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Argus Japan Utility Markets

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MARKET HEADLINE

POWER

Japan power assessments				¥/kWh
	Base load	±	Peak load	±
Tokyo				
Jul 21	9.10	-1.25	11.05	-0.93
Aug 21	13.86	-0.19	18.55	-0.05
Sep 21	10.88	-0.16	14.32	-0.15
Oct 21	9.70	-0.09	11.37	+0.57
Nov 21	10.19	-0.03	11.54	-0.26
Dec 21	12.27	-0.42	14.38	-0.75
4Q 21	10.72	-0.26	12.43	-0.15
1Q 22	14.63	+0.35	17.13	+0.23
2Q 22	8.85	+0.08	11.28	+0.38
Kansai				
Jul 21	9.72	-0.66	11.61	-0.73
Aug 21	14.07	-0.26	18.22	+0.22
Sep 21	10.50	+0.10	13.43	-0.08
Oct 21	9.82	-0.04	11.10	+0.32
Nov 21	9.73	+0.21	10.90	+0.20
Dec 21	11.02	-0.01	12.24	-0.20
4Q 21	10.35	-0.01	11.41	+0.10
1Q 22	11.93	+0.32	14.41	+0.50
2Q 22	7.93	+0.28	9.63	+0.22

Japan spark and dark spreads						¥/kWh
	Tokyo			Kansai		
	58% ANEA	58% oil linked	40% dark	58% ANEA	58% oil linked	40% dark
Aug 21	4.97	-	-	5.18	-	-
Sep 21	1.92	3.71	5.46	1.54	3.33	5.08
Oct 21	0.62	2.77	4.28	0.74	2.89	4.40
Nov 21	0.95	3.33	4.77	0.49	2.87	4.31

JEPX day-ahead base-load prices							¥/kWh
	Sat	Sun	Mon	Tue	Wed	Thu	Fri
	10 Jul	11 Jul	12 Jul	13 Jul	14 Jul	15 Jul	16 Jul
Tokyo	7.06	6.72	7.76	7.74	7.91	7.69	7.93
Kansai	7.47	6.94	7.76	8.56	8.68	8.35	8.68
Hokkaido	7.06	6.72	7.85	7.74	7.91	7.73	7.93
Tohoku	7.06	6.72	7.76	7.74	7.91	7.69	7.93
Chubu	7.43	6.80	7.76	8.56	8.68	8.35	8.68
Hokuriku	7.45	6.80	7.76	8.56	8.68	8.35	8.68
Chugoku	7.47	6.94	7.76	8.56	8.68	8.35	8.68
Shikoku	7.47	6.94	7.76	8.56	8.68	8.35	8.68
Kyushu	7.47	6.94	7.73	8.54	8.65	8.35	8.68
System price	7.13	6.79	7.76	8.02	8.05	7.93	8.39

— JEPX prices represent delivery date

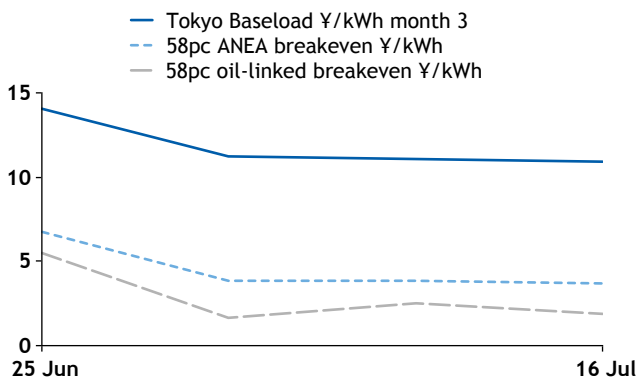
POWER MARKET COMMENTARY

Prices rise on firm demand in east Japan

Rising electricity demand in east Japan supported wholesale prices on the Japan Electric Power Exchange (Jepx) in the past week. But physical prices were not as high as previously expected, weighing on futures contract prices for July deliveries.

Jepx's system-wide prices for day-ahead contracts averaged ¥7.75/kWh ($72.70/MWh) during 10-16 July, up by 0.6pc from a week earlier. The average of prices in the three east Japan areas, where the grid runs at 50 hertz (Hz), rose by 1.4pc to ¥7.56/kWh. This outstripped a 4.1pc fall in the six west Japan areas, which runs at 60Hz, to ¥8.07/kWh.

