntary Carbon Markets 2022 Q3 briefing, "The Art of Integrity"***. The publication is well-worth a read. In addition to the headline picked up by many news-feeds to the effect that the voluntary carbon market is now worth areas **USD 2 billion**, the publication provides a fantastic infographic entitled **170 Types of Carbon Credit**, which is set out below.

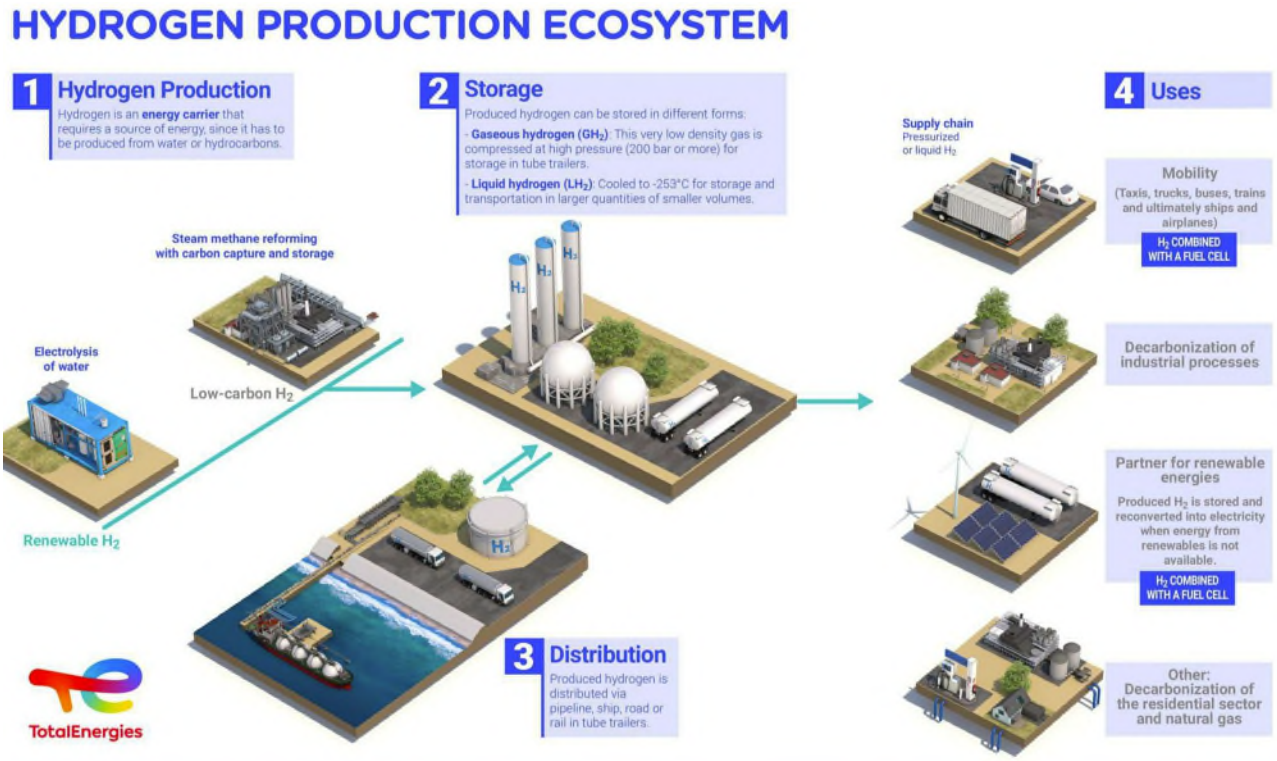
In addition, the good folk at **Ecosystem Marketplace** echo a number of themes that have been canvassed in Low Carbon Pulse, critically, the importance of high quality carbon credits underpinned by their integrity, which is achieved by transparency and verification. High quality carbon credits are essential to the establishment and the functioning of high-quality voluntary carbon markets.

- **Gold Standard and Partners scope digital carbon market**: On **August 11**, **2022**, **Gold Standard** (at https://goldstandard.org, under **Gold Standard and Partners start work to define future of digital carbon market**) announced that Gold Standard working groups are developing digital solutions and governance frameworks for: **1**. Digital Monitoring, Reporting and Verification (**MRV**); **2**. Digital Assets for Climate Impact, and **3**. Digital Infrastructure and Open APIs, with the intention to develop carbon markets that accelerate climate mitigation and sustainable development.
- **Treasure Trove**: **Carbon Growth Partners** continues to share articles on a range of topics. **Edition 45** of Low Carbon Pulse covered ***Carbon Credits 101, Episode 3: Less Harm, Or More Good?*** Since then Carbon Growth Partners have published ***Carbon Credits 101, Episode 4: Understanding COP26*** and ***Carbon Credits 101, Episode 5: How To Build a Forest***.

  For ease of reference, links are attached to **Episodes** 1 and 2 (***Episode 1: Building A Better Cookstove***, ***Episode 2: Mongolia's Power of the Wind***) in the **101-series**. In addition, ***Carbon Credits 101, Prologue: The Carbon Market Explained*** is attached.

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

- **TOTALEnergies infographic**: Various editions of Low Carbon Pulse have included infographics from the good folk at **TOTALEnergies**. On **August 3**, **2022**, the team at **TotalEnergies Green Gas and LNG** published the following infographic outlining some of the means of production and storage of hydrogen, and its distribution. As always, with infographics from **TOTALEnergies**, the infographic is excellent.



