

JERA: An enhanced SLB proposal for ambitious transition

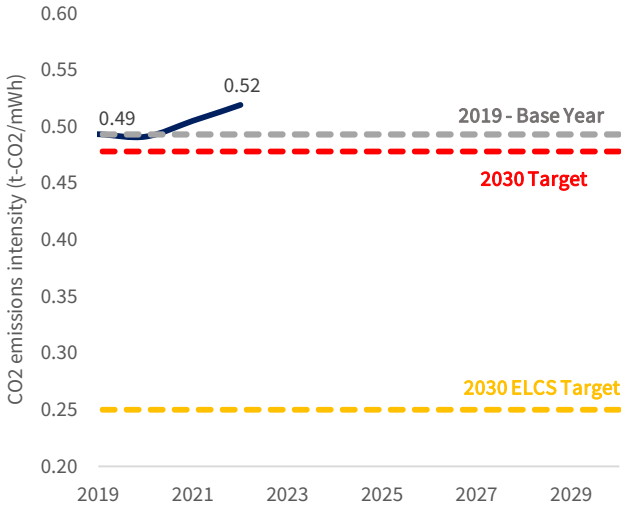
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JERA, Japan's largest power generation company, has a key role to play in her overall decarbonisation strategy. Its transition objectives, zero CO_2 emissions by 2050 and 60% reduction in emissions (relative to fiscal year 2013) by 2035, are consistent with Japan's wider Green Transformation (GX) plan[1]. Rather than actively diversifying into renewables, its development plans are targeted at improving efficiency at LNG units and introducing ammonia co-firing at coal units.

On 29 February 2024, JERA announced the issuance of its first "transition-linked bond", which is akin in structure to a sustainability-linked bond (SLB).[2] However, the issued bond may not be tailored for optimal pricing and impact benefits.

The bond issuance links to an existing fiscal year 2030 target, which our analysis shows is unambitious, for example when compared with Japan's Electric Power Council for Low Carbon Society's (ELCS) target (see Figure 1).[3]

Figure 1. Historic Carbon Emissions Intensity for JERA. Source: JERA.



The structure compels JERA to make a small charitable donation on missing the target, which is insufficiently material to deliver a JERA a meaningful pricing benefit.

In this note we propose an enhanced Sustainability-Linked Bond (SLB) structure, to offer complementary financing alongside JERA's existing transition bonds. By integrating a more ambitious target, this structure could promote outcomes-focused impact. A more stretching target could also lead to reduced financing rates for JERA.

Future financing requirements for JERA are substantial, so fixed income investors will have ample opportunities to engage with the company to influence its future decarbonisation strategy.

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[1] "The Basic Policy for the Realization of GX", METI, Feb 2023

[2] Currently available in Japanese at "Regarding the issuance of our first transition link bond", JERA, 29 Feb 2024.

[3] For more details on ELCS please see "Japan's Electric Power Council for a Low Carbon Society Released its Vision for a Long-Term Global Warming Strategy", JEPIC, 8 Nov 2019.

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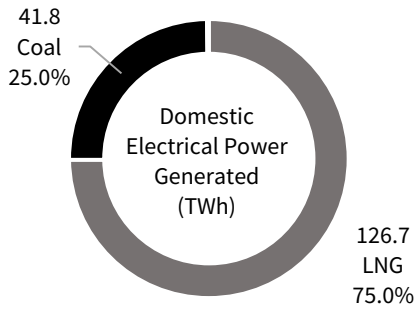
JERA is key to Japan's decarbonisation strategy

JERA Co., Inc. (JERA) is a 50-50 joint venture between TEPCO Fuel & Power, a wholly-owned subsidiary of the Tokyo Electric Power Company, and Chubu Electric Power Co. It was formed in 2015 to take ownership of all thermal power stations previously operated by its parents, making it Japan's largest power generation company.

JERA is the world's biggest buyer of LNG, which contributes 75% of its power generation. Coal makes up the remaining 25% (see Figure 2).

JERA currently accounts for about 11% of Japan's total carbon emissions,[4] which makes the ambition of its decarbonisation strategy integral to the success of the country's overall transition.

Figure 2. JERA's Domestic Electrical Power Generation (TWh). Source: JERA, accessed 31 Jan 2024.



