P2N0

NEWS AND VIEWS ON THE DRIVE TOWARDS NET-ZERO GHG EMISSIONS

Welcome to the **fifth edition** of **P_2N_0** covering the drive to reduce greenhouse gas (**GHG**) emissions to net-zero (**NZE**).

On:

- **December 15**, **2023**, the **sixth edition** of **P_2N_0** will be published, covering our take on the key outcomes from **COP 28** (the **COP-28 Edition**); and
- **January 15**, **2023**, the **seventh edition** of **P_2N_0** will be published, covering key news items arising during calendar year 2023.

The **eighth edition** of **P_2N_0** will be published during the first week of February 2024, and will include news items arising during January 2024.

At the moment, we anticipate publishing articles on **Carbon Capture Utilization and Storage** (during Q1 of 2024) and **Carbon Credits and developing Voluntary Carbon Markets** (during Q2 of 2024).

P_2N_0 identifies significant news items globally, reporting on them in short form, focusing on policy settings and project developments. **P_2N_0** will not cover news items relating to climate change generally, M&A activity, or that are negative.

Access previous editions of **P_2N_0** by clicking **here**.

Content:

Edition 5: November 1, to November 30, 2023 (covering news items arising during this period)

HEADLINES FROM NOVEMBER 2023

November 2023 was another "news-rich" month: each lead up to COP seems to provide the impetus for policy makers and legislators to make progress, and this year was no different.

The following matters seem to us to be the most news-worthy in the context of progress towards net-zero:

- **International Energy Agency** (**IEA**) **report on CCUS**: On **November 28**, **2023**, the **IEA** published **CCUS Policies and Business Modes: Building a Commercial Market – An IEA CCUS Handbook**. The publication is timely, and excellent.

  The publication dropped at the **European Commission** (**EC**) **CCUS Forum** (see **EC CCUS Forum below**) in Aalborg, Denmark, allowing many of the delegates there just enough time for a change of clothes before dashing to Dubai, for the start of **COP 28**.

- **China and US to work on CCS projects**: The **Sunnylands Statement of Enhancing Cooperation to Address Climate Change** was released jointly by China and the US on **November 15**, **2023**. The **Sunnylands Statement** outlines the plan for China and the US to work together to develop five CCS projects by 2030. In addition, the **Sunnyland Statement** contemplates the return of Government-to-Government (**G-to-G**) engagement. This was foreshadowed in **Edition 1** of **P_2N_0** which reported US Treasury Secretary, Janet Yellen, who noted the following whilst on a visit to Beijing:

> "As the world's two largest emitters of greenhouse gases and the largest investors in renewable energy, we have botha joint responsibility – and ability – to lead the way… Both our economies seek to spport partners in emerging markets and developing countries…" .

- **SB 6.4 adopts requirements for Article 6.4**: On **November 16**, **2023**, it was reported widely that the good folk comprising the **Supervisory Body for Article 6.4** (of the Paris Agreement) (**SB 6.4**) have agreed unanimously on the **methodology** for the purposes of the creation of emissions units (i.e., carbon credits), under **Article 6.4** of the **Paris Agreement**. In the context of carbon credits, this is the most important news items since **SB 6.4** started its work after **COP 26**.

  Over the last 12 months, the author has been presenting on the progress being made by **SB 6.4**, and in doing so, anticipating agreement on the methodology ahead of **COP 28**. The Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (**CMA**) will table the methodology at **COP 28**, and it is anticipated that it will be agreed upon. The **COP 28 Edition** (of **P_2N_0**) to be published on **December 15, 2023**, will report on **Article 6** in full.

- **World First**: On **November 15**, **2023**, **Gold Standard** (at **https://goldstandard.org**, under **Beyond National Commitments: Rwanda, atmosfair and Gold Standard Launch First Carbon Credit Aligned with Article 6**) announced it had placed on the **Gold Standard** registry credits designated "**as authorised for use under Article 6**". To the knowledge of the author, this is a first: to allow **Gold Standard** to designate the credits "**as authorised for use**", the Government of Rwanda will have agreed to apply for a "corresponding adjustment" so that the mass of carbon represented by the credits on the registry will not count towards the nationally determined contribution of Rwanda.

- **Global Plastics Treaty**: On **November 13**, **2023**, negotiations for a **Global Plastics Treaty** (**INC-3**) commenced in Nairobi, Kenya, with the primary purpose to discuss the **Zero Draft** of the **Global Plastics Treaty**, continuing through **November 19**. This is the first time that the text of the Treaty has been discussed. The link to the **UN Environmental Programme** website (at **unep.org** under **Third Session (INC 3)** provides background). The **Fourth Session** (**INC 4**) will take place between **April 21** and **30**, **2024**.

- **BloombergNEF CCUS Market Outlook 2023**: On **November 9**, **2023**, the good folk at **BloombergNEF** published **CCUS Market Outlook 2023**. As always, with **BloombergNEF**, the analysis is pared and punchy, and excellent. The headlines are: **1.** Blue Ammonia and Blue Hydrogen production will be key to the development of CCS / CCUS capacity through 2035, and the use of CCS / CCUS by the cement sector will continue to increase; **2.** The US will deploy CCS / CCUS at the fastest rate, and to store the greatest mass of CO_2, with Canada and the UK, and Australia, China and the Netherlands all making ever increasing use of CO_2; **3.** As prices on carbon increase, so will the use of CCS / CCUS by the "difficult to abate" industries, including cement, iron and steel, and currently unabated power generation will increasingly make use of CCS / CCUS; **4.** There are likely to be bottlenecks as the roll-out of transportation and storage infrastructure lags behind increasing demand.

- **Cooperation on H_2 procurement**:

  - In late **September** and early **October 2023**, it was reported widely that **Germany** and **Japan** are discussing cooperation on decarbonization and the energy transition, including in respect of procuring hydrogen.
  - On **November 10**, **2023**, it was reported that **Japan** and the **Republic of Korea** (**South Korea**) intend to work closely to develop a hydrogen and ammonia supply chain.
  - On **November 15**, **2023**, it was reported that **Germany** and the **Netherlands** had agreed to undertake jointly an auction in early **2024** to procure up to **€600 million worth** of **renewable hydrogen** for import (each of

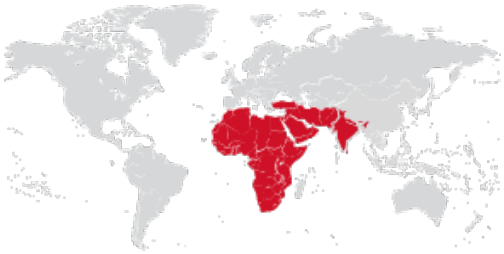
Germany and the Netherlands to contribute **€300 million**). For these purposes, the two countries have signed a **Joint Declaration of Intent to conduct a joint tender under the H2 Global Instrument**.

