JAPAN NRG WEEKLY

DEC 25, 2023

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ANALYSIS

2023: SUMMARY OF THE YEAR ACROSS KEY ENERGY SECTORS

In comparison with the energy crisis and associated turbulence of 2022, this year has been about preparation for the future for most major energy sectors. The lull in the ideological debates over the meaning and means of the energy transition helped fossil fuels recover policy and investor interest, especially in natural gas and LNG. But the net-zero battle lines will be drawn anew in 2024 as METI begins updating the Basic (Strategic) Energy Plan. We look back at some of 2023's key events in the major energy sectors.

ASIA ENERGY REVIEW

A wrap of top energy news from around the world.

EVENTS SCHEDULE

This section will be updated with the 2024 calendar in the first edition of Japan NRG next year.

JAPAN NRG WEEKLY

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OFTEN-USED ACRONYMS

METI	The Ministry of Economy, Trade and Industry	mmbtu	Million British Thermal Units
MoE	Ministry of Environment	mb/d	Million barrels per day
ANRE	Agency for Natural Resources and Energy	mtoe	Million Tons of Oil Equivalent
NEDO	New Energy and Industrial Technology Development Organization	kWh	Kilowatt hours (electricity generation volume)
TEPCO	Tokyo Electric Power Company	FIT	Feed-in Tariff
KEPCO	Kansai Electric Power Company	FIP	Feed-in Premium
EPCO	Electric Power Company	SAF	Sustainable Aviation Fuel
JCC	Japan Crude Cocktail	NPP	Nuclear power plant
JKM	Japan Korea Market, the Platt's LNG benchmark	JOGMEC	Japan Organization for Metals and Energy Security
CCUS	Carbon Capture, Utilization and Storage		
OCCTO	Organization for Cross-regional Coordination of Transmission Operators		
NRA	Nuclear Regulation Authority		
GX	Green Transformation		

NEWS: ENERGY TRANSITION & POLICY

Hyogo Pref to tighten regulations on solar power systems, to take effect in Oct 2024

(Government statement, Dec 12)

- Hyogo Pref plans to revise the Solar Power Ordinance and introduce permits for installation of facilities with an area of at least 5,000 m2, and for cut and fill areas exceeding 3,000 m2 in privately owned forests.
- CONTEXT: *Presently, solar projects over 5,000 m2 are required to report their plans to the municipalities but do not require permits.*
- The governor made the decision out of concern over potential accidents involving collapsed solar panels and possible impact on local biodiversity.
- The changes take effect on Oct 1, 2024, if the prefectural assembly approves the proposed amendments of the ordinance.

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Revealed: divide between winners and losers in Round 2 offshore wind auction

(Diamond, Dec 19)

- CONTEXT: *Local media has disclosed all bidders in the Round 2 offshore wind auction. In METI's Dec 13 announcement, only the announced winners of three of the projects were revealed.*
- Eight groups that took part in the auction included non-Japanese firms: U.S. power producer Invenergy and two German firms Skyborn Renewables, (formerly known as wpd offshore), and RWE, which was granted a license for the project in Niigata Pref together with trading house Mitsui and Osaka Gas.
- The groups that missed out in the Round 2 auctions are as follows:
    - **Akita project:** A consortium of Cosmo, JAPEX, Venti Japan, Shimizu that was led by trading house Mitsubishi; a group with Marubeni, Tokyo Gas and bp
    - **Niigata project:** A consortium of five firms led by Sumitomo with TEPCO's renewables unit, Taisei and Honma; a group consisting of JERA, Tohoku Electric and TotalEnergies; Invenergy
    - **Nagasaki project:** a JV between JRE and Skyborn Renewables

Winning vs losing bidders in Round 2:

Project Name	Vendors	Pricing evaluation (max 120 pts)	Operational feasibility (max 120 pts)	Total score	Planned start of operation
Akita Oga-KatagamiAkita Offshore Wind	W: JERA, Itochu, J-Power, Tohoku Electric	120	120	240	June 30, 2028
	L: Cosmo, JAPEX, Venti Japan, Shimizu, Mitsubishi	120	85.53	205.53	Dec 1, 2030

	L: Marubeni, Tokyo Gas, bp	120	68.08	188.08	June 30, 2030
Niigata Murakami-Tainai Offshore Wind	W: Mitsui, RWE, Osaka Gas	120	120	240	June 30, 2029
	L: Sumitomo, Cosmo, TEPCO Renewable Power, Taisei, Honma	120	102.85	222.86	June 30, 2030
	L: JERA, Tohoku Electric, TotalEnergies	120	91.43	211.43	June 30, 2029
	L: Invenergy	19.2	47.14	66.34	March 31, 2031
Nagasaki Saikai-Enoshima Offshore Wind	W: Sumitomo, TEPCO Renewable Power	120	101.25	221.25	Aug 31, 2029
	L: JRE, Skyborn Renewables	91.78	120	211.78	Aug 31, 2030

- The bids were rated based on a 240-point scale, with credits awarded for pricing and operational feasibility. The decision reflects major changes to the rules. In Round 1, one company, trading house Mitsubishi, was able to dominate thanks to a better price offer.
- Under the previous rules, up to 20 points were granted for the feasibility of a plan, with schedule considered as just one factor. The new rules grant up to 20 points for how quickly the plan can be executed.
- What was decisive in the auction was the schedule and ideas on how the project will contribute to the local economy.
- The Sumitomo-TEPCO alliance won the project in Nagasaki Pref thanks to better pricing as the consortium managed to secure several offtakers such as Sumitomo Metal Mining and SUMCO, a producer of silicon wafers for semiconductors.
- The winning bidders for the Niigata project, RWE and Mitsui, won approval from the local community with its business strategy, according to business insiders.