- **B&W and Newpoint Gas combine to advance hydrogen**: On **August 1**, **2022**, it was reported widely the **Babcock and Wilcox** and **Newpoint Gas** had teamed up to explore the use of the former **US DOE** Portsmouth Gaseous Diffusion Plant site to produce hydrogen (using the Babcock and Wilcox BrightLoop™ technology) and to capture ***CO_2*** arising from hydrogen production for its storage (and to supply the Babcock and Wilcox BrightGen™ hydrogen combustion technology).
- **PT Pertamina (Persero) plans pilot project**: On **August 2**, **2022**, it was reported widely that **PT Pertamina** plans a pilot project to produce Green Hydrogen using renewable electrical energy generated at its **Ulubelu Geothermal** project.
- **Wintershall Dea and Noord-West Oelleitung go blue**: It has been reported widely that on **August 2**, **2022**, **Wintershall Dea** (the largest independent oil and natural gas producer in Europe) and **Noord-West Oelleitung** entered into a memorandum of understanding (**MOU**) in respect of the development of the **BlueHyNow** hydrogen production facility to be located on the **Noord-West Oelleitung** site at Wilhelmshaven. **Wintershall Dea** and **Noord-West Oelleitung** will work together in relation to the development of the **BlueHyNow** hydrogen production facility which will use natural gas sourced from Norwegian natural gas fields as feedstock for the production of Blue Hydrogen, with the Blue Hydrogen to be transported to customers of **Wintershall Dea** using pipeline infrastructure owned and operated by **Noord-West Oelleitung**.
- **Project Bad Lauchstädt progresses**: On **August 4**, **2022**, **Uniper** announced (https://www.uniper.energy/news (under ***Hydrogen Lighthouse Project Bad Lauchstadt: Uniper orders Sunfire Electrolyser***) that the **Bad Lauchstadt energy park** is to enter execution phase, with **Uniper** having ordered a 30 MW pressurized alkaline electrolyser from **Sunfire GmbH**, with delivery scheduled for 2024.
- **At Liberty Hydrogen**: On **August 4**, **2022**, **Liberty Hydrogen** announced plans to develop a **100,000 metric tonnes** a year clean and renewable ammonia production facility in Western Australia using wood waste as feedstock to produce clean and renewable hydrogen, which will then be compounded with nitrogen.
- **New Fortress Energy Inc. Plugged in**: On **August 4**, **2022**, it was reported widely that **New Fortress Energy Inc** and **Plug Power Inc** had contracted for the supply of **120 MW** (50 metric tonnes a day, and 18,250 metric tonnes a year) of proton exchange membrane (**PEM**) electrolysers for the industrial-scale Green Hydrogen production facilities to be developed by **New Fortress Energy** near Beaumont, Texas. As reported, the Green Hydrogen production facility will be scalable to **500 MW**.
- **AGL Energy and FFI expand thinking**: **Edition 32** of Low Carbon Pulse reported on feasibility study to be undertaken by **AGL Energy** and **FFI** as to assess the development of the Hunter Energy Hub.

  On **August 9**, **2022**, it was reported widely that **AGL Energy** and **FFI** had agreed to expand the size and scope of the feasibility study to **2 GW** and to include new partners **Inpex**, and **APA** and **Jemena**.

  By way of reminder: **Edition 41** of Low Carbon Pulse (under **AGL leading two feasibility studies on *BESS***) reported that **AGL Energy Limited** (one the Big Three integrated energy corporations in Australia) was undertaking feasibility studies in respect of two sites, one at its **Liddell** site, in the Hunter Valley, New South Wales, and the other at **Torrens Island**, its site in South Australia.

  In respect of the **Liddell** site, **AGL Energy** was working with **Fortescue Future Industries** (see **Edition 32** of Low Carbon Pulse) and **Osaka Gas Australia**, now joined by new partners **Inpex**, and **APA** and **Jemena**.

  In respect of the **Torrens Island** study, **AGL Energy** is working with (in alphabetical order), **Adbri** (leading cement manufacturer), **Brickworks** (leading building products manufacturer), **Flinders Ports** (the leading port operator in

South Australia), **Inpex** (leading international energy corporation), **Osaka Gas Australia** (leading international gas and power corporation), **SK ecoplant** (a wholly-owned subsidiary of SK Group), and **Spark Renewables** (leading renewable energy development corporation).

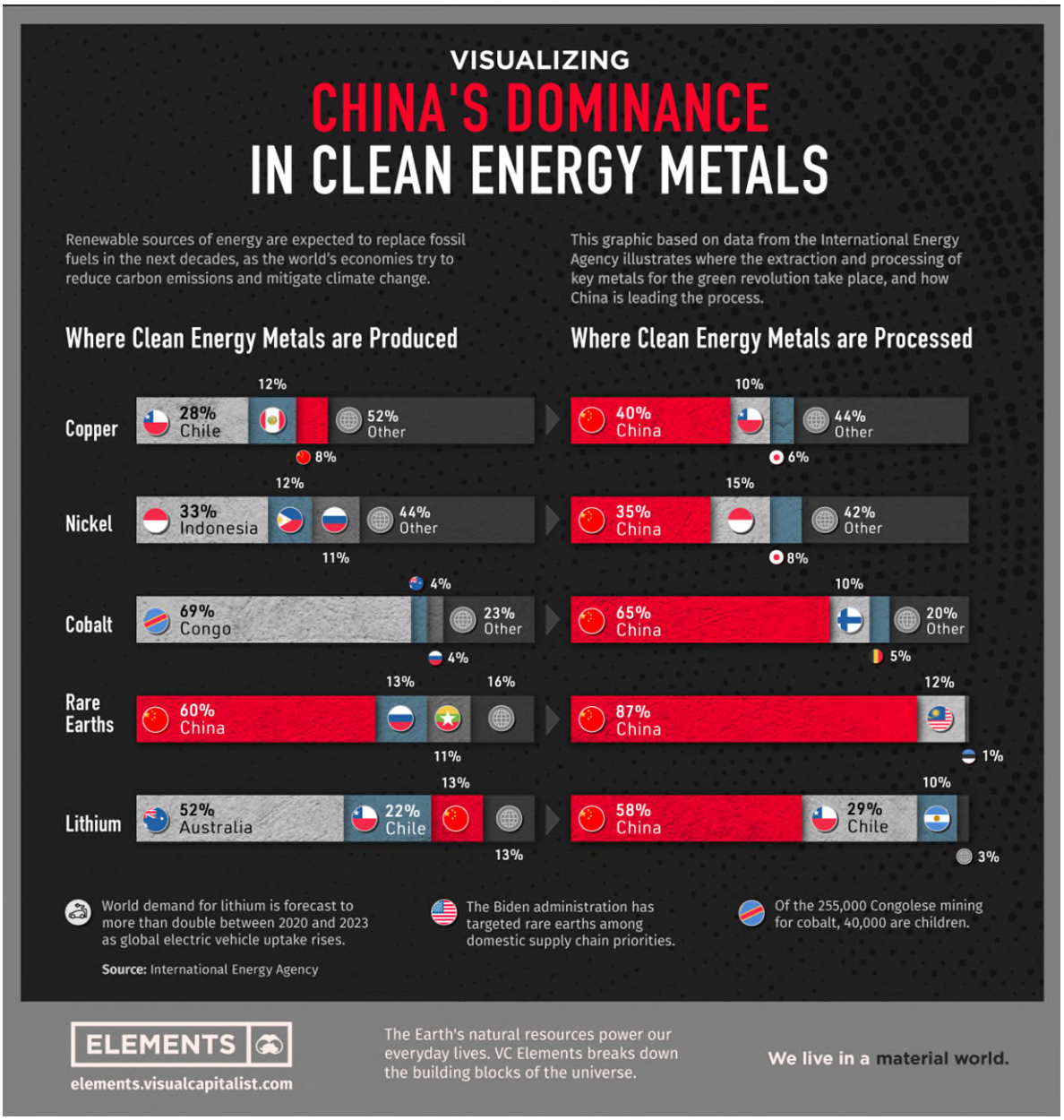
- **Cumbrian hydrogen hub**: On **August 10**, **2022**, it was reported widely that **Barrow Borough Council**, **Carlton Power**, **Cumbria Local Enterprise Partnership** and **Electricity North West** had signed a memorandum of understanding to develop a **35 MW** hydrogen hub in coastal town of Barrow-in-Furness, Cumbria, England.