The procurement jointly of hydrogen should come as no surprise: the key to the development of the use of hydrogen is the development of supply in tandem with demand, with supply slightly ahead of demand. The key to developing demand side is government policy settings to incentivize or to require the use of hydrogen or ammonia by corporations, and to ensure that there is sufficient supply at the right price point to provide the government and those corporations with assurance that the switch from one fuel or feedstock to another is sustainable. Once it is apparent that the switch is sustainable, investment decisions will be made on demand side.

- **H_2 Infrastructure Fund**: On **November 1**, **2023**, **Nikkei Asia** (at **https://asia.nikkei.com**, under **Toyota and SMFG launch Japan hydrogen investment fund**) reported that a consortium of Japanese corporations, under the aegis of the **Japan Hydrogen Association**, are to work with a Japanese investment corporation, **Advantage Partners**, to fund the development of production and storage of H2 equipment and infrastructure. It is estimated that to reach carbon neutrality by 2050, around **USD 990 billion** of investment will be needed, with the Japanese Government likely to provide **USD 200 billion** in public funding, with the balance to be sourced from private funding.

- **Good ideas cross borders**: It is understood that the **People's Republic of China** (**China**) is to introduce a requirement that intermittent electrical energy generators, critically, photovoltaic solar and wind renewable electrical energy generators, to integrate electrical energy storage capacity equivalent to the nameplate capacity of the renewable electrical energy capacity (**REEC**), having at least a 2 to 4 hour duration. A similar requirement is imposed by the **Federal Energy Regulatory Commission** (**FERC**) in the US[1]. As understood (noting that understanding of the author is still developing), the requirement in **China** of at least 2 to 4 hour duration is likely to be an absolute minimum, with the requirement for all **REEC** to reflect the weather conditions prevalent in the location of the **REEC**.

NEWS FROM AROUND THE WORLD



Africa, Middle East and South Asia

Government of Odisha approves NH_3 and CH_3OH plants: On **November 27**, **2023**, it was reported widely that the Government of the **Indian State of Odisha** had approved proposals for the development of four Green Hydrogen

[1] In February 2018, FERC published a final rule (84 FR 23902) to facilitate the participation of electric storage resources in the capacity, energy, and ancillary service markets operated by regional transmission organizations/independent system operators (RTOs/ISOs). The rule directed the RTOs and ISOs that run the country's wholesale electricity markets to craft new rules to allow storage resources to bid their services into the markets. This rule required regional grid operators to establish participation models for electric storage resources. The models must set minimum storage requirements of 100 kilowatts for electric storage sources. Through this rule, FERC sought to improve market efficiency by allowing electric storage resources to access the electricity markets.

production plants, to produce **green ammonia** (**GNH_3**) and green methanol (**GCH_3OH**) having a combined development cost of **USD 5.5 billion**.

Four Green Hydrogen Projects (Developer, production in metric tonnes, and estimated cost)	
Welspun: 700,000 mt GNH_3 production (USD 1.6 billion)	**Sembcorp**: 720,000 mt GNH_3 (USD 1.5 billion)
Aegis Vopak: 80,000 mt GNH_3 storage (USD 120 million)	**ReNew E-fuels**: 100,000 mt & 500,000 mt GCH_3OH (USD 1.2 billion)

By way of reminder: New Energy Outlook India: **BloombergNEF** published its **2050 outlook** in respect of two energy transition pathways for India, one an **Economic Transition Scenario** without constraints on emissions, and the other a **Net Zero Scenario** with a carbon budget consistent with achieving net-zero GHG emissions as contemplated by Article 4 of the Paris Agreement.

Africa-EU Energy Initiative enlivened: On **November 21**, **2023**, it was reported widely that the German Chancellor, Olaf Schulz, had committed to provide **€4 billion** to the **Africa-EU Energy Initiative** (part of the **Africa-EU Global Gateway Investment Package**, itself a part of the **EU Global Gateway program**). As noted above, there is an emerging theme: there is a role for government as a wholesale buyer of hydrogen and hydrogen based / derived fuels, with government to match supply to demand side. In the words of the German Chancellor: "A long-term partnership also includes a clear message to the Compact states: Produce green hydrogen and you will find reliable buyers in us!"

Oman to establish regulatory framework for Blue Hydrogen and carbon capture: On **November 9**, **2023**, the **Oman Daily Observer** (at **https://www-omanobserver-om**, under **Oman to establish Carbon Capture, Blue Hydrogen regulatory framework**) reported on the execution of a Terms of Reference "to establish a regulatory framework for blue hydrogen and carbon capture utilization policies in the Sultanate of Oman".

Namibia continues along its hyway: On **November 8**, **2023**, **hydrogeninsight** (at **https://www.hydrogeninsight.com**, under **Africa's first green-hydrogen based ironworks starts construction, with eye on exports to Germany**) reported that the pilot-project (**Oshivela Project**), funded by the Federal Government of Germany, **HyIron**, is to commence production of direct reduced iron (**DRI**) during 2024. As reported, the **Oshivela Project** will produce **15,000 metric tonnes** of **DRI** from the end of 2024.

By way of reminder: **Edition 4** of **P_2N_0** reported as follows in respect of **Namibia**:

- **EU pledges investment**: On **October 28**, **2023**, **The Namibian** (under **EU to pump N$20b into Namibia's green hydrogen, raw materials sectors**) reported that the **EU** had pledged to invest in the green hydrogen and critical metals and mineral sectors. The investment will be concentrated on the development of the **Walvis Bay-Maputo Corridor**, one of 11 strategic corridors that the **EU** has identified as part of its **EU-Africa Global Gateway Investment Package**. The **Walvis Bay-Maputo Corridor** is well-placed, being a natural gateway for international trade, including to the Southern African Development Community, with around 300 million people.
- **Debt funding for Hyphen**: On **October 25**, **2023**, **H2 View** (under **Hyphen plans to enter loan agreement for $10 bn Namibian green hydrogen project**) reported that **Hydrogen Energy** is progressing discussions with the **Development Bank of South Africa** (**DBSA**) to borrow to enable it to develop its **7 GW** of renewable energy, and **3 GW** of installed electrolysers, **2 million metric tonnes** a year green ammonia project.

UAE Hydrogen Strategy released: On **November 7**, **2023**, **GHD** (at **https://www.ghd.com**, under **Creating a brighter tomorrow for the UAE: Launching the National Hydrogen Strategy**) reported on the release of the **National Hydrogen Strategy** on **November 6**, **2023**, The **GHG** report outlines that **Fraunhofer** and **GHD** had developed the

National Hydrogen Strategy for the **UAE**. The **Strategy** reflects the target of the **UAE** to produce **1.4 million metric tonnes** of **low carbon hydrogen** by 2031.

