Financial risks and economic viability of coal power in Japan

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Presentation outline

1. Report background
2. Modelling methodology
3. Key findings
4. Recommendations and next steps
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

- Break-even 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

<table>
<thead>
<tr>
<th>Capacity factor (%)</th>
<th>IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>85%</td>
<td>16%</td>
</tr>
<tr>
<td>80%</td>
<td>14%</td>
</tr>
<tr>
<td>75%</td>
<td>12%</td>
</tr>
<tr>
<td>70%</td>
<td>10%</td>
</tr>
<tr>
<td>65%</td>
<td>8%</td>
</tr>
<tr>
<td>60%</td>
<td>6%</td>
</tr>
<tr>
<td>55%</td>
<td>4%</td>
</tr>
<tr>
<td>50%</td>
<td>2%</td>
</tr>
<tr>
<td>45%</td>
<td>0%</td>
</tr>
<tr>
<td>40%</td>
<td>0%</td>
</tr>
<tr>
<td>35%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Same sensitivity analysis conducted to measure impact of coal price, electricity price and CO2 price.
Modelling methodology: Relative economics model

Three inflection points which will fundamentally change power generation economics

- **Inflection point 1.**
  - **New renewables and gas outcompetes operating existing coal**
  - System value analysis i.e. When will coal not be the least-cost option after grid balancing?

- **Inflection point 2.**
  - **New renewables and gas outcompetes operating existing coal**
  - Levelised cost vs marginal cost analysis i.e. When will it be cheaper to build renewables or gas than run coal?

- **Inflection point 3.**
  - **New renewables and gas outcompetes new coal**
  - Levelised cost analysis i.e. What is the cheapest form of new generation?

**Implication of inflection point 1.**
- **Policymaker:** Stop incentivising new coal
- **Investor:** Stop building new coal

**Implication of inflection point 2.**
- **Policymakers:** Design a coal phase out
- **Investor:** Prepare for no revenues from coal

**Implication of inflection point 3.**
- **Policymaker:** Implemented a coal phase out
- **Investor:** No revenues from coal power

Least-cost power system
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$2.68/tCO$_2$ (Ministry of the Environment)
  - Capacity factor of 73% (OCCTO Supply Plan)

- **Renewables**
  - 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

<table>
<thead>
<tr>
<th>Project (outstanding examples chosen for the presentation)</th>
<th>Forecasted Net Present Value (NPV) (million US$)</th>
<th>Lowest capacity factor to achieve an IRR greater than WACC = 2.5% (%)</th>
<th>Highest fuel price to achieve an IRR greater than WACC = 2.5% (US$/t)</th>
<th>Lowest tariff to achieve an IRR greater than WACC = 2.5% (US$/MWh)</th>
<th>Highest carbon price in 2040 to achieve an IRR greater than WACC = 2.5% (US$/tCO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nakoso IGCC</td>
<td>$575</td>
<td>62%</td>
<td>$95/t</td>
<td>$75/MWh</td>
<td>$21/t</td>
</tr>
<tr>
<td>Yokosuka 1&amp;2</td>
<td>$5</td>
<td>47%</td>
<td><strong>$76/t</strong></td>
<td><strong>$82/MWh</strong></td>
<td><strong>$4/t</strong></td>
</tr>
<tr>
<td>Average all units</td>
<td>n/a</td>
<td>48%</td>
<td>$104/t</td>
<td>$72/MWh</td>
<td>$25/t</td>
</tr>
<tr>
<td>Average in 2018</td>
<td>n/a</td>
<td>73%</td>
<td>$105/t</td>
<td>$87/MWh</td>
<td>$2.68/t</td>
</tr>
</tbody>
</table>

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

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

By 2023, new solar PV could be cheaper than new coal plants.

By 2025, new onshore wind could be cheaper than new coal plants.

By 2022, new offshore wind could be cheaper than new coal plants.
Findings: New offshore wind cheaper than running coal by 2025

- By 2025, new solar PV could be cheaper than operating coal plants.
- By 2027, new onshore wind could be cheaper than operating coal plants.
- By 2025, new offshore wind could be cheaper than operating coal plants.
Findings: Without policy reform $71bn 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

- 44 Short-run operating cost ($/MWh)
- 56% Coal capacity cashflow negative by 2030
- $-255 bn stranded assets

When will renewables be cheaper than coal?
- 31 years to phase out coal
- 1,888 existing capacity (GW)
- 156 under construction (GW)

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

Paris-alignment of power utilities

https://companyprofiles.carbontracker.org/

Carbon Tracker Initiative Company Profiles - Utilities

American Electric Power Company

APL US Equity

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 68% of its total operating capacity.

To become Paris-aligned, American Electric Power Company needs to provide:
1. A cost-competitive schedule consistent with a credible climate scenario, and
2. A clear alignment with each coal unit.

Apart from climate considerations, our modelling of transition risk identifies other economic concerns with the company’s coal fleet:
1. 75% of American Electric Power Company’s coal fleet may have a negative EBITDA floor, and we anticipate that the 90% could have a negative EBITDA by 2023; and
2. 99% of American Electric Power Company’s coal capacity may have a higher long-run marginal cost (LRMC) that the lowest cost (CO2) of other utility-scale carbon-free ($/MWh) or nuclear plants today and the worst-case could be 100% by 2030.

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

We further highlight the following questions for consideration:
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 modified their emissions reductions targets align with wider climate scenarios and will they do so?
Thanks for listening

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

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ADDITIONAL SLIDES