

Japan's gas dependence needs a rethink, starting with a new steel plant

Japan is in its third gas crisis in 5 years. At the same time its steel industry is switching to electric furnaces, so where those furnaces get their power now decides how exposed steel is to the next crisis. Nippon Steel's planned Yawata furnace, to be powered by a captive LNG plant, is a useful case study of what the gas route means in practice.

AUTHORS Liying Qiu (Lilly), Senior Research Associate, Transition Asia
Akira Kanno, Research Analyst, Transition Asia

THE CRISIS

Gas dependence is Japan's structural risk.

¥25tn a year on fossil-fuel imports. For 50 years, energy security has meant securing more fossil fuel.

THE CASE STUDY

The gas route carries the crisis into steel costs.

A short fuel buffer, full exposure to gas price shocks, and a grid that becomes cleaner before the plant starts.

WHAT MUST CHANGE

Steel's next furnaces, and how Japan defines energy security.

Government: fund round-the-clock clean power contracts, not just the bills. **Investors:** price the risk: a ¥30–136bn/yr carbon bill by 2040, a plant that stays above the near-zero steel line, and LNG contracts still unsigned.

Japan is in its third gas crisis in 5 years

- **January 2021:** a winter supply squeeze tripled Asian spot LNG prices in weeks.
- **Late 2021 to 2022:** a global supply squeeze, then Russia's invasion of Ukraine, set off a bidding war for LNG.
- **March 2026, ongoing:** the Strait of Hormuz closed. Asian spot LNG went from about \$11 to \$24.8/MMBtu in 10 days, and crude oil rose 70% in 3 months (\$69 to \$117 a barrel), which feeds into oil-linked gas contracts a quarter later.

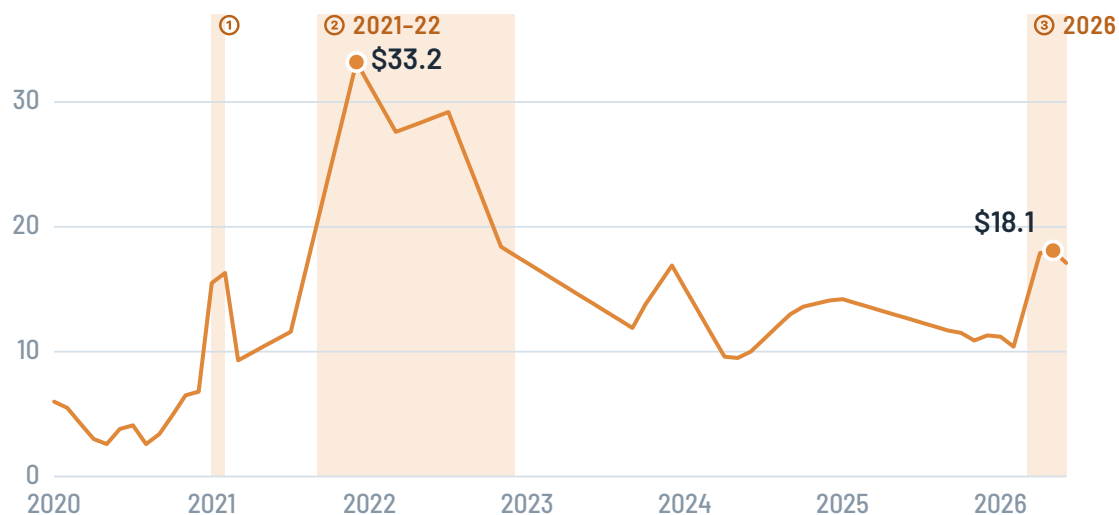
2.3×

Asian spot LNG in 10 days,
March 2026 ([Platts via METI](#)).

+70%

Japan's crude import price,
March to June 2026.

LNG spot price arriving in Japan, \$/MMBtu, monthly (METI)



Monthly averages of arriving cargoes; daily spot prints run higher. Months METI did not disclose are interpolated.

Sources: [METI spot LNG price survey](#) (chart and monthly spot prices; the March 2026 move is Platts JKM as reported by METI); Japan Crude Cocktail (JCC) series from [JOGMEC](#), based on MOF trade statistics (crude price); IEA Gas Market Reports (2021-22 events). Percentage changes: TA analysis.

Fossil dependence is a structural cost, and securing more fuel has not reduced it

¥25tn

Japan's yearly bill for imported fossil fuels (¥35.3tn in FY2022).

80%

Fossil share of primary energy in 2024, down only from 94% in 1973.

¥2.5tn

FY2026 contingency reserve for the Middle East situation, on top of about ¥1tn a year of fuel price subsidies.

For 50 years, Japan's energy-security policy has mostly meant securing fossil fuel: more suppliers, a switch from oil to gas and coal, stockpiles, and now price subsidies. That spread the risk across suppliers but kept the dependence. Most of the fall from 94% to 80% came from renewables, which rose from 1% to 12% of primary energy ([JCLP opinion paper, 30 July 2026](#)).

The government is now finalising an energy-security package in response to the Hormuz crisis. What it funds will shape Japan's exposure to the next crisis.

Sources: [MOF trade statistics](#) and [METI energy statistics](#) and budget documents, as compiled in the [JCLP opinion paper of 30 July 2026](#); [cabinet agendas \(kantei.go.jp\)](#).

Where steel goes electric, its power source decides its crisis exposure

Japanese steelmakers are replacing coal-fired blast furnaces with electric arc furnaces (EAF) that melt scrap. That cuts coal use but makes electricity a primary raw material: about 650 kWh per tonne, or 1.3 TWh a year for a 2 Mt furnace. Power costs about 6% of the hot-rolled coil price in normal times. In a gas-price spike, fuel bought at spot prices can push it to about 25%.

- Nippon Steel Yawata: 2 Mt/yr, from the early 2030s
- JFE Steel Kurashiki: planned conversion
- Nippon Steel Košice, Slovakia: 1.6 Mt/yr from 2030

	GRID + RENEWABLE CONTRACTS	CAPTIVE LNG PLANT
Exposed to	Grid prices, partly hedged by fixed-price contracts	LNG prices, the yen, and cargo supply
Emissions	Fall with the grid every year	Fixed for the plant's life
Near-zero steel	Reached as the grid cleans up, by about 2040	Not reached at 0.359 kg/kWh
Example	Nippon Steel, Košice (Slovakia)	Nippon Steel, Yawata (Japan)

Nippon Steel is using both routes: grid power in Slovakia and a captive LNG plant at Yawata. Yawata is the case study here.

