

Low Carbon Pulse - Edition 22

GLOBAL DEVELOPMENTS IN PROGRESS TOWARDS NET-ZERO EMISSIONS



Welcome to **Edition 22** of Low Carbon Pulse – sharing significant current news on progress towards net-zero emissions globally. This edition covers the period from Monday July 12, 2021 to Sunday July 25, 2021 (inclusive of each day).

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

Edition 22 will be posted again on **July 30 2021** to pick-up those reading later in the week. We will endeavour to publish the July Report on Reports on August 3, 2021.

The two weeks that were – reasons to be cheerful:

One of the joys of authoring Low Carbon Pulse is following both the connectedness of change, and the pace of change, in progress towards net-zero greenhouse gas (**GHG**) emissions (**NZE**). As readers of Low Carbon Pulse will have noticed, the length of the last few editions has increased, reflecting ever greater change, and an increase in the pace of change. Over the last two weeks in particular, a new coherence has emerged, built on policy s (existing and new), and the implementation of them, and the ever increasing level of activity of the private sector.

These dynamics are demonstrated clearly by the following:

1. the release of the **Fit for 55** package (providing a strong set of the policy settings for the **EU**);
2. the commencement of the operation of the **PRC ETS** - bringing over 4 giga tonnes (i.e., 4 billion tonnes) of CO₂ emissions into the **PRC ETS**, with a further 4 giga tonnes to follow in the near future; and
3. the close of applications for the **ScotWind Leasing Scheme auction process** that will add up to a further 10 GW of offshore wind capacity around Scotland – noteworthy for the identity and the number of participants in the process, and the ability for each of them to deliver projects and the benefits of them.

While recent editions of Low Carbon Pulse have been flagging these developments, each of them, in their different ways, mark material and significant progress towards **NZE**, both in terms of action and in terms of coherence of the policy settings, as well as providing other jurisdictions and economic blocs with a clear range of levers to pull, and options from which to choose, to progress to **NZE**.

The next three pages of this Edition 22 of Low Carbon Pulse provide an outline of these developments: the intention being to provide a sense of the pace, and range, of progress.

For those with the range of reference for new wave music, there is a certain synchronicity in the reference to **reasons to be cheerful** in the heading to this section: on July 20, 1979 (40 years, and week ago to the day) "Reasons to be cheerful, one, two, three" was released by Ian Dury, and the Blockheads. In this context, the author reflected on the passage of time: in the words of the Bard, "What is past, is prologue", we start from here, and in less than 30 years we have to achieve **NZE**.

Fit for 55 fit for purpose:

Purposes of FF55 package: On July 14, 2021 (as promised), the European Commission (**EC**) published its Fit for 55 (**FF55**) [package](#). The overarching purpose of the **FF55** package is to provide the policy settings that will enable the European Union (**EU**) to achieve a reduction in **GHG** emissions of 55% by 2030, consistent with the European Climate Law. For these purposes, the **EC** has proposed that at least 40% (up from 32%) of total energy consumption be sourced from renewable sources by 2030 (in a **Revised Energy Directive** or **RED**), and 49% for the building sector.

These revised policy settings are intended to promote: *"a more energy-efficient [including 9% less energy than currently projected] and circular energy system that facilitates renewables-based electrification ... the use of low carbon fuels, including hydrogen, in sector [in which] electrification is not yet a feasible option"*.

Whole of economy progress: These developments represent positive and bold policy setting, ensuring that action to decarbonise all sectors of the economy is taken, not just the electricity generation sector using renewable electrical energy. In light of the proposed new carbon market for building and transport proposed by **FF55**, distinct and separate from the **EU ETS**, it is now clear why modelling has been appearing left, right and centre on the appropriate price point under the new carbon market, critically, the price point for the transport sector.

President of the EC, Ms Ursula von der Leyen provided the headlines in saying: *"The fossil fuel economy has reached its limits. We want to leave the next generation a healthy planet as well as good jobs and growth that does not hurt our nature."* In the European Green Deal (**EGD**), the **EU** has "the design and detailed drawings" necessary to construct the road to **NZE**. While the fitness for purpose of **FF55** is not a surprise, **FF55** provides reason to be cheerful.

No surprises: As foreshadowed for a while (and as covered in Low Carbon Pulse for a while), the **EC** has gone beyond the **EU** in policy setting, in particular in the context of the Carbon Border Adjustment Mechanism (**CBAM**) (see Editions [12](#), [19](#), [20](#) and [21](#) of Low Carbon Pulse), and the extension of the EU Emissions Trading Scheme (**EU ETS**). See below for the implications of each of the **CBAM** (under **Tax Reform proposed and CBAM arrives**) and the **EU ETS** (next paragraph).

Next steps: The **FF55** package proposed by the EC needs to be approved by the European Parliament (**EP**) and the EU Member States. If approved, the legislative framework will exist for the **EU** to allow implementation of policy settings consistent with the **EGD**. Approval by the **EP** and EU Member States could take up to 24 months, but the EC hopes to finalise by 2022.

Not perfect: Apart from gripes from countries whose exports will be subject to **CBAM** and some more logical objections from the shipping industry about the extension of the EU ETS to the shipping industry (absent initiatives from the industry itself), the **FF55** package has received positive reactions, and is seen as a "mammoth package", for a "mammoth task", but it is not perfect.

The gripes from countries whose exports will be subject to **CBAM** are outlined below. In respect of the shipping industry, it is noted that the Maersk Mc-Kinney Moller Center for Zero Carbon Shipping has stated that: *"The [EC's] proposals to accelerate the decarbonisation of shipping is an important first step towards the introduction of Market Based Measures (MBM). As long as global consensus on [MBM] is not within reach, the [EU] should take the lead. In a parallel track, the EU and other maritime stakeholders should continue to encourage IMO regulation on global maritime MBM. Shipping is global by nature and needs global regulation to avoid multiple charges."*

Tax Reform proposed and CBAM arrives on time, intact, and fit for purpose:

- **Taxation reform proposed to drive low carbon use:** In the **FF55** package, the **EC** proposes the revision of the Energy Taxation Directive (**ETD**).

Consistent with the aims of the policy setting generally, energy taxation will follow the two following principles: **1.** energy taxation should be based on the environmental impact of the fuels used; and **2.** taxes on cleaner fuels should be lower than taxes on more polluting fuels, with the most polluting fuels having the highest taxes.

So as to level the playing field for these purposes, exemptions (using free emission allowances) will be removed on the use of kerosene as aviation fuel, and heavy fuel oil for ship bunkers, used by transport within the **EU**.

- **CBAM arrives on time, intact, and fit for purpose:**

CBAM Flagged: As noted on Editions [12](#) and [19](#) of Low Carbon Pulse, the **EC** flagged the introduction of **CBAM**, and the timing for its roll-out. **CBAM** (pronounced: "See? bam!" as promoted / reported in some newsfeeds) duly arrived on time, intact, and fit for purpose. There were no surprises.

The rationale for **CBAM** is clear: as stated in Edition [12](#) of Low Carbon Pulse, to impose a carbon price for goods sourced from countries that do not have a carbon price, and as such do not have a policy setting that is intended to achieve decarbonisation, and affords producers of those goods a price advantage.

- **CBAM – an imputation mechanism:** The imputation mechanism is to work on the following basis: importers into the **EU** must acquire carbon certificates in respect of goods for a price corresponding to a carbon price that would have applied had the goods imported into the **EU** been produced under **EU** carbon pricing.
- **CBAM – WTO "watertight" preventing carbon leakage:** The **EC** has stated that **CBAM** has been developed and structured so as to be consistent with the rules of the World Trade Organisation (**WTO**), and other international obligations, so as to prevent carbon leakage (defined below).
- **CBAM** has been criticised by some countries that will be affected by it, i.e., by countries that have not introduced a carbon price (whether under an Emissions Trading Scheme or Carbon Tax), and as such producers in those countries have a price advantage over goods produced (and services supplied) in the **EU** that have to embody a carbon price. While the criticism cannot be ignored, it is important to note that the criticism does not hold water: unlike **CBAM**, it is not watertight.

CARBON LEAKAGE

Carbon leakage is a phrase that is used to describe a situation in which a carbon price in one country may result in a shift in production of goods to another country (with a lower or no carbon price) with the result that there is an increase in total **GHG** emissions in respect of the production of goods.

The risk of carbon leakage is higher in industries and sectors that are fossil fuel (and feedstock) intensive and other carbon intensive fuel (and feedstock) industries and sectors.