EDF Renewables, Masdar and Nesma Renewable Energy successful bid: On **November 7**, **2023**, **Masdar** announced that **EDF Renewables**, **Nesma Renewable Energy** and it had been successful in their bid to develop the **1.1 GW Henakiyah Solar Project**, in **Al Madinah province** of the **Kingdom of Saudi Arabia**, having submitted the lowest bid, and had signed a **Power Purchase Agreement** with the **Saudi Power Procurement Company** (**SPPC**). **December 5**, **2023** is the last date of submissions in respect of the fifth round for the photovoltaic solar procurement by **SPCC**, with a power purchase agreements to the awarded for a further **3.7 GW** of installed capacity.

NHPC announces successful bidders for 3 GW of PV: On **November 6**, **2023**, it was reported widely that the following bidders had been successful in their bids to develop photovoltaic solar capacity connected to the interstate transmission system (**ISTS**): **Apraava Energy** (**250 MW**), **Avaada Energy** (**1,000 MW**), **Green Infra Wind Energy** (**300 MW**), **Hazel Hybren** (**300 MW**), **Hinduja Renewable Energy** (**250 MW**), **Jakson** (**400 MW**), **Solairedirect Energy India** (**250 MW**) and **Spring Energy** (**250 MW**). Each successful bidder will contract with **NHPC Ltd** under power purchase agreement.

On **November 9**, **2023**, **Avaada Energy** was awarded a **1,400 MW** DC photovoltaic solar project. **Avaada Energy** will contract with **NHPC Ltd** under a 25 year power purchase agreement.

Americas

CIP to invest in Mexico: On **November 24**, **2023**, it was reported widely that the **President of Mexico**, **Andres Manuel Lopez Obrador**, had announced the **CIP** was to invest up to **USD 10 billion** to develop a **hydrogen hub** in southern Mexico, in the Oaxaca region, to produce Green Hydrogen.

FFI FID For Phoenix: On **November 21**, **2023**, **FFI** announced that it had taken **FID** in respect of its **$550 million** Green Hydrogen production facility in Phoenix, Arizona, with first production scheduled for 2026.

Canada to mobilise funding:

- On **November 21**, **2023**, it was reported widely that the **Canadian Federal Government** is to introduce policy settings that will provide up to **$20 billion** to support the development of CCS and low to no carbon projects.
- On **November 20**, **2023**, it was reported that the **Canadian Federal Government** announced a **Call for Proposals** for the **Critical Minerals Infrastructure Fund** (**CIMF**). The **CIMF** will have funding of **$1.5 billion** through **2030**.

Brazil:

- On **November 28**, **2023**, it was reported widely that the **State of Ceará** and **Grupo Jepri** had agreed to develop a **€3.3 billion** Green Hydrogen production plant at the **Pecém Industrial and Port Complex**.
- On **November 20**, **2023**, it was reported widely that the EU is to providing funding support "to build one of the biggest hydrogen projects [10 GW] in the world, in the Brazilian state of Piaui", with a reported cost of €2 billion. As reported, the Green Hydrogen will be shipped to Krk, Croatia. The support will come from the **Global Gateway** funding pledged in June 2023 and reported on in Edition 1 of P_2N_0.

US Federal Government to provide further funding for Batteries: On **November 15**, **2023**, the **Biden-Harris Administration** announced (at **https://www.energy.gov**, under **Biden-Harris Administration Announces $3.5 Billion to Strengthen Domestic Battery Manufacturing**) funding (under the Bipartisan Infrastructure Law) "to boost domestic production of advanced batteries and battery materials" across the US.

Fifth National Climate Assessment published for the US: On **November 14**, **2023**, the **US Global Change Research Program** (**GCRP**) published the US' **Fifth National Climate Assessment** (**NCA5**). **NCA5** assesses the impact (by current and future risk) of climate and global change in the US across each of the 10 National Climate Assessment regions, **Alaska**, **Hawaii and US-Affiliated Pacific Islands**, **Midwest**, **Northeast**, **Northwest**, **Northern Great Plains**, **Southeast**, **Southwest**, and **Southern Great Plains**, and **US Caribbean**. The **GCRP** must release this (congressionally mandated) report every four years. **NCA5** concludes that increased risks associated with climate change exist and highlights state and federal opportunities to mitigate these risks. The most apparent manifestation of these risks is increased extreme weather events, and wildfires.

US Federal Government to provide further funding for CCS: On **November 14**, **2023**, the **Biden-Harris Administration** announced (at **https://www.energy.gov**, under **Biden-Harris Administration Invests $444 Million to Strengthen America's Infrastructure for Permanent Safe Storage of Carbon Dioxide Pollution**) funding (under the Bipartisan Infrastructure Law) for 16 CCS projects (all detailed in the announcement) across 12 US States. As announced, the 16 projects will store a total of **50 million metric tonnes** of **CO_2** over a **30-year period**.

TES Canada to develop 'Green' Hydrogen production plant: On **November 11**, **2023**, **CTV News** (at **https://www.ctvnews.ca/**, under **A $4 B hydrogen plant will be built in Quebec**) reported that **TES Canada** is to invest in the development of "a Shawinigan, Que. plant producing 'green' hydrogen". As reported, the main customer for the hydrogen produced by the plant will be **Énergir** which will use it to produce renewable natural gas (**RNG**).

Canadian Solar to develop gigafactory in US: On **November 10**, **2023**, **Canadian Solar** announced that it is to develop a **5 GW** a year photovoltaic solar cell production facility in **Jeffersonville**, **Indiana**.

Uruguay with sun and wind in all the right places: On **November 9**, **2023**, **hydrogeninsight** (at **https://hydrogeninsight.com**, under **Green hydrogen roadmap finalised / Uruguay plans to produce 1 GW of H2 by 2030 for as little as $1.20 / kg**) on the publication by **Uruguay** of its plans to develop its **Green Hydrogen sector**. **Uruguay** sources above 90% of its demand for electrical energy from renewable sources, and as such can concentrate resources on increased renewable electrical energy to allow the production of Green Hydrogen and other future fuels, including Green Ammonia and Green Methanol (using bio-genic CO_2).

- "By 2030, green hydrogen production costs could reach $1.2 – 1.4 / kg, with potential for installing renewable energies greater than 90 GW of power in the sites with the best wind and solar resources of wind and solar".
- In addition, **Uruguay** has high quality iron ore that can be used to produce direct reduced iron (**DRI**), using the high-heat temperature derived from the combustion of Green Hydrogen.