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

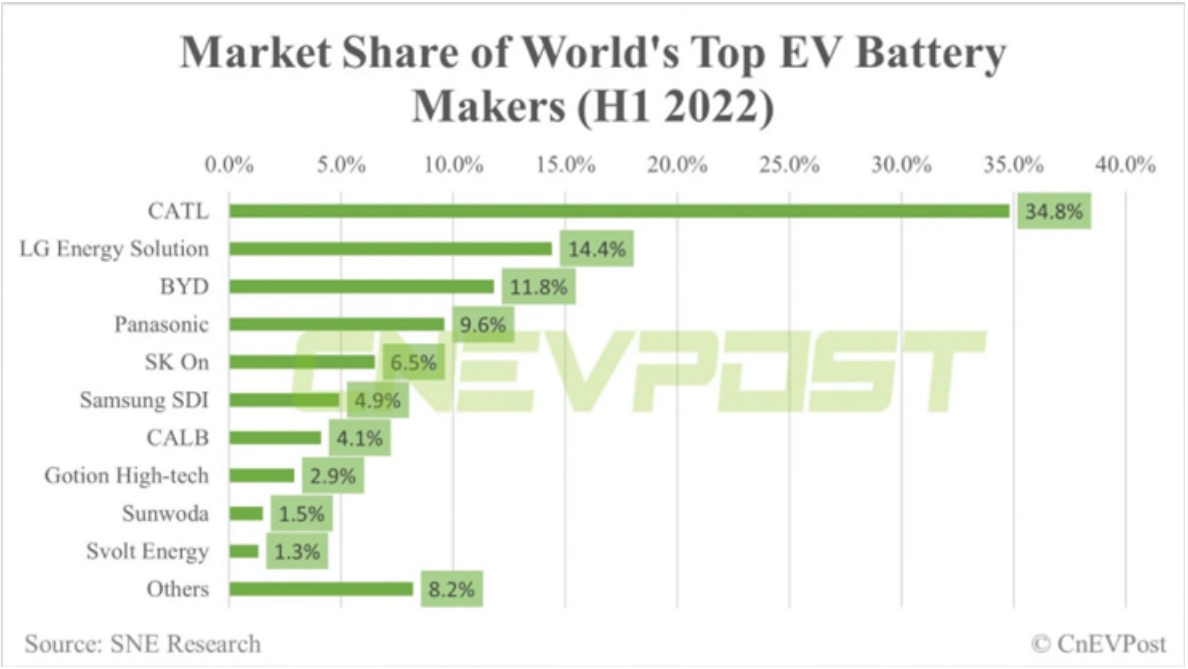
- **Sustainable Cities**: On **August 2**, **2022**, the good folk at the **Global Environment Facility** (**GEF**) published ***Advancing Urban Sustainability for Green Recovery – Learning from the GEF's Sustainable Cities Program***. The publication is well-worth a read, providing helpful and informative guidance on practical matters.
- **Navantia to build 500 MW electrolyser manufacturing plant**: On **August 3**, **2022**, https://rechargenews.com, under ***EXCLUSIVE/Shipbuilder Navantia to build 500 MW hydrogen electrolyser plant with "world-renowned technologist***, reported that Spanish shipbuilder **Navantia** intends to develop an assembly line in northwest Spain for the assembly of 500 MW of electrolysers initially, with the ability to increase rapidly the assembly capacity.
- **Nel doubles up**: On **August 11**, **2022**, it was reported widely that **Nel** is to develop a second production line at is giga-factory located in Herøya, Norway – see **Editions** 34 and 39 of Low Carbon Pulse.