Note: Slovakia is not part of our modelling; it shows only that the grid route is already a live option for a Japanese steelmaker.

Sources: EAF power use of 600–650 kWh per tonne including auxiliaries (Tokyo Steel), reported by [Nikkei, 9 April 2025](#); we use 650 kWh/t, so 650 kWh/t × 2 Mt = 1.3 TWh a year. Power-cost share of the hot-rolled coil price: TA analysis at 2020–2026 prices (TA analysis workbook, tab '2 Replay').

Yawata: a 2 Mt electric furnace on its own 2 GW LNG plant

ITEM	PLAN
Steel	2 Mt/yr electric arc furnace, around 85% scrap charge, ~650 kWh of electricity per tonne
Power	4 × ~500 MW gas turbines (combined cycle), units start 2031, 2033, 2036 and 2041; ~25-year life to about 2056
Fuel	LNG through the shared K-LNG terminal at Tobata (Kyushu Electric 75%, Nippon Steel 25%), 480,000 m ³ of tanks
Fuel contracts	Expected to be signed around 2027–29, before the first unit runs
Scale	~12 TWh/yr at full fleet, burning ~1.55 Mt of LNG a year
Stated case	Power emission factor "almost halved" against a 0.73 kg/kWh benchmark, to ~0.36

Methodology: we compare 2 ways of powering the same Yawata furnace, with the site, years and Kyushu prices held identical: the LNG plant as planned, and the Kyushu grid with renewable power purchase agreements (PPAs) for part of it. We price both at real 2020–mid-2026 market prices, and in 4,000 possible futures built from 2017–2026 history, both crises included. The full methodology is in the appendix.

Source: Nippon Steel, [environmental impact assessment scoping brochure](#) (環境影響評価方法書あらまし), Nov 2025, and [earlier planning-stage brochure](#) (配慮書あらまし), Apr 2025. Terminal: [K-LNG company profile](#) (Kyushu Electric 75%, Nippon Steel 25%) and [terminal facilities](#) (8 tanks of 60,000 kL).

On gas power, a crisis price turns into a steel cost: ¥30,600 per tonne at the 2022 spot peak

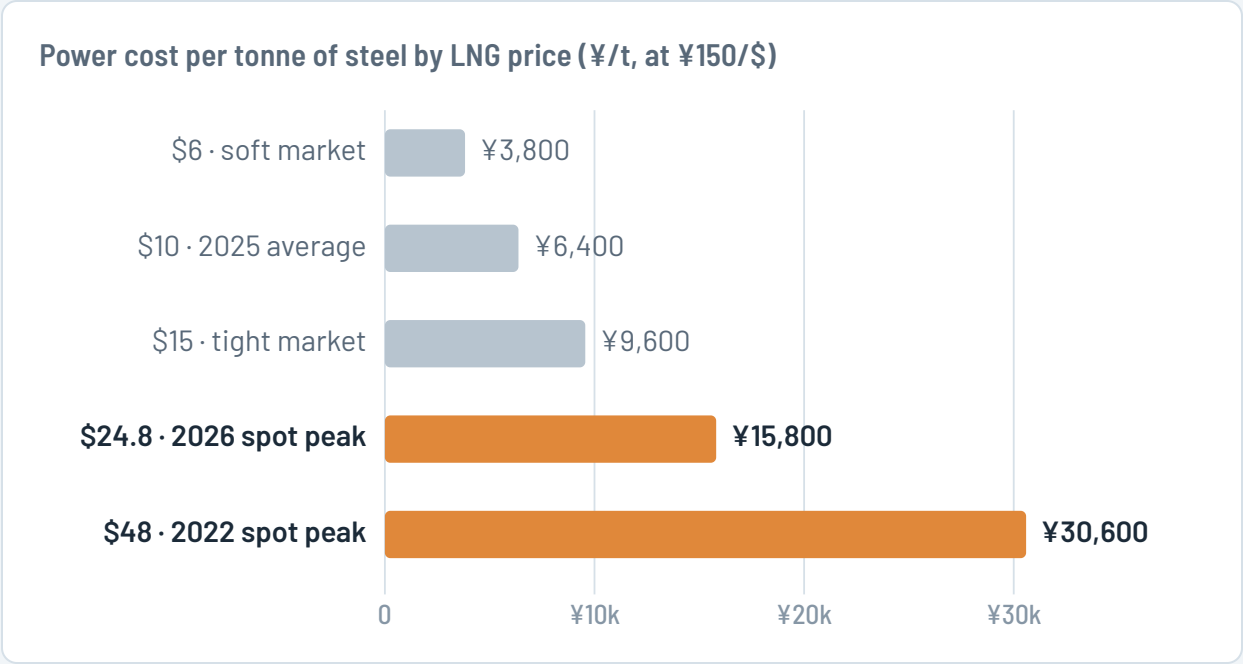
5×

Normal power cost per tonne is about ¥6,400 at a \$10 gas price.

25%

Of the hot-rolled coil price at the time (¥124,000/t) if all fuel were bought at that spot price. About 6% normally. With the Balanced contract mix (page 7), the 2020–2026 peak was about 9%.

A captive LNG plant passes the fuel price straight into the cost of steel. The 2026 spot peak so far (\$24.8 in March) reads about ¥15,800/t on the same scale, 2.5 times normal. The yen is weaker in 2026 (about ¥160/\$ against ¥135 in 2022), so the real 2026 figure runs higher than the chart shows.



Source: TA analysis; hot-rolled coil price: Tokyo Steel.

Oil-linked contracts protect buyers from price shocks, but less each time

35%

How much cheaper the heavily termed mix was than the spot-exposed mix in 2022.