JERA has reported that it aims to achieve zero CO_2 emissions by 2050. However, the ambition of its interim targets is essential for clarifying the pace of its transition and credibility of its decarbonisation trajectory. When comparing these interim targets to peers or the Electric Power Council, they seem unambitious (for full details please see Appendix 1: Background on JERA's decarbonisation strategy).

To meet these targets, JERA, in line with the government's strategy, is planning for zero-emissions thermal power by advancing initiatives for "clean hydrogen and ammonia" development.[5] These strategies offer limited absolute emissions reductions (please see Appendix 2: Decarbonisation potential of JERA's chosen technologies). Neither can offer a reduction of emissions intensity in line with targets set by the Electric Power Council. A transition to renewables is required for these targets to be achieved.

As JERA is so significant to Japan's overall transition, if the company fails to achieve its decarbonisation targets it could jeopardise the entire country's transition effort.

In summary, JERA achieving effective decarbonisation is essential for Japan to meet her targets. JERA's short-terms targets appear unambitious compared to peers, and hard to achieve using currently identified technologies.

[4] "Data – JERA Group Integrated Reported 2023", JERA, accessed 14 Feb 2024.
[5] "Medium and long-term strategy 2023", JERA, accessed 14 Feb 2023.

JERA's new transition linked bond – an SLB?

On 29 February 2024 JERA launched its first transition linked bond with the aim of realising a decarbonised society.[2]

This is not a bond label we've seen before, and may well have been chosen in response to the Japanese Government GX program.[1] The structure has features that make it redolent of an SLB. Proceeds are unrestricted, and there is a Sustainability Performance Target (SPT) to reduce group emissions intensity to below 0.477 $kgCO_2/kWh$ in fiscal year 2030, which if missed will trigger a donation of 0.1% of notional to the public good.

Utilities often deploy SLBs with targets linked to emissions, emissions intensities, or renewables capacity,[6] which offer a number of benefits over Use-of-Proceeds (UOP) bonds. It is therefore positive to see JERA using a SLB (albeit labelled as transition-linked) complementarily with UoP transition products. SLBs provide flexible financing, enabling issuers to choose investments that they believe are most likely to deliver decarbonisation outcomes.[7]

However, this JERA structure may not be optimised for either pricing benefit or impact.

The target used, as discussed earlier, is unambitious. JERA's effective decarbonisation is essential for Japan, and this level may be unsatisfactory for the broader trajectory.

In addition, the 0.1% donation is not material enough to produce a meaningful pricing benefit for JERA. The potential pricing benefit of an SLB is derived from the probability that investors may receive a higher coupon in the future, which allows them to accept a lower coupon at issuance.[8] On a discounted basis, the value of this donation is only 1bp running across the life of the bond, before accounting for the probability of the target being missed.[9]

The alternative of paying a charitable donation rather than a coupon step-up has been used before in the Japanese market.[10] We recognise that while this may reduce the financial benefit for international investors (who could always choose to donate a coupon step-up to charity), it seems to have been effective at broadening interest among domestic investors.

Enhanced Sustainability-Linked Bond Proposal

In order to maximise both the pricing benefit for JERA, and the impact opportunities for investors, we propose an enhanced structure. We use the same bond details as the transition-linked structure, but enhance the SPT and step-up elements.

Firstly, we propose a double KPI structure, with a second stretch target linked to the Electric Power Council levels, the achievement of which would trigger a coupon step down. The structure is

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[6] For some example analysis please see "Enel SLBs: update on 2023 observation date", AFII, 20 Oct 2023 or "A review of SLBs approaching KPI observation dates", AFII, 17 Nov 2023.
[7] For details of a similar proposal for the Japanese Sovereign please see "Transition Power, a JGB SLB prints in USD", AFII, 7 Feb 2024.
[8] For full details of the AFII option pricing method please see "An option pricing approach for Sustainability-Linked Bonds", AFII, 8 Nov 2022.
[9] For a broader discussion on materiality of SLB structures please see "Greenback SLBs: an impact standardisation proposal", AFII, 10 May 2023.
[10] For more information please see "Sustainability-Linked Bonds: alternative steps", AFII, 23 May 2023.

symmetric, to balance pricing benefit to the issuer for offering a step-up with incentives to achieve the step-down.[11]

Secondly, we increase the size of the coupon adjustment, to 37.5bps running, as a step-up and step-down, rather than a single premium payment. This increases the materiality of the structure, and so improves the pricing benefit.