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

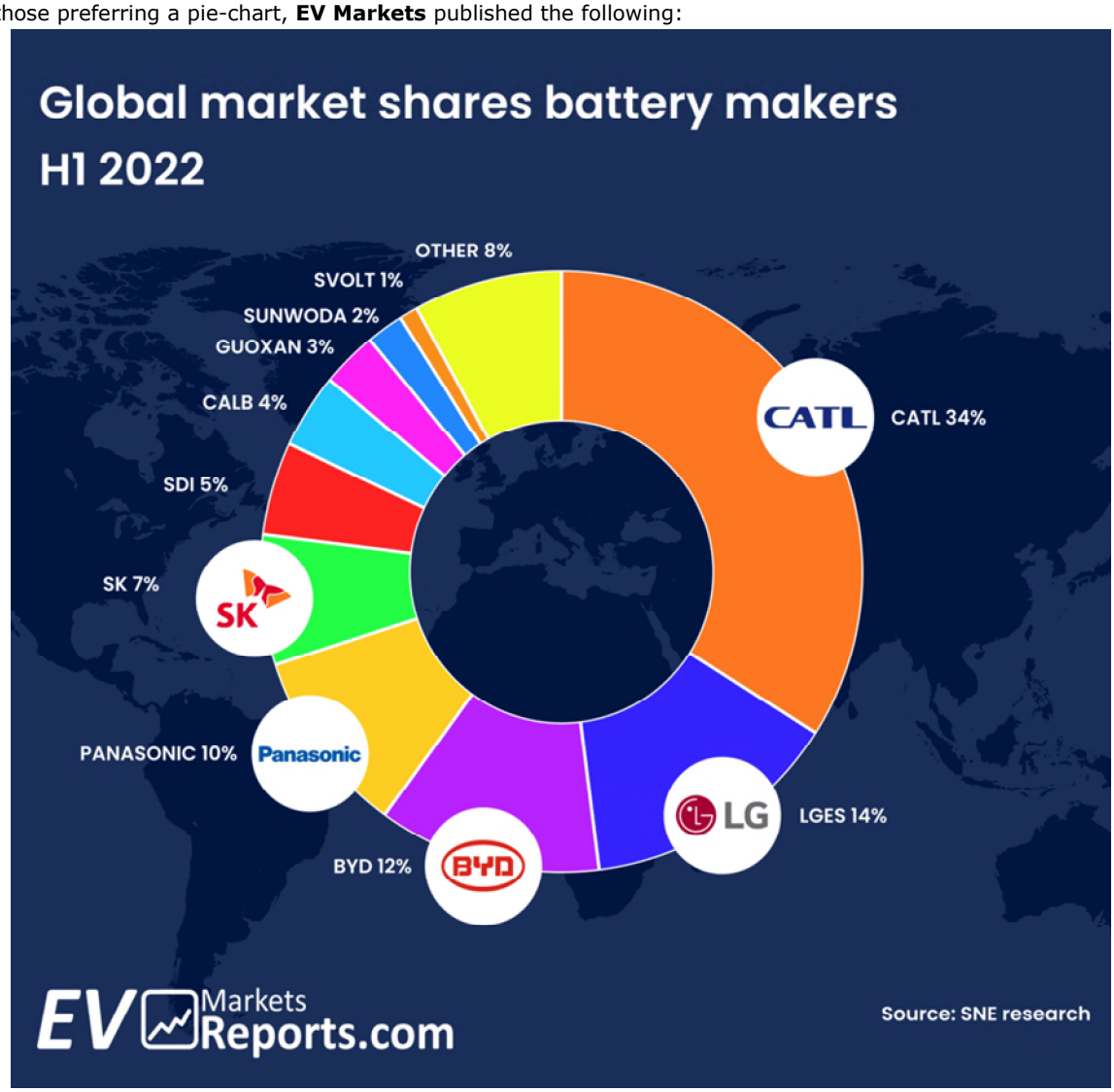
- **Size and scope of green metals and minerals**: During the week beginning **August 8**, **2022**, the good folk at the **Visual Capitalist** provided us with the following infographic providing a clear sense of the progress that the ***PRC*** has made in realising green metals and minerals to facilitate decarbonisation and the energy transition.



- **Size and scope of EV battery market**: On **August 8**, **2022**, **Batteries News** (at https://batteriesnews.com, under **CATL Holds 34.8% of Global Power Battery Market in H1**) reported on the global power battery market for H1 of 2022. The bar chart below provides a summary of the market share of each battery manufacturer.



For those preferring a pie-chart, **EV Markets** published the following:



- **140 MW roof-top array**: On **August 9**, **2022**, **PV Magazine** (at https://www.pv-magazine.com (under **140 MW rooftop PV project to help carbon-free 'green' steel industry**) reported that **SolarApex** had built the world's largest roof-top photovoltaic solar array to help **Tosyali** (Turkish iron and steel producer) to move to carbon-free 'green steel' production.