26%

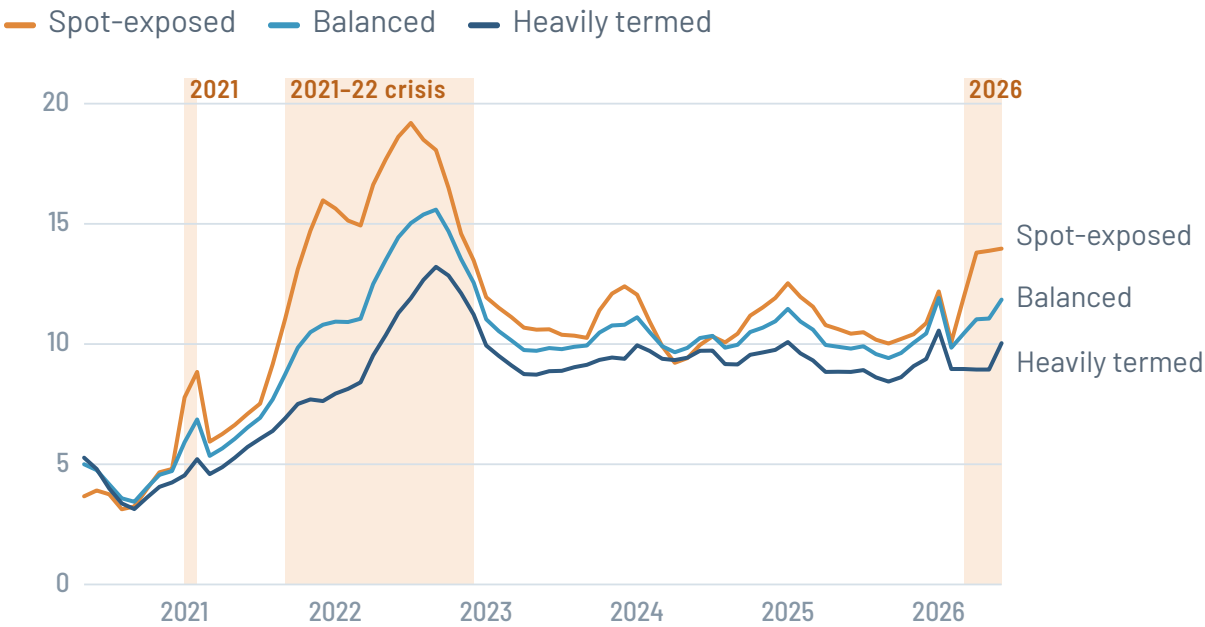
The same discount in the first half of 2026, and shrinking.

What we compare: Yawata's LNG contracts are not yet signed, so we price 3 possible fuel-buying mixes, each a blend of 3 contract types. **Oil-linked** contracts track crude prices; **US-gas-linked** contracts track the US Henry Hub price; **spot** cargoes pay the Asian market price of the day.

In 2022 gas spiked while oil rose moderately, so oil-linked buyers were sheltered. In 2026 the Hormuz closure pushed oil up 70% in 3 months (\$69 to \$117 a barrel). Oil-linked prices follow crude with a 2–4 month lag, so termed buyers are hit a quarter later: their cost jumped 12% in June 2026 alone.

In 2022 the gap between the two structures was worth **¥71bn a year** at Yawata's scale. Neither end is safe: spot brings price risk, and long-term contracts bring a longer gas commitment with shrinking protection.

Captive power fuel cost by contract structure, ¥/kWh, actual monthly prices



MIX	OIL-LINKED	US-GAS-LINKED	SPOT
Heavily termed	67%	28%	5%
Balanced (central)	44%	36%	20%
Spot-exposed	18%	32%	50%

Source: TA analysis.

The fuel buffer lasts days. LNG supply outages last months.

11 days

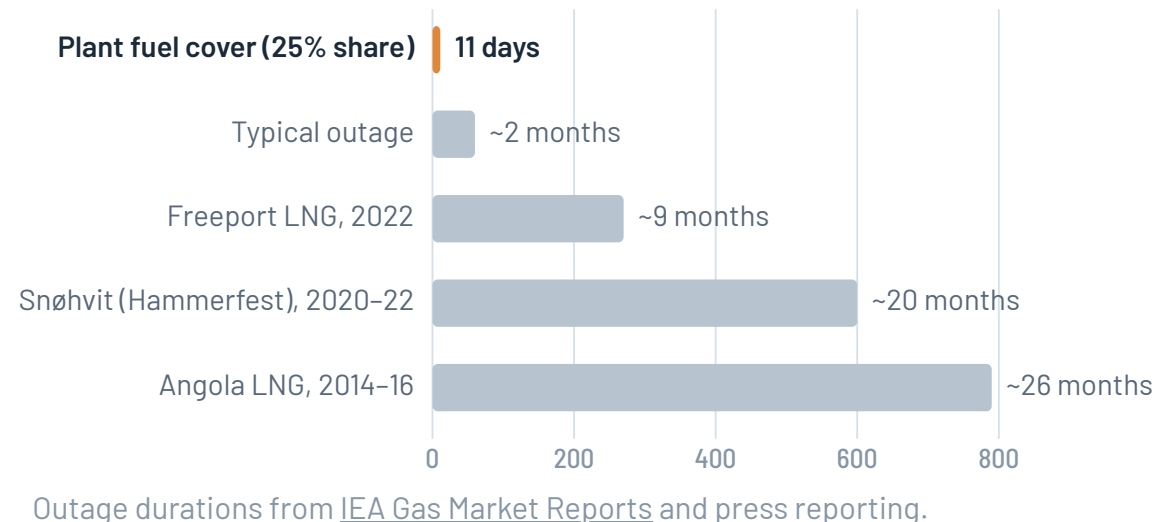
Fuel for the full 2 GW plant running 70% of the time (about 1.55 Mt of LNG a year), at Nippon Steel's 25% equity share of the shared tanks.

46

Unplanned liquefaction outages worldwide in 2021, about 4 times a normal year, while spot prices tripled.

- **Fuel cover:** 4.6 days at today's throughput share (about 10%) and 25 days if the share were renegotiated to 55%. Running only the furnace and idling the rest of the works would stretch the equity-share fuel to about 108 days.
- **Prices and volumes fail together:** one illustrative episode (30% of supply lost for 3 months, replaced at \$30) costs about ¥27bn, if replacement cargoes exist at all.

Fuel cover against documented LNG supply outages, days

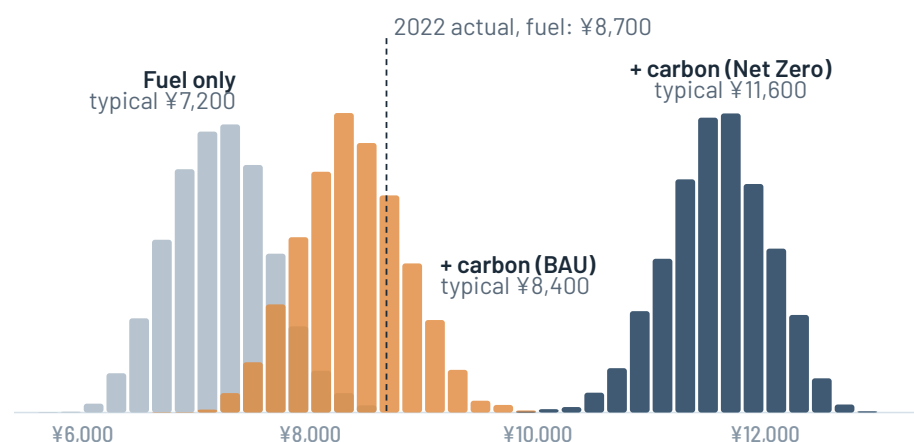


Source: [IEA](#), TA analysis.

