



Financial risks and economic viability of coal power in Japan

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Who we are

Identity

Carbon Tracker is an independent non-for-profit financial think tank funded by EU and US foundations interested in climate.

Vision

To enable a climate secure global energy market by aligning the capital markets with climate science.

Mission

Mapping the transition for the fossil fuel industry to stay within a two degree budget.

Strategy

Empower investors to identify and switch off capital to the highest cost, highest carbon projects.



Engage with companies to re-assess both the viability of such projects and of their business model.



Educate mainstream financial markets and policy-makers over the risk of a disorderly transition.



Work with financial regulators to bring transparency on carbon and stranded asset risk and the fossil fuel risk premium.



REPORT BACKGROUND

Report background: policy and investment contradiction?

"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."

Long-term Strategy for Decarbonization, submitted to UNFCCC in June 2019

- **11 GW** of coal capacity planned and under-construction in Japan
- Coal build-out inconsistent with other countries:
 - EU28 and the US rapidly closing coal due to poor economics
 - Korea to temporarily suspend half of its fleet due to air pollution
 - India stalled construction due to solar and wind costs

MODELLING METHODOLOGY

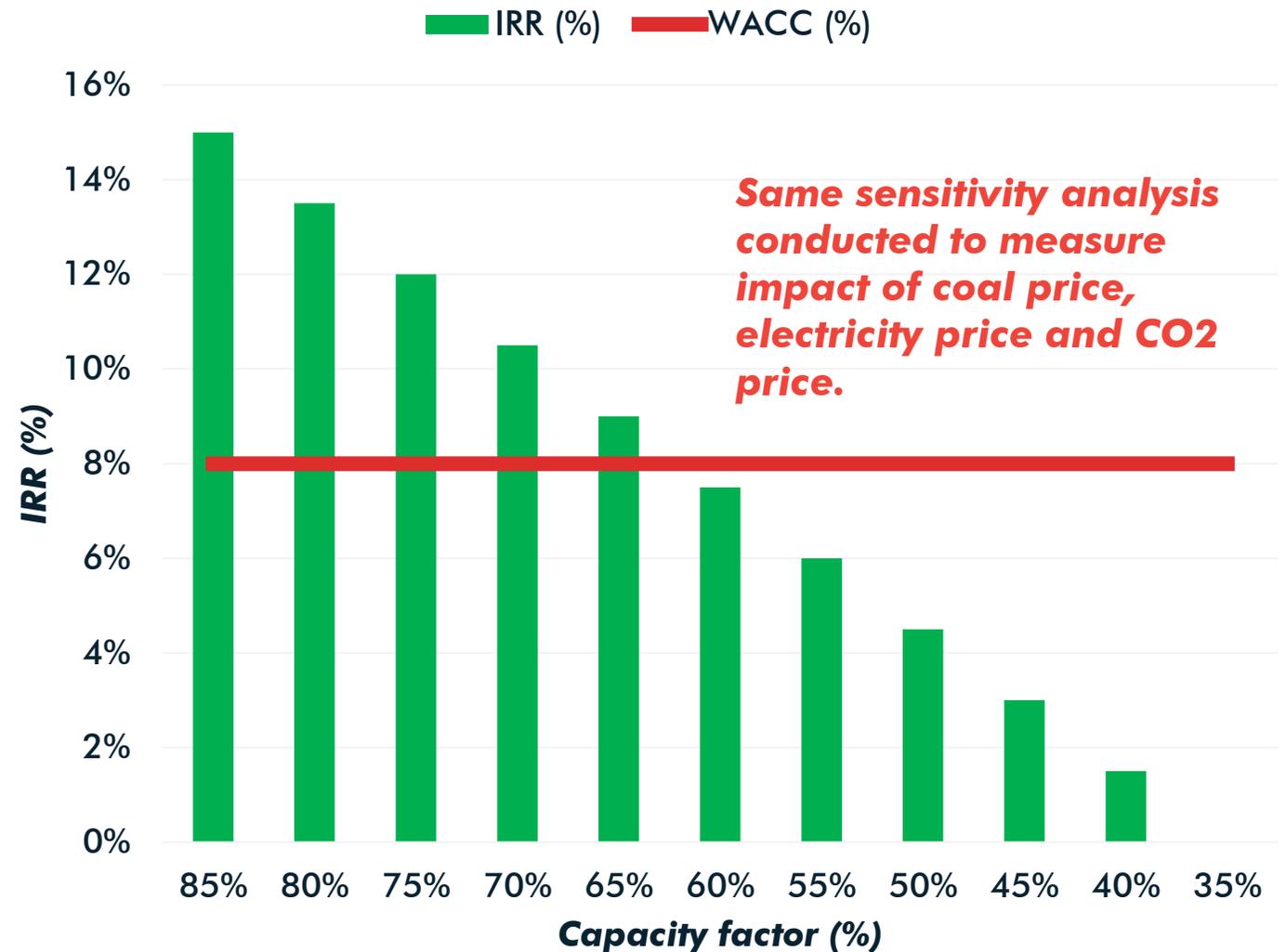
***Methodology:* three models**

1. Project finance model
2. Relative economics model
3. Stranded assets model

Modelling methodology: Project finance model

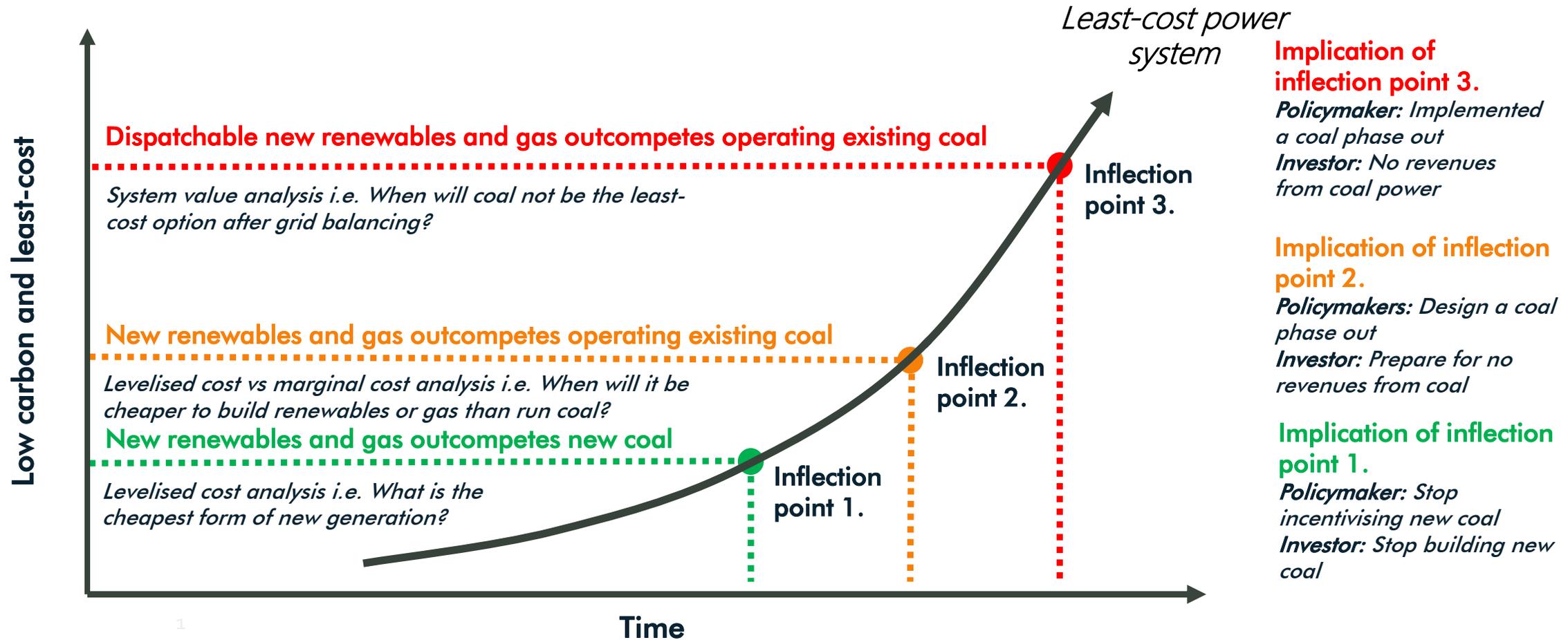
- Forecasted the IRR and NPV of every planned or under-construction coal unit
- Breakeven scenarios to understand project sensitivity to key variables
 - Capacity factor
 - Fuel price
 - Electricity price
 - Carbon price