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

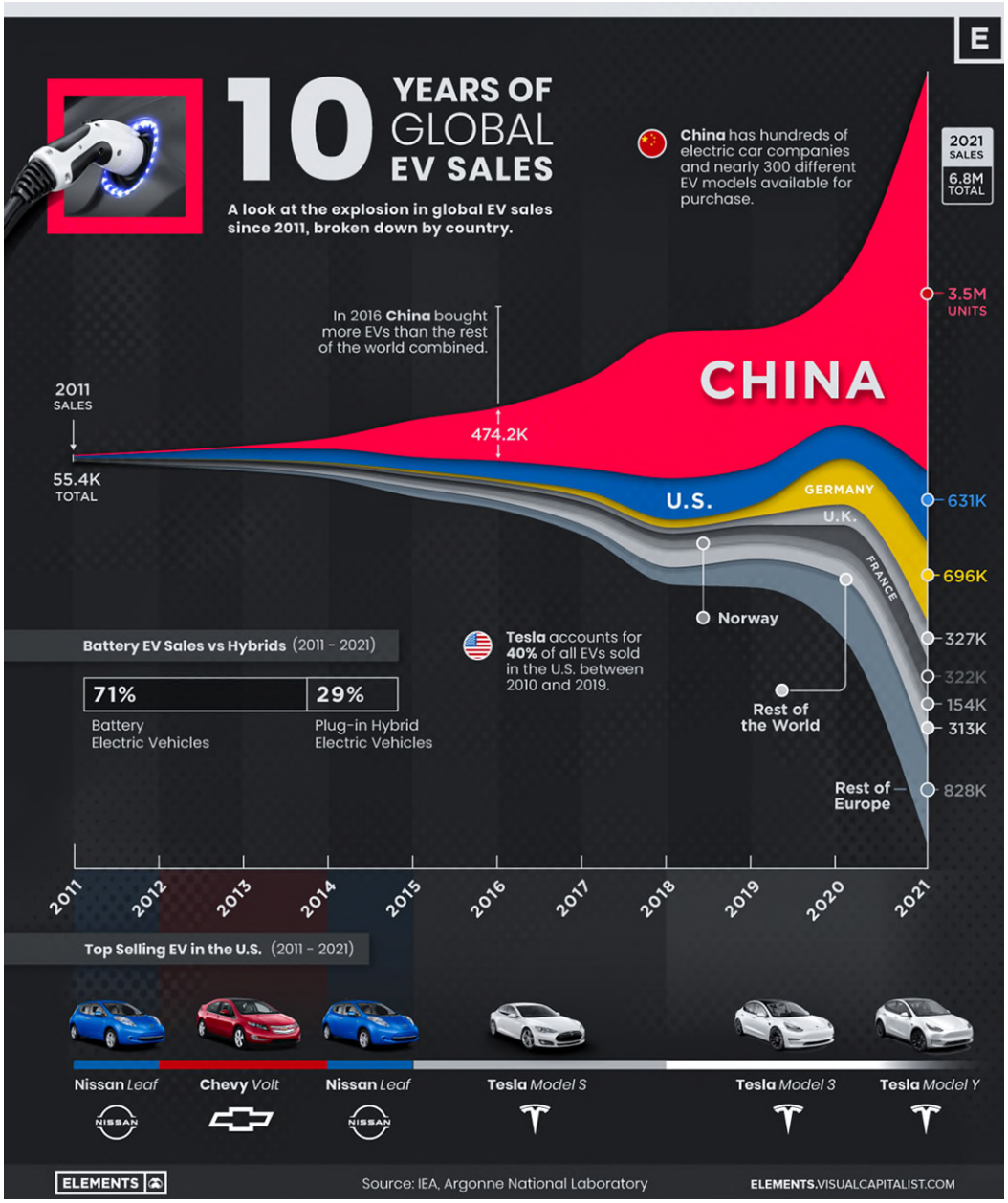
- **First electrical energy from Hollandse Kust Zuid**: On **August 7**, **2022**, **Renew Economy** (at https://www.reneweconomy.com.au, under **World's first subsidy free offshore wind farm starts to produce power**) reported that electrical energy from the 140, 11 MW, wind turbine, **1.5 GW**, **Vattenfall Hollandse Kust Zuid** offshore wind field project, had been dispatched to the grid in the Netherlands. The award to **Vattenfall** was on the basis that it would be a truly merchant offshore wind field project, dispatching electrical risk and assuming the risk of the price of that electrical energy.
- **US backs offshore wind in the Philippines**: On **August 8**, **2022**, **Offshore Wind** (at https://www.offshorewind.biz, under **US Backs Philippines Offshore Wind Development**) reported that the US Trade and Development Agency (**USTDA**) had awarded a grant to Aboitiz Renewables, a subsidiary of **Aboitiz Power Corporation**, to fund a feasibility study to develop up to **3 GW** of off-shore wind field capacity off-shore of the Philippines. As reported, the feasibility study will be undertaken with the Rocky Mountain Institute and Clime Capital Management (based in Singapore).
- **Financing off-shore wind field projects**: On **August 9**, **2022**, the good folk at **BlueFloat Energy**, **BVG Associates**, **Reuters Events** and **Vestas** released ***Financing Offshore and Floating Wind Projects*** (to be found at https://1.reutersevents.com, **under Analysis: Financing Offshore Wind**). The publication provides an overview of the current key dynamics, and is well-worth a read.
- **California firms to 25 GW of offshore floating**: **Edition 45** of Low Carbon Pulse reported on the desire of the Governor of California, Mr Gavin Newsom, for the US State of California to commit to the development of 25 GW of offshore floating wind field capacity. On **August 10**, **2022**, California committed to **25 GW** of offshore floating wind field capacity **by 2045**, and **5 GW by 2030**, with the **California Energy Commission** changing policy settings for these purposes.
- **Copenhagen Energy goes offshore Western Australia**: On **August 12**, **2022**, it was reported widely that **Copenhagen Energy** has submitted a proposal to develop a **3 GW** offshore wind project offshore of the coast of Western Australia, north of Geraldton. As reported, the proposed development straddles Federal waters and Western Australian State waters.

Solar and Sustainability (including *NZE* Waste):

- **ENEOS and TotalEnergies good to go**: On **August 5**, **2022**, it was reported widely that **ENEOS** and **TotalEnergies** had obtained clearance for their joint venture. The **ENEOS** / **TotalEnergies** incorporated joint venture, named **TotalEnergies ENEOS Renewables Distributed Generation Asia Pte Ltd**, plans to develop **2 GW** of photovoltaic solar projects across Asia over the next five years on a business-to-business basis, the joint venture company contracting under power purchase agreements to provide renewable electrical energy sourced from the **2 GW** of photovoltaic solar projects.
- **Holcim produces 100% recycled clinker**: On **August 4**, **2022**, **Holcim** announced (at https://www.holcim.com, under **A World First: Holcim Produces 100% Recycled Clinker**) that it had produced clinker made entirely from recycled materials at its plant in Altkirch, France.
- **Nigeria secures US Export-Import Bank loan**: On **August 8**, **2022**, **Energy & Utilities** (at https://www.energy-utiliites.com, under **Nigeria solar power development to get boost from US loan**) reported that leading Nigerian newspaper, **The Day**, had reported that Nigeria had secured a 20 year **USD 1.5 billion** term loan facility from **US Export-Import Bank** to fund the development of photovoltaic infrastructure.

Land Mobility / Transport:

- **Buses and coaches**:
  - **Dresden Line 68 electric**: On **August 8**, **2022**, **Daimler Truck AG** (at https://media.daimilertruck.com, under **Electrifying Dresden: Transport companies in the state capital are switching to electric on the 68 bus route with Mercedes-Benz eCitaro**) announced that from August 8, 2022, **Dresdner Verkehrsbetriebe** was using electric battery buses along the backbone of the public transport system in Dresden, Saxony.
  - **Brisbane City Council order 60 electrics**: On **August 8**, **2022**, **Sustainable Bus** (at http://www.sustainable-bus.com, under **Brisbane has officially ordered 60 extralong e-buses**) reported that **Brisbane City Council**, specifically, its **Metro Project**, had ordered 60 high-capacity, extralong (at 24.5 metres) bi-articulated battery electric buses from **HESS** (leading Swiss manufacturer), with deliveries to commence in 2023. The **Metro Project** will be powered by the first flash charging system in Australia, to be supplied and installed by **Hitachi Energy**, working with **HESS**.
- **Cars and taxis (and light-vehicles generally)**:
  - **The EV's journey**: On **August 9**, **2022**, the following infographic was published by the good folk at the Visual Capitalist.