A bad gas year hurts margins, not solvency. Carbon is the bigger cost.

Cost of the worst 12 months in each of 4,000 possible futures (2031–2045), ¥ per tonne of steel

— Fuel only — + carbon, business-as-usual — + carbon, Net Zero



How we built it: we reshuffled real 2017–2026 prices, both crises included, into 4,000 possible futures, priced the plant's power in each (Balanced contract mix, switching to grid power when cheaper), and took the most expensive 12 months in a row. Each bar counts futures. ¥/t = cost per kWh × 650 kWh per tonne, as on page 6.

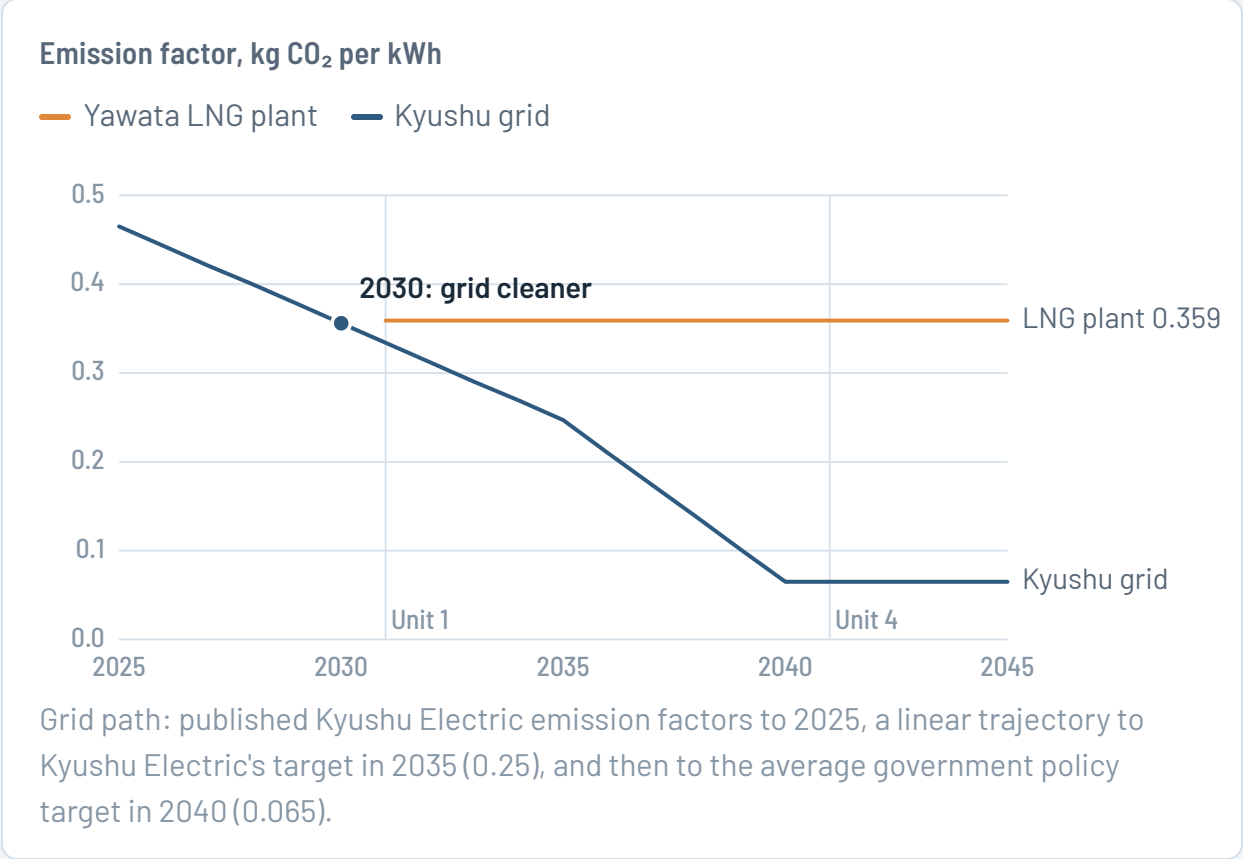
Source: TA analysis.

- A typical bad year costs about ¥7,200/t in fuel. A 1-in-20 bad year costs about ¥8,000/t: ¥750/t more.
- For the company, that ¥750/t is about ¥16bn across the whole plant, or 1.1% of Nippon Steel's ¥1.48tn cash and credit lines (1.0–1.6% across all contract mixes and carbon paths). Painful for margins, not a solvency threat.
- Carbon moves the whole bill up without widening that gap: about + ¥1,200/t on the business-as-usual path and +¥4,400/t on the Net-Zero path.
- 2022 was worse than every future here. A full year at 2022 prices (¥8,700/t) does not appear in any of the 4,000, because the simulation strings together 5-month pieces of history; the worst reaches about ¥8,600/t. Even a 2022 repeat would cost about ¥28bn, or 1.9% of liquidity.
- The risk to watch is a fuel spike, a steel downturn and the Yawata capital programme landing in the same years.

Carbon paths (GX-ETS allowance price, ¥/t CO₂): business-as-usual rises from ¥1,700 in 2026 to ¥6,900 in 2040; Net Zero follows the IEA Net Zero path to ¥30,800 in 2040. Paid allowances phase in from 20% in 2033 to 100% in 2040. Cost-side only: steel prices rose with fuel in both crises, so net exposure is smaller than shown.

Kyushu's grid becomes cleaner than the LNG plant in 2030, before it starts

The plant's emission benefit is stated against a coal-era benchmark (0.73 kg/kWh). For a new plant, the relevant comparison is the grid it would otherwise buy from, and the grid keeps improving over the plant's 25-year life. By 2040 the grid is at about 0.065 kg CO₂/kWh; the plant stays at 0.359, on the company's published figure.



Source: MOE/METI emission factors by electricity supplier (Kyushu Electric, to 2025); Kyushu Electric 2035 target; Strategic Energy Plan (2040); Nippon Steel (plant factor); TA analysis.

