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Japan could face US$71 billion of stranded coal assets without policy reform
Cheaper for Japan to build new offshore wind than run coal plants by 2025, calling into question the government's pro-coal stance and its implications for energy consumers

NEW YORK/LONDON, October 7 – The economic viability of Japan's coal plants could be severely undermined by low cost renewable energy, finds a new report by Carbon Tracker, University of Tokyo Institute for Future Initiatives and CDP.

Carbon Tracker in collaboration with the University of Tokyo Institute for Future Initiatives and CDP found Japan's planned and existing coal capacity could become stranded due to lower utilisation rates and tariff prices caused by low cost renewable energy.

Head of Power & Utilities at Carbon Tracker and co-author of the report, Matt Gray, said: *"There's a technology revolution coursing through the world's power markets. This revolution is coming to Japan, which means the government urgently needs to reconsider its pro-coal stance."*

Land of the Rising Sun and Offshore Wind uses asset-level financial models to analyse the project and relative economics of new and existing coal plants in Japan.

If the capacity factor goes below 48% or the tariff is lower than U$72/MWh, then projects could become unviable. For context, the capacity factor averaged 73%, while the tariff price (based on the Japan Electric Power Exchange) was US$87/MWh.

Based on a comparison of the levelised cost of energy (LCOE) analysis, onshore wind, offshore wind and utility-scale solar photovoltaics (PV) could be cheaper than coal by 2025, 2022 and 2023, respectively. Moreover, the long-run marginal cost (LRMC) of coal could be higher than offshore wind and solar PV by 2025 and onshore wind by 2027.

Land of the Rising Sun and Offshore Wind also explores the implications of Japan's coal fleet being shut down in a manner consistent with the temperature goal in the Paris Agreement – a policy the Japanese government intends to meet, according to the Long-term Strategy for Decarbonization submitted to the UNFCCC in June 2019.[1] In our below 2-degree scenario, where Japan's coal capacity is forced to shut-

[1] The Long-term Strategy for Decarbonization, which was approved by the cabinet and submitted to the UNFCCC in June 2019, states: "The Government will work to reduce CO2 emissions from thermal power generation to realize a decarbonized society and consistent with the long-term goals set out in the Paris Agreement. https://unfccc.int/sites/default/files/resource/The%20Long-term%20Strategy%20under%20the%20Paris%20Agreement.pdf

down by 2030, stranded asset risk from capital investments and reduced operating cashflows could amount to $71 bn. Of this US$71bn, US$29bn could be avoided if the Japanese government immediately reconsiders the development of planned and under construction capacity.

Gray added: *"Despite policy signals from the Japanese government, it is still investing heavily in coal. This capacity will become stranded which will likely result in higher energy costs for the consumer."*

Accelerating the transition away from coal would be good for investors, consumers and the wider economy according to *Land of the Rising Sun and Offshore Wind*. It makes the case for cancelling planned coal, stop coal under construction and develop a retirement schedule for the existing fleet.

Michiyo Morisawa, CDP Worldwide Japan Director said: *"Current market structures are insufficient to respond to climate change and will impact future generations. Those companies who take immediate action will reap the rewards. The shift beyond coal power is an irreversible trend."*

Model methodologies overview

Project economics model

The project economic model analyses the financial viability of planned and under-construction coal capacity. The purpose of this analysis to illustrate how, under different scenarios, a coal project could become unviable over its lifetime. Project finance modelling assesses the risk-reward of lending to, or investing in, a coal power project and includes a forecast of revenues, construction, operating and maintenance costs, tax, debt financing, the internal rate of return (IRR) and net present value (NPV).

Relative economics model

There are three economic inflection points that policymakers and investors need to track to provide the least-cost power and avoid stranded assets: when new renewables and gas outcompete new coal; when new renewables and gas outcompete operating existing coal; and when new firm (or dispatchable) renewables and gas outcompete operating existing coal. The relative economics model compares both the levelised cost of energy (LCOE) of new coal investments and the long run marginal cost (LRMC) of existing coal assets with the LCOE of onshore wind, offshore wind and utility-scale solar PV.

Stranded asset model

The stranded asset risk in our 2°C scenario is defined as the difference between the NPV of revenues in a BAU scenario and a scenario consistent with the temperature goal in the Paris Agreement. The retirement schedules are developed based on gross profitability, if a liberalised market; or LRMC, if a regulated market (as it is currently the case for Japan). Underlying this analysis is the logic that in the context of efforts to reduce carbon emissions and demand for coal power, the least economically efficient will be retired first.