As will be apparent, the ***PRC*** and the EU are leading the way in the EV journey.

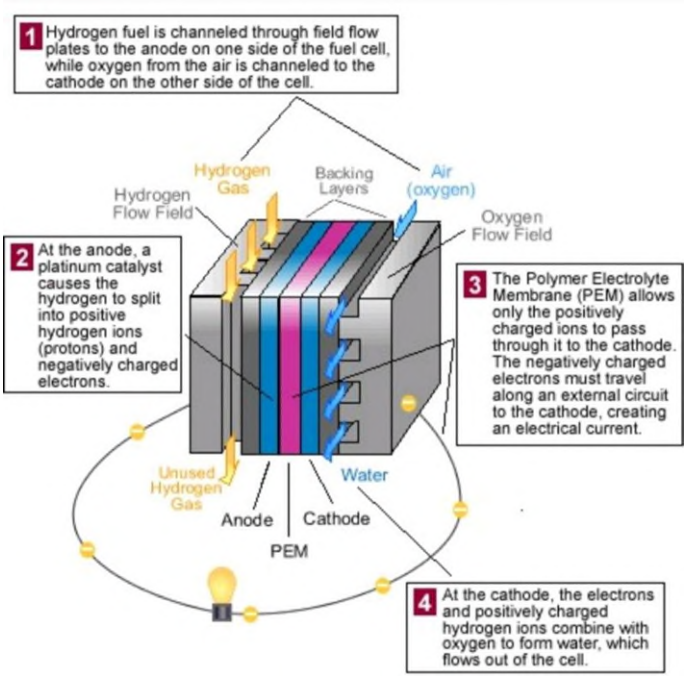
- **BMW and Toyota to deliver FCEV SUV by 2025**: On **August 12**, **2022**, **autoevolution** (at https://www.autoevolution.com, under **Hydrogen-Powered BMWs Co-developed With Toyota Are Coming in 2025**) reported that **BMW** plans to develop a the **iX5 Hydrogen**, working with Toyota (including using fuel-cell technology developed by Toyota).

- **Battery, Fuel Cell and ICE Technology**:
  - **Technology insight**: Sustainable-bus.com has run a series of articles about the application of hydrogen. In an article on the main benefit of the use a high voltage battery in fuel-cell technology buses it is stated that use increases efficiency through more efficient energy management, with electrical energy provided more flexibly from a combination of battery and fuel-cells.

    The key components of a hydrogen powered and propelled vehicle using fuel-cell and battery technology are the battery, the fuel-cell, the hydrogen fuel containment tank, the electric motor and the power control system. The fuel-cell, with oxygen from the environment, and the hydrogen from the containment tank, produce electrical energy, and the power control system determines whether the electrical energy is to be stored in the battery or is to be used directly to power and to propel the bus, while at the same time ensuring that the there is sufficient electrical energy stored within the battery.

    While this is the main benefit, the combined hybrid battery and fuel-cell technology bus can provide power and propulsion simultaneously to provide increased power, critically, during acceleration.
  - **How do fuel-cells work?**

    One of the questions that the author of Low Carbon Pulse is asked most frequently is to explain how fuel-cell technology works. On **August 12**, **2022**, the author came across the following diagram, which provides a clear and excellent answer:



- **Industrial Vehicles and Trucks**:
  - **Road loaded**: On **August 9**, **2022**, **H2 View** (at https://www.h2-view.com, under **5,000 hydrogen-powered trucks purchased in 'low single-digit' billion euro deal**) reported that **GP Joule** has announced on **August 8**, **2022**, that it would purchase **5,000 40 metric tonne** hydrogen powered and propelled trucks from **Clean Logistics** through 2027. The trucks will use heavy semi-trailer tractor units combining fuel-cell and battery electric technologies. For **GP Joule**, the acquisition and deployment of the trucks will enable it to provide customers with a one-stop supply / value chain, with **GP Joule** to procure and to produce Green Hydrogen, to develop and to deploy hydrogen fuelling / refuelling stations, and to offer trucks to haulage companies. A business model matching supply and demand.
  - **Retrofitting trucks**: On **August 9**, **2022**, **Fuel Cell Works** (at https://www.fuelcellworks.com, under **TECO 2030: the Market for Hytruck Concept**), reported on the European truck market and the plans of **TECO: 2030** (see **Edition 31** of Low Carbon Pulse) to mobilise its **HyTruck** concept. Currently there is around 6.2 million trucks in use across the European Union, each with an average life-cycle of 13 years. The **HyTruck** concept is to retrofit existing trucks with fuel-cell and battery electric technologies to achieve zero-emission hydrogen haulage. In 2021, 96.5% of new truck sales were diesel powered and propelled, 0.1% motor spirit, and 3.4% other fuels, with GHG emissions from diesel powered and propelled truck accounting for around 6% of total EU GHG emissions, and 25% of GHG emissions arising from road transport.
- **Recharging and refuelling infrastructure**:
  - **Air Liquide to supply Viva**: **Edition 36** of Low Carbon Pulse reported the planned development and deployment by **Viva Energy Australia** of a **New Energies Service Station** located at a site in **Geelong**, **Victoria**. On **August 4**, **2022**, it was reported widely that **Air Liquide** is to supply hydrogen to **Viva Energy Australia**, being the first hydrogen fuelling / refuelling station that **Air Liquide** is to supply in Australia.
  - **Jet Charges WA**: On **August 10**, **2022**, it was reported widely that the Government of Western Australian had awarded **Jet Charge** the contract to deploy 98 EV chargers at 49 locations in Western Australia. The EV chargers will be deployed from Kununurra in the north of Western Australia, to Esperance in the south, and to Eucla in the east, with 6,600 kms of coverage.
- **Trains**:
  - **Alpha Project on track**: On **August 1**, **2022**, it was reported widely that **Ofgem** is to provide funding support, from its **Strategic Innovation Fund**, to enable the progress of the **Alpha Project**, a pilot project under which Green Hydrogen is to be used to power and to propel prototype fuel-cell technology trains, as part of the plan to replace diesel powered and propelled trains across the Scottish rail network by 2035. For previous reporting on this initiative, see **Edition 37** of Low Carbon Pulse.
  - **FCH2RAIL commences dynamic testing**: **Edition 42** of Low Carbon Pulse reported on static tests by **CAF** in respect of the static testing of the electrical energy generation system of **FCH2RAIL**. During the week commencing **August 8**, **2022**, it was reported widely that **CAF** is to commence dynamic testing of its train on track. The results of the static and dynamic tests will allow a clear view to be reached on the use of a hydrogen powered and propelled train in contrast to the use of diesel powered and propelled trains. (See **Editions 26** and **35** of Low Carbon Pulse for other reporting in respect of **FCH2RAIL**.)