Japan spark spreads and power prices



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JAPAN POWER MARKET COMMENTARY

The increase in east Japan reflected firmer electricity demand for cooling purposes with hotter summer weather. East Japan saw a 7pc weekly growth in power demand to an average of 46GW across 9-15 July, according to the Organisation for Cross-Regional Co-Ordination of Transmission Operators (Occto). Temperatures at three major cities in east Japan averaged 23.44°C over 9-15 July, up by 1.98°C from a week earlier.

Thermal power capacity in east Japan was scheduled to increase by 3.3GW during the week to 18 July, similar to demand growth of 3.1GW. But limited solar power output with shorter than normal sunlight hours in large parts of the region helped support Jepx prices in the past week.

But west Japan saw relatively longer sunlight hours over 11-15 July, while thermal capacity was planned to increase by 2.6GW during the week to 18 July on stable operations at nuclear reactors. This weighed on prices in west Japan, although power demand edged up by 1pc from a week earlier to an average of 58GW over 9-15 July.

The Hokuriku area in west Japan suffered a power shortage on 15 July, because of an unexpected shutdown of utility Hokuriku Electric Power's 700MW Tsuruga No.2 coal-fired power unit. Fellow utility Kansai Electric Power provided 200MW of generation capacity to Hokuriku during 9-10am on 15 July, following an order from the Occto. But this temporary shortage did not lead to a hike in wholesale prices.

Overall bidding demand for day-ahead contracts on Jepx totalled 8,691GWh during the week to 16 July, up by 4.2pc from a week earlier. This exceeded offered volumes of 8,299GWh, up by 3.5pc. Transacted volumes increased by 5.1pc to 7,032GWh, which were around 40pc of the country's power demand over 9-15 July.

The firm Jepx system-wide prices failed to lift generation economics for the country's thermal power plants, as spot coal and LNG prices remained strong. Coal maintained its competitive edge against gas in the power mix, with spark spreads still negative.

A 44pc-efficient coal-fired power plant secured the largest theoretical margin averaging ¥1,722/MWh over 9-15 July, based on Jepx day-ahead prices and the latest *Argus* spot coal and freight assessments. This was lower by 6.5pc from the previous week. But the most economical 58pc-efficient gas-fired plant made an average loss of ¥1,064/MWh, based on the ANEA, the *Argus* assessment for spot LNG deliveries to northeast Asia.

Prompt *Argus* Newcastle 6,000 kcal/kg coal prices rose by 4pc from a week earlier to $140.79/t on 15 July, following a persistent supply shortfall and strong demand from northeast Asia. An uncertain supply outlook in Indonesia, which competes with Australia as a key coal supplier in Asia-Pacific, contributed to expectations that more consumers could be driven to seek limited Australian cargoes.

The ANEA for the prompt half-month also increased by 3pc from a week earlier to $13.345/mn Btu on 15 July, as buying interest remained. There is uncertainty about the strength of demand from Japan in the coming week as consumers monitored weather forecasts.

Japan's power futures contracts traded softer this week for a summer demand season, as Jepx prices have not risen to levels market participants had expected earlier, a broker said.

The Tokyo Commodity Exchange (Tocom) traded east Japan base-load July at ¥10/kWh on 12 July, lower than ¥10.69/kWh traded on 8 July. The German-based European Energy Exchange (EEX) cleared similar Tokyo base-load hours for July at ¥9.35/kWh on 13 July, down from ¥10.20/kWh on 7 July. The highest values previously traded for July east Japan or Tokyo base-load hours was ¥13/kWh on Tocom and ¥12.30/kWh on EEX. Jepx Tokyo area prices averaged ¥7.52/kWh over 1-17 July.

Tocom traded a total of 9,300MWh from 9-15 July, down by 80.1pc from a week earlier. This contrasted with a 10pc increase in EEX's cleared volumes to 108,888MWh during the same period. EEX's trades focused on this year's final quarter with 77,280MWh, or 71pc of the total, cleared. Tokyo base-load and Kansai base-load hours for the fourth quarter were concluded at ¥10.70-11.15/kWh and ¥10.35/kWh respectively for the fourth quarter.