Illustrative example of how a declining capacity factor could impact the project IRR



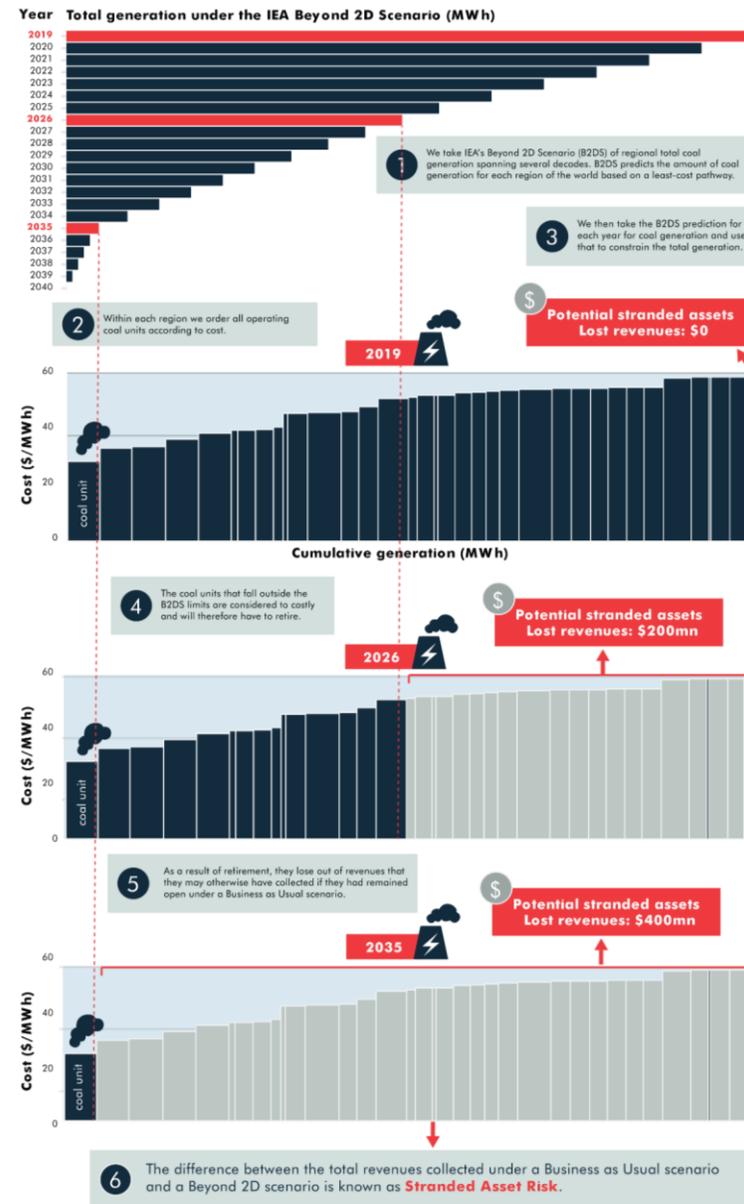
Modelling methodology: Relative economics model

Three inflections points which will fundamentally change power generation economics



Modelling methodology: Stranded asset model

- Forecasting stranded asset risk if temperature goal of the Paris Agreement is met
- The amount of wasted capital and lost revenues from premature closure of coal
- Where will the losses occur?
 - Shareholder value destroyed?
 - Higher energy prices?
 - Depleted fiscal resources?