Ports Progress and Shipping Forecast:

- **Ferries and other craft**:
  - **ERGO ARGO FOR CARGO**: On **August 9**, **2022**, **Splash 247** (at https://splash247.com, under **Shippers sign up for revolutionary hydrogen-powered box-carrying hydrofoil**) reported that **Boundary Layer Technologies** had announced that key Fortune 500 corporations will be "launch partners" for its zero-emission

freight service to launch in 2025. The freight service will be provided using a high-speed, hydrogen powered and propelled hydrofoils named **ARGO**s.

- **LNG to NH_3**: On **August 9**, **2022**, **Offshore Energy** (at https://www.offshore-energy.biz, **under NYK inks deal to convert LNG-fuelled tugboat to ammonia**), reported that **NKY Group** is to convert a tugboat (operated by NYK Group corporation, Shin-Nippon Kaiyosha Corporation), in Tokyo Bay, to use ammonia for power and propulsion, with the conversion scheduled for completion in 2024.
- **Venice last mile hydrogen delivery service**: **H2 View** (at https://www.h2-view.com, under **Venice waterways welcome a hydrogen-powered delivery service**) reported that on **August 10**, **2022**, **Nippon Express Italia** announced that it had launched a last mile delivery service us hydrogen powered and propelled vessels to make deliveries within Venice, Italy.

- **Green Corridors**:
  - **Port of Rotterdam to Port of Singapore**: On **August 2**, **2022**, two of the world's giant port authorities, the **Port of Rotterdam Port Authority** (**PORA**) and the **Maritime and Port Authority of Singapore** (**MP**A) announced that they are to establish the longest **Green and Digital Corridor** in the world. For these purposes, the **MPA** and **PORA** have signed a memorandum of understanding so as to promote and to enable lower, low and zero carbon shipping along the Green Corridor.

    For a fuller report please view **Maritime and Port Authority of Singapore and Port of Rotterdam to establish world's longest Green and Digital Corridor for efficient and sustainable shipping**, at https://www.zerocarbonshipping and **Singapore and Rotterdam to Establish 'World's Longest' Green Shipping Corridor** at https://gcaptain.com. For previous news items on Green Corridors in Low Carbon Pulse, please see **Editions 30**, **34** and **35**.

    By way of reminder:

    - **Edition 30** of Low Carbon pulse reported on Green Shipping Corridors as follows:

      "**Clydebank Declaration:** On November 10, 2021, the ***Clydebank Declaration*** was agreed at ***COP-26***. The ***Clydebank Declaration*** emphasises the importance of limiting "the increase in global average temperature to ***1.5^{o}C*** above pre-industrial levels", expressed great concern that if "no further action is taken, international shipping emissions are expected to represent 90% to 130% of 2008 emissions levels by 2050", and recognised that "a rapid transition in the coming decade to clean maritime fuels, zero-emission vessels, alternative propulsion systems, and the global availability of landside infrastructure to support these, is imperative for the transition to clean shipping".

    In addition the signatories to the ***Clydebank Declaration*** committed facilitate the development of ***Green Shipping Corridors***, with at least six ***Green Shipping Corridors*** by "the middle of this decade … [and] many more corridors … by 2030". A ***Green Shipping Corridor*** is a route between two or more ports that are "zero-emission maritime routes".

    The signatories to the ***Clydebank Declaration*** are: Australia, Belgium, Canada, Chile, Denmark, Fiji, Finland, France, Germany, Republic of Ireland, Italy, Japan, Republic of the Marshall Islands, Morocco, the Netherlands, Norway, Spain, Sweden the UK, and the US.

    - **Edition 34** of Low Carbon Pulse reported the Los Angeles and Shanghai Green Corridor as follows:

      "On January 28, 2022, or thereabouts, it was reported widely that the Port of Los Angeles, the Port of Shanghai and **C40 Cities** (a global network of mayors taking action to confront climate change), are to create the first transpacific Green Shipping Corridor between the US and the ***PRC***.

      It is difficult to overstate the significance of the establishment of the first transpacific Green Shipping Corridor between the US and the ***PRC***. The US and the ***PRC*** have the largest bilateral trading relationship globally, and the ports of Los Angeles and the Shanghai are key gateways to the seaborne trade, which accounts for the vast majority of trade."

- **Green Ports**:
  - On **August 1**, **2022**, the **Port of Amsterdam** and **Duisport** signed a memorandum of understanding to expand their existing cooperation to develop jointly a hydrogen supply / value chain and hinterland network. It is understood that the hydrogen supply / value chain will provide end-to-end capacity for producers and carriers of Green Hydrogen between the two ports.
  - On **August 8**, **2022**, **H2 View** (at https://www.h2-view.com, under 'Multi-hundred megawatt' hydrogen hub plans for UK's busiest port) reported that **ScottishPower** (owned by Iberdrola) had revealed plans to develop, build and operate a 'multi-hundred megawatt' Green Hydrogen production facility at the **Port of Felixstowe**, Suffolk, England. Hydrogen Director for Scottish Power, Mr Barry Carruthers, said: "*This strategically important project could potentially create a clean fuels hub that could unlock nationally significant decarbonisation for the region, as well as playing a role in international markets*".