- **Impact of CBAM:** As noted below (under *EC proposes changes to the EU ETS*) **CBAM** is to be introduced over time, and is to be applied to imports into the **EU** of goods and services (in the case of electricity) that have a high or higher risk of carbon leakage, being aluminium, cement, fertiliser and iron and steel (goods) and electricity generation (as a service) (**Carbon Leakage Goods and Services** or **CLGS**).
Organisations importing **CLGS** into the **EU** will have to report on the carbon embedded in those **CLGS**. If the **CLGS** are produced using green technologies, that reporting will reveal this, and ensure that producers producing **CLGS** with no embedded carbon will not have to acquire **CBAM** certificates corresponding to the carbon price that would have been paid had those **CLGS** been produced in the **EU**. It is a neat system.
- **Reflections on CBAM:**
 - **Rhetoric does not help, from any side:** The arguments and protestations from countries without a carbon price are at best brittle. This is not a question of forcing the hand of any country without a carbon price to introduce a carbon price: plainly and simply, it is a policy setting that levels the playing field, and that ultimately will result in the reduction and removal of negative externalities, leading to improved trade outcomes. This is economics and policy setting, and, in due course, trade, working perfectly in sync.
 - **As a policy setting CBAM makes sense:** The draft US Federal Budget contemplates the imposition of a tax on imports from countries that have not put in place policy settings that address achievement of **NZE** effectively: policy settings of this kind prevent carbon leakage, and are good for free-trade and as playing fields are levelled the true cost of production, reflected in market prices, will encourage more efficient and sustainable production – if green processes are used, no **CBAM** liability will arise.
 - **CBAM and world trade:** A number of countries have protested that policy settings of this kind are "just a new form of protectionism" in the sense of favouring producers in one bloc or country, over another: good politics in some countries, but not good policy. **CBAM** has been structured to comply with the obligations of the **EU** under the **WTO** Rules, and neither the broad structure, nor any of the more limited (as yet) detail, appears at risk of any meaningful, let alone a sustainable challenge.
 - **CBAM and environmental protection:** While **CBAM** is not protectionist in the context of world trade, it is protectionist in the sense of encouraging producers in non-**EU** countries to green their production processes: the greening of processes should mean that **CBAM** will not apply to them because there will be no embedded carbon to quantify.
It has to be said that this is one piece of detail that needs to be front and centre, and needs to be understood, because importers of goods and services (in the case of electricity) into the **EU** have to report on the emissions embedded in their goods and services; if green processes are used to produce those goods and services, that will be reported, and the **CBAM** should not apply.

How this all fits together as part of the European Green Deal:

Among the deluge of documents accompanying the **FF55** package was a document entitled [European Green Deal – Delivering on our Targets](#). This is a helpful document for those seeking to understand how all the policy settings come together as part of the overarching policy concept, the **European Green Deal**. The "honeycomb [graphic](#)" on page 9 is more helpful still.

ETSs news – PRC and EU

- **Commencement of trading on PRC ETS:** Edition [21](#) of Low Carbon Pulse reported that on July 7, 2021, at an executive meeting of the State Council, Chinese Premier, Mr Li Keqiang, announced that trading on the **PRC ETS** would commence for power generation during July 2021.
On July 16, 2021, the **PRC ETS** commenced trading. This represents a significant development in progress to **GHG NZE** for the PRC, and globally.
Given the size of the **PRC's** economy, it gives rise to significant **GHG** emissions.
As noted in previous editions of Low Carbon Pulse, initially the **PRC ETS** allows trading in quotas in respect of **GHG** emissions arising from the power generation sector (approximately 4 Gtpa (4 billion tpa)). In the first instance, trading is undertaken on the Shanghai Environment and Energy Exchange, with other trading platforms to be introduced over time.
In time, quotas in other sectors will be traded. As the quotas in other sectors are traded, the **PRC ETS** will have tradeable quotas in respect of 8,100 Gtpa of **GHG** emissions, or around 1/6th of global **GHG** emissions, and a little under ¼ of global **GHG** emissions arising from energy production and use.
The closing price for quotas on the first day of trading (on July 16, 2021) was reported as Y 51.23 (USD 7.72).
While the commencement of the **PRC ETS** may be a little behind the original schedule, and the price of quotas may not match the prices for equivalent carbon emissions allowances / permits / quotas in other **ETSs**, the **PRC** has made considerable progress over the last 18 months in putting in place policy settings, and implementing them. This level of progress, gives the author another reason to be cheerful.

- **EC proposes changes to the EU ETS:** As part of the **FF55** package, the **EC** has proposed the revision of the European Union Emissions Trading Scheme (**EU ETS**). In summary, the key revisions are as follows:
 - **2021:** Increase the 2030 target from minus 41% to minus 61% compared to 2030 levels (**EU ETS reduction**): this increase to the **EU ETS reduction** is a function of increased annual reductions to 4.2% (the **EU ETS Rebase**) and the inclusion of the aviation sector into the **EU ETS** by the removal of emission allowances for the sector, i.e., the removal of the aviation sector exemption.
 - **2023:** One-off reduction (**EU ETS Rebase**) in the cap on emissions under the **EU ETS** by 117 million allowances under the **EU ETS**;
 - **2023 to 2026:**
 - **2023:** Importers of specified goods into the **EU** will have to report, without having to acquire **CBAM** certificates;
 - **2025:** Establish a new carbon market, separate from the **EU ETS**, in respect of emissions from buildings (including heating) and transport.
This new, and separate, market will regulate the suppliers of energy and fuel suppliers, rather than households and car drivers. A cap will be set from 2026, and will reduce annually to 43% in respect of reductions across each sector by 2030, compared to 2005;
 - **2026:** Introduction of **CBAM** certificates under the **EU ETS** to give effect to **CBAM** (see above); and
 - **2023 to 2026:** Shipping is to be added to the **EU ETS**, commencing in 2023, and phased in over three years.
The owners of ships will have to acquire certificates under the **EU ETS** to acquit the **GHG** emissions arising from trade within waters, and 50% of **GHG** emissions arising on voyages starting and ending at a sea-port located within the **EU**. (See the FuelEU Maritime [Initiative](#) - the EU's initiative on increasing the use of sustainable alternative fuels in European shipping and ports.)

Deadline for applications for ScotWind passes:

Applications galore: As noted in the last few editions of Low Carbon Pulse, there was expected to be considerable activity ahead of the deadline for applications for ScotWind Leasing Scheme on July 16, 2021. And so it proved: on July 22, 2021, the BBC reported that "more than 70 bids have been lodged by developers seeking the rights to develop major off-shore wind projects ... around Scotland". (It is understood that 74 applications were submitted.)

Scotland on track to achieve NEZ by 2045: The ScotWind Leasing Scheme places Scotland in the first rank of off-shore global jurisdictions. The development of off-shore wind capacity under the Scheme will accelerate progress towards **NEZ**, which Scotland is committed to achieving by 2045. These dynamics are reflected in the number and the quality of the applicants for the lease areas being auctioned, and the plans accompanying them for on-shore investment and development, further progressing to **NEZ**.

Fifteen lease areas, 10 GW: The [Crown Estate Scotland](#) is running the auction process for 15 off-shore areas: Aberdeenshire (three areas - E1, 2 and 3), Argyll (W1), Moray Firth (five areas - NE 2, NE 3, NE 6, NE 5 and NE 7), Islay (N4), Lewis (N4), Orkney (three sites off the west of Orkney, into the outer Hebrides, N1, N2, and N3), Shetland (NE1). (Edition 8 of Low Carbon Pulse reported on the ScotWind Leasing Scheme auction process, noting that it reported that the total area of the 15 sites is 8,600 km² or 3,320 m².)

Director of Marine at Crown Estate Scotland, Mr Colin Palmer, is reported to have stated: "The high number of applications from developers shows just how much potential Scotland's seas hold for the future expansion of off-shore wind".

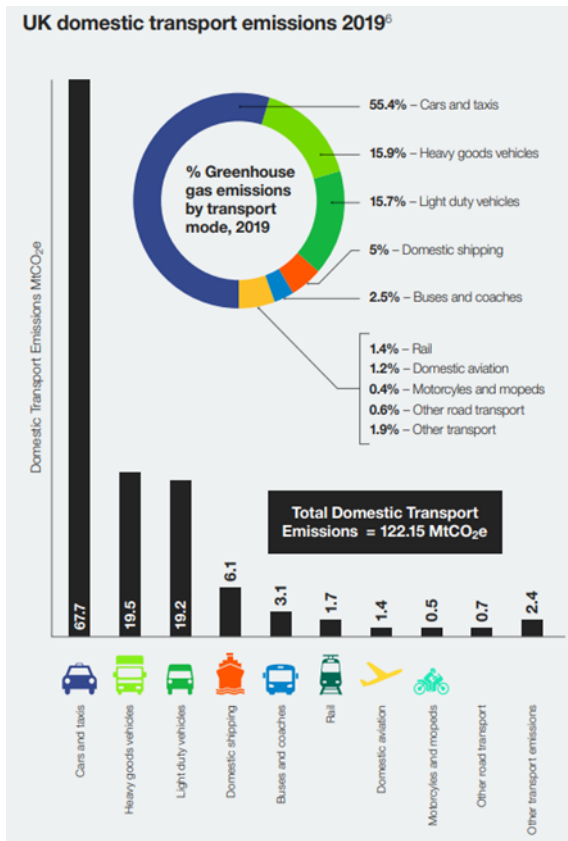
Some happy folk in the New Year: The successful applicants in the ScotWind Leasing Scheme auction process are expected to be announced in early 2022. The attached [link](#) shows the ScotWind Leasing Scheme lease sites. If leases are awarded in respect of each area, this will result in the development of up to a further 10 GW of installed off-shore wind capacity. Another reason to be cheerful.

The version of the edition of Low Carbon Pulse posted later during the week-beginning July 26, 2021, will include details of the applications made as reported, and the scale of associated economic benefit on the Scottish mainland.