Methodology: key assumptions

■ Coal

- Fuel price of US\$105/t (Carbon Tracker estimates)
- Electricity price of US\$87/MWh (Japanese Electric Power exchange)
- Carbon price of US\$2.68/tCO₂ (Ministry of the Environment)
- Capacity factor of 73% (OCCTO Supply Plan)
- Capex: US\$/kW 2,100 for subcritical, US\$/kW 2,400 for supercritical, US\$/kW 2,600 for ultra-super and US\$/kW 2,900 for IGCC (IEA)

■ Renewables

- Learning curves: solar PV – 60%, offshore wind – 25% and offshore wind – 20% (IRENA Power Costs 2017)
- WACC of 3.5% (Carbon Tracker)
- Capacity additions by 2040: solar PV – 282GW, offshore wind – 20GW and offshore wind – 30GW (IRENA REMAP)

FINDINGS

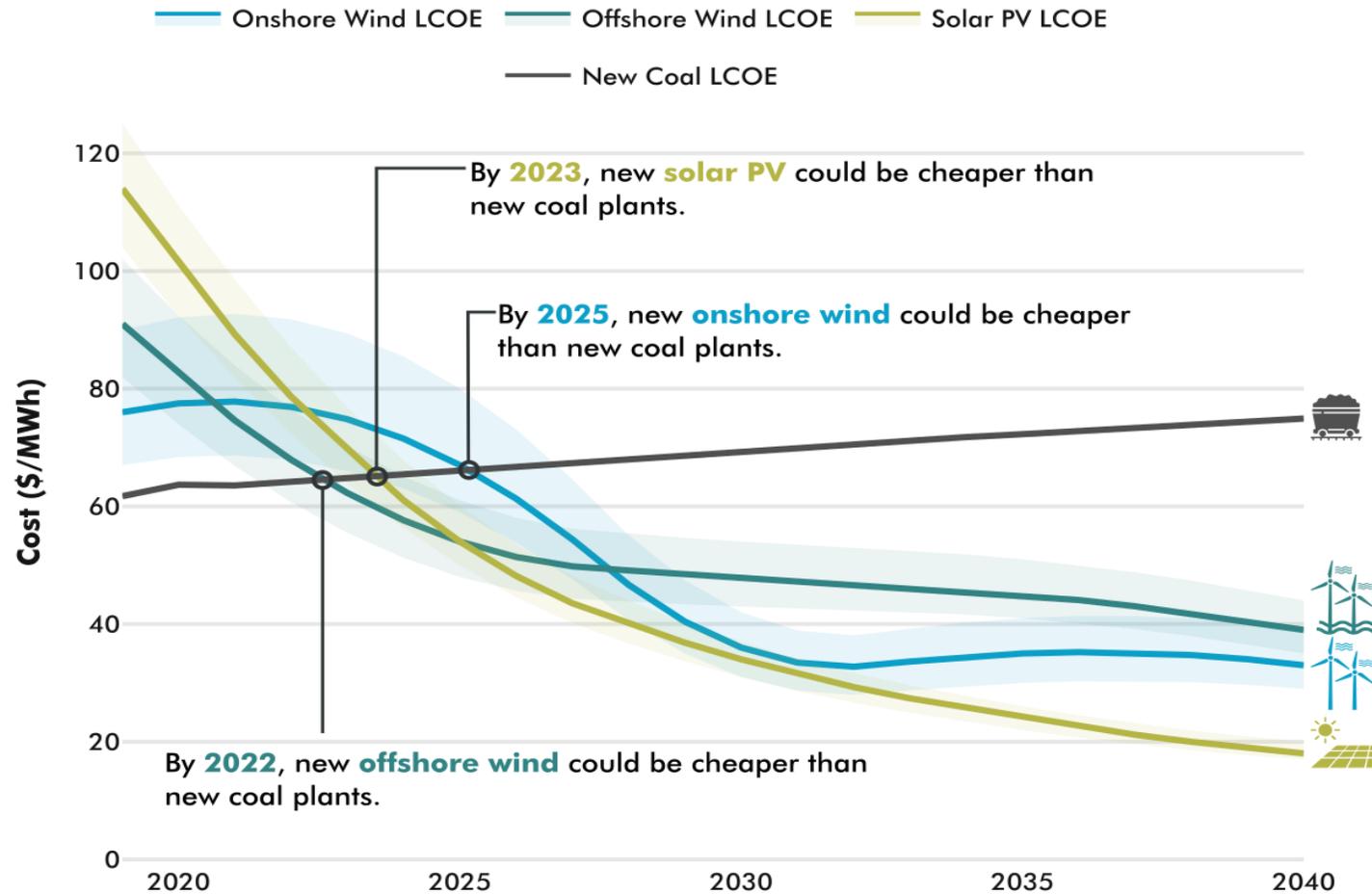
Findings: planned and under-construction coal units sensitive to changing market conditions