Michigan to accelerate the energy transition: On **November 28**, **2023**, the **State of Michigan, Governor Whitmer** signed into law a package of legislature intended to accelerate the energy transition within the **State**. Within the legislation package is **Senate Bill 271** which creates a renewable energy portfolio standard that 15% of electrical energy sold by electrical energy suppliers must be renewable through 2029, 50% must be renewable by 2030, 60% by 2035, and 100% by 2040.

Latin America Energy Outlook: On **November 8**, **2023**, the **International Energy Agency** (**IEA**) published is inaugural energy outlook dedicated to Latin and the Caribbean – the **Latin America Energy Outlook** (**LAEO**). The **LAEO** is an informative read. The key findings are: **1.** Latin America and the Caribbean are well placed to thrive through the energy transition; **2.** The energy transition offers opportunities for increased and more sustainable economic growth; **3.** Clean electrical energy will provide a springboard for energy transition across the region; **4.** Policy settings will determine the energy mix through the energy transition; **5.** The resources of the region will allow diversified clean energy; and **6.** The broad global energy transition provides large market for Latin America and the Caribbean.

Texas to establish USD 10 billion energy fund: On **November 7**, **2023**, the good folk of the **State of Texas** approved an amendment to the **Texas Constitution** to allow the establishment of a **USD 10 billion fund**, the **Texas Energy Fund**. With the aim of increasing energy security, the **Texas Energy Fund** will provide low-interest loans (on 20-year terms) to allow the development of gas-fired generation capacity (up to **10 GW**) and microgrids, and to refurbish and restore,

and to augment, the electricity grid. The **Texas Energy Fund** will be administered by the **Public Utilities Commission of Texas**, and the development of the gas-fired generation capacity will provide additional electrical energy security for the State.

Federal Buildings to be decarbonized: On **November 7**, **2023**, it was reported widely that the **Biden-Harris Administration** is to provide up to **USD 2 billion** in funding to decarbonize federal buildings. As reported, the funding is to be provided in respect of 150 buildings in 39 US States.

British Columbia and Canadian Governments provide preservation purse: On **November 3**, **2023**, the **Endangered Ecosystems Alliance** (at https://www.endangeredecosystemsalliance.org) reported that the **Governments of British Columbia** and **Canada**, working with the **First Nations Leadership Council**, had concluded the **BN Nature Agreement**, with initial funding of **USD 1 billion**, to fund activities and projects to help **British Columbia** to preserve 30% of its land mass by 2030.

Linde and NextEra Energy Resources: On **November 3**, **2023**, it was reported that **Linde** and **NextEra** plan to develop a **USD 1 billion** hydrogen production plant (**Gila Hydrogen Facility**) one hour west of **Phoenix**, **Arizona**.

SolHyCal operational: On **November 2**, **2023**, it was reported widely that the **SoHyCal** Green Hydrogen production plant was operational. The plant is in Fresco, California, and is the largest Green Hydrogen production plant in the US to achieve operation.

Connecticut cuts to the chase: On **November 1**, **2023**, it was reported widely that the **US State of Connecticut** (Department of Energy and Environmental Protection (**DEEP**)) had issued a **request for proposals** (**RfP**) for the procurement of **2 GW** of offshore wind field (**OWF**) capacity. The **RfP** was issued on October 27. 2023, and the return date for proposals is January 31, 2024. Previous editions of **P_2N_0** have reported on the **OWF** procurement initiatives of **Massachusetts** and **Rhode Island**. Between them, the three north eastern States are procuring **6.8 GW** of **OWF** capacity.

Government of Quebec approved the development of gigawatt factory: On **November 1**, **2023**, the **Government of Quebec** (Ministry of the Environment) authorised the development, by **Reseau Allege Quebec** (**RAQ**), of the first phase (**7 GWh**) of **energy storage production capacity** (the second phase to increase to increase production capacity to **20 GWh**).

APAC

JERA on target for coal and ammonia co-firing: On **November 29**, **2023**, it was reported widely that **JERA** is to commence co-firing coal (80%) and ammonia (20%) at Unit 4, the 1 GW unit, at **JERA's Hekinan** coal-fired power plant,

Toyo Solar commences manufacturing at gigafactory: On **November 28**, **2023**, it was reported widely that **Toyo Solar** had commenced manufacturing at its **4 GW** solar cell gigafactory, in the province of **Bắc Giang**, **Vietnam**, being the first stage of an **8 GW** gigafactory.

West Papua, Indonesia – CO_2 storage: On **November 24**, **2023**, it was reported widely that the **President of Indonesia**, **Joko Widodo** had announced Indonesia's first CO_2 storage project developed as part of the **BP** operated **Tangguh LNG Project**, capturing CO_2 arising from the **Project** (which has recently completed train 3), and injecting and storing it permanently. As reported, the geological formation being used to store the CO_2 has capacity to store up to **1.8 giga tonnes** of CO_2.

BP and Corio stay the course: On **November 22**, **2023**, it was reported widely that **BP** and **Corio Generation** had submitted investment plans to the **Ministry of Trade, Industry and Energy** of South Korea with a cost of **€1.06 billion**.

Renewable Energy Investment Plan for Indonesia: On **November 21**, **2023**, Indonesia released the final **Comprehensive Investment and Policy Plan** (**CIPP**) based on the framework provided by the **Just Energy Transition Partnership**. The **CIPP** provides for the acceleration of the roll-out of renewable electrical energy projects with the aim of achieving **44% renewable electrical energy** by **2030**: the **CIPP** states that investment of **USD 97.3 billion** is needed to achieve this aim, with around **USD 66.8 billion** to be allocated for **400 projects** that have been identified.

E-Methane – more than just a concept: On **November 21**, **2023**, **LNG Prime** (at **https://lngprime.com**, under **Santos and Tokyo Gas plan e-methane production in Australia**) reported that **Santos** and **Tokyo Gas** are to work together to produce e-methane. This builds on other initiatives of **Tokyo Gas** to deploy methanation. The benefit of **e-methane** and the **e-LNG** arising on its liquefaction is that it allows continued use of the LNG supply chain.

METHANATION

Methanation involves the use of CO_2 (and CO) to produce CH_4 (methane) through the combination of CO_2 (and CO) with hydrogen, producing synthetic CH_4. If the hydrogen is Green Hydrogen, the CH4 produced from its combination with recycled CO_2 is e-NG.

Alternatively, methanol (CH_3OH) can be produced, as e-methanol. -NG is in gaseous form at room temperature, e-methanol in liquid form. The key variables are the mass of H_2 and the amount of renewable electrical energy required to produce e-NG or e-methanol, and as such its cost of production.