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METI seeks ¥2.5 trillion FY2024 budget, surging on GX spending

(Government statement, Dec 22)

- The Cabinet authorized the FY2024 budget requests of the national govt, to be discussed in the Diet in early 2024.
- METI seeks a total of ¥2.5 trillion, surging from ¥1.7 trillion in the previous fiscal term as the GX promotion budget doubled to ¥1.1 trillion.
- SIDE DEVELOPMENT:
  GX Promotion Organization to be established
  (Government statement, Dec 22)
  - The GX Promotion Organization, a state agency to accelerate public and private investments into net zero projects, will be established on Feb 16, 2024.
  - CONTEXT: *This was planned in the GX Promotion Act that took effect in June.*

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Energy outlook for 2024 by Prof Kikkawa: Investment in innovative energy tech is key

(Diamond, Dec 19)

- CONTEXT: *This is an opinion piece by Kikkawa Takeo, head of the International University of Japan and a professor of economics specializing in the energy sector. Kikkawa discusses trends likely to emerge in 2024.*
- The energy industry will see decisions driven by global goals for CO2 reduction by 2035 in line with the recent G7 target to cut emissions by 60% over 2019 levels.
- The govt will hasten to formulate the 7th Basic Energy Plan to meet its decarbonization targets and implement measures included in the updated policies and regulations on the Green Transformation (GX).
- Investment in the following sectors and technology in the next decade is expected to reach ¥105 trillion; the minimum budget for each is in brackets:
    - **Automotive industry (¥37 trillion):** advancement of EVs, FCVs and PHVs with expansion of battery storage tech, hydrogen and e-fuels, respectively;
    - **Renewables (¥20 trillion):** expected progress in offshore wind as the price to generate electricity is anticipated to drop to ¥10/ kWh; wider use of perovskite solar PVs for power generation at public facilities;
    - **Real estate and construction (¥14 trillion):** expected progress in thermal insulation improvement as a way to address challenges in energy conservation;
    - **Next-gen networks (¥11 trillion):** two HVDC transmission lines connecting Hokkaido and Honshu, combined capacity of 1.2 GW to launch in 2028;
    - **Ammonia and hydrogen (¥7 trillion):** ammonia could become more widely used than hydrogen;
    - **Battery storage tech (¥7 trillion):** increasing domestic lithium-ion battery supply chain amid excessive reliance on China.
- Nuclear power (including next-gen reactors) isn't included in the policy, and the projected amount of public and private investment is only ¥1 trillion.

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Japan and AZEC discuss finance for energy transition; Asia needs ¥4 quadrillion

(Nikkei Asia, Dec 18)

- During the AZEC summit in Tokyo, the 11 member countries discussed strategies to support "transition finance" to fund clean energy projects.
- PM Kishida said that decarbonizing Asia needs about ¥4 quadrillion (about $28 trillion). He announced the world's first 'climate bonds', worth ¥1.6 trillion, which will be issued in February, aiming to catalyze private sector and regulatory collaboration.

- TAKEAWAY: 'Climate bonds' is likely a reference to the GX-linked bond issuance by the government that was previously referred to as GX Economic Transition Bond. That was always a temporary name, and it is not clear if 'Climate bonds' is now the finalized term. But whatever the bonds are labeled as, they will be viewed skeptically by a significant portion of European and American investors. This is due to concerns over potential greenwashing. Japan relies on fossil fuels and strategies such as mixing greener fuels with coal, as well as hydrogen with natural gas, in power plants. These combinations are deemed acceptable under the Japanese taxonomy, but may not align with those from other jurisdictions. After all, what is allowed to be called "green" or "clean" is still subjective and varies across countries and regions. So, investors will need to consider which

standards and taxonomies they wish to align with. For sure, a notable amount of funds will find Japan's taxonomy at odds with their local standards and refrain from allocating to GX-related issuances.

Still, Japan's initiative is significant as it could influence other countries, especially AZEC members. Many other countries in Asia have a similar power mix to Japan and do not, at this point, wish to commit entirely to renewable energy sources. So, investors skeptical of Japan's approach would need to extend the same to other AZEC members, which could result in missing out on (likely) a significant section of the bonds market. Thus, the investment sector will need to address these taxonomy differences. And, should the AZEC approach find sympathy, Japan could emerge as a leader in this new financial space.

Santos poised to dominate Japan's e-methane exports with Toho deal

(Japan NRG, Dec 22)

- Gas producer Santos (Australia) could become the largest exporter of synthetic methane (e-methane) to Japan, according to a Japan NRG analysis.
- On Dec 13, Toho Gas and Santos Ventures signed a joint study agreement to produce synthetic methane (e-methane) in the Cooper Basin area and export 30,000 tons /year to Japan by 2030.
- Tokyo Gas and Osaka Gas have similar agreements with the Santos group (See table). The three gas utilities satisfied their 2030 supply requirements with Santos supplies.
- Japan's e-methane supply goal is 360 million m3 (257,142 tons), or 1% of total city gas supplies in 2030. Santos alone will have 58% of the Japanese market.

Gas utilities' agreements with Santos

	Partner	Agreement type	2030 supply goal
Toho Gas	Santos Ventures	Joint study agreement	30,000 tons /year
Tokyo Gas	Santos Ventures	MoU	60,000 tons /year
Osaka Gas	Santos	Contract	60,000 tons /year

Panasonic nixes plans for a $5 billion EV battery plant in Oklahoma

(Nikkei, Dec 20)

- Panasonic Energy will drop plans to build a $5 billion battery factory in Oklahoma.
- But the company said that construction continues on a $4 billion factory in Kansas that's set to launch in March 2025.
- The company said: "This decision will not impact our operations in Nevada or Kansas; we have made a long-term commitment to investing in and advancing the EV industry in the United States."
- CONTEXT: *Demand in Japan for EVs remains modest. In October, Panasonic Energy announced plans to slash its electric battery production in Japan by 60%. Meanwhile, EV sales in the U.S. have surpassed 1 million, up about 50% YoY, and the first time they've exceeded that milestone in a single sales year. With Tesla its biggest customer, Panasonic Energy is growing its presence in the U.S. Of the 11 overseas plants in operation owned by Panasonic Energy, two are in the U.S. (Nevada and Georgia) and one is in Mexico.*

Tokyo Gas partner Octopus Energy raises $800 mln in latest funding round

(Financial Times, Dec 18)

- UK-based Octopus Energy raised $800 million, boosting its valuation to $7.8 billion, almost double the $4.6 billion in 2021.
- Founded in 2015, Octopus Energy is the UK's second-largest household energy supplier.
- CONTEXT: *Tokyo Gas owns almost 10% of Octopus, which used this partnership to expand into Japan's market. The company's mission statement is to "bring smart energy to Japanese homes… focusing on solar and EV expansion, and with the latest rollout of our EV tariff in Japan."*

Solar startup PXP reports 23% efficiency for perovskite-CIGS tandem cell

(Nikkei Sangyo, Dec 18)

- Solar startup PXP reported a 23% efficiency for a tandem solar cell composed of a perovskite crystal layer and a CIGS (copper-indium-selenium-gallium) layer. The article did not elaborate on cell size.
- CONTEXT: Power efficiencies of PSC modules are generally below 20%. Tandem types seek increases by putting silicon, CIGS, cadmium telluride (CdTe) and other thin photovoltaic materials on the perovskite layer. However, the tandem modules may become less bendable.