Nakoso IGCC shows the highest capacity factor required to achieve an IRR greater than WACC

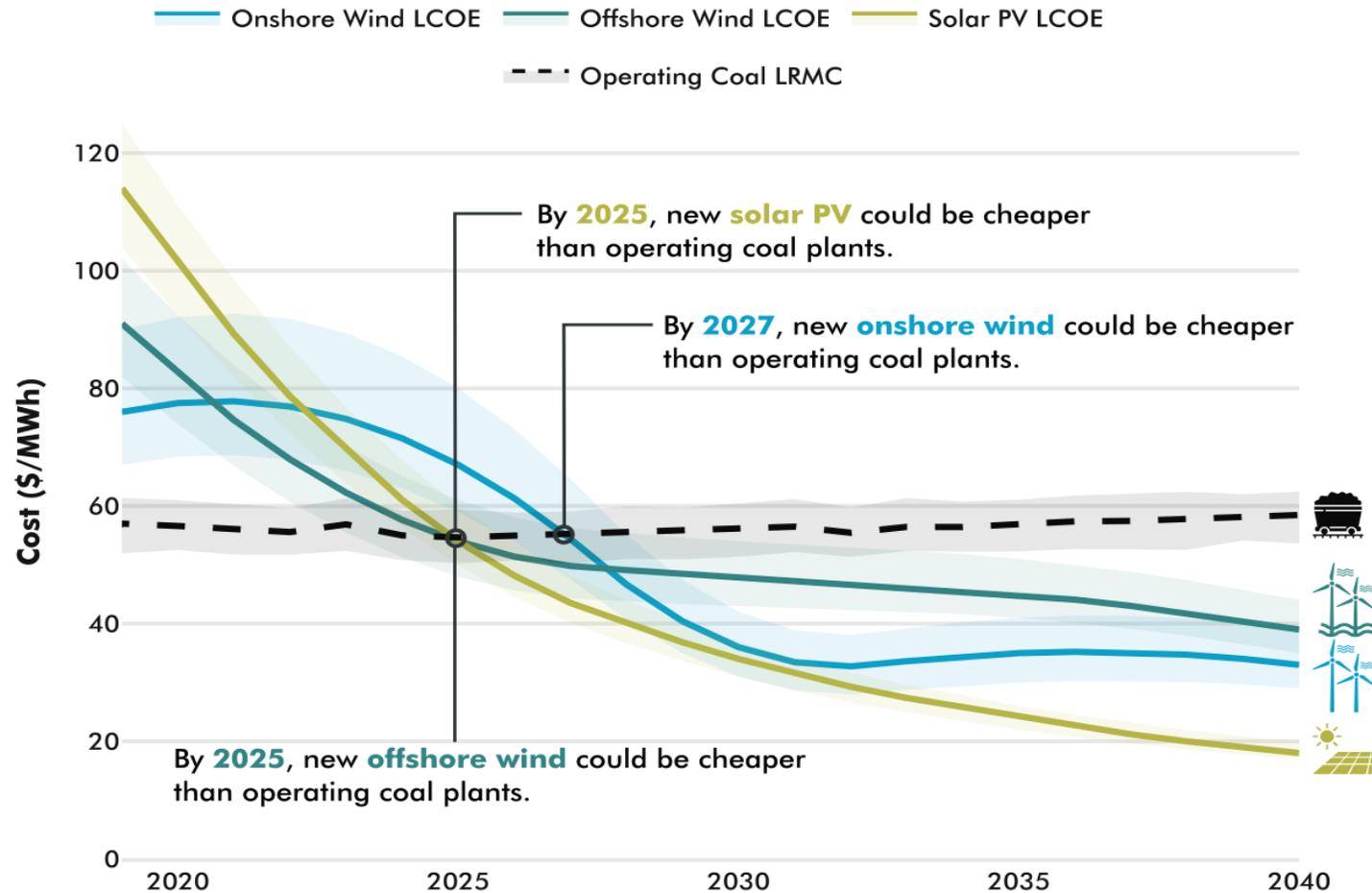
Project (outstanding examples chosen for the presentation)	Forecasted Net Present Value (NPV) (million US\$)	Lowest capacity factor to achieve an IRR greater than WACC = 2.5% (%)	Highest fuel price to achieve an IRR greater than WACC = 2.5% (US\$/t)	Lowest tariff to achieve an IRR greater than WACC = 2.5% (US\$/MWh)	Highest carbon price in 2040 to achieve an IRR greater than WACC = 2.5% (US\$/tCO ₂)
Nakoso IGCC	\$575	62%	\$95/t	\$75/MWh	\$21/t
Yokosuka 1&2	\$5	47%	\$76/t	\$82/MWh	\$4/t
Average all units	n/a	48%	\$104/t	\$72/MWh	\$25/t
Average in 2018	n/a	73%	\$105/t	\$87/MWh	\$2.68/t