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GENERATION FUELS PRICES

LNG

LNG front-month and index prices, 16 Jul			$/mmBtu
Delivery point	**Price**	**±**	**Month Index**
ANEA des	13.490	-0.065	13.490

JCC indexes, 16 Jul			$/bl
Delivery point	**Delivery**	**Price**	**±**
Argus JCC index (fixed)	Apr 21	66.3094	4.6626
Argus JCC index (preliminary)	May 21	65.4513	-0.8048

LNG round voyage rates, 16 Jul			$/day
Delivery point	**Price**	**±**	**Month index**
ARV1: Australia-Northeast Asia	70,500	nc	72,083
ARV3: USGC-Northeast Asia	78,000	-500	82,375
LNG freight day rate TFDE - east of Suez	64,000	nc	66,125

COAL

Coal assessments, 16 Jul					$/t
Energy	**Basis**	**Timing**	**Port**	**Price**	**±**
6,000 kcal	NAR	2 mths	fob Newcastle	145.490	+4.700
5,500 kcal	NAR	2 mths	fob Newcastle	87.390	+3.960
6,500 kcal	GAR	2 mths	fob Indonesia	117.290	+4.570
5,800 kcal	GAR	2 mths	fob Indonesia	106.030	+3.970
6,000 kcal	NAR	2 mths	fob Vostochny	135.600	-1.690
5,500 kcal	NAR	2 mths	fob Vostochny	107.200	-0.660

Asia-Pacific freight assessments, 16 Jul						
	Basis	**Energy kcal/kg**	**Size '000t**	**Freight $/t**	**Coal $/t landed**	**±**
EC Australia-Japan	NAR	6000	75	20.60	166.09	+4.70
Indonesia-Japan	GAR	6500	75	14.55	131.84	+4.57
Indonesia-Japan	GAR	5800	75	14.55	120.58	+3.97

CRUDE

Crude oil forward prices, 16 Jul												$/bl
	Sep 21	**Oct 21**	**Nov 21**	**Dec 21**	**Jan 22**	**Feb 22**	**Mar 22**	**Apr 22**	**May 22**	**Jun 22**	**Jul 22**	**Aug 22**
Argu Calculated Japanese Crude Cocktail	76.49	73.86	73.14	72.54	72.02	71.57	71.17	70.81	70.45	70.09	69.75	69.42

WEATHER

Tokyo Weather - Average Temperature and Precipitation												°C
Location	**17 Jul**	**18 Jul**	**19 Jul**	**20 Jul**	**21 Jul**	**22 Jul**	**23 Jul**	**24 Jul**	**25 Jul**	**26 Jul**	**Precipitation (mm)**	
	Avg	**Avg**	**Avg**	**Avg**	**Avg**	**Avg**	**Avg**	**Avg**	**Avg**	**Avg**	**5-day**	**15-day**
Tokyo	26.6	26.3	27.5	28.0	27.1	26.3	26.3	26.4	26.6	26.8	5.9	96.4

— Ensemble forecasts (12.00 GMT) provided by Speedwell Weather

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MARKET NEWS

Kanda biomass power plant starts operation

Japan's Kanda biomass power plant recently started commercial operations, further boosting the country's demand for wood pellets and palm kernel (PKS) shell.

The 75MW biomass-fired plant at Miyako in southern Japan's Fukuoka prefecture began generation on 21 June as scheduled, around 2½ years after construction started in November 2018, according to major stakeholders renewable power developer Renova and wood product producer Sumitomo Forestry on 15 July.

The Kanda plant burns around 360,000 t/yr of biomass fuels, including wood pellets from north America, PKS from southeast Asia and wood chips made with locally-supplied timber from forest thinning and unused woody material.

The project sells around 500 GWh/yr of electricity at ¥24/kWh for generation from wood pellets and PKS and ¥32/kWh for wood chips-derived portion under the country's feed-in-tariff scheme to utility Kyushu Electric Power.

Renova holds a 43.07pc stake in the Kanda project, while Sumitomo Forestry owns 41.5pc. Other partners are Veolia Japan with 10pc, Kyushu Mirai Energy with 5pc and Mihara Group with 0.43pc.

Japanese demand for wood pellets and PKS has been growing in line with expansion of biomass-fired power capacity. The country's wood pellets imports totalled around 1.2mn t in January-May, up by 47.5pc from a year earlier, according to finance ministry data. PKS imports also rose by 20pc to 1mn t during the period, and could be higher as importers occasionally use an alternate customs code when bringing PKS into Japan.

By Motoko Hasegawa

Forest Energy plans 0.48MW biomass plant

Japanese biomass power company Forest Energy has started construction of 0.48MW Tsuwano biomass-fired power generation plant in southwest prefecture Shimane, aiming to begin commercial operation in June 2022.