Table and Charts

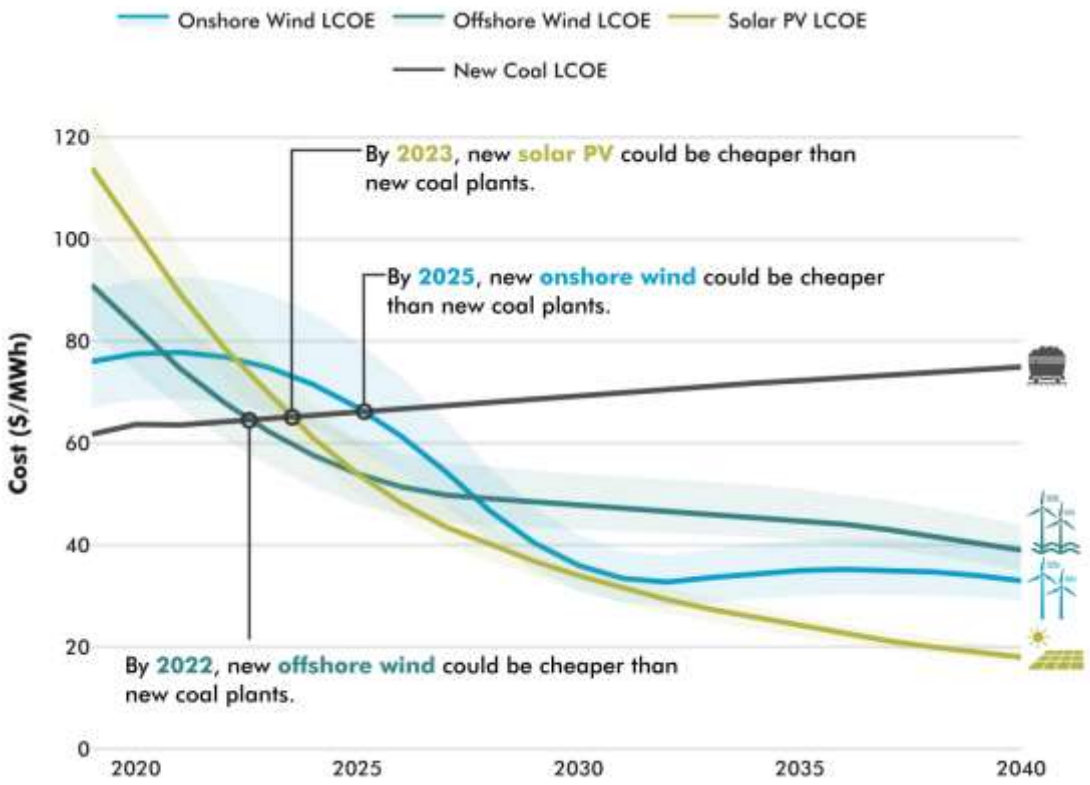
Results of the project economics model for planned and under-construction coal units

Project	Parent owner	Forecasted Net Present Value (NPV) (million US$)	Lowest capacity factor to achieve an IRR greater than WACC = 2.5% (%)	Highest fuel price to achieve an IRR greater than WACC = 2.5% (US$/t)	Lowest tariff to achieve an IRR greater than WACC = 2.5% (US$/MWh)	Highest carbon price in 2040 to achieve an IRR greater than WACC = 2.5% (US$/tCO2)
Akita Unit 1	KEPCO, Marubeni	$1,110	49%	$109	$70	$28
Akita Unit 2	KEPCO, Marubeni	$1,110	49%	$109	$70	$28
Hirono IGCC	Mitsubishi (90%), TEPCO (10%)	$539	62%	$95	$75	$21
Hitachinaka Kyodo Unit 1	JERA	$766	50%	$100	$73	$24
Kaita	Chugoku Electric Power (50%), Hiroshima Gas	$65	59%	$85	$78	$10
Kobe Unit 3	Kobelco Power Kobe 2	$1,050	45%	$111	$69	$32
Kobe Unit 4	Kobelco Power Kobe 2	$1,028	44%	$111	$69	$31
Kushiro	IDI Infrastructures F-PowerCoal Mine, Taiheiyo	$201	40%	$106	$68	$23
Misumi Unit 2	Chugoku Electric Power	$1,970	42%	$121	$66	$38
Nakoso IGCC	Mitsubishi (90%), TEPCO (5%), Joban Joint Power (5%)	$575	62%	$95	$75	$21
Saijo Unit 1	Shikoku Electric Power	$1,239	42%	$125	$64	$40
Kashima Unit 2	Nippon Steel, J-power	$1,011	47%	$111	$70	$33
Takehara New Unit 1	J-POWER	$1,029	44%	$112	$68	$34
Taketoyo Unit 5	JERA	$1,954	43%	$118	$67	$36
Tokuyama East Power No. 3	Tokuyama, Marubeni, Tokyo Century	$176	57%	$87	$77	$11
Ube Unit 1	J-POWER, Ube Industries	$1,122	43%	$117	$67	$34
Ube Unit 2	J-POWER, Ube Industries	$1,113	42%	$119	$67	$34
Yokkaichi	Mitsubishi	$74	54%	$87	$77	$11
Yokosuka Unit 1	JERA	$5	48%	$76	$82	$4
Yokosuka Unit 2	JERA	$5	47%	$76	$82	$4
Average	**n/a**	**n/a**	**48%**	**$104**	**$72**	**$25**

Source: Carbon Tracker analysis

Notes: Our project economics model is based on a number of high-level assumptions, due a lack of publicly available data. See Table 2 and 4 as well as Section 6 of the report for the modelling assumptions and risks associated with this analysis.