- **Green shipping**:
  - **LPG and LAG carriers ordered**: Various editions of Low Carbon Pulse have reported on the use dual-purpose / use carriers – liquified petroleum gas (**LPG**) and liquified ammonia gas (**LAG**), and the likelihood of increased development and use. On **August 5**, **2022**, off-shore-energy.biz (under ***Kawasaki books order for LNG-powered newbuild from NYK***) reported that **Kawasaki Heavy Industries** (**KHI**) had concluded a shipbuilding contract with for a **86,700 m^3** LPG / LAG carrier with **Nippon Yusen Kabushiki Kaisha** (**NYK**). As reported the LPG / LAG carrier is equipped to carry LPG and LAG at the same time, but in separate containment tanks (having separate systems). The LPG / LAG carrier is schedule for delivery in 2025, and follows an order from Kumiai for a like carrier, with an option for another.

    KHI stated: "*The advantage of this dual-purpose vessel is its capability to carry simultaneously LPG, which is already used as a low-carbon energy source, and NH_3, new fuel contributing to the establishment of a decarbonized*

society. Another feature is the greater capacity of the cargo tanks as compared to conventional carriers, which was achieved without changing significantly the vessel's length, breadth or other main specifications".

[**Note**: As noted in previous editions of Low Carbon Pulse, while ***NH_3*** is carbon free on oxidation it gives rise to nitrous oxide (***N_2O***) which is a ***GHG***, being one of the three well-mixed ***GHG***s, along with ***CO_2*** and ***CH_4***]

- **PETRONAS and signs with six ROC corporations**: On **August 2**, **2022**, it was reported widely the **PETRONAS** had signed a memorandum of understanding (**MOU**) with **GS Energy Corporation**, **Lotte Chemical Co**, **Samsung Engineering**, **Samsung Heavy Industries**, **SK Earthon** and **SK Energy**. Under the **MOU**, the parties are to assess carbon storage sites within Malaysia, and assess the entire ***CO_2*** supply / value chain, including the cross-border import of ***CO_2*** into Malaysia.
- **All abroad for carbon capture**: On **August 5**, **2022**, **Splash 247** (at https://splash247.com, under **Cosco and Dialian develop tankers with carbon capture tech**) reported that **Dalian Shipbuilding Industry Co** (**Dalian**) and **Cosco Shipping Energy Transportation** (**Cosco**) had developed two types of tankers equipped with carbon capture and storage systems. The two types of tankers are a very large crude carrier (**VLCC**) and a **suezmax**, each of which has obtained approval in principle (AiP) issues by **ABS**, **CCS** and **DNV**.
- **More sails**: On **August 10**, **2022**, it was reported that **BHP** is to work with **Norse Power Oy Ltd** and **Pan Pacific Copper Co Ltd** to assess the installation of a wind-assisted propulsion system on a combination carrier trading between Chile and Japan.
- **More methanol**: On **August 10**, **2022**, it was reported widely that **MAN Energy Solutions** and **Stena Teknik** are to work together, with **Proman**, to retrofit **MAN 48/60** engines to make them dual-fuel compatible, diesel and methanol. For these purposes, these leading corporations have signed a memorandum of understanding.

Airports and Aviation:

- **Lufthansa and Shell bind over SAF**: On **August 1**, **2022**, **Shell** announced (at https://shell.com, under ***Shell and Lufthansa Group sign non-binding Memorandum of Understanding for sustainable aviation fuel (SAF) supply***) that it and **Lufthansa** are exploring the supply of up to **594 million gallons** (**1.8 million metric tonnes**) of ***SAF***. **Shell** would produce the ***SAF*** using four different approved technology pathways using feedstock from a broad range of sustainable sources.
- **American Airlines invests in ZeroAvia**: On **August 3**, **2022**, **ZeroAvia** announced (at https://www.zeroavia.com, under ***American Airlines Announces Investment in Hydrogen-Electric Engine Developer ZeroAvia***) that American Airlines (the world's largest airline) had invested in **ZeroAvia** and signed a memorandum of understanding under which it may order up to **100 ZeroAvia** hydrogen-electric engines (intended to power and to propel regional jet engine aircraft).
- **Brisbane Airport timeline accelerated**: On **August 5**, **2022**, it was reported (at https://newsroom.bne.com.au, under ***Brisbane Airport accelerates net zero target by 25 years***) that **Brisbane Airport Corporation** (**BAC**) had "slashed its net zero emissions deadline by 25 years, in a bold move to improve the planet", with the aim to each net zero emissions by 2025, in contrast to 2050.

  The Chief Executive Officer of **BAC**, Mr Gert-Jan de Graff, said that: "*BNE is more than an airport. We are a sustainability leader. We want to create a world-leading Airport City that future generations can be proud of, because of how we acted today, to protect the community of tomorrow*".

  The accelerated net zero target is in respect of Scope 1 and 2 emissions. To achieve net zero in respect of Scope 1 and 2 emissions, **BAC** has committed to transition to 100% renewable electrical energy, to operate all electric vehicles and to develop an onsite carbon removal project within its Biodiversity Zone (being an area of 285 hectares within the precinct of BNE airport to preserve biodiversity, and "to act as an improved carbon removal asset").

  In addition, **BAC** is committed to sourcing 50% of its water from recycled sources, and to achieve zero waste to landfill by 2030.

  BAC is a signatory to the **Clean Skies for Tomorrow** initiative, under which it is committed to the acceleration of the supply and use of **SAF** by 2030, and has recently become a signatory to the Mission Possible Partnership Aviation Strategy (see **Edition #** of Low Carbon Pulse).
- **bp aims to start producing green jet fuel**: Taking up the theme of ***SAF*** from the previous piece, **bp** is to produce ***SAF*** at its Perth Future and Renewable Fuels refinery in Perth, Western Australia.

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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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