SLB pricing

Now we will price the transition-linked bond and SLB in parallel, using the AFII option pricing approach.[8] Pricing the value of both the premium payment and the step-up coupon requires an estimation on the probability of achieving the emission intensity targets.

JERA's self-selected target will need a reversal in emissions trend to achieve (see Figure 1). We assign a 50% probability to the company succeeding.[12] The stretch target has very low model value, given it represents such a significant reduction. We will assign 10% probability of it being achieved.

Using these parameters, the transition-linked bond has an option value of 0.5bps and the AFII SLB has an option value of 3bps running. Table 1 shows a full comparison.

Table 1. Comparison between JERA transition linked bond and hypothetical AFII SLB. Indicative/hypothetical pricing. Not a recommendation. Source: AFII.

	Transition linked bond	**AFII SLB**
Maturity	10y, Feb 2034	10y, Feb 2034
Observation and step date	Fiscal Year 2030 (Mar 2031)	Fiscal Year 2030 (Mar 2031)
SPT 1	0.477 kg-CO2/kWh intensity, -3% from 2019 baseline.	0.477 kg-CO2/kWh intensity, -3% from 2019 baseline.
SPT 2	none	0.25 kg-CO2/kWh intensity, -49% from 2019 baseline, and aligned with Electric Power Council (or ELCS) target.
Step-up	+0.1% premium on not achieving SPT1	+37.5bp on not achieving SPT1 -37.5bp on achieving SPT2
Option value	-0.5bp	-3.0bp
of which:	-0.5bp option value of SPT1	-3.8bp option value of SPT1
		+0.8bp option value of SPT2

The JERA transition-linked bond has very low option value, driven by the low materiality of the premium payment at maturity (which is donated for public good). An alternative structure using a 37.5bps symmetric step-up/step-down coupon could integrate a more ambitious target, and have increased materiality for investors.

[11] This structure was used by Uruguay as described in "Uruguay SLB: market update", AFII, 5 Jun 2023, and is the same structure that we propose for Japan.

[12] Sometimes self-selected targets are easier to achieve, but given the low intensity of its planned investments and the fact its recent performance has been of increasing intensity above its baseline, we consider the target challenging.

JERA's existing transition bond

JERA issued JPY 20 bn (USD 0.13 bn) of transition bonds on 24 May 2022, with proceeds restricted to transition investments. DNV provided the Second Party Opinion (SPO), confirming alignment with the International Capital Market Association (ICMA)'s Green Bond Principles 2021.

Table 2. JERA Co., Inc bond issuance. Source: Bloomberg, accessed 14 Feb 2024.

Description	ISIN	Issue Date	Maturity	Currency	Amount Outstanding
JERA ¥0.6 32s	JP338672BN50	24-May-22	25-May-32	JPY	8,000,000,000
JERA ¥0.4 27s	JP338672AN51	24-May-22	25-May-27	JPY	12,000,000,000

The funds raised through the issuance of transition bonds will be used to carry out various transition projects, aiming to achieve JERA's Zero CO_2 Emissions 2050 and Environmental Targets for fiscal year 2030 and 2035.

Use-of-Proceeds

Around 14% of the total proceeds were allocated to the ammonia co-firing demonstration at the Hekinan coal-fired power station. Some proceeds were also used for technical verification of hydrogen co-firing taking place at hydrogen supply facilities and other related infrastructure at JERA's LNG thermal power plant.

Table 3. JERA Co., Inc bond issuance. Source: DNV, 23 May 2023

Category	Allocated Amount (JPY Bn)	% of total funds allocated
Ammonia co-firing demonstration	1.7	13.7
Hydrogen co-firing demonstration	0.1	0.8
Decommissions of existing inefficient thermal power generation facilities	10.6	85.4
Total Allocation (of which refinancing amount)	12.4 (11)	100%
Unallocated Balance	7.5	n.a

In addition, around 85% of the allocated funds have been used to demolish the existing power generation facilities at Goi Thermal Power Station, operational since 1963.

While the project involves decommissioning a 60-year-old plant, the replacement capacity includes the construction of three new gas-fired combined-cycle units with a total capacity of 2.34GW to replace six ageing gas-fired steam power units at the facility.