Reports and report on reports:

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

- **EU regulators joined up:** On July 16, 2021, the **EU** Agency for the Cooperation of Energy Regulators (**ACER**) published a [study](#) outlining the two likely options for the haulage of hydrogen through pipelines (**ACRS**). As has been noted in Low Carbon Pulse (including in Edition 21), the development of assured hydrogen supply needs to contemplate the development of storage capacity for hydrogen. The **ACRS** recognises this need, identifying sub-surface sites suitable for storage.
- **IEA sustainable rate of reports:**
On July 20, 2021, the International Energy Agency (**IEA**) published its flagship report [Sustainable Recovery Tracker – Monitoring progress towards sustainable recoveries from the Covid-19 crisis \(SRT\)](#). In 2020, the **IEA** developed, in collaboration with the International Monetary Fund (**IMF**) a [Sustainable Recovery Plan \(SRP\)](#). The **SRT** measures progress against the **SRP**. As might be expected, there have been challenges, as countries have diverted scarce funding to address COVID.



The last couple of weeks in the in UK:

On July 14, 2021, the Department for Transport in the UK has released the Transport Decarbonation Plan (entitled [*Decarbonising Transport – A Better, Greener Britain*](#)) outlining the policy settings and other initiatives to ensure that the UK transport sector (aviation, rail and road (cars and trucks)) achieves **NZE** by 2050.

As will be apparent from the bar chart on the left, the modes of road transportation are those that require the more intensive levels of decarbonisation to enable the UK to achieve **NZE** across the transport sector.

The decarbonisation of Bus and Coach and Rail transportation is likely to prove most achievable (both in terms of the scale of the task, and the existing highly developed policy settings, including the National Bus Strategy, and NetworkRail's Traction Decarbonisation Network Strategy (**TDNS**)).

The decarbonisation of the Domestic Shipping and Domestic Aviation sector may be regarded as likely to take longer, because perceived as more difficult (being reliant on the development of new bunkers and synthetic fuels, and power and propulsion systems), but the **TDP** acknowledges this perception, and is seeking to accelerate decarbonisation.

The **TDP** provides a helpful summary of existing policy settings and commitments across the transport sector.

Part 2(a) of the **TDP** provides a summary of the commitments and a description of what needs to be done to achieve **NZE** across the transport sector, and benefits of doing so. **Part 2(b)**, entitled **Multi-modal decarbonisation and key enablers**, provides a framework, remaining to be developed fully, to allow decarbonisation, and outlines what will enable decarbonisation.

The report on reports for July will include more key facts and statistics from the **TDP**.

Recent editions of the Low Carbon Pulse have noted that during the third full week of July 2021, the UK Government was expected to release its Hydrogen Strategy (**UKH2S**), and that ahead of this release, the All-Party Parliamentary Group (**APPG**) released a [report](#) urging the UK Government to set ambitious targets both under the **UKH2S**.

All indications are that the publication of the **UKH2S** has been delayed. The Ashurst Global Towards Net Zero team will publish a flyer soon after the **UKH2S** is published, likely in the UK autumn / fall.

Royal Dutch Shell appealing:

Edition [18](#) of Low Carbon Pulse reported on the decision of the District Court in The Hague, the Netherlands on May 26, 2021. The effect the decision was to require Royal Dutch Shell plc (**RDS**) to reduce the net CO₂ emissions of the **RDS** Group by at least 45% by 2030, compared to 2019.

In context of the decision by **RDS** to appeal, the CEO of Royal Dutch Shell, Mr Ben van Beurden, is reported to have stated that "*urgent action is needed*" to reduce carbon emissions, but **RDS** will appeal "*because a court judgment, against a single company, is not effective*".

From the perspective of effective and coherent policy setting this has to be right. More than this, the logic expressed by Mr van Beurden may be regarded as both right and as unassailable. As the author of Low Carbon Pulse has written in a soon to be published article, entitled **Realising Reserves and Realising Capital**, "Ultimately governments must ensure that all corporations act in a way that is consistent with the Paris Agreement. This requires countries to legislate rather than to leave existential policy settings to the courts to determine".

As CEO of BlackRock, Mr Larry Fink is reported to have said back in May 2021 when the **RDS** decision was handed down:

"It is not about running away from the current hydrocarbon companies, it's working with them as they navigate the move forward".

Hydrogen Council News:

- **Hydrogen Council membership continues to increase:** On July 12, 2021, it was widely reported that membership of the Hydrogen Council continues to increase, with 123 organisations now members, including on July 13, 2021, the addition of notable NOC, ADNOC. The Hydrogen Council was established by the World Economic Forum in 2017.
- **Hydrogen Council and McKinsey on the money, again:** Edition [10](#) of Low Carbon Pulse reported on the first Hydrogen Council and McKinsey & Co report, dated February 17th, 2021 ([February Report](#)). On July 15, 2021, the Hydrogen Council and McKinsey & Co published their second report ([July Report](#)).

While there are many indicators of the speed of progress, reflecting on the five months between Reports, the **July Report** provides a real sense of acceleration and the scale of it since the **February Report**. For once, the numbers proclaim: pace and scale of change!

HIGH LEVEL COMPARISON, FEBRUARY TO JULY			
Large Scale Projects (February)	230	Large Scale Projects (July)	359
Total Investment Amount (Feb)	USD 300 billion	Total Investment Amount (July)	USD 500 billion
30% of Total Investment Amount was firm at USD 80 billion		30% of Total Investment Amount is firm, at USD 150 billion	

Key quotes in context:

- **Mr Tom Lineberger**, CEO of Cummins and Co-chair of the Hydrogen Council: "... 80% of the world's GDP is now located in countries that have [ambition to achieve] net-zero [emissions], up from 50% at the beginning of 2021. This is another turning point for hydrogen, the energy transition, and a clean energy future".
- **Mr Benoît Poitier**, CEO of Air Liquide and Co-chair of the Hydrogen Council: "The momentum is now global. It is clear that hydrogen has become a central element of investment plans by many countries towards carbon neutrality. While Europe remains a strong contributor, with 80% of new announced projects, other regions are stepping up, with an impressive number of hydrogen projects currently in the pipeline around the world".
- **Just in case you missed first time around:** McKinsey & Co released two publications, one on mining, the other on use of negative **GHG** emission initiatives in late June, 2021. Both publications are well-worth a read: [Creating the zero-carbon mine](#) published on June 29, 2021, McKinsey & Company, Metals and Mining, providing an overview of the activities undertaken at mine sites, and the means of decarbonising them, and [How negative emissions can help organizations meet their climate goals](#) published on June 30, 2021, McKinsey, Sustainability, providing an outline use of negative **GHG** emission initiatives, and their required scale.

Free markets will respond to policy settings, but do not set policy:

- **Policy setting a prerequisite:** On July 17, 2021, The Guardian reported on wise words from Mr Mark Carney, the former governor of the Bank of England.

Mr Carney, now a United Nations envoy on Climate Change, and finance adviser to the UK Government of climate change said:

"We need clear, credible and predictable regulation [covering] ... air quality rules, building codes, that type of strong regulation is needed. [If you] have strong regulation for the future, then the financial market will start investing today, for the future. Because that's what markets do, they always look forward ... It [won't] happen spontaneously by the financial sector ... but we can't get there without the financial sector".

Mr Carney's perspective is to be welcomed, and, it is, hoped acted upon – policy settings are required.

Mr Carney, in leading the Taskforce for Scaling Voluntary Carbon Markets, has recently shared thoughts on **carbon neutral** and **net-zero emissions**. As noted in previous editions of Low Carbon Pulse, there is a difference, and this difference is coming into ever sharper focus, as organisations recognise that achieving **GHG** net-zero emissions across Scope 1, 2 and 3 is challenging, and some have taken to promoting the concept of "carbon neutral" (in respect of Scopes 1 and 2), and "carbon natural (in respect of Scope 1 and 2) on a path to net-zero emissions (in respect of Scope 3)", with Scope 3 commitments being matched by use of carbon offsets, typically, referred to "avoided emissions offsets".

Mr Carney is reported to have said that:

"There is a difference between carbon neutrality and net zero. The company should be compensating for its emissions on that pathway to net zero as well".

- **Debating carbon neutral versus net zero:** The debate around the promotion of the concept of "carbon neutral" in contrast to "net zero emissions" is focussed on there being a difference between these familiar, and similar, terms, and ensuring that the difference is understood. This requires clarity around the use of the terms, to ensure that terminology does not get in the way of good policy setting, and implementation.
While the debate around use of the terms may be regarded as of interest, the bigger issue is ensuring, whatever term is used, that the decarbonisation of activities occurs over time, such that carbon offsets, if used, work, and, over time, are used as a tool to bridge an ever narrowing gap between decarbonised activities and activities remaining to be decarbonised.
This of course, leads to the existential debate around decarbonisation being the only way to achieve sustainable slowdown in, and cessation of, the release of **GHG** emissions into the atmosphere. This debate appears to be developing, and is becoming ever more informed, critically by data.
- **Patience is a virtue, and patient capital has virtue:** On July 15, 2021, a World Economic Forum (**WEF**) publication was released entitled [In emerging markets, patience is a virtue in the race to net zero](#). The publication notes that South Asia, South East Asia and Sub-Saharan Africa have some of the lowest historic **GHG** emissions per person. In these areas of the world, the **WEF** notes that **patient capital** is required, provided by both the public and private sector, so as to ensure an "equitable transition to global net zero". In the context of an "equitable transition to global net zero", the **WEF** notes that capital is required to leap-frog "fossil fuels and combustion engines" to allow continued population growth and urbanisation without a concomitant increased in **GHG** emissions.
For a more detailed assessment on some of the issues relevant to the **WEF** narrative, see [The Geographic disparity of historical greenhouse emissions and projected climate change](#) published in Science Advances on July 14, 2021.
Both the **WEF** publication and the **Science Advance** article provide considerable food for thought.