China Tianying Group's GESS work: On **November 16**, **2023**, it was reported widely that **China Tianying Group** is commissioning a gravity energy storage system (**GESS**) and had contracted with **State Grid** to provide electrical energy from the **GESS**. The **GESS** is the work of **China Tianying Group** using technology provided by **Energy Vault**. (For an outline of **Energy Vault,** the following article is helpful: **https://cleanenergyrevolution.co**, **World's First Gravity Battery Stores Energy for up to 18 hours**.)

ExxonMobil and PERTAMINA to evaluate CCS in Java Sea: On **November 16**, **2023**, it was reported widely that **ExxonMobil** and **PERTAMINA** are evaluating the possible development of up to **3 GT** of **CO_2** storage capacity in the **Java Sea**.

Hyundai Motor Company (HMC) breaks ground in Ulsan: On **November 16**, **2023**, **Battery Industry** (at **https://batteryindustry.tech**, under **Hyundai Motor building US$1.53B EV plant in Ulsan Complex**) reported that HMC had broken ground on the development of an EV plant in Ulsan, South Korea.

Commonwealth of Australia allows export and import of CO_2: On **November 14**, **2023**, the upper house of the Australian legislature amended the **Environment Protection (Sea Dumping) Act 1981** (Cth). Among other things, this will allow the import of CO_2 for storage in geological formations with Australian Federal waters.

Ready and able: On **November 13**, **2023**, it was reported widely that the **ABEL Energy Ball Bay Powerfuels Project** is progressing, with **John Matthey** and **SunGas Renewables** to supply services and technologies for the **300,000 metric tonne** a year methanol project. The **Powerfuels** project is to deploy **240 MW** of electrolyser capacity to produce Green Hydrogen, and a syngas production unit to derive syngas using gasification of a wood fibre feedstock.

Hydrogen-ready power station: On **November 10**, **2023**, it was reported widely that the Australian **State of Queensland** (state-owned corporation), **CS Energy**, is to develop a **hydrogen-ready gas-fired power station** at Kogan Creek, on the Western Downs. The power station will have nameplate capacity of **400 MW**, and in the first phase will be able to co-fire using 35% H_2 / 65% CH_4, with the intention to progress to **100%** hydrogen powered over time.

PLN and Masdar live on the water: On **November 9**, **2023**, it was reported widely that the **145 MW** (**192 MWp**) floating photovoltaic solar facility, developed by **PLN** and **Masdar** (with senior debt funding provided by Société Générale, Standard Chartered Bank, and Sumitomo Banking Corporation) had been inaugurated. The floating

photovoltaic solar facility is the largest in Southeast Asia and is located on the water mass behind the **Cirata Dam**, **Purwakarta**, **West Java**, **Indonesia**. As reported, there are plans to expand installed capacity to **500 MWp** (and prospectively up to **1,000 MWp**). The good folk at **Masdar** have posted an informative video about the inauguration. Here is the **link**.

BriHyNergy gigafactory good to go: On **November 7**, **2023**, it was reported widely that **BriHyNergy (Shenzhen) Co Ltd** had completed the development of its **1 GW PEM** electrolyser gigafactory in **Shenzhen, China**.

South Australia constant renewal continued: On **November 1**, **2023**, it was reported widely that **ElectraNet**, the transmission network in the State of **South Australia**, will be 100% "**net renewable**" as soon as 2028. For South Australia, a first mover in renewable electrical energy, necessity has been the mother in invention: the progress towards 100% "net renewable" is being achieved using photovoltaic solar and wind.

UNCTAD updates China policy publication: During **November 2023**, the good folk at the **United Nations Conference on Trade and Development** (**UNCTAD**) updated its 2022 publication, now titled, **China's Policy Strategies for Green Low Carbon Development**. The publication is well-worth a read for those seeking to understand (and, as appropriate to emulate), the policy settings that China is using to avoid, reduce and remove GHG emissions.

Also, during **November 2023**, the author unearthed **China's Hydrogen Strategy: National vs. Regional Plans** published by the **Center on Global Energy Policy**. The publication is well-worth a read, tying policy to production, and carbon intensity. It is worth reading with the **China Hydrogen Industry Outlook** (August 2023) publication from **BCG**.

ENEOS and JFE Steel Corporation close the loop: In early **November 2023**, it was reported by **Nikkei** and **Japan NRG** that **JFE Steel Corporation** is to use hydrogen sourced by **ENEOS** from overseas for use in a "carbon-recycling blast furnace" at the **Mizushima Complex**, Okayama Prefecture, **Japan**. As reported, the CO_2 captured will be combined with hydrogen to produce methane, with the methane used to provide high heat temperature for the blast furnace. This is another example of methanation.

Europe and the UK

Lhyfe lived large: On **November 30**, **2023**, it was reported widely that **Lhyfe** intends to develop an **800 MW Green Hydrogen** production plant in **Lubmin**, **Germany**, with the Green Hydrogen produced to carried across the German hydrogen network (see **Germany framing thinking on funding of hydrogen grids** – see below.)

EC proposes cross-border166 PCIS and PMIs: On **November 28**, **2023**, the **EC** announced **Projects of Common Interest** (**PCIs**) and **Projects of Mutual Interest** (**PMIs**), being part of the **European Green Deal**, with the list having been developed and adopted under the **Trans-European Networks for Energy Regulation**. (For detailed coverage of the announcement click to **https://ec.europa.eu**, under **Commission proposes 166 cross-border energy projects for EU support to help delivery the European Green Deal**.)

EC considers CfDs for H2 purchases: On **November 28**, **2023**, **hydrogeninsight** (at **https://www.hydrogeninsight.com**, under "**European Commission is considering Contracts for Difference for green hydrogen offtakers**") reported that the **EC** is considering the introduction of EU-wide Contracts for Differences (CfDs) to subsidize the purchase of hydrogen.

EC CCUS Forum: On **November 27** and **28**, **2023**, the **EC** held its **CCUS Forum** in Aalborg, Denmark. During the CCUS Forum:

- 14 CO_2 / CCUS network projects were announced (all of which are included in the **PCI** list mentioned above)

- Denmark, France, Germany, the Netherlands and Sweden signed the **EU CCUS Aalborg Declaration**, under which these countries are to work together on cross-border CCUS projects.

(As reported in **Edition 4** of **P_2N_0**, on **October 20**, **2023**, the **EU Joint Research Centre** published **Carbon Capture, Utilisation and Storage in the European Union – *Status Report on Technology Development, Trends, Value Chains and Markets***. The publication is excellent and has been travelling with the author of **P_2N_0** since its publication.)

UK Battery Strategy: On **November 26**, **2023**, the **UK Government** (Department of Business and Trade) published the **UK Battery Strategy**.