Although the bulk of the proceeds focuses on decommissioning the Goi thermal power plant, equal attention must be given to accounting for the replacement plant. Our analysis shows that even with plant replacements, carbon emission intensity is projected between 0.5083 and 0.5183 kg-CO2/kWh. The best-case scenario aims for a 1.0% reduction in absolute carbon emissions, suggesting a limited impact on JERA's overall emissions (see detailed calculation in Appendix 2).

Impact

Our view is that there is significant risk for investors in JERA's transition bond, which could be addressed with effective KPI-linked issuance.

First, JERA's transition bond encourages investments in technologies like ammonia and hydrogen co-firing in coal and LNG power plants. However, these technologies are far from being accepted internationally as a credible transition option and may prolong the lifespan of thermal plants, particularly coal-fired ones.

Second, decommissioning an aging LNG plant essentially to replace it with new gas-fired plants has limited impact on JERA's overall emissions. It is also worth noting that the contract for the replacement of the Goi power plant with these new generation facilities took effect in June 2019, predating JERA's announcement of its Zero CO_2 Emissions 2050 objective in October 2020.

Although various factors contribute to the timing of the decarbonisation announcement and the decommissioning of the Goi power plant, **our analysis suggests that the decommissioning of this plant is not genuinely part of a "transition" strategy. Instead, it appears to be a strategic move aimed at addressing the management of an already aging plant, fitting into the narrative of the decarbonisation strategy.**

Conclusions

As Japan's largest power generator, JERA plays a significant role in the nation's transition. JERA's generation is primarily focused on thermal capacity, LNG, and coal, so the opportunities for decarbonisation and diversifying through renewables are evident. JERA has historically issued Use-of-Proceeds debt to fund investments in its selected transition strategies. Those investments risk locking in fossil fuel usage for many years and exacerbating stranded asset risk. Our analysis also shows these investments will not achieve the significant decarbonisation necessary for an effective transition in Japan.

JERA is in the market with a transition-linked bond, with a target to reduce emissions intensity. Alas, JERA's current emissions reduction targets are unambitious, especially when compared to industry peers and the nationwide target set by the Electric Power Council for a Low Carbon Society.

We have proposed an enhanced Sustainability-Linked Bond structure, which could be appealing for investors and the issuer. We have included a target aiming to align with the national objective of achieving a 46% reduction in greenhouse gas emissions by fiscal year 2030,[13] which would achieve a greater impact and be strongly complementary to JERA's issued transition bonds.

For investors this structure can deliver accountability, and ensure a focus on decarbonisation outcomes rather than untested technologies. This is a benefit not only to bond investors directly, but to stakeholders across the capital structure.

For JERA, choosing an ambitious structure could deliver an attractive funding cost, and raise capital for its ongoing investment needs.

[13] "Japan Inc.'s plans to cut emissions fall short of 2030 national target", Nikkei Asia, Jan 2024

Appendix 1: Background on JERA's decarbonisation strategy

JERA's targets

Table 4 shows JERA's targets, on absolute emissions, emissions intensity, and renewable generation. These figures are established at the domestic level within the JERA group.[14]

Table 4. JERA's current emissions targets to achieve carbon neutrality by 2050. Source: CDP.

	Long Term Target (after 2030)	Short term Target (2030)	Other Target related to emissions target
Description	Absolute Emissions *(metric tons CO_2e)*	Emissions Intensity *kg-CO2/kWh*	Renewable Energy Capacity *(GW)*
Base Year	2013	2019	2019
Base Performance	182,700,000	0.493	1.1
Target Year	2035	2030	2025
Target Performance	73,080,000	0.478	5.0
% of target relative to base year	-60%	-3.04%	354.5%
Reported Year	2023	2023	2023
Reported Performance	129,076,498	0.522	2.4
% change in target relative to base year	-29%	+5.9%	+118%

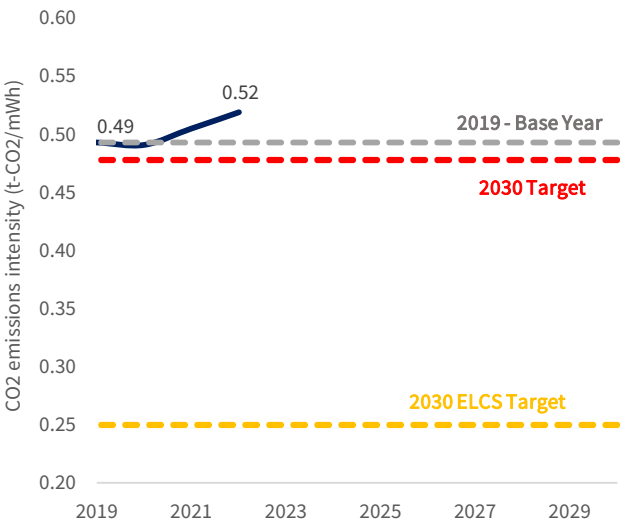
2030 target comparison with peers

Now we assess the 2030 emissions intensity target for ambition.