Tandem PSC research in Japan

Key developers	Tandem types
PXP, Idemitsu Kosan, Tokyo University	CIGS
Kaneka, Sharp, Toshiba, Kyocera, Tokyo City University, Tokyo University	Silicon

- TAKEAWAY: A 23% efficiency is not so impressive; Tokyo University and Idemitsu Kosan reported 28%. However, PXP is worth noting because it was founded in 2020 by Kameda Shigeaki, a former top executive at Solar Frontier, an Idemitsu affiliate. Competition is expected to heat up between these companies in the tandem PSC / CIGS space. Solar Frontier commercialized CIS (a type of CIGS) in 2011, but stopped production last year.

Japan to invest ¥3 trillion over 15 years to promote hydrogen and ammonia

(Denki Shimbun, Dec 19)

- Japan will invest ¥3 trillion over 15 years to compensate for the price difference between existing fuels and cleaner alternatives – hydrogen and ammonia – to promote and expand their distribution volume and cut the cost for consumers.
- The govt will support the use of hydrogen and ammonia with funds raised from GX transition bonds that will be issued starting February 2024. The scale of investment using green bonds is around ¥13 trillion.
- It also plans to support the low-cost development of next-gen renewables such as perovskite PVs, production facilities, and the establishment of supply chains.

IHI aims for ¥900 billion in ammonia sales in 2040-2050

(Denki Shimbun, Dec 19)

- IHI seeks to boost ammonia fuel sales to about ¥900 billion for 2040-2050.
- Specifically, it plans to develop ammonia combustion tech for large gas turbines with General Electric to boost fuel demand. Research is being conducted in Southeast Asia and the Middle East on potential production and sales of green ammonia.
- IHI seeks to establish an ammonia supply network in Yamaguchi Pref with Idemitsu, and in Osaka Pref with KEPCO and Mitsui.
- CONTEXT: *IHI's revenue is projected at ¥1.3 trillion in FY2023, which indicates the significance of the projected ¥900 billion in sales from the ammonia business. IHI President Ide said that IHI "will invest firmly in ammonia and methanation, which we have positioned as our growth business."*

IHI, Malaysian Gentari to commercialize 100% ammonia-fueled power by 2026

(Japan NRG, Dec 18)

- IHI and Gentari Hydrogen signed an MoU to commercialize 100% ammonia-fueled power generation in Malaysia in 2026.
- Gentari, which is an affiliate of Petronas, will install IM270, a 2 MW turbine developed by IHI. If the timeline is met, Gentari might be the world's first power supplier to commercialize full ammonia-firing.
- IHI developed a dual flow ammonia burner that enables greater control over ammonia combustion and cuts NOx emissions.
- CONTEXT: *JERA's plan to commercialize 20% ammonia-coal co-firing at a 1 GW plant is so far the world's largest ammonia-fueled power project but it is not expected to move onto commercial phase until 2027 at the earliest.*

- TAKEAWAY: IHI's fully ammonia-fueled turbine rollout is ahead of schedule, as FY2027 was the target to complete it under the Green Innovation Fund program. However, 2 MW is tiny for a commercial operation. It's not clear whether Gentari will deploy a dozen turbines or just one.

Kyushu Electric, Sojitz and Sembcorp to produce green ammonia in India for export

(Company statement, Dec 18)

- Kyushu Electric and Sojitz are considering green ammonia production in India in partnership with Sembcorp Green Hydrogen (Singapore).
- The firms plan to make hydrogen through water electrolysis and then turn it into ammonia for export to Japan.
- The three companies plan to establish an operating company that will handle everything from renewable power generation to ammonia production.
- Sembcorp will lead the project and select the site and technology. Kyushu Electric and Sojitz will handle financing, oversee transport and secure offtakers.

TEPCO and Indonesia's Pertamina to cooperate on green hydrogen and ammonia

(Company statement, Dec 15)

- TEPCO and Pertamina Power Indonesia signed a Joint Development Agreement to cooperate on green hydrogen and green ammonia.
- This is part of a feasibility study by TEPCO and Yamanashi Hydrogen Company to develop hydrogen production and transportation.
- The goal is to use surplus electricity and heat from geothermal power generation.
- The companies plan a hydrogen production facility near the Lahendong geothermal power plant in Indonesia, and eventually to export to other countries, including Japan.

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Mitsubishi, SKI, Amogy to study ammonia cracking for hydrogen transport

(Company statement, Dec 20)

- Mitsubishi Corp, South Korea's SK Innovation and Norwegian tech startup Amogy will explore large-scale transport of hydrogen in Japan and South Korea.
- A demand and cost analysis of hydrogen transport will be conducted while studying application of Amogy's technology for large projects.
- Amogy has developed ammonia cracking processes that are combined with hydrogen fuel cells to generate power. It seeks to apply the technology in hydrogen transport.
- CONTEXT: *Both Mitsubishi and SKI are Amogy shareholders. METI forecasts Japan's annual ammonia demand to grow to 3 million tons by 2030, up from the current 1 million tons, to be used for power generation and industrial furnaces. South Korea aims to introduce ammonia co-firing at 24 out of 43 coal power plants by 2030.*

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Japan / EU commission confirms progress in nuclear fusion

(Denki Shimbun, Dec 18)

- The Steering Committee of the Broader Approach Agreement, a joint framework for research between Japan and Europe on nuclear fusion, confirmed the progress of all its projects, including the experimental JT-60SA, and approved its research plan for 2024.
- The main achievement in 2023 was the first plasma achieved on Oct 23, making the JT-60SA the world's largest operational superconducting tokamak.
- CONTEXT: *This group's activities include supporting the International Thermonuclear Experimental Reactor (ITER) project and conducting research to related to DEMO reactors, construction and operation of the JT-60SA (located in Ibaraki Pref), and research at the International Fusion Energy Research Center (Rokkasho), etc.*

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MHI subsidiary contributes to Europe's first industrial-scale ethanol production

(Company statement, Dec 14)

- British Primetal Technologies, now fully owned by MHI, has partnered with three other firms in Europe's first CCU project to produce ethanol on an industrial scale.
- The project used a bio-recycling process that captures carbon-rich gasses and converts them into ethanol. It was conducted at the Steelanol CCU Plant in Ghent, Belgium.
- The MHI subsidiary joined the project alongside ArcelorMittal, now ERM, and LanzaTech. The firms used carbon bio-recycling tech developed by LanzaTech.