European Hydrogen Backbone: On **November 23**, **2023**, **the European Hydrogen Backbone** published **Implementation Roadmap – Cross Border Projects and Costs Update**. The publication provides a helpful update.

OWF procurement for Finland: On **November 23**, **2023**, it was reported widely that the **Finnish Government** is to conduct a tender for the installation of up to **3 GW** through the **Ebba Project** (off Pyhäjoki and Raahe) and the **Edith Project** (in the Narpio sea), both off the west coast of Finland, with a combined development cost of up to **€8 billion**. As reported, it is understood that tenders will be conducted in respect of three further offshore areas.

EU Upstream and Downstream Clean Energy Fund: On **November 23**, **2023**, the **European Union** announced a **€4 billion** fund to provide funding support for the development of clean energy projects (upstream and downstream, including energy storage). The source of the **€4 billion** in funding is the **Innovation Fund** (which is funded by the sale of emissions permits under the EU ETS)

As first Hydrogen Bank Auction commences, second scheduled: On **November 21**, **2022**, it was reported widely that the second round of procurement under which the **EU Hydrogen Bank** is to procure hydrogen (see **Edition 2** of **P_2N_0**) will take place in spring 2024. The first round of procurement commenced on **November 23**, **2023**, with a procurement budget of **€800 million**.

Net Zero Industry Act (NZIA) and Carbon Removal Certification Framework (CRCF): On **November 21**, **2023**, the **European Parliament** voted to adopt the **NZIA** and the **CRCF**, among other things, providing support for increased deployment of carbon dioxide removal (**CDR**) across Europe.

ENECO green for go: On **November 20**, **2023,** it was reported widely that **ENECO** is to develop an **800 MW** Green Hydrogen production facility within the precincts of the Port of Rotterdam to produce **80,000 tonnes** of Green Hydrogen a year.

Yara International to capture & store CO_2: On **November 20**, **2023**, **Yara International** (at **https://www.yara.com**), announced that it had signed an agreement with **Northern Lights** for the "cross-border transportation and storage of CO_2". The CO_2 will be captured and liquefied in the Netherlands and shipped using LCO_2 carriers for storage permanently.

North Sea Cooperation Countries to coordinate OWF procurement: On **November 20**, **2023**, **Recharge** (at **https://www.rechargenews.com**, under **'15GW every year' / North Sea nations back collective offshore wind tender planning**) reported that **eight EU** countries (Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, and Sweden), and **Norway** (together the **North Sea Cooperation Countries**) had agreed on a collective approach to the tendering for **OWF** capacity, working with the **European Commission**. As reported, the **North Sea Cooperation Countries** will procure **100 GW** of offshore wind field capacity by **2030**, at a rate of **15 GW a year**.

Romania coal mines to work with gravity: On **November 17**, **2023**, it was reported widely **Romania** has plans to cease mining and using coal by 2032, moving to a mix of gas-fired, nuclear and renewable electrical energy sources, and to maximize the use of energy storage, including using **gravity energy storage systems** (**GESSs**) located in coal mine shafts. For these purposes, a study is being undertaken by the **Ministry of Energy**, **Complexul Energetic Valea Juilui**, and **Green Gravity**.

Applications for Sørlige North Sea II: On **November 16**, **2023**, it was reported widely that **the Norwegian Ministry of Petroleum and Energy** had received seven applications in respect of the **1.5 GW Sørlige North Sea II** area.

Portugal electrical load matched by renewable energy dispatched: On **November 15**, **2023**, it was reported widely that from **October 31** to **November 6**, **2023**, the electrical load of Portugal was matched by electrical energy dispatch from photovoltaic solar, wind and hydro-electric power. This is a first for Portugal.

EU progresses CH_4 reduction: On **November 15**, **2023**, the **Council of the European Union**, the **EC**, and the **European Parliament** agreed, in principle, on the **Methane Regulation**. The headline from the **Methane Regulation** is the requirement to survey existing infrastructure for leaks, and to develop action plans to rectify those leaks, and to fix ongoing leaks of CH_4 within one month. In addition, the **Methane Regulation** will require CH_4 intensity to be determined, and will impose maximum CH_4 intensity specifications (backed by prohibitions).

German and Dutch networking: On **November 15**, **2023**, (in addition to signing **Joint Declaration of Intent to conduct a joint tender under the H2 Global Instrument**):

- **Germany** and **the Netherlands** signed a **Joint Declaration on Further Energy Cooperation in the Field of Hydrogen Infrastructure** to develop four hydrogen interconnectors to form an integral part of the **European Hydrogen Backbone**;
- **ACE Terminal** and **EnBW** announced their intention to cooperate to allow the supply of hydrogen from the **ACE Terminal** facilities (planned for the Port of Rotterdam) to customers of **EnBW** (in Germany);
- **BP**, **ENGIE**, **E.ON/Essent**, **Equinor**, **Onyx Power** and **Uniper** signed a memorandum of understanding to allow for the supply of hydrogen via the Netherlands to customers in Germany; and
- **Gasunie**, **Hynetwork Services**, **Open Grid Europe** and **Thyssengas** signed a cooperation agreement to allow connection of the hydrogen networks of Germany and the Netherlands.

On **November 16, 2023**, the **Constitutional Court** the use of **€60 billion** originally allocated for pandemic assistance in 2021 to fund climate change initiatives breached the **Basic Law of Germany**. This decision is forcing the Federal German Government to consider how to how the many initiatives that have been announced.

UK Government to increase strike price: On **November 15**, **2023**, it was reported widely that the **UK Government** is to increase the strike price for the contracts for differences awarded to successful bidders for offshore wind field capacity in AR6. The strike price will increase **£73/MWh** (for fixed bottom wind), and **£176/MWh** (for floating wind). The announcement from the UK Government can be found at **https://www.gov.uk**, under **Boost for offshore wind as government raises maximum prices in renewable energy auction**.

The increase in the strike price may be seen as a response to the fact that no bids were received to develop offshore wind field capacity through the **AR5** process. **Edition 3** of **P_2N_0** reported on the **AR5** process as follows:

> "On **September 8, 2023,** it was reported widely that in the UK Government's **Allocation Round 5** (**AR5**), no offshore wind developments had been successful in the award of contracts for differences (**CfDs**), with both fixed bottom and floating offshore wind not being awarded **CfDs.** In contrast, in **AR4** held in 2022, **7 GW** of offshore wind capacity was awarded **CfDs**. Notwithstanding the becalmed OWF sector, **CfDs** were awarded in respect of **3.7 GW** of capacity, including in respect of **1.9 GW** of **photovoltaic solar projects** and **1.5 GW** of **on shore wind farm projects**."