Energy efficiency, Electrification and Renewable Energy not enough:

- **Consistent means and continuing themes:** Various editions of Low Carbon Pulse have reported on **Net Zero by 2050 – A Roadmap for Global Energy Sector (IEA Roadmap)** published by the **IEA**, and **World Energy Transitions Outlook (WETO)** published by the International Renewable Energy Agency (**IRENA**).

Both the **IEA Roadmap** and the **WETO** describe means to achieve **NZE** and in doing so conclude that achieving **NZE** is not possible, in any scenario, by relying solely on improving electrical energy efficiency and maximising electrification and renewable electrical energy development. Rather, other means are required, and they are required promptly. This was a developing orthodoxy before the **IEA Roadmap** and **WETO**, and it is now firmly established.

- **By way of a memory jogger:** The **IEA Roadmap** outlines seven pillars, the **WETO** six pillars, to support progress towards achieving **NZE**.

IEA ROADMAP AND WETO – SIX AND SEVEN PILLARS	
IEA Roadmap	The seven pillars of the IEA Roadmap are: 1. Energy efficiency; 2. Behavioural change; 3. Electrification; 4. Renewables; 5. Hydrogen and hydrogen-based fuels; 6. Bioenergy and land use change; and 7. Carbon capture, utilisation and storage.
WETO	The six pillars of the WETO are: 1. Energy Conservation and efficiency; 2. Renewables (power and direct uses); 3. Electrification of end use (direct); 4. Hydrogen and its derivatives; 5. CCS and CCUS in industry; and 6. BECCS and other carbon removal measures.

The seventh pillar under the **IEA Roadmap** is **Carbon capture, utilisation and storage**, and one of the three key uncertainties is **CCUS applied to emissions from fossil fuels**. The seventh pillar of the **IEA Roadmap** is **Bioenergy**, and one of the three uncertainties is **Bioenergy and land use change**. (The third uncertainty is **Behavioural Change**.)

- **Wood for the trees:** In a recent Wood Mackenzie [publication \(WMP\)](#), dated July 9, 2021 (that did not come to the attention of the author until after the publication of Edition 21 of Low Carbon Pulse), CCS / CCUS is considered in the context of progress to achievement of **NZE** by 2050.

The **WMP** echoes the **IEA Roadmap** and **WETO**: "Renewables alone can't resolve the net zero emissions challenge. We have to think in terms of carbon avoidance and carbon removal".

The **WMP** estimates an increase in CCS / CCUS use capacity from 56 mtpa (across all forms of carbon capture in 2021) to between 4 gtpa and 8 gtpa by 2050: in a world of coincidences, the scale of the required CCS / CCUS matches the mass of CO₂ to be subject to the **PRC ETS**.

If this level of CCS / CCUS is achieved, certainly towards the upper-end of the estimate, one of the key uncertainties identified in the **IEA Roadmap** (and echoed in the **WETO**), or rather the consequences of not achieving the level of CCS / CCUS, will be avoided.

The **WMP** emphasises the importance of the relationship between development of CCS / CCUS and a carbon price. The best estimates for a carbon price are USD 90 pt of CO₂, for iron and steel up to USD 120 pt of CO₂, and for cement up to USD 200 pt of CO₂. As ever, the issue is whether carbon prices will result in outcomes other than the use of CCS / CCUS.

In addition, and picking up the theme of Mr Carney (under **Policy setting a prerequisite** above), there are roles for government in the development of CCS / CCUS, going beyond policy settings intended to achieve carbon prices at stated levels. Government has a role in the development of CCS / CCUS facilities itself, and to subsidise the use of CCS / CCUS, whether developed by the government or the private sector. In the Netherlands for example, subsidies are being used to support the development of carbon capture capability by industrial businesses, and the storage of that carbon (see Edition 17 of Low Carbon Pulse).

BloombergNEF releases NEO – current level of electrification not enough:

On July 21, 2021, BloombergNEF published the **New Energy Outlook, 2021 (NEO)**. The **NEO** provides another perspective on achieving **NZE** by 2050, placing it in the context of the carbon budget that is available before reaching a 2°C increase in global average temperatures compared to pre-industrial times.

The **NEO** notes that based on current trends, the world is on track to exceed its carbon budget, and the 2°C increase in average global temperatures, by 2044.

Neither the **IEA Roadmap** nor the **WETO** (nor for that matter the **WMP**) provide this perspective, and, as a perspective, it certainly provides the right perspective: i.e., climate change is upon us, increased action is required. [Note: As will be apparent from the narrative above about the **IEA Roadmap** and **WETO**, the focus in **NEO** is on the decarbonisation of the energy sector, producing around 75% of **GHG** emissions annually.]

While difficult to do the **NEO** justice in summary form, the following may be regarded as key takeaways [Note: The graphics in the **NEO** are copy-righted, and as such we have referred to them, not reproduced them below]:

1. the carbon budget for each sector and industry is identified, as is the required rate of reduction for each sector (see graph on page 4 of the executive summary).
2. the years between now and 2030 are critical to the achievement of **NZE**: the world needs to get back on track, and for this purpose there needs to be "an immediate, unprecedented acceleration in deployment of existing technologies, such as renewable energy and electric vehicles" at the same time as innovation and deployment of developing technologies;

3. the decarbonisation of the energy sector is key, and part and parcel of this is developing renewable electrical energy for both direct and indirect use, and the need to accelerate this before 2030 (see graph on page 5 of the executive summary); and
4. the scale of the deployment of renewable electrical energy required by 2050 is outlined under three scenarios: Greens, Gray and Red. The scale of the deployment of renewable electrical energy has been a matter around a few folk have done the calculations. The next two graphics are helpful, and the second is compelling (see the graphics on pages 3 and 7 of the executive summary).

Another finding in the **NEO** is that the shipping industry should transition to the use of ammonia. As noted in previous editions of Low Carbon Pulse (and this Edition 22), ammonia is one of a number of fuels being considered by the shipping industry (see below under **Port News and Shipping Forecasts – Why methanol?**).

Empowering Cities for a Net Zero Future:

On July 22, 2021, the International Energy Agency (**IEA**) published a report entitled [**Empowering Cities for a Net Zero Future- Unlocking resilient, smart, sustainable urban energy systems \(Smart Cities Report\)**](#). As with **IEA** reports generally, this report is well-worth a read, and provides the context for the report: "Cities account for more than 50% of the global population, 80% of global GDP, two-thirds of global energy consumption and more than 70% of annual global carbon emissions".

The concentration of these factors is going to increase as progress is made towards 2050, and in this context, the role of cities in the development of energy delivery is key to achieving **NZE**.

The report on report for July will include a summary of the **Smart Cities Report**.

PRC study names 25 mega cities:

On July 24, 2021, Malaysia daily, The Star, reported on a new study (which the author has not sighted yet) from researchers at the PRC's Sun Yat-sen University and Guangdong Provincial Key Laboratory of Environmental Pollution and Remediation Technology in Guangzhou.

The study finds that 25 mega-cities are responsible for 52% of GHG emissions arising in an urban setting, the cities in the PRC, Japan, Russia "notably singled out", including, Beijing, Handan, Shanghai, Tokyo, and Moscow.

Japan revises its 2030 energy source mix in draft plan:

- **Fewer flames from fossil fuels:** On July 21, 2021, Japan released a draft 2030 plan setting out thinking in respect of the energy source mix to allow it to move to a 46% reduction in **GHG** by 2030, compared to 2013. The plan is summarised below.

ENERGY SOURCE	2021 PLAN	CURRENT 2030 PLAN	DRAFT 2030 PLAN
LNG	37%	27%	20%
Coal	32%	26%	19%
Oil	7%	3%	2%
Renewable energy	18%	23%	37%
Nuclear	6%	21%	21%
Hydrogen / hydrogen based fuels	Zero	Zero	1%

There are clear implications for countries that export LNG, coal and oil to Japan, and for the development of the off-shore wind industry around Japan. The achievement of **NZE** requires a mammoth increase in the generation of renewable electrical energy, and otherwise zero-carbon electrical energy, and hydrogen.

As will be apparent from the draft plan for Japan, nuclear energy is seen as having a key role to play. It is unlikely that Japan will be alone in making this choice: nuclear energy is able to make a contribution to progress towards **NZE**.

While the draft plan is about Japan's choices as an importer, it is difficult not to reflect on the fact that importers are narrowing the choices for exporters of fossil fuels, and goods that are produced using them. For countries depending on exporting fossil fuels and goods that do not have an embedded carbon price, there is a need to recognise that markets will be foreclosed over time, and how best to position to manage this transition.

- **Torches (Flames from Hydrogen):** It is reported that the Olympic Flame, symbol of the Olympic Games, currently taking place in Tokyo, is using a hydrogen fuel source for the torch. Another first.

Energy Storage round-up (including BESS):

- **Iron-Air Battery Storage:** On July 23, 2021, PV Magazine reported that Form Energy has secured funding for the development multi-day storage using iron-air technology.

While Low Carbon Pulse does not usually report on technology development as such, the technology is understood (from work that we have done in other contexts), and there is a clear market need for long term electrical energy storage. If this technology is commercialised, it will secure further grid integrity and stability.