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Nippon Steel to acquire U.S. Steel to boost capacity

(Company statement, Dec 18)

- Nippon Steel will acquire U.S. Steel pending regulatory approval, hoping to expand annual production to 8.6 million tons, up from the current 6.6 million tons.

- TAKEAWAY: While Nippon Steel claims that in the long run the deal with U.S. Steel will cut emissions, in the short term they'll increase along with output. Rather than acquiring hydrogen steel startups or CCUS operators, Nippon Steel seeks to secure its business in North America. This move is not positive for electric arc furnace operators, which do not consume coal and have lower carbon intensity; they are specialized small businesses and can't compete with integrated steelmakers like Nippon Steel.

NEWS: ELECTRICITY MARKETS

ANRE clarifies guidelines and criteria for nuclear operating periods beyond 60 years

(Denki Shimbun, Dec 20)

- ANRE compiled guidelines for a new system to allow nuclear power plants to extend operations beyond 60 years. They include a plan to specify examination criteria for extension approval.
- As METI is set to start reviewing applications to extend the operating period of NPPs that are already in operation for 40 years, it will need to follow new criteria from June 2025 and include safety reviews.
- The agency also unveiled its plan to strengthen support measures to foster human resources, to secure on-site skilled workers for construction, maintenance and parts manufacturing.
- SIDE DEVELOPMENT:
  KEPCO applies to NRA to operate Ooi NPP Units 3 and 4 over 30 years
  (Nikkei, Dec 21)
  - KEPCO applied to the NRA to extend the operation of Units 3 and 4 of the Ooi NPP (Fukui Pref) beyond 30 years. This move comes in anticipation of a law set to be implemented in June 2025 that allows NPPs to operate for over 60 years.
  - The application is a first under Japan's new system that requires a long-term management plan for operation beyond 30 years. The Ooi NPP's Unit 3 has been operational for 32 years, and Unit 4 for 30 years.
  - CONTEXT: *Takahama Unit 2 and Mihama Unit 3, operating for 48 and 47 years respectively, are also preparing to apply for similar extensions.*
- SIDE DEVELOPMENT:
  NRA to lift operational ban on TEPCO's Kashiwazaki-Kariwa NPP
  (Nikkei, Dec 20)
  - On Dec 27, the NRA will lift its operational ban on TEPCO's Kashiwazaki-Kariwa NPP (Niigata Pref). The NRA determined that TEPCO's self-initiated safety improvements satisfied regulatory standards.

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TEPCO's renewables unit eyes wind power off Kujukuri coast in Chiba Pref

(Company statement, Dec 19)

- TEPCO Renewable Power began the environmental impact assessment by sending to Chiba Pref, relevant municipalities and METI a scoping document for a 465 MW fixed foundation offshore wind project along the Kujukuri coast.
- The scoping document will be available to the public from Dec 20 to Jan 26, 2024 to accept feedback.
- CONTEXT: *The proposal is part of TEPCO RP's efforts to increase total power capacity by 6 to 7 GW in Japan and abroad by FY2030.*

Yasu Shigeru becomes new president of JWPA

(Organization statement, Dec 20)

- Yasu Shigeru, founder of JRE, now a wholly-owned subsidiary of ENEOS, was tapped president of the Japan Wind Power Association.
- The JWPA set up a committee to review its decision-making and activities, seeking to restore trust. The govt had ordered the JWPA to review its practices.

KEPCO cancels construction of thermal power plant in Wakayama

(Company statement, Dec 19)

- KEPCO canceled construction of a planned thermal power plant in Wakayama City.
- The project was first conceived 30 years ago, but never got off the ground. As a result, KEPCO expects to take a hit of ¥123 billion.
- The proposed LNG-fired power plant was intended to be the largest in KEPCO's portfolio and have a capacity of 3.7 GW.

- TAKEAWAY: KEPCO's recent strategy is to prioritize nuclear power over coal/gas-fired power. The company is decommissioning thermal power units and developing co-firing hydrogen and LNG, resulting in losses of at least ¥100 billion. Still, the company's financial performance remains strong, thanks to NPP restarts. Consolidated net profit for FY2023 is expected to be ¥405 billion, surpassing the ¥161 billion in FY2005, and setting a new record high.

    - SIDE DEVELOPMENT:
      JERA's Yokosuka thermal power plant starts earlier than planned
      (Company statement, Dec 22)
        - Unit 2 at the Yokosuka thermal power plant, operated by JERA, began commercial operations. The approximately 650 MW coal-fired facility uses an ultra-supercritical (USC) power generation system.
        - Unit 2 was scheduled to begin in February 2024, to address winter's supply needs.

METI seeks change to balancing charge of FIT installations to promote FIP

(Denki Shimbun, Dec 20)

- METI and ANRE proposed to review the balancing charge for certified operators under the FIP system. The balancing cost was introduced to encourage the transition away from FIT for renewable energy operators.
- Under the current system launched in FY2022 alongside the FIP, a balance cost of ¥1/ kWh is granted to certified operators and the amount is reduced each year until FY2030.
- A proposal was made to set the amount at ¥1/ kWh for the first year of operation in order to increase FIP certification, and then to reduce it in stages.
- CONTEXT: *The system was supposed to encourage a swift transition to FIP, but so far only 1 GW of new FIP and transition projects have been completed.*

End of an era as electronics giant Toshiba delists from stock exchange

(Denki Shimbun, Dec 18)