Forest Energy plans to burn 6,500 t/yr of wood chips manufactured from raw wood materials collected in the town of Tsuwano. The plant will be equipped with a co-generation system and a wood chip production plant will also be built nearby. Heat produced from the biomass plant's co-generation system will dry the fuel wood chips.

The company expects to generate 3.74 GWh/yr of electricity and to sell it to Chugoku Electric Power Transmission and Distribution, the wholly-owned subsidiary of utility Chugoku Electric Power.

Forest Energy is also planning the 7.1MW biomass power plant at Fukui city in the central prefecture of Shizuoka. The company will consume 90,000 t/yr of unused wood biomass accumulated in Shizuoka.

By Nanami Oki

Japan faces hurdles to cut coal power ratio

Japan is facing challenges to further reduce coal-fired power generation to 20pc of the energy mix, as it has to ensure supply security and limit the impact to in-house power generators in the industry sector.

The trade and industry ministry (Meti) on 13 July shared its views that it would be quite difficult to cut the ratio of coal-fired power capacity to 20-25pc by the April 2030-March 2031 fiscal year, although it will gear up efforts to reduce the share as much as possible. The current 2030-31 power portfolio prescribed a 26pc ratio for coal, lower than 32pc in 2019-20.

The government is pushing forward with a plan to phase out inefficient coal-fired power units to meet the 2030-31 goal, while the 26pc target incorporated nine coal power units under construction. The further cuts in on-site coal power units in the industry sector would erode the international competitiveness of the country's manufacturers, Meti said.

Meti has estimated that the industry sector would bear additional costs of ¥10bn/yr ($90.6mn/yr), if a manufacturer scraps a 100MW in-house coal-fed generator and buys electricity to make up the lost capacities.

Meti is discussing a new power mix target for 2030-31, to adapt to tougher greenhouse gas (GHG) emission goals for the same year. Japanese premier Yoshihide Suga pledged in April that the country will achieve a 46pc cut in the country's 2030-31 GHG emissions from 2013-14 levels, in line with the 2050 decarbonisation goal. This was revised up from the 26pc reduction target in the similar comparison.

By Motoko Hasegawa

Solar energy to gain cost advantage in Japan

Solar power energy in Japan is expected to gain a competitive edge against thermal and nuclear power sources by 2030, as solar generation costs is forecast to fall further with rising production of solar cell module at lower costs.

A working group to discuss power generation costs, which was created under the trade and industry ministry (Meti), has provisionally estimated output costs for solar power for business use in the low-¥8s/kWh to high-¥11s/kWh in 2030, compared with high-¥12s/kWh in 2020, based on capacity of 250kW. The 2030 price outlook was also lowered from the

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previous forecast of ¥12.70-15.60/kWh made in 2015 considering 2,000kW.

Solar power output costs in the household sector are forecast at the high-¥9s/kWh to low-¥14s/kWh in 2030, down from high-¥17s/kWh in 2020, based on the 5kW scale.

The costs for solar output would fall below those for thermal power units in 2030, as costs derived from lower utilisation of thermal units, amid expanding renewable power supplies, are likely to increase. Generation costs for coal-fired units in 2030 are estimated in the high-¥13s/kWh to low-¥22s/kWh, while those for LNG are predicted in the high-¥10s/kWh to low-¥14s/kWh. Costs for oil-fed units would be much higher at high-¥24s/kWh to high-¥27s/kWh.

The 2030 output costs for solar would be also competing with those for nuclear at high-¥11s/kWh, the working group said. Nuclear costs for 2030 were revised up from the 2015 estimate at ¥10.30/kWh, as more costs for safety measures are incorporated in the latest forecast.

Meti has so far confirmed that Japan could increase solar power capacity to 87.6GW by the April 2030-March 2031 fiscal year, by continuing current efforts. This is higher by around 57pc from 55.8GW in 2019-20. The environment ministry separately plans to add 20.1GW of solar capacity by 2030-31, while the ministry of land, infrastructure, transport and tourism is mulling the installation of 2.3GW of solar capacity at the country's air ports.

Generation costs for offshore wind power supplies, whose demand is also set to increase further, are predicted to fall to low-¥26s/kWh in 2030 from low-¥30s/kWh in 2020. But the costs are relatively high compared with other power sources. Japan aims to develop 10GW of offshore wind power capacity by 2030.

The draft generation costs were based on costs to build and operate a new power plant. This may be changing in accordance with update in assumptions, including fuel costs, operating period of a power plant, utilisation rates and volumes of solar power capacity, the working group noted.