Yokosuka 1&2 show the lowest breakeven values of fuel and CO₂ costs and highest of tariff to achieve an IRR greater than WACC.

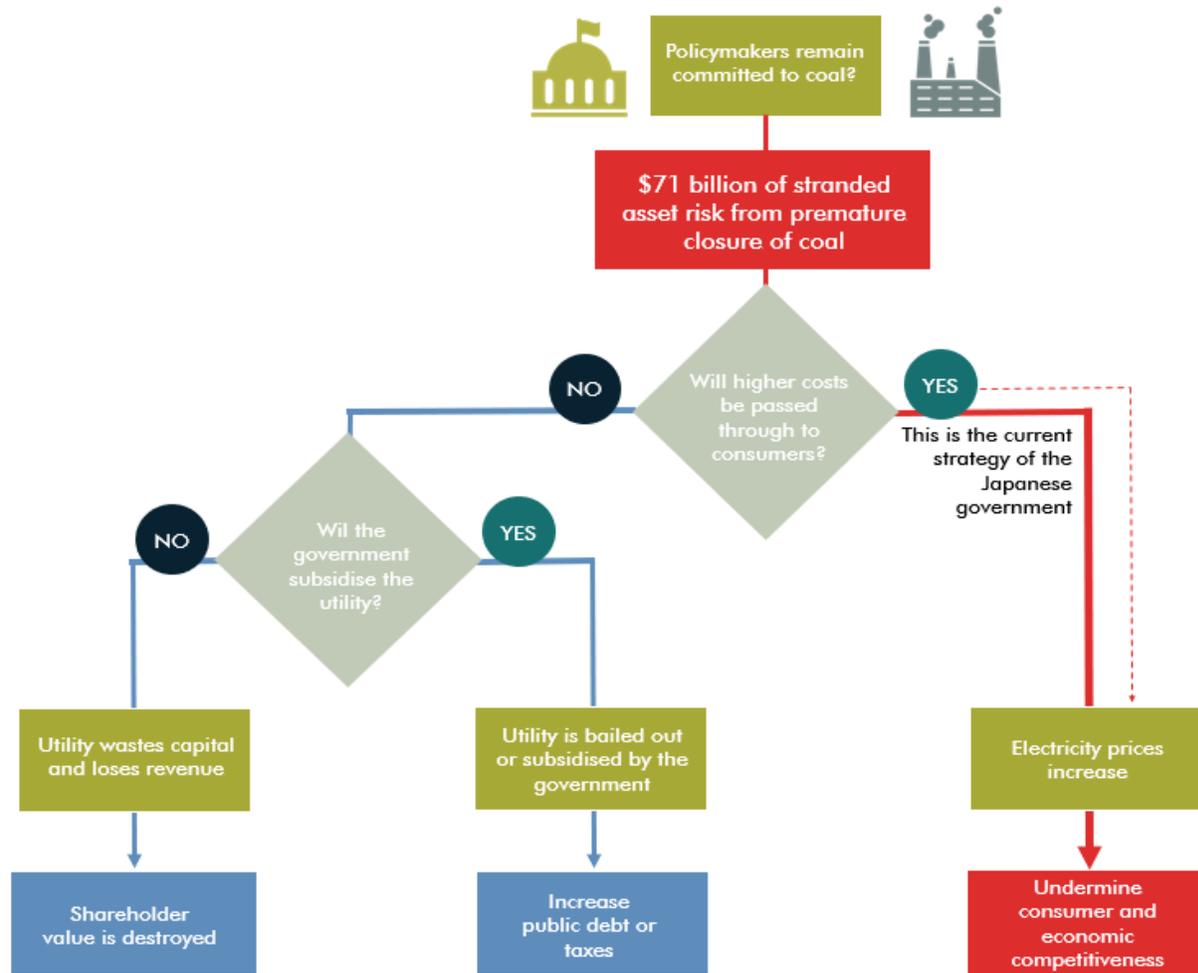
Findings: New offshore wind cheaper than new coal by 2022