- Toshiba announced a new management structure as it approaches delisting on Dec 20. The company aims to rebuild its management under the supervision of minority shareholders after fending off activist investors.
- To repay the substantial debt incurred related to privatization, Toshiba is considering re-listing. However, there are challenges: the unresolved handling of Kioxia Holdings after the failed sale, and factors such as stock market conditions and interest rates.
- The alignment of more than 20 investors and lenders will also be key in reconstruction. Companies like Rohm, Chubu Electric, Orix, and MinebeaMitsumi, with diverse interests, are involved.
- CONTEXT: *Once the leader of Japan's global dominance in electronics, Toshiba's delisting ends a 74-year history with Tokyo's Stock Exchange. Since 2015, Toshiba has been accused of inflating its profit by $1.6 billion. An investigation in 2021 found that Toshiba colluded with METI, which saw the company as a strategic asset, to suppress the interests of foreign investors. Also, in 2016, Toshiba said it would take charge of construction of a nuclear power plant that Westinghouse Electric had bought a year earlier. Three months later, Westinghouse filed for bankruptcy leaving Toshiba facing the collapse of its nuclear business and more than $6 billion in liabilities.*

TEPCO's fourth release of Fukushima treated water slated for February

(Company statement, Dec 21)

- In February, TEPCO will begin the fourth ocean discharge of treated water from Fukushima Daiichi NPP. Like the previous three times, about 7,800 tons will be diluted with seawater and released about 1 km offshore through an undersea tunnel.
- The same amount will be released for a 5th and 6th time, some time after April.
- CONTEXT: *Since August, TEPCO has carried out three discharges, totalling about 23,400 tons of treated water. The entire discharge will only be completed around 2051.*

TEPCO, NTT Data to form JV for data center in Chiba Pref

(Company statement, Dec 19)

- TEPCO Power Grid, NTT Data Group and NTT Global Data Centers Japan will form a JV to build a 50 MW data center complex in the Inzai Shiroi area in Chiba Pref and start operation in 2026-2027.
- TEPCO will make use of distributed renewable power sources to reduce the data center's carbon footprint.

- TAKEAWAY: Power consumption by graphic processing units (GPU) used in AIs and non-AI applications alike, and the need to cool the hardware's temperatures, are causing data center power demand to surge. Development of energy efficient cooling technologies is essential as it takes more energy to decrease than increase temperatures.

Sharp inks MoU with Indonesian firm on solar power

(Company statement, Dec 15)

- Sharp Solar Solution Asia (SSSA) and Indonesia Comnets Plus, a subsidiary of Indonesia's state-owned power company PLN, signed an MoU for solar power generation in Indonesia.
- The project involves roof-mounted solar power systems, mainly for Japanese companies in Indonesia.

Solaris Nexus and Chiba Ecological Energy to promote farm-based solar power

(Company statement, Dec 18)

- Agrivoltaic firm Solaris Nexus and Chiba Ecological Energy will build PVs and agri-voltaic systems with 100 MW of capacity by 2030.
- CONTEXT: *The deal addresses Japan's societal challenges such as the decreasing number of farmers, and less food self-sufficiency especially in remote areas.*

NEWS: OIL, GAS & MINING

Shell buys Mitsui's stake in U.S. Gulf of Mexico offshore oil and gas project

(Company statement, Dec 13)

- Mitsui sold its 20% stake in the Kaikias field in the U.S. Gulf of Mexico; it was held via Mitsui's subsidiary, MOEX North America.
- The buyer is Shell Offshore, which operates the Kaikias field about 100 km southeast of New Orleans. Reserves are about 12.7 MMboe.
- CONTEXT: MOEX acquired this 20% stake in Dec 2016; production began in May 2018. Now, MOEX will be dissolved. Mitsui expects a profit from this deal, included in its FY2023 forecast.

Tokyo Gas and partners get license for $2 bln LNG-fired power plant in Vietnam

(LNG Prime, Dec 19)

- Tokyo Gas, Kyuden International, and Vietnam's Truong Thanh Viet Nam received an investment license from the Vietnamese govt to develop a $1.99 billion LNG-fired power plant in the province of Thai Bin. The proposed capacity is 1.5 GW.
- According to a statement by the govt of Vietnam, the license was awarded to the JV during the Japan-ASEAN summit in Tokyo.
- CONTEXT: *Vietnam became an LNG importer this year. In October, PetroVietnam Gas, a unit of state-owned PetroVietnam, launched its Thi Vai LNG import terminal, the country's first such facility. It consists of one 180,000-cbm LNG tank, a jetty, and regas area. The terminal has a capacity of 1 mtpa in its first phase, but PetroVietnam Gas plans to boost the capacity to 3 mtpa in the next stage. The country is planning to develop up to 13 LNG power plants with a combined capacity of 22.4 GW by 2030.*

- TAKEAWAY: Currently, no LNG-fired power plants operate in Vietnam. It's important to remember that awarding an investment certificate is only the first step. The issue of financing is still unclear and the project's success will depend on whether it can secure a power purchase agreement from state utility Vietnam Electricity.

JERA and PT Pertamina ink MoU for cooperation on LNG and ammonia fuel

(Company statement Dec 15)

- During the ASEAN-Japan Economic Forum, JERA and Indonesia's national oil and natural gas company, PT Pertamina, inked an MoU to collaborate in the energy sector.

- The MoU seeks cooperation on the improvement of the operations of Indonesia's LNG receiving terminals, and seeks to foster opportunities in hydrogen/ammonia. This includes transportation, terminal operation and maintenance, and CCS development.
- CONTEXT: *Indonesia's electrification rate is increasing, and demand is expected to continue increasing. However, Indonesia remains highly dependent on coal-fired power generation. Japan is keen to promote LNG as a low-carbon fuel that can replace coal.*

JFTC notifies Chubu Electric, Chubu Miraiz, Toho Gas of violations

(Company statement, Dec 20)

- The Japan Fair Trade Commission ruled that Chubu Electric, Chubu Electric Power Miraiz and Toho Gas violated the Anti-monopoly Act in city gas sales.
- The JFTC sent warning letters to the companies.
- The companies did not say if they'd accept or challenge the JFTC's warning.
- CONTEXT: *In April 2021, the JFTC conducted a dawn raid on Toho Gas as well as Chubu Electric, Chubu Miraiz, Kyushu Electric and Chugoku Electric, exposing the largest cartel in Japan's history. The new allegations against Toho Gas and Chubu Electric are separate from the power cartel.*

LNG stocks rise again to 2.65 mln tons

(Government data, Dec 20)

- As the temperature began to fall, LNG stocks of 10 power utilities increased again to 2.65 million tons as of Dec 17, up 4.7% from 2.53 million tons (adjusted from 2.54 million tons) a week earlier.
- This is 4.7% up from late December 2022, and 3.9% higher than the past five-year average of 2.06 million tons.