The cost estimation will be reflected in discussion to update the 2030 energy mix, as a material to consider which power sources Japan should focus on. It is still unclear when Tokyo will announce the new energy mix goal, although this is widely expected to be drafted soon.

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By Motoko Hasegawa

Power utilities add to LNG stocks in June

Japan's main power utilities replenished their LNG inventories during June, in preparation for expected increased summer gas-fired electricity demand for cooling purposes.

Their LNG stocks were around 2.03mn t as of 30 June, according to a survey by Japan's trade and industry ministry. The inventories were around 100,000t higher compared with a month earlier and an average of end-June stocks of the past four years, although it remained lower by around 110,000t against a year previously. The figures exclude around 500,000t of dead stocks unable to be pumped up from storage tanks.

The utilities have been urged to secure more LNG summer supplies earlier than in past years, as the government called on buyers to take precautionary measures to tackle possible power shortages during the summer peak demand season that typically runs from July-September.

Japan's overall LNG imports, including supplies for feedstock of city gas, rose by 8.2pc from a year earlier to around 5mn t in May, finance ministry data showed.

By Motoko Hasegawa

More thermal units return in power mix

Japan is planning to restart more thermal power generation units from maintenance this week as electricity demand for summer cooling purposes rises.

Japan's thermal power capacity is scheduled to increase by 5,888MW over 12-18 July, with the return of 6,737MW and the closure of 849MW, according to a power plant operational status notice by the Japan Electric Power Exchange (Jepx). The net increase includes 2,238MW for gas-, 2,600MW for coal- and 1,050MW for oil-fired capacity.

East Japan, where the grid runs at 50 hertz (Hz), is forecast to add 3,287MW of thermal capacity during the week to 18 July. West Japan, which runs at 60Hz, is expected to increase by 2,601MW.

Japan's thermal power capacity has increased for the 11th consecutive week, gradually ending the spring turnaround season and maintenance checks in preparation for the peak summer demand season. The country's electricity use is expected to increase further this week, as the daily highest temperatures are forecast to exceed 30°C in large parts of Japan, especially in western areas.

The southern Kyushu area ended the rainy season on 11 July, 17 days earlier than last year and four days earlier than usual, following Okinawa on 2 July and Amami on 3 July.

Day-ahead system-wide prices on Jepx averaged ¥8.02/kWh ($72.62/MWh) on 12 July, higher than the weekly average of ¥7.76/kWh over 6-12 July. Day-ahead prices in the Tokyo area averaged ¥7.74/kWhon 12 July, maintaining

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discounts against Kansai's ¥8.56/kWh. The east-west spread has remained at a discount since 19 June.
By Motoko Hasegawa

Hokuriku adds to coal-fired power disruptions

Japanese utility Hokuriku Electric Power halted operations on 15 July of the 700MW No.2 coal-fired unit at its Tsuruga power generation plant in central Japan's Fukui prefecture because of a technical problem.

Hokuriku has identified a technical issue with the unit's combustion air fan. It is currently inspecting the equipment, although it unclear when Hokuriku can bring the unit back on line.

The utility also halted operations on 15 July of its 265MW No.1 and 123MW No.2 Arimine hydropower generation plants in Toyama prefecture.

The unplanned shutdowns resulted in tighter power supplies in Hokuriku's service area. Fellow west Japan utility Kansai Electric Power provided 200MW of generation capacity to Hokuriku today during 9-10am following an order from power agency the Organisation for Cross-regional Coordination of Transmission Operators.

Hokuriku managed to secure a 6pc power surplus for today, above the minimum 3pc required for emergencies.

Wholesale power prices on Jepx in the Hokuriku area averaged ¥8.68/kWh ($81.98/MWh) for 16 July delivery, higher by 3.9pc from ¥8.35/kWh for 15 July.

Japanese joint venture Nakoso IGCC Power yesterday unexpectedly halted operations of its 525MW coal-fired power generation unit in northeast Japan's Fukushima prefecture after detecting an issue with the unit's gasifier. The company is unsure when it can resume operations of the unit.
By Nanami Oki

Small power retailers expand sales in April

Japanese small-scale power retailers continued to increase their electricity sales in April from a year earlier, despite a fall in the country's overall power demand.

Power sales by smaller retailers totalled 12.8mn MWh in April, up by 22pc from the same month last year, according to data released on 15 July by the Japan Electricity and Gas Market Surveillance Commission, part of the trade and industry ministry (Meti). The market share of these retailers grew by 3.7 percentage points to 19.9pc over the period.