See: [**Form Energy Unveils Chemistry of Multi-day Storage Battery Technology**](#)

BECCS / BECCUS and CCS / CCUS round-up:

- **Oaks to Acorn:** Edition [21](#) of Low Carbon Pulse reported that INEOS (UK based international conglomerate) and Petroineos (a joint venture between PetroChina International and INEOS) had entered into a memorandum of understanding with the equity participants in the Acorn Project (see Editions [14](#) and [17](#)) for the provision of CCS services to INEOS and Petroineos (at Grangemouth).

On July 16, 2021, The Financial Times reported that ExxonMobil, Royal Dutch Shell and North Stream Midstream Partners (**NSMP**, owned jointly by the Kuwait Investment Authority and JPMorgan Infrastructure Fund) had signed provisional deals (under memorandums of understanding) with the Acorn Project. The underlying business case for the Acorn Project is that CO₂ captured from natural gas processing terminals at St Fergus, Peterhead (and Grangemouth) will be stored by it. The provisional deals with ExxonMobil and Shell are in respect of their terminal and in respect of the **NSMP** owned terminal (with **NSMP** also the owner of the main feeder lines to it).

The recent firming up of contractual off-stake for storage services in respect of the terminals at St Fergus (close to Peterhead) and facilities at Grangemouth appear likely to drive the Acorn Project forward. The CEO of Storegga Geotechnologies (whose subsidiary, Blue Dot, in joint venture with Harbour Energy and Shell, is developing the Acorn Project), Mr Nick Cooper, said that the signing of the provisional deals on the "St Fergus CO₂ emissions represent[ed] a key milestone for the Acorn Project".

See: [Acorn Project Partners, Storegga, Shell U.K. and Harbour Energy, Sign MOU with the Owners of the Segal and Fuka Gas Terminals at St Fergus](#); [ExxonMobil to participate in carbon capture and storage project in Scotland](#); [NSMP Signs Memorandum of Understanding with Acorn CCS Project](#)

- **CCS can be a challenge:** While Low Carbon Pulse takes a positive outlook around progress towards **NZE** there are occasions when it is worth noting the challenges that arise. The Gorgon LNG Project (with natural gas processing, treatment and liquefaction facilities) located on Barrow Island, off-shore of Western Australia, has carbon capture and storage (**CCS**) facilities. The **CCS** facilities are intended to capture CO₂ associated with the production of LNG and to store that CO₂ in depleted fields around Barrow Island. It is reported that around five million tonnes of CO₂ has been captured and stored using the **CCS** facilities, being less than the licensing requirements for **CCS** for the Gorgon LNG Project: some of the off-shore fields from which natural gas is extracted have relatively high levels of CO₂, and as such as part of the approval and permitting process for the Gorgon LNG Project the **CCS** facilities were required.

On July 19, 2021, it was widely reported that the Gorgon LNG Project is seeking to make arrangements with regulators in respect of the shortfall in CO₂ captured and stored in the **CCS** facilities. In the context of carbon capture and storage generally, this illustrates the key risk in respect of any CCS / CCUS project – the regulatory risk of shortfall (and the lower risk of not working at all).

CARBON CAPTURE AND STORAGE IN CONTEXT OF OIL AND GAS

Enhanced Gas Recovery (**EGR**) (or Enhanced Oil Recovery (**EOR**)) involves the capture of CO₂ and returning CO₂ into the field from which the hydrocarbon was extracted. This may be regarded as part of good oil field practice to enhance the recovery of natural gas (or oil).

Carbon Capture and Storage in the context of the Gorgon LNG Project does not involve the return of CO₂ into the field from which hydrocarbons were extracted, rather it involves the injection of CO₂ captured (on processing of natural gas before LNG production) into depleted fields.

E-fuel / Future fuel round-up:

- **Neptune Energy in the Blue:** On July 12, 2021, it was reported that Neptune Energy has contracted for the development of a Blue Hydrogen production plant to be located at the former Theddlethorpe Gas Terminal site in Lincolnshire, England. Also it is reported that Neptune Energy has contracted with PX Group to operate the power plant that will use the Blue Hydrogen as fuel.

See: Neptune Energy [website](#)

- **A lot of investment from Lotte:** On July 13, 2021, it was widely reported that Lotte Chemical had released a roadmap (entitled **Every Step for H2**) indicating its plans to accelerate investment in transition to hydrogen. **Every Step for H2** contemplates that Lotte Chemical will achieve carbon neutrality by 2040 having progressed to carbon neutral growth by 2030, with the production of clean hydrogen, with 160,000 tpa of Blue Hydrogen by 2025 (using **CCS**), and up to 600,000 tpa by 2030.

See: Lotte Chemical [website](#)

- **Self-fulfilling dynamics in Oman:** Edition [18](#) reported on the Hyport DUQM Green Hydrogen project in Oman (**Hyport DUQM**) (under **Oman goes Green by Blue**). On July 19, 2021, it was reported that Uniper (leading international energy company) has signed a cooperation agreement with the shareholders in **Hyport DUQM** to develop the business case for the off-take of Green Hydrogen through the negotiation of an exclusive off-take agreement for Green Ammonia and to provide related engineering services.

As noted in previous editions of Low Carbon Pulse, there is palpable progress across the Gulf Cooperation Council (**GCC**) countries towards the development of Green Hydrogen and Green Ammonia (and Blue Hydrogen and Ammonia). Edition [20](#) of Low Carbon Pulse included a narrative around the highly prospective, world-class resources that exist in the **GCC** countries (see under **Black Gold and Blue and Green Gold**, and **Oman's aim is true and New petroleum**).

See: [Hyport DUQM Signs Cooperation Agreement with Uniper to Explore Green Ammonia Offtake](#)

- **NZE: Singapore and NZ in combination:** Editions [21](#) and [20](#) (under **Singapore seeks to deepen partnerships** and **Singapore chilled about CCUS and hydrogen** respectively) it was reported that key agencies in Singapore are considering the findings of two reports, one on [CCUS](#), the other on [hydrogen](#). On June 29, 2021, it was reported that those key agencies are looking to build on these findings.

On July 15, 2021, New Zealand and Singapore signed an **Arrangement regarding Cooperation on Low-Carbon Hydrogen (LCH2A)**. The **LCH2A** is consistent with the Singapore's plan to develop strategic partnerships with other countries, in particular to allow Singapore to play the role of a hub in low carbon hydrogen supply chain.

This is seen as important to contributing to the achievement of "[enhanced 2030 Nationally Determined Contribution and Long-Term Low Emission Development Strategy](#)", and the [Singapore Green Plan 2030](#)"

- **Green Hydrogen to deliver NZ NZE:** On July 22, 2021, the [Otago Daily Times](#), outlined plans for the development of renewable electrical energy, and use of that energy at Tiwai Point, Southland. Contact Energy and Meridian Energy (two of New Zealand's electricity generation corporations) are testing the appetite for the development of a world-scale Green Hydrogen production facility (**Southern Green Hydrogen**).

The CEOs of Contact Energy (Mr Mike Fuge) and Meridian Energy (Mr Neal Barclay) regard the development of the **Southern Green Project** as "whole of economy" development, facilitating the development of domestic demand for hydrogen and allowing New Zealand to achieve 100% renewable electrical energy generation country wide. Also, it is important to read this with the initiative outlined above under **NZE: Singapore and NZ in combination**.

- **PosHYdon pilot project progresses:** On July 22, 2021, it was widely reported that the Netherlands Enterprise Agency (**RVO**) has agreed to provide financial support (in the form of a subsidy) to allow the installation and testing of a 1 MW NEL electrolyser to produce up to 400 kg per day of Green Hydrogen, using renewable electrical energy from off-shore winds fields to electrolyse desalinated sea-water, with the Green Hydrogen blended with natural gas and delivered to shore via pipeline.

The PosHYdon pilot project is being hosted by Neptune Energy on its Q13a-A platform, and in this regard it is a world first.

Edition [19](#) of Low Carbon Pulse reported on the plans of Neptune Energy to develop CCS in the Dutch sector of the North Sea by using its three depleted gas fields in the L10-A, L10-B and L10-E areas.

- **Nuclear energy to hydrogen pilot project:** On July 23, 2021, it was reported, in Hydrogen Fuel News, that Rosatom is to run a pilot program to produce hydrogen at its Kola nuclear power plant (Kola NPP I), on the Kola Peninsula in north western Russia. The pilot program ties in to long plans for Rosatom to develop Kola NPP II.
- **Bloom Energy and SK Energy continue progress:** On July 22, 2021, it was widely reported that Bloom Energy is to undertake the development of a combined heat and power project (**CHPP**) with SK Energy to develop South Korea's first **CHPP** using solid oxide fuel cell technology (**SOFC**) to derive 4.2 MW.

See: [Bloom Energy to Power Korea's First Utility-Scale Combined Heat and Power Project with Solid Oxide Fuel Cells](#)

- **Cromarty Firth ideal location for Green Hydrogen production facility:** Edition [18](#) of Low Carbon Pulse reported on the arrangements relating to the development of the Port of Cromarty as a hydrogen hub.

On July 23, 2021, it was reported that Cromarty Firth has been identified as the ideal location for a 35 MW, Green Hydrogen production facility.

See: [North of Scotland Hydrogen Programme feasibility study](#)

Green Metals and Minerals, the Mining Industry and Difficult to Decarbonise industries:

- **ArcelorMittal Green Base:** On July 13, 2021, ArcelorMittal announced that its Sestao steel mill in Spain is to be developed into a zero carbon emissions steel plant following the development of a direct reduced iron (**DRI**) plant and an electric arc furnace (**EAF**).