Based on its response to CDP,[15] the targeted reduction in carbon emission intensity of scope 1 and 2 emissions is 3.04% below its base year (2019), leading to approximately 0.477 kg-CO_2/kWh or less in fiscal year 2030.[16]

However, JERA's target is 1.9 times more than the national target of 0.25 kg-CO_2/kWh set by the Electric Power Council for a Low Carbon Society (ELCS)[17] to align with the national objective of achieving a 46% reduction in greenhouse gas emissions by fiscal year 2030.[18]

Figure 3. Historic Carbon Emissions Intensity for JERA. Source: JERA.



Furthermore, the comparison with industry peers, especially Kyushu and J-Power, suggests that JERA is falling behind its targeted performance by 2030 (see Table 5).

[14] It includes JERA in Japan and domestic joint venture companies.
[15] "JERA Co., Inc. - Climate Change 2023", CDP, 2023.
[16] "JERA Sustainable Finance Framework", JERA, Nov 2023
[17] ELCS established in February 2016 with the aim of moving forward with the attainment of these targets for all electric utilities as a whole.
[18] "The Electric Power Industry in Japan", JEPIC, 2023.

The contrast between Kyushu and JERA is stark when evaluating their environmental commitments. Kyushu stands out with the most robust target in terms of emissions intensity and has also articulated climate transition plans that align with the stringent 1.5°C scenario.[19] Conversely, as of February 2023, JERA has not produced an analysis demonstrating its alignment with the 1.5°C scenario.[20]

Table 5. JERA's emission intensity target compared against ELCS and peers. Source: Various.

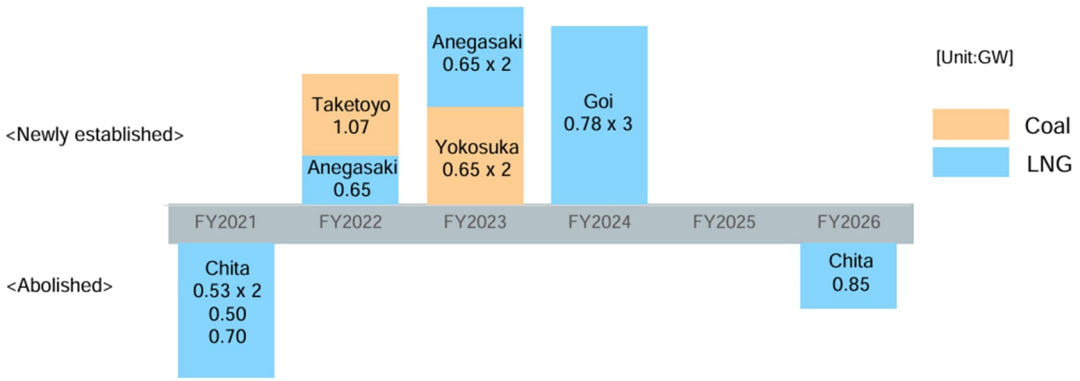
	ELCS	JERA	Chubu[2]	J-Power	Kyushu
Base Year	2013	2019	2013	2013	2021
Base Performance (kg-CO2/kWh)	0.569[1,3]	0.493	0.57	0.68	0.351
Target Year	2030	2030	2030	2030	2031
Target Performance (kg-CO2/kWh)	0.25	0.477	0.371	0.324[1]	0.183
Target Relative to ELCS	-	1.9x	1.5x	1.3x	0.7x
Annualised Reduction (kg-CO2/kWh)	0.015	0.001	0.012	0.021	0.017

1. Some figures are estimated based on targeted absolute emissions reductions or the latest available data.
2. Been a part of JERA's joint venture since 2015.
3. CO_2 emissions in fiscal 2017 (preliminary figures) – 0.496 kg-CO_2/kWh

JERA's strategy

JERA is committed to decommission or abolish around 3.1 GW of its LNG plants by 2026. Concurrently, the company aims to enhance power plant efficiency by replacing inefficient thermal plants with new facilities, almost doubling the "newly established" capacity compared to the "abolished" capacities of both LNG and coal-based plants.