Findings: New offshore wind cheaper than running coal by 2025



Findings: Without policy reform \$71 bn in stranded coal assets, resulting in high energy costs



RECOMMENDATIONS AND NEXT STEPS

High-level policy recommendations for the Japanese government

1. Immediately reconsider new build to avoid stranded assets
 - \$29bn could be avoided if the development of planned and under construction capacity is cancelled
 - Sends a clear investment signal to financial community
 - Improves Japan's international reputation on climate
2. Develop a retirement schedule for the existing fleet that is consistent with the Paris Agreement
 - High efficiency boiler technologies without CCS are inconsistent with the Paris Agreement
3. Accelerate renewable energy through non-discriminatory regulations to avoid missing economic opportunity associated with the renewable energy megatrend

We're here to help!

Coal power economics portal

CLICK HERE TO SEE THE FULL INTERACTIVE REPORT

Preview of the portal and high-level key global findings



<https://www.carbontracker.org/reports/coal-portal/>

Paris-alignment of power utilities

Selected public utilities x American Electric Powe...

CARBON TRACKER INITIATIVE COMPANY PROFILES - UTILITIES

American Electric
Power Company
AEP US Equity



Carbon Tracker's company profiles provide investors with the data and analysis needed to evaluate the alignment of company operations with the temperature goal in the Paris Agreement.

BOTTOMLINE: PARIS-UNALIGNED

Our analysis indicates that American Electric Power company (AEP) is not on track to align its power generation activities with the temperature goal of the Paris Agreement. American Electric Power Company's coal capacity represents 60% of its total operating capacity.

To become Paris-aligned American Electric Power Company needs to provide:

- I. A coal unit retirement schedule consistent with a credible climate scenario; and
- II. A date assigned to each coal unit

Apart from climate considerations, our modelling of transition risk identifies economic concerns with the company's coal fleet:

- I. 70% of American Electric Power Company's coal fleet may have a negative EBITDA today and we anticipate 92% could have a negative EBITDA by 2030; and
- II. 90% of American Electric Power Company's coal capacity may have a higher long-run marginal cost (LRMC) than the levelized cost (LCOE) of either utility-scale solar photovoltaics (PV) or onshore wind today and we anticipate this could be 100% by 2030.

Our cost-optimised retirement schedule as well as our EBITDA and relative competitiveness estimates can be seen in the Paris-alignment & transition risk assessment section.

We further highlight the following questions for management:

- 1 Will AEP implement a coal phase-out by 2030 in line with the Paris Agreement?
- 2 How are the emissions reductions targets used to inform strategic decision making?
- 3 Have AEP modelled how their emissions reductions targets align with wider climate scenarios and will they do so?

<https://companyprofiles.carbontracker.org/>



Thanks for listening

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If you are interested in knowing more,
please get in touch:

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ADDITIONAL SLIDES