The plant brings its own carbon bill and keeps its steel above the near-zero line

4.4 Mt CO₂/yr

Added to Nippon Steel's own obligation under GX-ETS at full fleet. A grid buyer avoids most of it.

¥30–136bn

Per year at 2040 carbon prices (business-as-usual to IEA Net Zero), with full auctioning.

278 vs 110 kg CO₂/t

Emissions per tonne of steel made with the LNG plant's power, against about 110 kg: the IEA's "near-zero" steel line for a furnace melting ~85% scrap.

¥40bn

Per year of green-steel tax credit (¥20,000/t × 2 Mt). Paid on either route: the rule rewards the switch to an electric furnace, not the power behind it.

- **When each option qualifies:** grid-supplied steel crosses the near-zero line by 2040 on the grid path alone, earlier with renewable contracts added. Steel from the LNG plant never does, or only around 2048 under the full co-firing pledge.
- **Arithmetic:** 650 kWh/t × 0.359 kg/kWh + 45 kg of process emissions ≈ 278 kg/t. Threshold 400 – 350 × 0.83 ≈ 110 kg/t.

The tax credit covers steel made in an electric furnace that replaces blast furnaces ([METI Ordinance No. 16, March 2025](#)). Its CO₂ condition, a 50% cut against the blast-furnace route, is met by any electric furnace whatever its power source. The near-zero line is the [IEA sliding scale](#) used by buyers and standards such as ResponsibleSteel. The carbon bill is smaller if new captive plants receive free allocation, which is one of our policy asks.

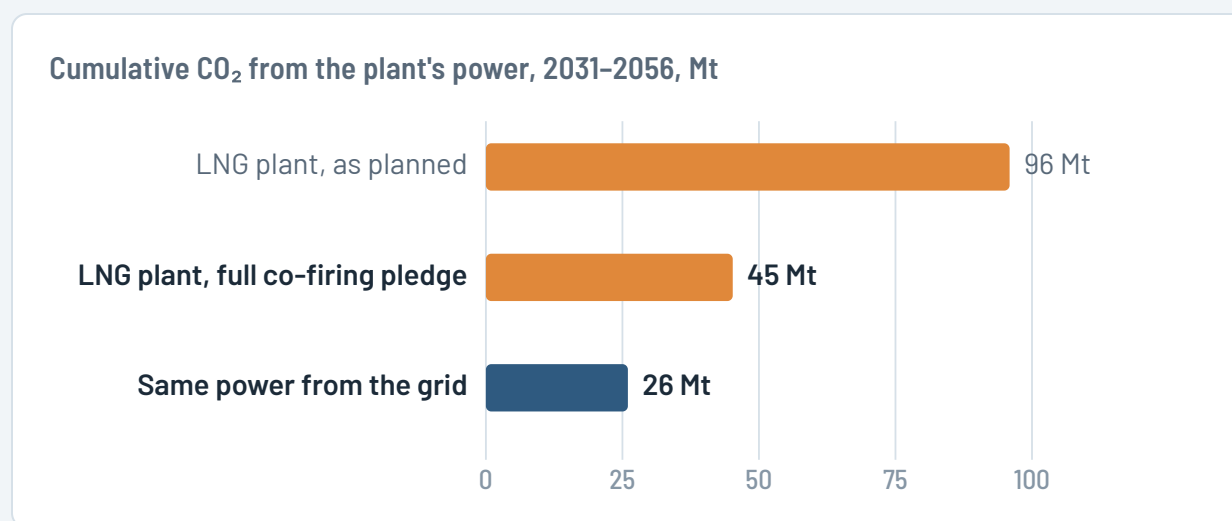
Source: METI (tax credit), IEA (near-zero threshold), Nippon Steel, TA analysis.

Even the hydrogen co-firing pledge leaves 1.7× the grid's emissions

The company's stated co-firing ambition is also not sufficient: with the emission factor flat to 2040, then falling in a straight line to zero by 2050, the crossover year and the 2040 carbon bill do not move, because the decline starts after both.

- Co-firing shares are usually quoted by volume. Hydrogen carries about 30% of methane's energy per unit of volume, so "30% hydrogen" cuts CO₂ by only about 11%.
- Reaching zero means firing close to 100% hydrogen or ammonia, at roughly 3 to 4 times the fuel cost of LNG, almost all of it imported.

Public information does not yet give committed volumes, dates or fuel contracts, so we treat the ambition as a scenario rather than the central case. Grid held at its 2040 value after 2040, which understates the grid's advantage.



Source: TA analysis.

The LNG plant is cheaper than spot power, but the grid spreads gas risk.

On cost, the LNG plant wins: if the electricity the LNG plant would generate (rising to about 12 TWh a year at full build-out) were bought entirely at Kyushu spot prices, it would cost about ¥114–131bn a year against the LNG plant's ¥95bn, capital included (2029–2045). Grid power is not gas-free. Its case is how it handles gas risk over time:

- **Many fuels, not one.** Gas is one source among nuclear, coal, solar, hydro and geothermal. When LNG is short or expensive, other plants carry more load. The LNG plant has no second fuel.
- **Pooled supply.** The grid draws on several terminals, large utilities' long-term LNG portfolios and interconnectors to the rest of Japan. The LNG plant relies on one shared terminal.
- **Hedgeable.** A grid buyer can fix part of its price with renewable contracts (next page).
- **Less gas every year.** Renewables become the largest power source by 2040 under national policy, so a grid buyer's gas exposure shrinks. The LNG plant fixes its fuel to about 2056.
- **Flexible demand.** A furnace can shift melting into sunny hours, using solar Kyushu would otherwise curtail.

	GRID + RENEWABLE CONTRACTS	CAPTIVE LNG PLANT
Fuels behind the power	Nuclear, coal, solar, gas, hydro, geothermal	LNG only
Fuel supply	Many terminals, utility portfolios, interconnectors	One shared terminal, ~11 days at its share
Price protection	Fixed-price renewable contracts	Depends on LNG contracts not yet signed
Gas share over time	Falls as the grid adds renewables	Fixed to ~2056

The grid's gas exposure enters through real spot prices from 2020 to mid-2026. The diversity and pooling advantages above are qualitative; we do not simulate a physical shortage on the grid, which would hit both routes. Nor do we model plant-level differences such as the efficiency of the gas units behind grid power, or whether Kyushu's grid can connect and firmly serve a furnace load of this size. Grid readiness is the next question, and it needs steelmakers, utilities, grid operators and METI to work on it together.