The increase came despite a 0.5pc year-on-year decline in Japan's total power retail sales to 64.5mn MWh in April, amid warmer-than-usual weather. Warm air from the southwest and high pressure sent the average temperatures in Japan's 10 major cities up by 1.9°C on the year to 14.8°C in April, the country's meteorological agency said.

Retail power sales at Japan's main utilities fell by 4.8pc from a year earlier to 51.7mn MWh in April, in response to softer electricity demand. The utilities' share of the retail power market declined by 3.7 percentage points to 80.1pc in the same comparison.

Power sales by major utilities at regulated prices in the low voltage electricity market fell by 11pc from a year earlier to 19.1mn MWh in April. This resulted in a 4.5 percentage point increase in the ratio of their sales in the liberalised market to 52.9pc.

Japan deregulated the country's retail power market in April 2016, allowing firms other than the main utilities to start a retail power business. But consumers still have the option to choose regulated prices in their electricity contracts with the utilities, to protect them from potential hikes in retail prices in a nascent market. It is still unclear when the government will remove controls on retail power prices.
By Motoko Hasegawa

Kyushu, J-Power resume coal imports at Matsuura

Japanese utility Kyushu Electric Power and power producer and wholesaler J-Power resumed coal imports for their Matsuura power plants on 16 July in southern prefecture Nagasaki, after an incident damaged the unloading system.

Kyushu and J-Power stopped operating the entire coal unloading system after an incident damaged the No.1 unloader and hurt two workers on 4 April. Kyushu and J-Power use the same import system at the Matsuura import terminal.

The companies restarted operation of the undamaged No.3 and No.4 unloaders after inspection. But the No.2 will remain closed after a technical issue was identified. The companies are unsure when they can bring it back on line. The companies removed the No.1 equipment, and it is unclear if they will replace with new one, Kyushu said.

Kyushu and J-Power received a cargo of coals at Matsuura on 16 July, the first time since the incident. They accepted limited volumes of the fuels from small non-international coastal vessels to unload with the temporary equipment. They halted the temporary coal unloading equipment on 6 July after achieving stockpiling targets, but will not remove it until the end of July.

Kyushu plans to resume the 700MW No.1 unit at its Matsuura power plant on 18 August, while restarting the 1,000MW No.2 unit on 12 July. J-Power restored operation of the 1,000MW No.1 and No.2 units at its Matsuura plant on 14 and 9 July respectively, according to notices on the Japan Electric Power Exchange website. But J-Power will maintain

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the unusual schedule, restarting and stopping operations every few days until late August to maintain its coal inventories.

By Nanami Oki

Central bank to back energy transition finance

The Japanese central bank is planning to offer zero-interest long-term financing to banks that finance energy transition efforts by Japanese companies towards achieving the country's decarbonisation goal by 2050.

The Bank of Japan (BOJ) today outlined its new climate funding scheme planned for a launch later this year. The BOJ under the scheme will back-finance Japanese financial institutions that extend funding to energy transition projects via green loans and bonds, sustainability-linked loans and bonds with performance targets related to climate change efforts and transition finance, it said.

The scheme is planned to last until the end of March 2031. Eligible financial institutions are expected to disclose a certain level of information on their climate change efforts, the bank said.

The BOJ added it will purchase foreign currency-denominated green bonds issued by foreign governments and institutions using its foreign reserves as part of efforts to tackle global warming. It will also strengthen co-operative efforts with other central banks to promote investment in climate-related financial products, such as green bonds.

More Japanese firms are considering resorting to sustainable finance tools to push energy transition in a move also backed by the Japanese government. Shipping firm NYK Line earlier this month announced a plan to issue the country's first transition bonds to raise around ¥20bn ($182mn) for investment in climate transition efforts, including development of zero emissions vessels.

The BOJ has followed a growing movement among central banks to take action to combat climate change. The European Central Bank last week said it will shift its asset-purchase stimulus programme away from heavy carbon-emitting companies and further incorporate climate change considerations into its monetary policy.

The BOJ on 16 July revised downwards an economic growth forecast to 3.8pc for the April 2021-March 2022 fiscal year compared with a previous forecast of 4pc, citing the extended impact of the Covid-19 pandemic. But the bank has revised up its growth forecast for 2022-23 to 2.7pc from an earlier 2.4pc projection.

By Rieko Suda

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