Figure 4. Progress of replacement of thermal power plants as of December 2023. Source: JERA.



The company has also committed to achieving a 2025 goal of holding five gigawatts (GW) in renewable energy assets globally. However, this target appears modest when compared to its current generation capacity, standing at approximately 72GW.[21] As of December 2023, there is currently no domestic power generation from renewable energy sources within JERA.

The current initiative involves the decommissioning of certain thermal plants. Nevertheless, dependence on technologies such as ammonia and hydrogen, coupled with the progressive

[19] "Kyushu Electric Power Co Inc - Climate Change 2023",CDP, 2023.
[20] "SGX Whistleblower Complaint Regarding JERA Bonds", Market forces.org.au., 15 Feb 2023
[21] "Business Development", JERA, accessed 14 Feb 2024

development of ostensibly 'efficient' LNG and coal plants, introduces the potential for fossil fuel lock-ins over the long-term.

Appendix 2: Decarbonisation potential of JERA's chosen technologies

Here we analyse the decarbonisation potential of both making LNG generation more efficient and blending coal with ammonia. We seek to understand what overall decarbonisation is possible using these two technologies.

LNG efficiency savings

JERA is currently undertaking an efficiency improvement exercise in LNG generation, by decommissioning the Goi thermal power plant and replacing it with an enhanced facility, which is targeting a thermal efficiency of 64%.[22]

We have conducted several scenario analyses to comprehensively evaluate the potential impact of carbon reduction resulting from this investment.

Table 6. Scenario analysis for GOI LNG plant decommissioning. Source: AFII.

	Scope	Unit	BASE (FY 2022)	Scenario 1 No emissions intensity improvement	Scenario 2 18.75% emissions intensity improvement	Scenario 3 ELCS target for new generation
Emissions intensity	this plant	kg-CO_2/kWh	0.4030	0.4030	0.3274	0.2500
Generation per year*	this plant	GWh	13,217	16,399	16,399	16,399
Emissions per year	this plant	thousand-mtCO_2	5,326	6,609	5,370	4,100
2022 emissions	excluding this plant	thousand-mtCO	123,065	123,065	123,065	123,065
2022 generation*	excluding this plant	GWh	233,783	233,783	233,783	233,783
Emissions intensity	JERA total	kg-CO_2/kWh	0.5198	0.5183	0.5134	0.5083
Change in emission intensity vs base year	JERA Total	%	-	-0.3%	-1.2%	-2.2%

Note :1 GW = 1,000,000 kW and 1 thousand-mtCO_2 = 1,000,000 kg- CO_2. The reported figure in JERA's report for the base of fiscal year (FY) 2022 is 247 billion kWh, 128,391 thousand-mtCO_2 and 0.5198 kg-CO_2/kWh.

Table 6 shows our scenario analysis using different estimated intensities of the new plant. The base emissions intensity is sourced from UNECE.[23]

Scenario 1 assumes no enhanced efficiency, purely increased capacity. This does lower the overall JERA intensity by 0.3% as LNG has a lower intensity than the JERA average.

[22] "Goi Thermal Power Station Replacement", NS Energy, Undated.
[23] "Carbon Neutrality in the UNECE Region: Integrated Life-cycle Assessment of Electricity Sources", United Nations Economic Commission for Europe – UNECE, Mar 2022.

Scenario 2 assumes a 18.75% reduction in intensity (an increase of 52%[24] to 64% of efficiency). This would deliver a reduction in JERA intensity of 1.2%.

Scenario 3 assumes the new generation achieves the ELCS target of 0.25 kg-CO_2/kWh. This would deliver an overall reduction of 2.2%.