ENEOS president dismissed over inappropriate behavior

(Company statement, Dec 19)

- ENEOS Holdings, Japan's largest oil company, announced the dismissal of its president, Saito Takeshi, due to inappropriate behavior with a woman at an event. The company also announced the resignation of executive vice president Yatabe Yasushi and pay cuts for Sunaga Kotaro, senior vice president.
- Vice President Miyata Tomohide will serve as acting president until April.
- CONTEXT: *This is the company's second incident of inappropriate conduct towards women at the executive level. In 2022, Sugimori Tsutomu, chairman and CEO, resigned for similar reasons.*

ANALYSIS

BY JAPAN NRG TEAM

2023: Summary of the Year Across Key Energy Sectors

In comparison with the energy crisis and associated turbulence of 2022, this year has been about preparation for the future for most major energy sectors. As one industry insider joked, everyone's favorite word this year was "MoU". Likewise, "pilot", "test", "explore", "consider" and "study" filled almost every issue of *Japan NRG*, reflecting the preparatory phase of technologies such as CCS, hydrogen and ammonia fuels, SAF, and Perovskite solar cells (PSC).

More advanced energy sources, such as batteries and biofuels, made greater advances, though also at a cautious pace. The renewables complex in general had a tough time in Japan as solar's breakneck rollout over the past decade noticeably slowed, partly due to land and cost issues, as well as a more complex regulatory and fiscal environment. Wind power saw a slew of major onshore projects canceled over community opposition, but Japan finally took big steps forward in developing offshore resources.

The lull in the ideological debates over the meaning and means of the energy transition helped fossil fuels recover policy and investor interest, especially in natural gas and LNG. But the net-zero battle lines will be drawn anew in 2024 as METI begins updating the Basic (Strategic) Energy Plan. All stakeholders will be keen to see their imprint in the national vision for 2030 (or will this now be 2035…?).

More than vision, however, most of the energy sectors will be looking for investment, and 2024 is expected to deliver on a lot of large-scale commitments that will carry Japan's energy sector to the end of this decade and beyond. Developers and end users involved with hydrogen and ammonia in particular have great expectations for funding from the government and private sources. But significant financing is also expected in the battery storage / BESS space, in carbon capture, and of course in (floating) offshore wind. The government's maiden GX Economic Transition bonds should open the floodgates to a much broader wave of capital-raising by both startups and blue chips.

Below we look back at some of 2023's key events in the major energy sectors.

HYDROGEN / AMMONIA

In 2023, solar-derived green hydrogen traded close to ¥10,000/ nm3, a far cry from the 2030 government cost target of ¥30/ nm3. Yet, a real-world business case kicked off in Kawasaki City. Resonac, which has been producing ammonia from plastic waste and natural gas since 2003, started commercial supply of "semi-green" hydrogen to users in the area, transporting the gas through underground pipes installed decades ago for petrochemical plants. The pipelines eliminated the need for the gas to be chilled to minus 253 Celsius for transportation on land and cut costs.

Businesses testing hydrogen ideas are emerging, thanks to the enactment of the Green Transformation (GX) Act which gave METI the capacity to subsidize projects. In July, the Hydrogen and Ammonia Division was newly created in ANRE to write

subsidy policies and measures to push a shift to green hydrogen. In December, the division released the project criteria: meeting requirements for safety, energy security, environmental, and economic efficiency (S+3E).

The environment part of the S+3E philosophy was more elaborately addressed in the second version of the Basic Hydrogen Strategy, published in June, which was the document's first update since its initial release in 2017. The strategy stated that hydrogen means "low-carbon" hydrogen, not just any hydrogen. It added a new goal to expand the water electrolyzer capacity to 15 GW by 2030 from the present 13 MW.

On the ammonia front, JERA started an ammonia-coal co-firing demo at the Hekinan No. 4 plant in fall. The ammonia ratio will be raised to 20% by March 2024, before moving into commercial operation before 2030. In October, JGC Holdings and Asahi Kasei started construction of the first commercial-level green ammonia plant in Fukushima Prefecture.

SOLAR

It's easy to focus on the negatives in the sector, and there have been plenty. The "uprising" of northern governors keen to slap a new tax on renewables projects to supplement local funds is expected to slim the project pipeline by as much as a quarter. But there are plenty of positives for the industry.

Recent solar auctions delivered the first sub ¥8/ kWh bid in the country. In a late December 2020 issue, *Japan NRG Weekly* highlighted a NEDO goal to have solar costs drop to ¥7/ kWh by 2025, in part due to innovation in crystalline silicon, CIS (Copper Indium Selenide), and Perovskite solar cells (PSC). Not all of the technologies covered in that issue have blossomed, but the ¥7 target, then seen as laughable, is no longer a joke.

Of course, not all projects can rely on a superfluous golf course for land, but developers are starting to get more creative with access and cost solutions. Rail companies are offering space along their lines for solar PV in return for sourcing green electricity. More industrial complexes are open to both onsite and offsite PPAs. And while the agrisolar and floating sectors remain difficult niches in Japan, there's been a surge in enthusiasm around building-integrated solar.

In fact, the strides made by domestic PSC developers, and the government's willingness to elevate the technology to a priority field, shows that the state of the solar market will change rapidly this decade. Inserting light, flexible PSC cells in constructions and even on car bodies will offer a way to bring energy closer to consumers – and likely enable them to take greater control and responsibility for their electricity supply and emissions footprint.

Of course, PSC's development is unlikely to be smooth, but it offers another branch for the solar sector's growth, in addition to rooftop solar PV, an area that's finally getting stronger regulatory support and government purchasing orders.

WIND

Over 500 MW of onshore wind capacity was canceled or shelved indefinitely in the last six months due to the eruption of local community or government concerns about

environmental impact. That has fed into an unfortunate narrative in the media that many operators are poor planners or don't communicate enough with residents. In fact, *Japan NRG* conversations with local officials suggest there was plenty of time and effort invested by companies. For all that, sometimes a community isn't going to budge anyway.

The trouble with onshore projects will put the onus back on the national government to find land where developments may be more welcome. As we reported earlier this year, the MoE's campaign to get towns and cities to designate zones for new solar and wind projects has stalled, largely due to a lack of resources at the local level.

At some point, however, ministerial task forces set up to solve such issues will need to deliver. Japan's signature on the COP28 goal to help triple renewables (globally) within this decade will provide plenty of fuel for environmental groups to prod the authorities into action.