Air Products to develop carbon capture facility in Rotterdam. On **November 14**, **2023**, **Air Products** announced (at **https://www.airproducts.com**, under **Air Products to Build Europe's Largest Blue Hydrogen Plan and Strengthens Long-term Agreement**) it is to build, own and operate a state-of-the-art carbon capture and CO_2 treatment facility at its existing hydrogen production plant in Rotterdam. The **Blue Hydrogen** produced by the plant will be supplied to

ExxonMobil for use at its refinery within the precincts of the **Port of Rotterdam**, and the CO_2 will be stored permanently in the Porthos project offshore of Rotterdam. (See **Edition 3** for **Porthos project**.[2])

EU aligns on CMMM: On **November 13**, **2023**, the **Council of the European Union** and **European Parliament** agreed (provisionally) the basis for a regulation to secure the sustainable supply of critical raw materials (or as the author refers to the, critical metals, minerals and other materials). The **Critical Raw Materials Act** will provide the regulation.

- "Today's agreement lays the foundation for Europe's strategic autonomy. Our dependency on raw materials is the Achilles' heel of our competitiveness, with the Critical Raw Materials Act we can turn this … into a strength. We can create a truly European extracting sector; we can turn our waste into a resource; we can build closer ties to third countries and we can secure the lifeline of our industry in a truly sustainable way". (Teresa Ribera Rodriguez, Third Deputy Prime Minister of Spain)

The ever excellent **EU website** provided an excellent overview of the **Critical Raw Materials Act** (at **https://single-market-economy.eu**, under **Critical Raw Materials Act**).

Eni and Snam to develop Ravenna CCS project: On **November 13**, **2023**, **Eni S.p.A** announced that it and **Snam S.p.A** are to develop the **Ravenna CCS project** in the Adriatic Sea, off the east coast of Italy. The CO_2 will be piped to the Porto Corsini Mare Ovest platform for injection into the depleted **Ravenna offshore gas field**.

The CO_2 to be stored will be increased progressively: **25,000 metric tonnes** in **2024** (captured from the Eni natural gas treatment plant in Casalborsetti), **4 million metric tonnes** by **2026**, and **16 million metric tonnes** after **2030**. As announced, the **Ravenna CCS project** has capacity to store permanently **500 million metric tonnes** over the life of the project, and will store CO_2 arising from difficult to decarbonize industries. This is a first for Italy.[3]

UK announces plan to upscale offshore wind field capacity: On **November 9**, **2023**, it was reported widely that **The Crown Estate** in the UK intends to enable the generation of up to a further **4 GW** of offshore wind field capacity. As reported, **The Crown Estate** is considering requests made by seven developers of offshore wind fields to develop increase capacity within the lease areas already granted.

Spain to announce OWF regime before year end: On **November 8**, **2023**, it was reported widely that **Spain** is to announce the form and substance of its legal and regulatory regime for offshore wind fields by the end of 2023. The **National Integrated Energy and Climate Plan** for Spain contemplates the installation of **3 GW** of offshore wind field capacity, the legal and regulatory regime will outline the basis for this.

Germany framing thinking on funding of hydrogen grids:

- On **November 7**, **2023**, **Euractiv** (at **https://www.euractiv.com**, under **Berlin to present first European Rules on hydrogen grid financing**) reported on two options to support funding: a Germany-wide grid charge from 2025 to fund the development cost or state guarantees of guarantee the development cost. As reported, Germany contemplates the development of up to 11,200 km of hydrogen pipelines to comprise its grid.
- On **November 14**, **2023**, the **Federal German Economy and Climate Minister** (Robert Habeck) shared a map detailing the **core hydrogen grid for Germany**; the **core hydrogen grid** comprises a little over **9,700 km** of hydrogen pipelines. The development of the **core hydrogen grid** will cost **€20 billion**. The **core hydrogen grid**

[2] Porthos takes positive final investment decision: On October 17, 2023, the Porthos pro-ponents, Port of Rotterdam Authority, Gasunie and EBN B.V., took a positive final investment decision to develop the €1.3 billion, 2.5 million metric tonnes a year, CO2 transport and storage system, taking CO2 (captured within the precincts of the Port of Rotterdam) for injection and storage around 20 km offshore, 3 km below the seabed.

[3] **Edition 4** of **P_2N_0** reported as follows in respect of the Eni UK project in Liverpool Bay: Eni and UK Government aligned on Liverpool Bay: On October 17, 2023, it was reported widely that Eni UK and the UK Government had agreed heads of terms on the transportation and storage of CO2 in Eni's depleted natural gas field beneath the seabed of Liverpool Bay in the Irish Sea. As report-ed, the Liverpool Bay injection and storage complex will be developed in two phases, phase 1 with capacity of 4.5 million metric tonnes of a year of capacity, and phase 2 with capacity of up to 10 million metric tonnes a year.

will comprise existing natural gas pipelines (up to 60% of the grid). On **November 14**, **2023**, the **German TSOs** submitted a draft application for the **core hydrogen grid** to the German Federal Ministry for Economics and Climate Change.

On **November 10**, **2023**, amendments to the **Energy Act** (**EnWG**) were passed on the German Federal Parliament to provide the framework to allow the development of the hydrogen grid.

Germany and UK continue cooperation:

- On **November 3**, **2023**, **Germany** and the **UK** (the two largest economies in Europe) signed an agreement providing a blueprint for cooperation on energy and climate change (see **https://www.gov.uk**, under **Cooperation on energy and climate: joint declaration between United Kingdom and Germany**). The agreement provides for the sharing of knowledge, and cooperation in the respect of offshore wind field developments and to enhance further interconnection across the North Sea. (See **Edition** 3 of **P_2N_0** for details of the agreement between Germany and the UK in respect of hydrogen.)
- In addition, Germany raised with the UK the construction of a **400 mile hydrogen pipeline** from Scotland to Germany.

Greece goes offshore: On **November 1**, **2023,** it was reported widely that **Greece** had announced a draft **National Development Program for Offshore Wind Farms**. As reported, the **draft Plan** comprises **25 offshore areas** (**Organised Development Areas** or **ODAs**) of a little over **2,700 km²**, with estimated total installed capacity of **12.4 GW**. The **draft Plan** identifies 10 **ODAs** for development by 2032, so as to achieve the target of **4.9 GW** of installed capacity by 2032. Also, it is understood that most of the **ODAs** are suitable for floating wind (rather than fixed bottom).

Energy Act 2023 goes live: At the end of **October 2023**, the **UK Energy Bill** became law as the **Energy Act 2023**. The **Energy Act 2023** provides for the development of a **CCUS strategy and policy statement**, which will be subject to review every five years. The **Office of Gas and Electricity Markets** (**Ofgem**) is the economic regulator of CO_2 transport and storage, and in its role will assist the Secretary of State for Energy and Net Zero to achieve the policy settings and targets of the UK.