The **DRI** and **EAF** projects are to proceed following the signing of a memorandum of understanding (**MOU**) by ArcelorMittal and the Spanish Government, with the development of the projects scheduled for completion in 2025, with up to 1.6 mpta of zero carbon emission steel to be produced annually. In addition to the use of renewable electrical energy to produce Green Hydrogen, it is reported that all electrical energy requirements will be sourced from renewable electrical energy, including in respect to the operation of the **DRI** and **EAF** projects. Consistent with the greening of steel production elsewhere in the **EU**, it is expected that **EU** and Spanish government support will be provided.

See: [ArcelorMittal Sestao to become the world's first full-scale zero carbon-emissions\[1\] steel plant](#)

- **Acerinox and Tecnicas Reunidas work on decarbonisation of steel production:** On July 21, 2021, it was widely reported that Acerinox and Tecnicas Reunidas are working together to assess the basis upon which Acerinox Europa facilities, located in Cadiz, Spain, may be decarbonised. It is reported that each possible method of decarbonisation will be assessed, including renewable electrical energy, Blue Hydrogen and Green Hydrogen, bioenergy, and CCS / CCUS.

See: [Acerinox and Tecnicas Reunidas Will Work Together on the Decarbonisation of the Acerinox Europa Plant in Cadiz](#)

- **Greening Glass:** During the week beginning July 19, 2021, the, as yet, sleeping giant of the difficult to decarbonise industries, glass, stirred, in both Britain and Italy, with the biggest movement in Italy. The production of glass is highly energy intensive, both electrical and heat.

On July 20, 2021, Glass International reported that a group of Italian glass manufacturers, and furnace and energy suppliers, are collaborating to reduce **GHG** emissions through the use of hydrogen for the high-heat temperature processes used in glass manufacture: Italy is the **EU's** second largest producer of glass. It is reported that the group comprises Bormioli Luigi, Bormioli Rocco, IFRF Italia, Rina, RJC Soft, Snam, Stara Glass, Stazione Sperimentale del Vetro and UNI.GE.

Hydrogen Cities, Councils, Hubs, Infrastructure and Valleys:

- **Siemens Smarts:** On July 12, 2021, it was announced that Siemens Smart Infrastructure has commenced construction of a Green Hydrogen production plant in Wunsiedel, Bavaria, Germany, to produce 1,350 tpa on Green Hydrogen (**WUN H2 Project**), with production scheduled to commence in 2022. The **WUN H2 Project** is being developed by sponsor, WUN H2 GmbH, in which Siemens Financial Services holds a 45% equity share. The **WUN H2 Project** is to form part of the Wunsiedel Energy Park, and will be connected with Siemens existing battery storage and industrial hub. The **WUN H2 Project** continues the development of the hydrogen economy in Bavaria, and Germany, including neighbouring Czech Republic, and the **EU** generally.

It is understood that the **WUN H2 Project** is to offset 13,500 tonnes of CO₂ a year, which implies that the production of Green Hydrogen is offsetting the production of Grey Hydrogen giving rise to 10 tonnes of CO₂ per tonne of H₂ produced: it is not clear if this an actual or nominal decrease in CO₂ emissions.

See: [Siemens to build one of Germany's largest carbon-free hydrogen generation plants in Wunsiedel](#)

- **Carbon Capture Services:** On July, 12, 2021, it was announced that Aker Carbon Capture has launched "Carbon Capture as a Service": CEO of Aker, Mr Valborg Lundegaard said: "With our offering customers will simply pay per tonne captured CO₂. We will handle the CO₂ throughout the full value chain – from the point of emission to permanent storage". Consistent with the sales pitch, Aker Carbon Capture will deliver and operate carbon capture facilities, transport and deliver carbon into storage.

See: [Aker Carbon Capture launches Carbon Capture as a Service](#)

- **Shell proposes large-scale CCS facility in Alberta:** On July 13, 2021, Shell announced the development of a CCS project at its Scotford Complex, Edmonton, Alberta, Canada (**Scotford CCS** or **Polaris Project**). The development of the **Scotford CCS** would continue the development by Shell of five Energy and Chemical Parks globally (see Edition [18](#) and [21](#) of Low Carbon Pulse for outline of the Shell Energy and Chemicals Park Rhineland, Cologne, Germany, that has developed a 10 MW PEM electrolyser **Refhyne Electrolyser**). As announced, the **Scotford CCS** will have aggregate life-cycle storage capacity of 300 mt of CO₂.

See: [Shell Proposes Large-Scale CCS Facility in Alberta](#)

- **Clear line of sight for nuclear to NZE:** On July 14, 2021, the UK's Nuclear Sector Deal's Innovation Group makes a number of recommendations to allow the use of nuclear power to achieve **NZE**. The recommendations are contained in a report entitled [Unlocking the UK's Nuclear Hydrogen Economy to Support Net Zero](#). In summary, the report outlines 10 suggested actions for industry, and 10 suggested commitments for government to consider. Whatever one's perspective on nuclear energy, the report is excellent, and well-worth a read.
- **Hydrogen Storage:** One of the key requirements for industrial users of hydrogen is the real time availability of hydrogen. For these purposes, hydrogen storage is key.

On July 15, 2021, it was announced that Equinor (global international energy company) and SSE (Scottish energy giant) were working together to develop hydrogen storage capacity close to a cluster of industrial users. The focus of the initial work is the use of the existing Aldborough natural gas storage capacity (**Aldborough Gas Storage Facility** or **AGSF**) on the east coast of England, with the focus contemplating use for the storage of low carbon hydrogen by 2028 (**H2S Capacity**). (Equinor and SSE own jointly the **AGSF**, comprising non sub-surface salt caverns, each large enough to house St Paul's Cathedral.) It is estimated that the storage capacity would equate to 320 GWh, converting salt caverns within the existing **AGSF** or creating new caverns.

The development of the **H2S Capacity** would be part of an integrated hydrogen production, storage, transportation and supply chain: Equinor has proposed the development of 1.8 GW low carbon hydrogen (in the form of Blue Hydrogen) production capacity, comprising the 600 MW **H2H Saltend Project** (see Edition [14](#) of Low Carbon Pulse) and 1.2 GW of production capacity to supply low carbon hydrogen to the Keadby power station (see Edition [21](#) of Low Carbon Pulse).

- **Clustering and hubbing:**

The development of an integrated hydrogen production, storage, transportation and supply chain is entirely consistent with the **NZE** initiatives and plans in the Humber and Teesside regions on the east coast of England: Edition [21](#) of Low Carbon Pulse reported on Northern Endurance Partnership's submission to the UK Government seeking support for decarbonisation initiatives in the Humber and Teesside regions.

There are a number of hydrogen hubs around the UK, all of which offer the opportunity to develop integrated hydrogen production and carbon capture activities.

As Equinor has noted:

"Hydrogen is essential for decarbonisation. And there is no better place in the world for low carbon hydrogen than the Humber cluster in the UK. We have the perfect combination of natural gas supplies, renewable power generation, hydrogen production, hydrogen demand and the potential for underground hydrogen storage in salt caverns and offshore CCU".

The Humber is a cluster with a lustre if you will!

It has to be said that this sentiment can be expressed in respect of a number of clusters and hubs around the UK. Edition 23 of Low Carbon Pulse will outline the scope of hydrogen clusters and hubs around the UK, and note common themes.

See: [SSE Thermal and Equinor join forces on plans for first-of-a-kind hydrogen and carbon capture projects in the Humber](#); [SSE and Equinor Developing Plans for World-Leading Hydrogen Storage Facility in Yorkshire](#)

Sustainable Energy Round-up:

- **Australian Energy Market Operator wants to aim for 100% renewables:** During the week beginning July 12, 2021, it was widely reported that the new CEO of the Australian Energy Market Operator (**AEMO**), Mr Daniel Westerman, considers that by 2025 grids across Australia should be able to operate with 100% of load matched by renewable electrical energy dispatched. Mr Westerman recognised that while this is *"unchartered territory for a large, independent grids anywhere in the world .. this must be the goal ... because we know this is where we're headed!"*

This may be regarded a measure of many things, but critically it may be regarded as a measure of the increased confidence of **AEMO**. In 2020, **AEMO** was contemplating up to 75% of load matched by renewable electrical energy, but with load matched by renewable electrical energy dispatch on occasion, and over 50% on a good number of occasions, aiming for 100% of load matched by renewable electrical energy which appears appropriate.

In the week beginning July 19, 2021, it was widely reported that on April 11, 2021, new records were set in the National Electricity Market (**NEM**) for the percentage of renewable electrical energy dispatched to match load across the NEM, at 57% of load at the trading interval ending 11.30 hours. A little earlier on the same morning, 7,370 MW of variable renewable energy (**VRE**) set a new record for the dispatch of **VRE** to match load. (As noted in previous editions of Low Carbon Pulse, these record percentage levels of renewable energy dispatch tend to occur on weekends, at times of the day when load is reduced, and there is strong solar availability.)

In setting the 100% load target matched by renewable electrical energy, **AEMO** is not out on its own. In a recent survey undertaken by science alert there is support for the proposition not just on a grid by grid basis, but generally. Further, Mr Westerman's speech has resulted in a four page paper from Engevity entitled [Australian Grid to be Capable of 100% Renewables – What does this mean?](#), concluding that: *"What is abundantly clear is that overcoming the physical challenges of renewable integration is a question of when, not if"*. Echoing the sentiment of Mr Westerman, *"this is where we're headed"*.