Meanwhile, earlier this month the industry celebrated the results of the Round 2 auction for fixed bottom offshore wind projects. Despite the proliferation of winning parties in comparison with Round 1, clearly a number of firms also lost out. Still, there's one more project result due in March and the Round 3 auction will start shortly. The sector is in its infancy in Japan and near-term opportunities far outweigh the challenges and frustrations.

Some companies that did not enter the Round 2 auction, or did and lost out, admit that while winning would have been welcomed, it was also a relief…? There are a number of engineering and community nuances that Round 2 winners will now need to navigate.

One thing that many in the sector will agree on, though, is that the future of wind projects will be intricately linked with finding anchor clients for offtake. Understanding of power markets will also be an important factor for future profits, but to compile a competitive bid and sell it to investors, developers will need a solid PPA or similar with a large user or two.

BATTERIES

The fact that Japan's power grid demands such a high level of curtailment of solar and wind projects is the best business argument for installing more battery storage. That's the motivation behind companies like Gurin Energy and Akaysha Energy, headquartered in Singapore and Australia, respectively, to enter the Japanese market.

The number of battery developers has proliferated this year, and not only in Hokkaido, which initially experienced a rush of applications for new storage battery sites. Many non-utility firms are also involved, with trading house Itochu one of the most prominent domestic players.

What divides the market players, however, are considerations around the business model. Most opt for government subsidies and see them as crucial to project success. A minority trust in their ability to trade the power in the markets, pointing to the rapid tempos of growth in both the physical and derivative electricity contracts.

Electricity futures trading in Japan hit close to 0.5 TWh in a single day earlier this month. Trading platforms are also updating their processes, rolling out more short-term products, such as daily contracts, and cooperating with analytics and data firms to attract more liquidity and players to the market from inside and outside of Japan.

Of course, another concern shared by battery players is where and at what cost they'll be able to secure the actual equipment. Material and other costs across the battery supply chain have distorted the downward cost trend of the past decade. However, this situation should ease in 2024-25, not least because Japanese manufacturers seek to bolster their offering and grab a bigger market share. GX funding should help to make domestic battery production more competitive.

NUCLEAR

The sector made massive strides this year in terms of policy and public appeal. COP28 saw the signing of a declaration by over 22 countries, including Japan, to aspire to tripling nuclear power capacity by 2050. Public opinion polls in Japan not only continue to provide majority approval for using nuclear energy, but the release of treated water at the Fukushima Daiichi NPP did not raise much public objection. Two-thirds of those surveyed in Japan about the release said they understand the need for it and tacitly approve.

The sentiment is favorable for nuclear, but what does this mean in practice? Last summer, PM Kishida promised the restart of up to 17 reactors. A year on, 12 reactors have actually restarted, but due to the need for regular maintenance and safety checks, only eight units are operating.

In the next 12-18 months, another two to three units are expected to restart. But the real litmus test of the industry's revival is not the absolute number – it is whether TEPCO will be able to restart the units at its only operable facility, the Kashiwazaki Kariwa NPP, and whether any of the stations north of Tokyo are given a green light (from both regulators and local officials). TEPCO's multiple blunders over personnel, security, maintenance procedures, etc have kept Kashiwazaki Kariwa offline since March 2012. Some of its units have not worked in 16 years. Today, a whole generation of TEPCO nuclear staff have no experience of being in an operational NPP.

The problem for TEPCO may be that Tokyo and the surrounding Kanto area are no longer as short of power capacity as they were in recent years. How soon it can turn at least one reactor back on will determine how much of that NPP will remain a "going concern". Recent signals from the NRA suggest that their approval at least is edging closer. This will likely be a closely followed topic in 2024.

As far as new NPPs, everything remains on a very distant horizon. Since the publication of the industry roadmap, a few basic computer drawings of reactor designs have appeared in the media but nothing more. According to some in the startup community, there's more chance of Japan building a new fusion reactor than one based on nuclear fission. And so, Japanese nuclear vendors will look to overseas contracts to sustain them, though at this point it's hard to see which market they can penetrate.

LNG

China seems to have re-emerged as the top global LNG importer this year. Japan's import volumes, on the other hand, have plummeted by over 10%, based on data from the first 10 months of 2023. In part, this is the effect of milder weather and the uptick in renewable energy production, but also the restart of a few more nuclear reactors. Also, renewables now account for close to 22% of the electricity mix in Japan.

The decline of LNG volumes, however, is not all about the weather or other energy sources. For the main buyers – the EPCOs – LNG has simply become too much of a risk. In addition to the chance of non-delivery due to geopolitical tensions, typhoons or delays at major choke points such as the Panama Canal, the utilities have to contend with ever greater uncertainty in power demand and prices.

LNG cargoes cost hundreds of millions of USD and require months of planning and negotiations with sellers, shippers, storage facilities and more. Add to this the uncertainties over gas demand due to decarbonization and it's clear why Japanese utilities have now reduced their LNG purchases to below pre-Fukushima levels.

The trend worries Japan's energy planners. For one, utilities are not always turning to CO2-free sources to compensate for gas, with coal a frequent beneficiary. Also, a number of existing long-term LNG supply contracts are due to run out in the next few years, which would leave Japan relying on the volatile spot market to plug the gap. Historically, Japan has bought over 80% of its LNG via long-term deals, which protected the country from the worst excesses of fossil fuel price spikes during 2021/22.

The future of Russian LNG supply, which still makes up close to 10% of Japan's total, seems at the mercy of decisions made outside Japanese shores.

Thus, to make Japanese LNG buyers more comfortable with new long-term deals, the government has created a strategic fuel buffer. In effect, state-run JOGMEC agrees to buy "surplus" LNG cargoes from importers in case demand wanes below expectations. At present, this covers only one cargo a month, but officials say this will be expanded. Similarly, Japan has proposed to the International Energy Agency (IEA) to set up an international LNG reserve to create supply stability and security in times of crises. The proposal is up for review at the IEA ministerial meeting in February 2024.

These subtle initiatives to create a backup network for LNG to counter the fuel's occasional logistical and other challenges is seen as a way to support the sector's expansion to new markets, such as in Southeast Asia. Tokyo Gas's recent JV with PetroVietnam Gas to develop the LNG industry in Vietnam is just the latest example of the strategy.