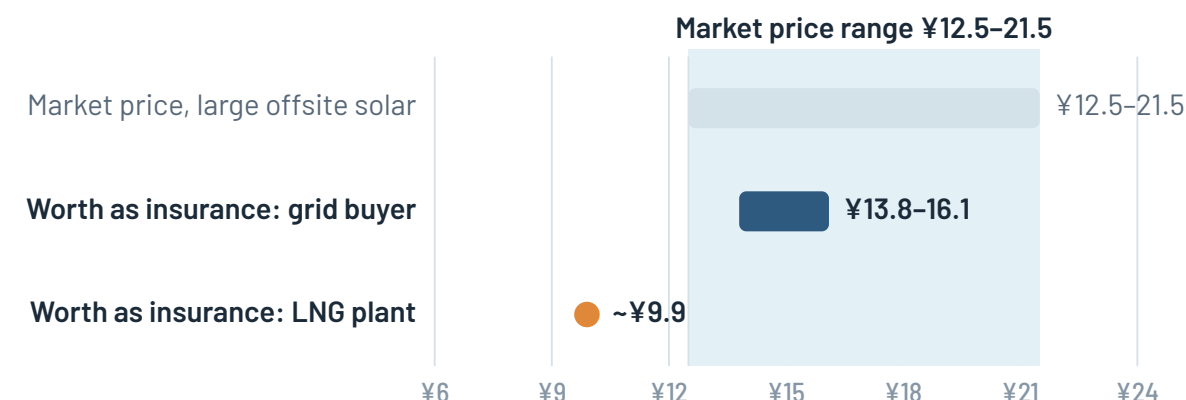
Source: JEPX Kyushu prices, TA analysis.

Renewable contracts protect grid buyers from price spikes. Backing them also speeds the grid's shift.

As crisis insurance, a fixed-price solar contract is worth up to **¥14–16/kWh** to a grid buyer, because it hedges real grid price spikes.¹ That sits inside today's market price range for large offsite solar contracts, ¥12.5–21.5/kWh. Bolted onto the LNG plant, the same contract is worth about ¥9.9/kWh, below the market: the plant already has a thin cost tail, so there is less left to insure. Contracts for new solar and wind plants also add clean capacity to the grid, so supporting them protects buyers and speeds the grid's shift.

- Solar-only contracts stop adding protection at about 25% of demand, because they deliver at midday while crisis exposure sits in winter evenings. Wind and storage could lift that ceiling, but Japan's contracts so far are small (Amazon Japan 33 MW, Tokyo Metro 18 MW) against the roughly 150 MW a 2 Mt furnace draws on average, and storage-backed contracts are still at pilot stage (Azbil, Clean Energy Connect).² Closing that gap is what policy support is for.
- Kyushu curtailed between 4.5% and 9.1% of its solar output each year in 2023–2025. An electric arc furnace can shift melting into those hours.³

Value of a solar contract as crisis insurance, ¥/kWh



At about ¥9.9/kWh, a solar contract would pay as insurance even for the LNG plant. That is below today's market range, so cheaper solar or policy support could close the gap.

¹ In the same 4,000 futures, we add a fixed-price solar contract covering 30% of demand, delivered on Kyushu's real half-hourly solar profile, and raise its price until it stops paying off, meaning each ¥1 of extra average cost no longer cuts at least ¥1 from the 1-in-20 bad-year cost. The range spans carbon passing into grid prices from none to all. Market range: announced large offsite solar deals, JCLP/RE100 disclosures and BNEF (register D04). ² Renewable Energy Institute, *Corporate PPA Latest Trends in Japan* (2025); Zenbird, 30 August 2026; *Azbil news release*, 17 February 2025. ³ Kyushu Electric Transmission & Distribution, *2025 curtailment outlook* (2025年度出力制御見通し), METI Next-Generation Grid Working Group, 24 September 2025.

Yawata shows how gas dependence reaches steel. It points to two changes.

WHAT YAWATA SHOWS	CHANGE 1 · FOR STEELMAKERS AND INVESTORS	CHANGE 2 · FOR POLICYMAKERS
Gas price shocks pass straight into steel costs, and contract protection is fading	Contract exposure is a material risk that investors should see disclosed	Subsidising fuel prices treats the symptom
11 days of fuel against outages lasting months	Captive gas alone does not secure a furnace's power supply	More fuel supply cannot close the gap at plant level
The grid is cleaner from 2030; the plant adds 4.4 Mt CO ₂ a year	Gas capacity after 2040 is a stranded-asset candidate	A new LNG plant should be judged against the grid, not against coal
The ¥40bn-a-year green-steel tax credit is paid whether or not the furnace runs on gas	The tax credit does not favour either route; low-emission steel buyers do	Credit rules can steer every new furnace to clean power at no extra fiscal cost
Renewable contracts pay as insurance for grid buyers	The grid route is investable and already in use in the sector, for example at Košice	Market design, not more fuel, is what unlocks secure clean power

Steel's next electric furnaces should be benchmarked against the grid route

Yawata may be locked in; the furnaces that follow it are not. Nippon Steel's own furnace in Slovakia shows that the grid route is already on the table.

Investment case

Benchmark against grid power plus renewable contracts

Compare any captive plant with the grid route over the plant's full life, with carbon costs and low-emission steel sales included. The LNG plant wins on today's expected cost; that edge narrows as carbon prices rise and the grid cleans up.

Plant design

Build the furnace to melt flexibly

Kyushu curtailed 4.5–9.1% of its solar output each year in 2023–2025. A furnace that can shift melting into those hours turns surplus clean power into a cheap input.

Power procurement

Contract for clean power around the clock

Solar-only contracts stop adding protection at about 25% of demand. Wind- and storage-backed contracts carry it further. To a grid buyer, a fixed-price solar contract is worth ¥14–16/kWh as crisis insurance.

Fuel commitments

Keep any gas commitment short and switchable

The grid is cleaner than the LNG plant from 2030. Fuel contracts and plant plans that leave room to move onto the grid avoid locking in 25 years of gas exposure.

Investors should price the gas route's carbon and combined-stress risk, not just its fuel cost

Liquidity

Fuel risk is a margin risk, until it combines

A 1-in-20 bad gas year adds about ¥16bn, roughly 1% of Nippon Steel's ¥1.48tn cash and credit lines. The draw would be much higher if it landed alongside a steel price slump and the Yawata construction spending.

Carbon

Carbon is the bigger, surer cost

4.4 Mt CO₂ a year: ¥30–136bn a year at 2040 carbon prices, from business-as-usual to Net Zero.

Asset life

Gas capacity after 2040 is a stranded-asset candidate

By then the grid runs at under 20% of the plant's emission factor, and the plant is planned to run to about 2056.