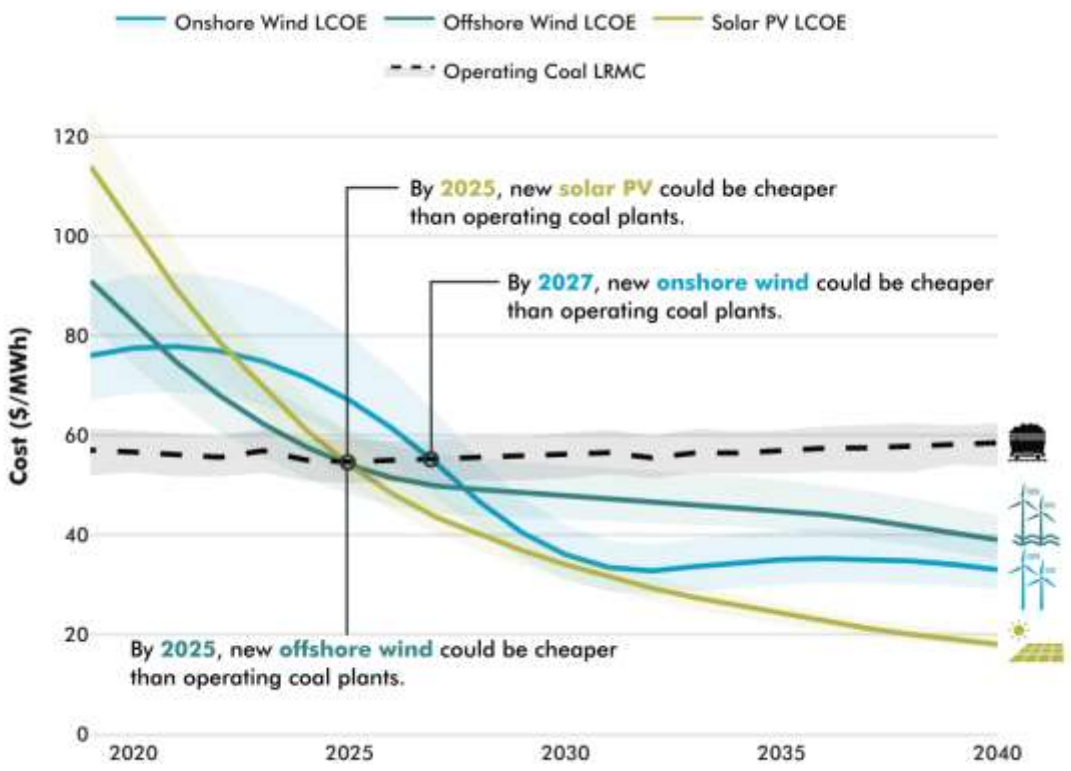
The LCOE of renewables versus the LCOE of coal in Japan



Source: Carbon Tracker analysis

Notes: the key assumptions for onshore wind include: CAPEX of US$2231/KW, O&M of 1.7% of CAPEX, capacity factor of 26%, capacity projection of 30 GW by 2040, real WACC of 3.5%, debt equity split of 80:20, a learning rate of 25%. The key assumptions for solar PV include: CAPEX of US$1932/KW, O&M of 1.3% of CAPEX, capacity factor of 14%, capacity projection of 282 GW in 2040, real WACC of 3.5%, debt equity split 80/20 and learning rate 60%. The key assumptions for offshore wind include: CAPEX of 4135 US$/kW, annual O&M costs 2.5% of CAPEX, capacity factor of 49%, real WACC of 4.2%, debt equity split of 75:25, capacity projection of 20 GW in 2040 and learning rate of 12%. See Table 2 and the appendix for more information.

The LCOE of renewables versus the LRMC of existing coal in Japan



Source: Carbon Tracker analysis

Notes: Upper and lower bounds for the cost of operating coal units are calculated using several scenarios. Notes: Operating coal cost is capacity-weighted and based on long-run marginal cost, which includes fuel, variable O&M and fixed O&M (SRMC plus fixed operating and maintenance costs). Imported coal is assumed from Australia, Russia and Indonesia. The upper and lower bounds represent the 25% and 75% confidence intervals in the long-run marginal cost given the variance in historical coal prices from the last 10 years. The historical mean coal price is $75/ton. See Figure 1 notes and Table 2 of the main report for other assumptions.

ENDS

Once embargo lifts on October 7 the report will be available for download at:
www.carbontracker.org

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NOTES TO EDITORS

About Carbon Tracker
Carbon Tracker is an independent financial think tank that carries out in-depth analysis on the impact of the energy transition on financial markets and the potential investment in high-cost, carbon-intensive fossil fuels. Its team of financial market, energy and legal experts apply ground-breaking research using leading industry databases to map both risk and opportunity for investors on the path to a low-carbon future. It has cemented the terms "**carbon bubble**", "**unburnable carbon**" and "**stranded assets**" into the financial and environmental lexicon.