See: [AEMO CEO Daniel Westerman's CEDA keynote address: 'A view from the control room'](#)

- **Australian renewable energy activities continue to scale-up:**
 - During the week beginning July 12, 2021, it was widely reported that the world's largest renewable energy hub is planned for the southern coast of Western Australia. As reported in previous editions of Low Carbon Pulse, Australia has world class renewable energy resources, and south and south west coast of Western Australia has some of the best wind resources globally. As such it comes as no surprise that there are plans to develop a renewable energy hub in the region. What is a surprise is the world scale of the proposed **Western Green Energy Hub**, which when fully developed is planned to have 50 GW of installed solar photovoltaic and wind capacity used to produce Green Hydrogen for domestic use, and for export: the production is estimated to be up to 3.5 mtpa of Green Hydrogen and up to 20 mtpa of Green Ammonia. The **Western Green Energy Hub** is sponsored by CWP Global and Intercontinental Energy, leading corporations developing the 26 GW Asia Renewable Energy Hub, in the Pilbara, in the north of Western Australia.
 - On July 15, 2021, Spark Renewables (a company within Spark Infrastructure Limited Group) announced plans to develop a 2.5 GW solar photovoltaic, wind and BESS integrated renewable energy hub in the south west of New South Wales, Australia (**Dinawan Energy Hub**).

See: [Spark Infrastructure Announces Proposal to Develop a Renewable Energy Hub for up to 2.5GW in South-West NSW](#); [Dinawan Energy Hub website](#)

NTPC to develop 4.75 GW renewable energy park: Edition 21 of Low Carbon Pulse noted plans by NTPC (India's largest generator of electrical energy) to develop a 4.75 GW renewable energy park as part of its plans to transform its core business.

On July 19, 2021, it was reported that the Ministry of New and Renewable Energy (**MNRE**) had approved the development of the project. The project is located at Rann of Kutch, Gujarat, India (**REP**). The **REP** will generate renewable electrical energy that will be used for both direct supply and as a resource of renewable electrical energy for the production of Green Hydrogen.

See: NTPC [website](#)

Wind round-up:

- **Market responding to perceived need:** On July 16, 2021, it was announced that DEME Concessions Wind (**DCW**) and Zarubezhneft (Russian oil and gas corporation) had signed a memorandum of understanding (**MOU**) to provide a framework for **DCW** and Zarubezhneft to develop jointly the €2.7 billion 1 GW Vinh Phong off-shore wind field off Vietnam (**VPOWF**). The development is to be staged, with 600 MW of capacity to be installed by 2026, and 400 MW by 2030.
 - **Australian off-shore increasing prospects:** Editions 6, 14 and 16 of Low Carbon Pulse have touched on the potential for the development of off-shore wind field resources around Australia. As noted in Edition 14 of Low Carbon Pulse, there are high quality off-shore wind field resources that are close to load and to existing electrical transmission and distribution infrastructure, and close to mining and electrical generation heartlands of the Hunter Valley, New South Wales, the Latrobe Valley, Victoria, and Gladstone, Queensland.
- It has been reported that the off-shore wind resources around Australia, and in these areas in particular, are truly world class, with the ability to install 2,000 GW of off-shore wind capacity within 100 km of the nearest substation on land (see [Blue Economy Cooperative Research Centre report](#) - published by CSIRO and the Australian Government's Cooperative Research Centre) (Australia currently has around 230 GW of grid connected electrical energy capacity.)

While these statistics do not define an early stage business case, they do however help to crystallise early thinking around the possible use of off-shore wind resources, and their location, and the capacity that Australia has to produce Green Hydrogen if the renewable electrical energy derived from off-shore wind fields is used for that purpose.

- **California dreaming of floating off-shore wind fields:** On July 14, 2021, it was widely reported that California is considering the installation of off-shore floating wind capacity. Northern California has some of the best off-shore wind resources off the US coast. The challenge with the development of off-shore wind fields has been that fixed-bottom turbines are not practical off Northern California because the continental shelf falls away relatively close to shore, and as such will not allow realisation of the best of the wind resources.

Solar round up:

- **Expansion of solar in Vietnam:** On July 20, 2021, it was widely reported that there are plans to increase the capacity of the Xuan Thien Ea Sup solar photovoltaic project in to 2.8 GW by early 2022. This is a timely reminder that demand for electrical energy in Vietnam is increasing, and that the renewable electrical energy is likely to respond to increased demand, likely at a rate than exceeds the current planned development.

See: [Huge Vietnamese solar park could hit 2.8 GW within a year](#)

- **Sunseap floating solar photovoltaic:** During the week commencing July 19, 2021, it was widely reported that that Sunseap Group (leading Singapore based, energy system developer, owner and operator) is to develop a USD 2 billion, 2 GW floating solar photovoltaic solar project (**SFSP**). The **SFSP** is to be developed on Duriangkang Reservoir, Batam Island (covering around 1,600 hectares). It is understood that Sunseap and the Badan Pengusahaan Batam (**BP Batam**) have signed a memorandum of understanding to allow the development of the **SFSP**. The intention is for construction of the **SFSP** to commence in 2022, with completion and commencement of operation planned for 2024.

It is understood that the renewable electrical energy generated by the **SFSP** will be supplied within Batam Island: Chair of BP Batam, Mr Muhammad Rudi, stated: *"This investment by Sunseap will be a timely boost for Batam's industries as they seek to reduce the carbon footprint of their operations"*.

It would seem likely that renewable electrical energy may be supplied to Singapore using a sub-sea cable, but this has not been described as going to **SFSP** feasibility.

Edition [13](#) of Low Carbon Pulse reported on the completion and commencement of operation of the floating solar photovoltaic system developed near off-shore Singapore – another Sunseap project. Further, Edition [18](#) reported on the increasing use of floating solar photovoltaic projects elsewhere across the Asia Pacific region, critically, off-shore South Korea, and on its reservoirs.

It is hoped that the **SFSP** is the start of sustained progress towards use of floating solar photovoltaic resources across Asia.

See: [Sunseap signs MOU with BP Batam to build world's largest floating solar farm and energy storage system](#)

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

As will be apparent, Low Carbon Pulse continues to report on first, or early, movers into technologies and jurisdictions, including Ballard, Cummins, Hyundai, Hyzon Motors and Plug Power. While the size of the orders may not be breath-taking, the commitment to keeping moving, and finding new ways to deliver into new jurisdictions is both breath-taking and inspiring.

- **Cummins' continued pivot:** For some time, the continued pivoting of Cummins, Inc (**CMI**) to transform its business to leading provider of hydrogen solutions (including to the transportation and hydrogen production and use industry) has been marked (see Edition [18](#)) of Low Carbon Pulse.

On July 15, 2021, it was reported that **CMI** and Chevron (**CVX**) had signed a memorandum of understanding (**MOU**) to provide a basis to explore a strategic alliance. It is reported that the **MOU** contemplates that the two leading corporations will work together to advance public policy that promotes hydrogen as a decarbonising solution for transportation and industry, building market demand for commercial vehicles and industrial applications powered and propelled by hydrogen, developing infrastructure to support the use of hydrogen for fuel cell electrical vehicles (**FCEVs**), and to explore opportunities to leverage **CMI's** electrolyser and fuel cell technologies (**FCTs**), including at **CVX** US refineries.

See: [Chevron and Cummins Announce Strategic Collaboration on Hydrogen](#)

- **Ballard rolling:** For some time, Ballard Power Systems (**BPS**) has been making progress across a number of sectors. On July 15, 2021, it was widely reported that **BPS** is to supply 200 kw fuel cell modules under arrangement with Siemens Mobility GmbH to power a two car Mireo Plus H passenger train trials in Bavaria, Germany (one of the hydrogen hot spots in the **EU**). The fuel cell modules are located on the roof of the passenger train, and power and propel the train with electric battery technology located underneath the floor of the train. It is reported that that trials will start in 2022. The Mireo Plus H passenger train is designed for use on non-electrified lines at speeds of up to 160 kph.

See: [Ballard and Siemens Sign \\$9M Multi-Year Development Agreement For Fuel Cell Engine to Power Cutting-Edge Mireo Commuter Train](#)

- **On the high road and on the road overhead:**

- **Hyzon Motors Inc keeps trucking to deliver – where there is a will there is a way:**

- **Hyzon Motors Inc and TotalEnergies achieve deeper alignment:** Edition [16](#) of Low Carbon Pulse reported that TotalEnergies (leading global international energy company) had taken an interest in Hyzon Motors via a direct investment through TotalEnergies Ventures.

On July 12, 2021, it was announced that Hyzon Motors signed a memorandum of understanding with TotalEnergies' Marketing and Services division to work together to develop hydrogen refuelling infrastructure (**HRI**) across Europe, and to continue to develop long-haul transport solutions for customers for those services across Europe. This arrangement continues to emphasise the importance of supply and demand developing in tandem. In addition, for Hyzon Motors and TotalEnergies, in a developing market, an advantage will arise in engaging with fleet owners and purchasers – assurance of both vehicle supply and hydrogen supply. (There are a number of solutions for fleet decarbonisation and these will be covered in the next **Hydrogen for Industry** feature.)

This is another instance of the private sector positioning to be able to match supply to demand, and making purchasing decisions easier for other participants in the private sector. While further progress needs to be made, including Hyzon Motors being able to supply fuel cell technology vehicles with a total cost of ownership (**TCO**) equal to or less than diesel powered and propelled vehicles, it has traction.