Before backing the next furnace, ask for

- **A grid benchmark:** a grid-plus-renewable-contract case with carbon costs and low-emission steel sales.
- **Contract structure:** the planned mix of oil-linked, US-linked and spot LNG, how long it runs, and who bears a 2022- or 2026-style price event.
- **Fuel security:** the firm storage entitlement at K-LNG, and the plan for a supply outage lasting months.
- **Carbon cost:** the GX-ETS price assumed in the investment case, and whether it relies on free allocation.
- **Green steel:** how the steel will be certified and sold as low-emission, at about 278 kg CO₂/t against a near-zero line of about 110.
- **Co-firing:** hydrogen or ammonia share by energy (not volume), start year, and fuel cost.

Energy security should mean less fossil exposure, not more fossil supply

This is not only a climate position. A 237-company business coalition ([JCLP, opinion paper of 30 July 2026](#)) makes the same argument on energy-security grounds, and the government's own plan makes renewables Japan's largest power source by 2040.

	THE PREVAILING NARRATIVE	WHAT THE EVIDENCE SUPPORTS
Security means	Securing fuel: more suppliers, stockpiles, subsidies	Needing less imported fuel in the first place
Gas is	A stable bridge fuel	The source of 3 price crises in 5 years
A new LNG plant is compared with	Coal	The grid it actually competes with, which is cleaner from 2030
Crisis money goes to	Price subsidies (about ¥1tn a year) and reserves (¥2.5tn)	Clean power industry can buy around the clock: storage, wind, grids
Heavy industry is	A price-taker to be shielded	Flexible demand that can absorb clean power, such as electric furnaces using curtailed solar

4 policy decisions can steer the next furnaces to clean power

Green-steel tax credit · METI ordinance, March 2025

Add a carbon-intensity condition on the electricity used

Today the ¥20,000/t credit is defined by process: steel from an electric furnace that replaces blast furnaces. It pays the same whether the furnace runs on captive gas or clean power. An intensity condition would steer every new furnace to clean power at no extra fiscal cost.

Energy-security package · being finalised

Fund clean power that industry can buy around the clock

Support storage- and wind-backed renewable contracts, and let electric furnaces absorb Kyushu's curtailed solar through flexible melting. Plan the grid connections new furnaces need with utilities, grid operators and steelmakers together. This reduces exposure; further fuel subsidies (about ¥1tn a year plus a ¥2.5tn reserve) only pay for it.

GX-ETS design · auction phase-in 2033–2040

No free allocation for new-build captive fossil generation

A plant financed around 2027 on soft allocation assumptions locks in 25 years of emissions that the grid alternative avoids.

Yawata environmental review · Fukuoka, Kitakyushu, MOE, METI

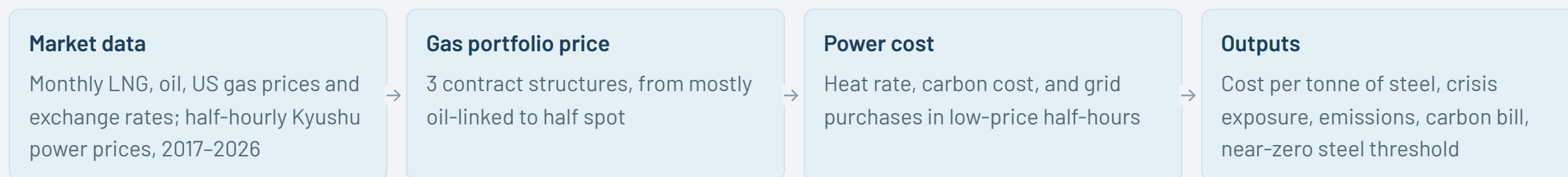
Assess new captive plants against the grid, not only against coal

Require any co-firing claim to state the share by energy, the start year and the fuel cost, and test it against the grid's emission path.

Japan's energy shocks come from fossil dependence. The next electric furnaces can reduce that exposure, or add to it.

The Yawata case shows that a captive LNG plant leaves a furnace exposed to gas crises and keeps its steel above the near-zero line for the plant's life. The grid route spreads that risk and offers a path to near-zero steel. The rules now being written, and the furnaces being financed next, decide which route Japanese steel takes.

Methodology: LNG- vs grid-powered steelmaking on real prices and 4,000 simulated futures



1 • Historical replay (January 2020–June 2026)

We apply observed monthly fuel prices and half-hourly Kyushu power prices to the plant as configured, and calculate the cost of power per tonne of steel for each route. The same calculation gives fuel storage cover, emissions, the carbon bill and the gap to the near-zero steel threshold. All inputs are public data.

2 • Monte Carlo simulation (2029–2045)

We resample observed 2017–2026 price history, including both recent crises, to build 4,000 price paths for 2029–2045 and price the plant's power in each. As a validation, running the simulation on the actual 2020–2025 prices reproduces the historical replay.

Data sources: [METI spot LNG survey](#) · [Japan Crude Cocktail \(customs\)](#) · [Henry Hub and USD/JPY \(FRED\)](#) · [JEPX Kyushu 30-minute prices](#) · [Kyushu Electric T&D area solar actuals](#) · [Tokyo Steel hot-rolled coil prices](#) · [K-LNG terminal data](#) · [GX-ETS](#) and [IEA carbon price paths](#) · [company filings](#). Central assumptions are on the next page.

Central assumptions

PARAMETER	VALUE	BASIS
LNG plant efficiency	58% LHV	Between a modern combined-cycle rating (~63% LHV) and METI's benchmark for new LNG thermal (50.5% HHV, about 56% LHV)
Gas price basis	HHV	LNG prices per MMBtu are on a gross (HHV) basis, so fuel bought per kWh is the heat rate $(3.6 \div 58\%) \div 0.9$
LNG plant emission factor	0.359 kg/kWh	Nippon Steel: "almost halved" from 0.73 kg/kWh
Capacity factor	70%	Operating hours assumed in Nippon Steel's environmental impact assessment
Furnace electricity	650 kWh/t	Operational, incl. auxiliaries
Exchange rate	¥150 /\$	Central assumption for 2029-2045
Grid add-ons	¥4.6 /kWh	Wheeling 2.0 + capacity 1.9 + levy 0.7 (after 80% exemption)
Carbon price, 2040	¥6,910-30,750 /t	GX-ETS business-as-usual: ¥1,700 (2026) to ¥6,900 (2040); Net Zero: IEA path, \$205/t at ¥150/\$
Auctioned allowances	20% → 100%	2033 → 2040 phase-in
LNG plant capital cost	¥150,000 /kW	WACC 5.5%, 25 years

Sources: Nippon Steel, [environmental impact assessment scoping brochure](#) and [planning-stage brochure](#); METI, [generation cost verification working group](#); METI, [GX-ETS design materials](#) and [IEA World Energy Outlook 2025](#). Values not sourced there are this analysis's central assumptions.