These scenarios do not account for the additional capacity and carbon emissions from the Yokosuka and Anegasaki thermal plants established in fiscal year 2023, potentially offsetting the carbon reduction achieved by these replacement plants. (see Figure 4)

Ammonia co-firing

JERA is also relying on co-firing technology for its coal-fired power stations; indeed, the company is set to showcase its commitment to innovation by undertaking a demonstration of co-firing 20% ammonia at the 1-gigawatt Hekinan coal-fired power station. This demonstration is scheduled to take place by the conclusion of the financial year ending on 31 Mar 2024. Meanwhile, technical verification for hydrogen co-firing is also being conducted to build hydrogen supply facilities and other related infrastructure at its LNG thermal power plant. Given these demonstrations are at a technical verification stage, it is challenging to estimate the carbon reduction of these technologies. Coal-fired generation is the most emissions intensity source of electricity, estimated as 0.8702 kg-CO_2/kWh.[25]

If 20% of coal were replaced with ammonia or hydrogen, generated via an emissions-free process, the co-fired generation could have intensity of 0.6527 kg-CO_2/kWh, still far above the target intensity generation figures, both for JERA and for ELCS.[26]

That said, given Japan's lack of renewables capacity, it is hard to see how ammonia or hydrogen could be produced in an emissions-free process, and so these techniques are unlikely to reduce GHG emissions.[27] In addition, ammonia and hydrogen co-firing in coal power plants will lock-in the use of fossil fuels for longer, reducing the opportunity to cut emissions in the future.

[24] "Data – JERA Group Integrated Reported 2023", JERA, accessed 14 Feb 2024.
[25] This is calculated using the 75% LNG / 25% coal split on generation from Figure 2 combined with the base LNG emissions intensity of 0.4030 kg-CO_2/kWh sourced from UNECE. We observe that the IPCC coal emission intensity range is 0.740 to 1.689 kg-CO_2/kWh. This appears to be on the lower side, but it is contextually appropriate.
[26] 20% of ammonia means that 25% less coal is needed.
[27] For our earlier work please see "MHI: The wrong kind of transition", AFII, 6 Sep 2022.

Decommissioning of fossil fuels

Achieving JERA's 2030 target, which requires an average emissions intensity reduction of 8% from 0.5198 to 0.478 kg-CO_2/kWh, is numerically possible by using the two technologies described above.

Table 7 shows one such hypothetical solution, where 10% of generation comes from co-firing coal, and 16.6% comes from enhanced LNG.[28]

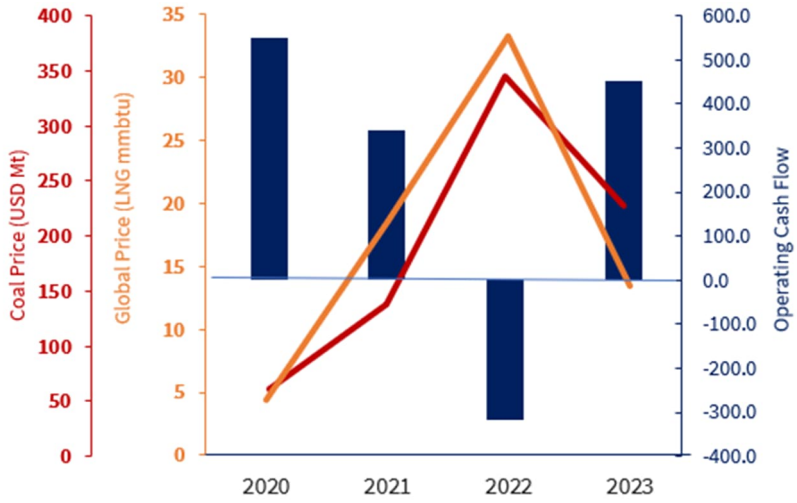
Table 7. Potential JERA emissions intensity using estimated figures for new technologies. Source: AFII.

Generation method	Intensity (kg-CO_2/kWh)	Starting mix	Possible future mix	Maximum reduction
LNG	0.4030	75.0%	58.4%	0.0%
Enhanced LNG	0.2821	0.0%	16.6%	75.0%
Coal	0.8702	25.0%	15.0%	0.0%
Co-firing coal	0.6527	0.0%	10.0%	25.0%
Average intensity		0.5198	0.4780	0.3748

Table 7 also shows the maximum reduction possible using these two technologies, which is an average figure of 0.3748 kg, far short of the ELCS target of 0.25 kg-CO_2/kWh. In order to achieve emissions intensity aligned with the ELCS target, renewables must be commissioned to replace emissions-intensive methods of generation.

Appendix 3: JERA operating cash flows against volatile fuel prices

Figure 5. JERA operating cash flows against volatile fuel prices. Source: Bloomberg, accessed 24 Jan 2024.



[28] Note here we are using the most optimistic scenario for coal co-firing, even though we believe delivered reductions will be far lower.

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