For TotalEnergies, this is a further piece in the three-dimensional decarbonisation jigsaw puzzle that all international energy companies are seeking to resolve from reservoir (H₂O) to bowser (H₂).

As noted in Edition [16](#) of Low Carbon Pulse, TotalEnergies is a member of the Hyzon Zero Carbon Alliance.

See: [Hyzon Motors deepens strategic hydrogen mobility partnership with TotalEnergies SE](#)

- **One HHT to Europe month:** Edition [21](#) of Low Carbon Pulse reported that Hyzon Motors was to deliver a 154-tonne **FCT** powered and propelled heavy goods vehicle / truck (**HHT**) to a customer in the **EU**: the **HHT** is reported to have a range of 400 to 600 km, and has 480 kW (or 644 horse power).

Five HHTs to Australia the next: On July 13, 2021, it was announced that Hyzon Motors is to deliver five 154-tonne **HHTs** to Ark Energy Corporation (**AEC**) and Townsville Logistics (Australian subsidiaries of Korea Zinc, reportedly the world's largest lead, silver and zinc producer). The **HHTs** will be used at **AECs** Sun Metals Corporation zinc refinery (the second largest electrical energy user in Queensland) as part of a broader plan to develop the world's first green zinc refinery. (As was noted in Edition [4](#) of Low Carbon Pulse, Korea Zinc has contracted with Origin Energy (one of Australia's Big Three integrated energy companies).)

This is an exciting development for the use of hydrogen powered and propelled trucks in Australia, with the **HHT** to be used in road-train configuration: CEO of Ark Energy, Mr Daniel Kim commented: "When we scoured the world for fuel cell trucks .. Hyzon Motors was the only hydrogen mobility company that could manufacture fuel cell stacks with sufficient [energy] density to meet our requirements including the ultra-heavy payload and built to Australian Design Rules". The **HHT** will displace diesel powered and propelled trucks. Ark Energy will produce the hydrogen required to fuel the **HHTs**.

It is understood that Ark Energy has joined the Hyzon Zero Carbon Alliance (see Edition [20](#) of Low Carbon Pulse). Sun Metals Corporation is a member of RE100 (see Edition [18](#) of Low Carbon Pulse).

See: [Hyzon Motors signs Australian subsidiary of Korea Zinc, world's largest zinc producer, as the second customer for its ultra-heavy-duty 154-ton class hydrogen truck](#)

- **ICE iced:** Part of the **EC FF55** package is the phasing out of internal combustion engines (at least powered and propelled by fossil fuels) by 2035.
- **London Buses: all aboard the Wrightbus for East Acton, all stops, Oxford Circus:** On June 24, 2021, it was reported that the first **FCT** London Buses went into service on the East Acton to Oxford Circus route. Twenty Wrightbus vehicles (see Edition [16](#) of Low Carbon Pulse) are now in service.

Lord Mayor of London, Mr Sadiq Khan, is reported to have said: "Our investment in these hydrogen buses is not only helping us clean up London's air but is supporting jobs and local economies across the UK".

See : [London launches England's first hydrogen bus fleet](#)

Port News and Shipping Forecasts:

- **MSC and Shell well-suited:** Royal Dutch Shell Group (leading global international energy company) continues its progress towards **NZE**. On July 15, 2021, it was announced that MSC Mediterranean Shipping Company (**MSC**) and Shell International Petroleum Limited (**Shell**) have agreed to work closely with a view to accelerating the decarbonisation of the global shipping industry, including to develop a range of competitive, and safe and sustainable, technologies. It is reported that **MSC** and **Shell** have worked together for over 10 years on a number of initiatives, including on biofuel bunkering and the trialling of very and ultra-low sulphur fuels. As is apparent from previous editions of Low Carbon Pulse, as an international energy company, **Shell** is leading the way across Scope 1, Scope 2 and Scope 3 emissions.

See: [MSC and Shell Sign Collaboration Agreement on Decarbonising Shipping](#); [Shell and MSC Sign Collaboration Agreement on Decarbonising Shipping](#)

- **Why methanol?** Edition [21](#) of Low Carbon Pulse reported that Maersk announced that it had signed a shipbuilding contract with Hyundai Mipo Dockyards to build the world's first containership powered and propelled by carbon neutral methanol. Methanol is one of a number of e-fuels being considered by the shipping industry. In a global context, 12 vessels powered and propelled by methanol are in operation, with a further 10 understood to be on the order books. As such, methanol powered and propelled vessels have yet to achieve scale use. As with hydrogen, supply and demand for methanol is around 70 mtpa. If supply is to develop, demand needs to develop. As discussed more broadly, leaving to one side the perspective of the World Bank (see Edition [18](#) of Low Carbon Pulse), LNG and methanol are being compared as bunkers, with ammonia and hydrides, and, on a longer timeline, hydrogen.

It occurred to the author of Low Carbon Pulse that there is a good deal of discussion around the use of methanol as a carbon neutral or low carbon fuel, without an accompanying explanation. Compared to the use of fuel oils,

methanol produced from natural gas reduces CO₂ emissions in a range, the middle of which is probably around 10%, and provides reductions in NO_x and SO_x emissions. For methanol to be carbon neutral, it needs to be produced from a renewable resource, for example, biogas or biomass, with the electrical energy used to produce the biogas or biomass, and the methanol, being from a renewable source. This does not mean that on oxidation of methanol that CO₂ will not arise, but, in theory, because the CO₂ that arises will be absorbed into a renewable resource, with the continued growth of that renewable resource providing a carbon neutral outcome.

- **Shore to Shore (S2S) project continues implementation:** A number of previous editions of Low Carbon Pulse reported on the **S2S** project, including as related to the California Fuel Cell Partnership, involving the Port of Los Angeles and a number of first and early movers, including Shell and Nikola (**S2S Project**).
On July 15, 2021, Shell announced that it had opened hydrogen refuelling infrastructure (**HRI**) in Southern California. The **HRI** comprises two heavy goods vehicle / truck (**HGVT**) refuelling stations. In addition, consistent with matching supply and demand, Shell announced the mobilisation of five **HGVT** as part of the **S2S Project**.
See: Shell [website](#)
- **Hydrogen from Production to Bunker:** On July 16, 2021, The Maritime Executive, published an article entitled [Five Lessons to Learn on Hydrogen as a Ship Fuel](#). The article recognises the barriers that exist to the use of hydrogen as a ship fuel or as an enabler for synthetic fuels. One of these barriers relates to the safety challenges that arise from the production, storage, transportation to port, bunkering at port and use "well to wake". To address these challenges, a consortium, led by DNV (DNV Spadeadam Research and Testing Centre in the UK), is working on the MarHySafe joint development project (**JDP**). The consortium has published a [Handbook for Hydrogen Fuelled Vessels](#), providing guide to safe hydrogen operation using fuel cell technology (**FCT**) using liquefied hydrogen (**LH2**). While vessels can be powered and propelled using hydrogen in absorbed organic form in a Liquid Organic Hydrogen Carrier (**LOHC**) (a **LOHC** absorbs hydrogen, hydrogen is then released when required), or ammonia, or blending with other fuels, the MarHySafe project is focussing on **LH2** using **FCT**.

Carbon credits and Carbon offsets, Insurance, Negative Emissions Initiatives and Sustainability:

NASA surveys for Vital Signs of the Planet: On July 20, 2021, it was widely reported that a recent NASA [study](#), undertaken by its Jet Propulsion Laboratory (**JPL**) in Southern California, had considered whether forest and savanna areas of the world were sources of carbon or sinks for carbon. In monitoring carbon sources and carbon sinks it is possible to plan the most appropriate locations to introduce negative **GHG** emission initiatives, including by reference to how climate change is affecting the ability of flora to absorb carbon. One of the headline grabbing by-lines from reporting of the study has been that the Amazon Basin is both a carbon source and a carbon sink, and that across the entire Amazon Basin it is close to becoming neutral. The reasons for this are many and varied, but are reported as arising as a result of deforestation, and the degradation that results, the impact of increased average temperatures, including drought and its affects.

Aviation:

As part of the **FF55** package, the ReFuelEU Aviation Initiative (**RFEAI**) has been hailed by a number of aviation fuel suppliers, more accurately synthetic aviation fuel (**SAF**) suppliers. For supply side certainty of demand is required, and the **RFEAI** provides that: by 2030, 5% of all aviation fuel used at **EU** airports should contain **SAF** and 0.7% of aviation fuel used must be **SAF**.

NZE reports:

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

ORGANISATION	TITLE / SUBJECT MATTER
European Union Agency for the Cooperation of Energy Regulators (ACER)	Transporting Pure Hydrogen by Repurposing Existing Gas Infrastructure: Overview of existing studies and reflections on the conditions for repurposing
Hydrogen Counsel and McKinsey & Company	Hydrogen Insights: An updated perspective on hydrogen investment, market development and momentum in China
National Nuclear Laboratory	Unlocking the UK's Nuclear Hydrogen Economy to Support Net Zero
International Energy Agency	Empowering Cities for a Net Zero Future- Unlocking resilient, smart, sustainable urban energy systems
Jet Propulsion Laboratory	Changes in global terrestrial live biomass over the 21st century
International Energy Agency	Sustainable Recovery Tracker
All-Party Parliamentary Group	The role of hydrogen in powering industry

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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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