To feed the belief in LNG's longevity as a transition fuel, METI may consider revising up its share in the 2030/35 energy mix of Japan when the latest edition of the Basic Energy Plan is drawn up next year.

COAL

When PM Kishida announced a gradual phase-out of Russian coal imports in 2022, no specific timeline was stated. Before the conflict in Ukraine, Russia was Japan's third-largest supplier of thermal coal, accounting for around 12% of its total. By the end of 2023, Russia's share in the fuel decreased to just below 3%, making it Japan's fifth-largest supplier.

Australia remained Japan's top coal provider, consistently accounting for 65% of total imports. But Australian coal is not cheap; the nation's benchmark reached a record high of over $400/ton in autumn 2022. Since then, prices for thermal coal have cooled, reaching $180/ton in early spring 2023 and more recently, it has traded around $120/ton (November) to around $140/ton (early December).

The end of the year is anticipated to bring the highest imports of thermal coal since March. Japan is set to import over 10 million tons to cover winter heating demand, with around 6.9 million tons coming from Australia. Meanwhile, Kishida stated at COP28 that Japan will stop building new coal power plants that do not have emissions reduction measures.

Since about 70% of Japan's electricity still comes from fossil fuels, and the country has no way to store natural gas for longer than a few weeks, the government is unlikely to authorize an exit from coal any time soon. Alternatives will need to tick all the "S+3E" principles mentioned in the hydrogen section. So, for now, it's more likely that Japan will reshuffle its portfolio of importers, seeking to add suppliers from exporters such as Indonesia and reduce the reliance on Australia.

The key to what happens next lies in ammonia and carbon capture / CCS.

CARBON CAPTURE & STORAGE (CCS)

The year started with Japan's CCS roadmap targeting the storage of 6-12 mtpa of CO2 by 2030. JOGMEC identified five domestic sites and two abroad for national CCS development, with a focus on storing about 13 mtpa of CO2 from these in total. Looking further ahead, Japan has set sights on finding locations (at home and abroad) to store 120-240 mtpa by 2050.

Among the projects supported by JOGMEC, there are notable collaborations in Tomakomai that focus on creating a hub for CCS and CO2 reuse. In western Kyushu, ENEOS, JX Nippon Oil & Gas Exploration, and J-Power aim to get the nod for CO2 storage by 2030. In the Tohoku region, Itochu, MHI and others are working on a scalable project that would serve the needs of steel and cement industries, among others.

Internationally, Japan's CCS initiatives extend to Southeast Asia and beyond. It signed accords with Vietnam, Indonesia, and Malaysia, focusing on CCS/CCUS development and exploration. Under JOGMEC's banner, Mitsui is working on transporting CO2 from Japan to Malaysia. Mitsubishi, Nippon Steel and ExxonMobil are working on transportation to Oceania.

Such efforts are part of a strategy to create a broad Asia-Pacific CCS market, which would address the needs of a region still heavily reliant on fossil fuels.

Still, economic viability and a lack of regulations linger over CCS development. To address this, the CCS Business Act drafted by METI is promised to enter the Diet early in 2024. Developers will also want to hear more about subsidy terms and the potential to link their operations with Japan's burgeoning carbon credit market. The latter started in trial mode earlier this year but is not expected to be in full operational mode until at least 2026.

HONORABLE MENTIONS

In addition to the above, there have been a number of key developments in biofuels (example: SAF to make up 10% of all domestic airline fuel in Japan by 2030); there is tentative progress with synthetic fuels and e-methane (hats off to producer Santos in Australia on a flurry of deals with Japanese gas players); sustainability principles are transforming textiles and other materials; and hydro power plants are tapping into AI to improve their efficiency.

All these developments have made 2023 much more than just a year of preparing for the energy transition. Undoubtedly, bigger changes are yet to come. We hope you'll continue to join us in reading and learning about Japan's energy sector in 2024!

ASIA ENERGY REVIEW

BY JOHN VAROLI

This weekly column focuses on energy events in Asia and the Pacific, and all that directly impacts markets in the region.

China / Coal investments
Financial institutions arranged about $120 billion for coal projects last year, reports Bloomberg. China garnered 76% of the total coal financing, or $93 billion. The U.S. was a distant second at $10 billion

China / Critical metals
China, the world's top processor of rare earths, banned export of technology to extract and separate these critical metals, thereby protecting its dominance over strategic metals. Rare earths are a group of 17 metals used to make magnets that turn power into motion for use in EVs, wind turbines and electronics.

China / Wind power
Sembcorp Industries acquired Qinzhou Yuanneng Wind Power that operates 200 MW of wind assets in Guangxi. The company now has renewables capacity of 12.6 GW comprising solar, wind, and energy storage assets.

India / Battery storage
In 2023, the govt awarded tenders of more than 8 GW of grid-scale battery storage, reports the Institute for Energy Economics and Financial Analysis. The govt estimates it needs about 42 GW of BESS and 19 GW of pumped hydro storage capacity by 2030.

Indonesia / Natural gas
The UAE's Mubadala Energy discovered a major deep sea gas reserve in Indonesia's South Andaman Block, believed to be the world's second-largest deep-water discovery this year, with potential gas-in-place for more than 6 trillion cubic feet (tcf).

North Korea / Nuclear power
A new reactor at the Yongbyon nuclear complex appears to be operating for the first time, said the U.N. nuclear watchdog. North Korea has for years used spent fuel from a 5 MW nuclear reactor at Yongbyon to produce plutonium for its nuclear arsenal.

Philippines / Renewable energy
Aboitiz Power expanded its clean energy portfolio to 4.6 GW, including 1 GW in the pipeline. It also commissioned new energy projects with a 1 GW capacity from solar, hydro, geothermal, wind, and energy storage systems.

Philippines / Energy exploration
The country seeks to resolve geopolitical issues in the South China Sea so it can start new energy exploration. The govt said tensions in the South China Sea have increased rather than diminished in recent months, warning that a "more assertive China" posed a "real challenge" to its Asian neighbors.

Qatar / LNG deals

QatarEnergy expects to ink more long-term LNG supply deals in Asia and Europe, with several imminent. In past months, the company signed a number of supply deals with European and Asian partners for its North Field expansion project that's expected to produce 126 mtpa of LNG by 2027, up from 77 mtpa now

South Korea / Renewable energy

Amazon is investing in its first renewable energy project in South Korea with about 60 MW capacity. The company's goal is to power operations with 100% renewable energy by 2025.

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