- As noted in **Edition** 4 of **P_2N_0**, on **October 30**, **2023**, the **UK Government** concluded consultation on **Proposals for hydrogen production and industrial carbon capture regulations**, with the intention to proceed based on its proposals, and published an update of the proposal.
- Among other things, the **Energy Act 2023** provides the framework for revenue support, providing five forms of contract: **1.** carbon dioxide transport and storage revenue support contract; **2.** hydrogen transport revenue support contracts; **3.** hydrogen storage revenue contract; **4.** hydrogen production revenue support contract; and **5.** a carbon capture revenue support contract.
- For the context of the **Energy Act 2023** and the CCUS **development plans** of the private sector see **CCUS Delivery Plan Update 2023**, for the **CCSA** (September 2023).

On **November 9**, **2023**, the **North Sea Transition Authority** (**NTSA**) published its **Carbon Storage Permit** operator guidance. The operator guidance is intended to provide an "easy-to-follow" guide outlining the expectations of the **NSTA** of what makes a good carbon storage operator.

Gas Storage Denmark running CO_2 storage tender: On **October 25**, **2023**, **Gas Storage Denmark** opened its tender for the first onshore **CO_2 storage** capacity to be provided at the **CO_2RYLUS** project. The tender offers **two million metric tonnes** of CO_2 storage over a **10-year period**, with the CO_2 to be stored to be transported by tanker. The tender closed on November 24, 2023.

HELPFUL PUBLICATIONS AND DATA BASES

Energy Efficient 2023: On **November 29**, **2023**, the **International Energy Agency** (**IEA**) published **Energy Efficiency 2023**. The publication is excellent, and well-worth a read (it was weekend reading for the author on December 3, 2023).

The Oil and Gas Industry in Net Zero Transitions: On **November 23**, **2023**, the **IEA** published **The Oil and Gas industry in Net Zero Transitions - World Energy Outlook Special Report**. The report is insightful.

CCS publications: In addition to the **CCUS Policies and Business Models: Building a Commercial Market** published on **November 27**, **2023**, on **November 9**, **2023**, the **Global CCS Institute** published **Global Status of CCS 2023 – Scaling Up Through 2030**. The publication is excellent, providing a regional overview (matching the regions in **P_2N_0**), and providing helpful analysis globally and regionally.

Global Energy Scenarios 2023: On **November 20**, **2023**, **Rystad Energy** published **Global Energy Scenarios 2023 – Tipping Point – An accelerated transition is emerging**. The publication is excellent and is well-worth a read. The key findings are: **1.** Global emissions peak coming soon, likely around 2027; **2.** Low-carbon investments are moving toward an inflection point; **3.** Photovoltaic manufacturing capacity is now more than 1,200 GW, ahead of the 1.6°C scenario (in the publication); **4.** Peak global primary energy supply by the coming decade; **5.** CCUS and hydrogen remain the most viable solutions for the hard-to-abate sectors; **6.** 45% of global mileage to transport fuels to be avoided as fossil fuel use declines; and **7.** EVs to overtakes ICEs within four years.

Hydrogen Council busy:

- In **October 2023**, The **Hydrogen Council** and **Baringa** published **Hydrogen in Decarbonized Energy Systems**. The publication is an excellent reminder of the application and benefits of the deployment of H_2;
- On **November 16**, **2023**, the **Hydrogen Council** and **McKinsey & Co** published **Global Hydrogen Flows – 2023 Update**. The publication continues the ongoing work of the **Hydrogen Council** and **McKinsey & Co** in tracking the production and trade in hydrogen and hydrogen based / derived fuels.

TotalEnergies Energy Outlook 2023: On **November 14**, **2023**, **TotalEnergies** published **TotalEnergies Energy Outlook 2023**. The publication is well-worth a read. (**Links** to the previous three Outlooks are attached: **2022**, **2021** and **2020**.) The key findings of the **Outlook** are: **1. CO_2** emissions increased during 2022; **2.** The pace and scale of the deployment of the new low-carbon energy system needs to be accelerated significantly; and **3.** "Another challenge is to reduce fossil fuel consumption at the right pace". In addition, "no regrets" actions are canvassed.

UN Production Gap Report: Each year ahead of **COP**, the **UN** publishes the **Production Gap Report**. The **Report** quantifies the difference between the planned production of fossil fuels and the production levels for fossil fuels consistent with limiting the increase in global average temperatures to 1.5°C and 2°C. The headline is that the plan of governments is to produce 110% more fossil fuels in 2030 than would be consistent with a 1.5°C increase, and 69% more than would be consistent with a 2°C increase. The **Production Gap Reports** for **2019**, **2020**, **2021**, and **2022** can be accessed through clicking on the year.

Carbon Direct – New Buyer's Guide for Sustainable Biomass Sourcing: On **November 8**, **2023**, Carbon Direct published a new **Buyer's Guide for Sustainable Biomass Sourcing for Carbon Dioxide Removal**, for buyers contracting for **biomass-based carbon dioxide removal** (**CDR**). The publication is a useful addition to orientate buyers.

Carbonfuture – The Buyer's Guide to Carbon Dioxide Removal (CDR) Policy: On **November 7**, **2023**, **Carbonfuture** published **The Buyer's Guide to Carbon Dioxide Removal (CDR) Policy**. The publication is a useful addition.

Emissions Measurement in Supply Chains: During **November 2023**, the good folk at **Business at OECD** and the **World Economic Forum** published **Emissions Measurement in Supply Chains: Business Realities and Challenges**. The publication provides a helpful summary of the issues faced, which can then be viewed in the broader context of emission measurement more broadly.

H_2 v HVDC: During **November 2023**, the good folk at **The Oxford Institute for Energy Studies** published **Hydrogen pipelines vs. HVDC lines: Should we transfer green molecules of electrons?** The publication is helpful in framing issues that go to the economics of each concept, although, as expected, distance is determinative, and as such defines them as complementary, not in competition.

World of Solar: During **November 2023,** the good folk at the **International Solar Alliance** published the **World Solar Technology Report 2023**. The rate of rollout of photovoltaic solar technology is imperative and the progress staggering. The Report does not rest on any laurels, rather it is emphasizes the imperative of ever more staggering progress, and identifies seven areas for deployment or increased deployment of photovoltaic solar: **1,** with energy storage to improve generation flexibility; **2.** to provide electrical energy for co-located Green Hydrogen production and industrial use; **3.** on agricultural land to improve the efficiency of land use; **4.** to power cooling and heating; **5.** to charge electric vehicles; **6.** to be integrated into buildings and vehicles; and **7.** on water to minimise land use. The **Report** is well-worth a read.

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