3 LNG contract structures

STRUCTURE	OIL-LINKED	US-GAS-LINKED	SPOT
Heavily termed	66.5%	28.5%	5%
Balanced (central)	44%	36%	20%
Spot-exposed	17.5%	32.5%	50%

Yawata's LNG procurement contracts are not yet signed, so we test 3 mixes. Each is a spot share plus a split of the term volume between oil- and US-linked contracts. *Heavily termed*: 5% spot, term split 70/30, as in Japan's contract stock in FY2024. *Balanced* (central): 20% spot, 55/45. The 20% is close to how Japan buys today: spot and short-term cargoes (contracts of up to 4 years) were 15–33% of imports in 2017–2021 (GIIGNL), and the regression below puts the spot-priced share at about 17%. It also leaves room for a plant whose gas burn can flex with grid prices. *Spot-exposed*: 50% spot, 35/65, as in JOGMEC's projection for FY2035. Japan's portfolio today is more oil-indexed still (about 84% in a regression of import prices on oil, spot and US gas prices), but Yawata's contracts will be new ones, signed around 2027–29, and new contracts lean more to US-linked pricing.

How each price is built

CONTRACT	PRICE, \$/MMBTU	WHERE THE TERMS COME FROM
Oil-linked	$\text{slope} \times \text{JCC} + 0.5$	JCC is the average cost of crude imported into Japan (\$/bbl), averaged over the 2nd to 4th month before delivery, because these contracts reprice with a lag. Slope: 11.5% heavily termed, 13.5% balanced, 14.4% spot-exposed, the range and weighted average of long-term contracts signed in 2024 (GaffneyCline for the ACCC); longer, more rigid contracts buy the lower slope. The \$0.5 constant follows JOGMEC's worked example (published constants run \$0.3–1.0).
US-gas-linked	$1.15 \times \text{HH} + 3.0 + 1.6$	The buyer pays 115% of the Henry Hub (HH) gas price for feed gas, the extra covering gas used up in liquefaction (US EIA); a fixed liquefaction fee of \$3.00, the indicative level for long-term US contracts (Argus, 2025; fees typically \$2.25–3.50); and \$1.6 shipping to Japan, the middle of a \$0.85–2.37 range.
Spot	METI monthly price	METI spot LNG survey, arrival basis. Months METI does not disclose are interpolated.

Example, balanced mix with crude at \$80/bbl, Henry Hub at \$3.5 and spot at \$12: $0.44 \times (0.135 \times 80 + 0.5) + 0.36 \times (1.15 \times 3.5 + 4.6) + 0.20 \times 12 =$ \$10.5/MMBtu.

References

Market data

- METI, [spot LNG price survey](#) (monthly arrival prices), 2017–2026.
- Ministry of Finance, [Trade Statistics of Japan](#): Japan Crude Cocktail and customs LNG prices.
- US EIA Henry Hub and USD/JPY series (FRED); World Bank Commodity Price Data.
- JEPX, [30-minute day-ahead prices, Kyushu area](#).
- [Kyushu Electric Power Transmission & Distribution](#): area solar output, [curtailment \(出力制御\)](#) and [wheeling tariffs](#).
- [OCCTO, capacity market auction results](#).
- [Tokyo Steel, hot-rolled coil list prices](#).
- US EIA, [Ten years after the first Sabine Pass cargo](#) (24 February 2026), and Argus, [US LNG margins tighten on higher Henry Hub prices](#) (2025): US contract terms.
- [JOGMEC, LNG contract survey](#); [GaffneyCline for the ACCC, LNG price estimates](#) (oil slopes).
- [IEA, Gas Market Reports](#) (supply outage history).

Policy and regulation

- METI Ordinance No. 16 (25 March 2025), [産業競争力基盤強化商品に関する省令](#), and the [戦略分野国内生産促進税制](#) materials; National Tax Agency, [Tax Answer No. 5922](#).
- [MOE/METI, utility-specific emission factors \(電気事業者別排出係数\)](#).
- [METI, GX-ETS design materials](#); [IEA World Energy Outlook carbon price paths](#).
- [METI, generation cost verification working group](#) (LNG plant capital cost).
- [Cabinet Office agendas on the energy-security package](#) ([kantei.go.jp](#)).

Company and project

- Nippon Steel, [integrated report](#) and [carbon-neutral vision](#) (Yawata plan, 0.73 kg/kWh benchmark).
- Nippon Steel, FY2025 [決算短信](#) (13 May 2026) and [有価証券報告書](#) (cash and committed credit lines).
- [Yawata power plant environmental impact assessment filings](#).
- [Kitakyushu LNG \(K-LNG\), terminal storage capacity disclosure](#) (31 July).

Reports and news

- Japan Climate Leaders' Partnership, [opinion paper on energy security](#), 30 July 2026. Transition Asia is a JCLP member.
- Nikkei, [Nippon Steel's Košice electric furnace](#), 16 September 2026.
- Nikkei, [electric furnace power use](#), 9 April 2025.
- [IEA, near-zero emission steel definitions](#); [ResponsibleSteel certification thresholds](#).

About this report

Disclaimer

This analysis is for informational purposes only and does not constitute investment advice, and should not be relied upon to make any investment decision. The report represents the authors' views and interpretations of publicly available information. The authors and Transition Asia expressly assume no liability for information used or published by third parties with reference to this report.

About Transition Asia

Founded in 2021, Transition Asia is a non-profit think tank dedicated to accelerating decarbonisation in Asia's materials and heavy industries to achieve the 1.5°C climate goal. Our multidisciplinary team combines diverse perspectives, experience and expertise, underpinned by a strong research foundation in Asia and a nuanced understanding of the region. Using analytical models and in-depth assessments, we evaluate and monitor corporations' decarbonisation efforts and actions. By engaging with stakeholders across sectors, including corporates, investors, policymakers and civil society organisations, we facilitate informed and impactful discussions that drive sustainable, low-carbon transitions aligned with a 1.5°C future.