

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

Japan is in its third gas crisis in 5 years and spends about ¥25tn a year on imported fossil fuels. At the same time its steelmakers are replacing blast furnaces with electric arc furnaces, so where those furnaces get their power now decides how exposed Japanese steel is to the next crisis. Nippon Steel's planned 2 Mt furnace at Yawata, to be powered by its own 2 GW LNG plant from 2031, is a case study of what the gas route means in practice.

¥30,600 /t

Power cost per tonne of steel at the 2022 spot LNG peak, against about ¥6,400 normally.

11 days

Fuel for the full plant at Nippon Steel's 25% share of the shared tanks. Supply outages last months.

2030

The year Kyushu's grid becomes cleaner than the LNG plant, before its first unit runs.

¥30–136 bn/yr

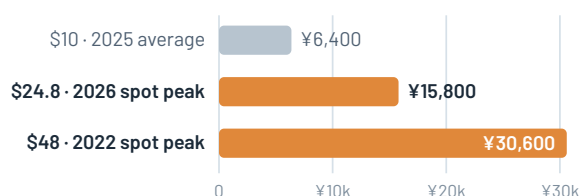
Yearly cost in 2040 of the plant's 4.4 Mt of CO₂, with all allowances paid: ¥30bn at current-policy carbon prices, ¥136bn on the IEA Net Zero path.

WHAT THE YAWATA CASE SHOWS

The gas route carries every LNG crisis into the cost of steel

- **Price shocks pass straight through.** A captive LNG plant turns the fuel price into a steel cost. At the March 2026 spot peak (\$24.8/MMBtu) power reads about ¥15,800/t, 2.5 times normal, and the weaker yen pushes the real figure higher.
- **Contract protection is fading.** Oil-linked contracts made the heavily termed mix 35% cheaper than the spot-exposed mix in 2022, but only 26% in the first half of 2026, as the Hormuz closure lifted oil as well as gas. Yawata's LNG contracts are not yet signed, and longer contracts would trade price risk for a longer gas commitment.
- **The buffer lasts days.** Documented LNG supply outages lasted 2 to 26 months, and prices and volumes fail together: one illustrative episode costs about ¥27bn, if replacement cargoes exist at all.
- **A margin risk, not a solvency risk.** In 4,000 simulated futures a 1-in-20 bad gas year adds about ¥16bn, roughly 1% of Nippon Steel's cash and credit lines. The danger is a fuel spike, a steel downturn and the Yawata capital programme landing together.

Power cost per tonne of steel on the LNG plant, by LNG price (¥/t, at ¥150/\$)



Assumes all fuel bought at that price. On the central contract mix, power peaked at about 9% of the hot-rolled coil price in 2020–2026, against about 6% normally.

And it keeps the steel above the near-zero line

- **The grid overtakes the plant before it starts.** Kyushu's grid falls below the plant's 0.359 kg CO₂/kWh in 2030 and to about 0.065 by 2040; the plant is planned to run to about 2056.
- **Steel stays at about 278 kg CO₂/t** against the IEA near-zero line of about 110 for this scrap share. Even the full hydrogen co-firing pledge leaves 1.7 times the grid's cumulative emissions.
- **The ¥40bn-a-year green-steel tax credit is paid either way:** the rule rewards the switch to an electric furnace, not the power behind it.

THE ALTERNATIVE: THE GRID PLUS RENEWABLE CONTRACTS

	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
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

On cost, the LNG plant wins today. The same electricity bought entirely at Kyushu spot prices would cost about ¥114–131bn a year, against the plant's ¥95bn with capital included. Grid power is not gas-free; its case is how it handles gas risk over time.

Renewable contracts are insurance for grid buyers, worth up to ¥14–16/kWh against a market range of ¥12.5–21.5, but only about ¥9.9 on the LNG plant. Nippon Steel's own new furnace in Slovakia will run on grid power from 2030.

WHAT MUST CHANGE

The electric furnaces still to be built are not locked in. Steelmakers and investors should judge new furnaces against the grid route, and policymakers should treat energy security as needing less imported fuel, not securing more of it.

STEELMAKERS

Benchmark the next furnace against the grid route

- **Investment case:** compare any captive plant with grid power plus renewable contracts over its full life, including carbon costs and low-emission steel sales.
- **Power procurement:** contract clean power around the clock, adding wind and storage to solar.
- **Plant design:** build furnaces that melt flexibly, using the 4.5–9.1% of solar output Kyushu curtails each year.
- **Fuel commitments:** keep any gas contract short and switchable.

INVESTORS

Price the carbon and combined-stress risk, not just fuel

- **Grid benchmark** with carbon costs and low-emission steel sales.
- **Contract structure:** the planned LNG mix, how long it runs, and who bears a 2022- or 2026-style event.
- **Fuel security:** the firm storage entitlement and the plan for an outage lasting months.
- **Carbon cost:** the GX-ETS price assumed, and any reliance on free allocation.
- **Green steel:** how 278 kg CO₂/t steel will be sold as low-emission.
- **Co-firing:** hydrogen or ammonia share by energy, start year and fuel cost.

POLICYMAKERS

Steer the next furnaces to clean power

- **Green-steel tax credit:** add a carbon-intensity condition on the electricity used, at no extra fiscal cost.
- **Energy-security package:** fund clean power industry can buy around the clock (storage, wind, grids), not only fuel subsidies (about ¥1tn a year plus a ¥2.5tn reserve), and plan new furnaces' grid connections with utilities and grid operators.
- **GX-ETS design:** no free allocation for new-build captive fossil generation.
- **Environmental review:** assess new captive plants against the grid, not only against coal.

HOW WE DID IT

We priced the same Yawata furnace on its own LNG plant and on the Kyushu grid with renewable contracts, at real 2020–mid-2026 prices and in 4,000 futures for 2029–2045 resampled from 2017–2026 history. Central case: 58% plant efficiency (LHV), 0.359 kg CO₂/kWh, 650 kWh/t, ¥150/\$, and an LNG mix of 44% oil-linked, 36% US-gas-linked and 20% spot.

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