Brown coal exit: A market mechanism for regulated closure of highly emissions intensive power stations

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Figure 5: Emissions by sector, Australia, annual, year to September 2005 to 2015

Source: Department of the Environment.
NEM overview

Problem in absence of carbon price:
One or more black coal power stations could exit, rather than lignite stations
Capacity and demand in the NEM

Over Capacity

Surplus generation capacity in the NEM: who might exit and when?


Emissions intensity in the NEM, 2014 (kgCO2/kwh)

- Hazelwood
- Yallourn
- Loy Yang A
- Loy Yang B
- Black Coal, average
- Gas, average
- Total (incl renewables)

Victoria's brown coal plants

Table 1: The four large brown coal generators in Victoria

<table>
<thead>
<tr>
<th></th>
<th>Hazelwood</th>
<th>Loy Yang A</th>
<th>Loy Yang B</th>
<th>Yallourn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner (Nov 2015)^a</td>
<td>GDF Suez</td>
<td>AGL</td>
<td>GDF Suez</td>
<td>Energy Australia</td>
</tr>
<tr>
<td>Capacity, MW^b</td>
<td>1,760</td>
<td>2,295</td>
<td>1,200</td>
<td>1,585</td>
</tr>
<tr>
<td>Capacity utilisation rate, 2014 (%)^b</td>
<td>70.8</td>
<td>80.0</td>
<td>71.5</td>
<td>77.1</td>
</tr>
<tr>
<td>Electricity dispatched, 2014 (GWh)^b</td>
<td>9,819</td>
<td>14,630</td>
<td>6,952</td>
<td>9,749</td>
</tr>
<tr>
<td>CO2 emissions, 2014 (kt)^b</td>
<td>14,944</td>
<td>17,702</td>
<td>8,606</td>
<td>13,814</td>
</tr>
<tr>
<td>Emissions intensity, 2014 (tCO2/MWh dispatched)^b</td>
<td>1.52</td>
<td>1.21</td>
<td>1.24</td>
<td>1.42</td>
</tr>
</tbody>
</table>

Notes: a) Sourced from the respective company websites: Hazelwood - GDF Suez (2015a); Loy Yang A – AGL (2015); Loy Yang B – GDF Suez (2015b); Yallourn – Energy Australia (2015). b) The third party software NEMSight from Creative Analytics was used to extract the relevant AEMO data (Creative Analytics 2015).
Decarbonisation of electricity supply: A 100% renewable electricity grid by 2050

ClimateWorks/ANU:
Pathways to Deep Decarbonisation in 2015
(part of global Deep Decarbonization Pathways project)

Figure 2.10 – Projected national electricity generation by technology, 100 percent renewable grid, 2010–2050
Fuel mix in the National Electricity Market before, during and after the carbon price

Source: UPDATED FROM O'Gorman and Jotzo (CCEP working paper 1411, ANU)
A proposal for a specific policy intervention while there is no carbon price:

Avoiding the wrong exit pathway

Context:
- Policy uncertainty
- Investment climate
- Electricity market design for high renewables penetration
Traditional approaches to plant closure – with problems:

Negotiated payments to operators
   Information asymmetry – extracting rents from government?
   Politically difficult esp if on-budget payments
   Australia’s failed ‘contract for closure’ scheme

Direct regulation to force exit (eg CO2 standard)
   Information asymmetry – which is the best plant to close?
   Could be politically difficult
Germany: paying for exit while power prices are falling?

Companies & Markets

PITFALLS FOR VATTENFALL
Low-Down Brown Coal Blues

BY JÜRGEN FLAUGER AND KLAUS STRATMANN

The Swedish power company Vattenfall has found no buyer willing to pay the price for its nearly worthless lignite division in Germany. Their only hope be creating a foundation to manage the unwanted operations.
Farewell to brown coal without tears: how to shut high-emitting power stations

November 19, 2015 6.11am AEDT

Loy Yang power station in Victoria’s Latrobe Valley. Takver/Flickr, CC BY-SA

Accepted Manuscript

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The idea:
An industry-funded, competitive exit payment mechanism

1. No government outlays
2. The beneficiaries of exit – remaining generators – pay the exiting plant
3. Breaks the deadlock
The proposal:
Competitive bidding process for power station closure

1. Plants bid over the payment they require for closure
   - Including site remediation
   - Plus structural assistance to communities; renewable energy at site?

2. Regulator chooses the best (most cost effective) bid
   - Indicator: $/tCO2 expected to be saved
   - Regulator may choose not to accept any bids

3. Remaining generators pay for exit
   - In line with their future CO2 emissions, over some period of time
   - Other models possible – consider incentive effects and price uplift
Incentives to bid low are strongest, future profitability of high-emitting plants lowered, limited (no?) scope for collusion

Payments made by remaining brown coal power stations

Payments by all remaining generators in proportion to CO2 emissions

Incentives to bid low exist but less pronounced, price uplift higher (gas), some scope for collusion?

Payments by all remaining generators in proportion to electricity sent out
Assuring site rehabilitation
  • to agreed (perhaps especially high) standard

Providing money for structural adjustment programs
  • eg local infrastructure, business development, retraining

Could support low-carbon power investment
  • Eg solar or gas with CCS on site

VIC State government should like this
CO2 savings per year

Depends on what replaces the exiting plant, scenarios:
  100% black;  70% black and 30% brown (this is very much on the high side)

Hazelwood exit: 5-6 MtCO2/year
Yallourn exit: 4-5 MtCO2/year

Conservative estimates, eg no substitution into gas

~1% of annual national emissions

For how long? Depends on counterfactual
How high might the bids be?

“Two is enough for competition”

Exit bid > expected future profits

- Taking into account price uplift and payments to exiting plant
- Taking into account other future policies, eg carbon price or regulation
- Rehabilitation costs will be incurred anyway
- Adjusted for market and policy risk: bird in the hand
- Taking into account the effects on the full portfolio owned by the company
Analysis needed

Modelling for this proposal
- Price uplift, output by plant, state-by-state analysis
- Bidding strategies under exit scheme

Mechanism design
- Design for effectiveness and political acceptability
- How much capacity to target (here illustrated with 1 plant)
Brown coal exit mechanism
   A specific proposal for a specific situation

Longer term policy settings
   RET or other renewable energy support?
   A long-term ‘exit mechanism’, eg by regulation?
      Better: a price on carbon
   Policy predictability to support investment climate

Market structure and regulatory settings
   Energy-only market for a renewables-heavy system?
   Cost-effective integration of local generation and storage
   Demand-side management
What would happen to prices in the NEM?

Stylized bid stacks for hypothetical half hour trading interval.

- Demand averaged over the half hour trading interval is 2,750 MW (from 2100 MW at the five minute period to 3:05 to 3,200 MW at the periods to 3:20 and 3:25)
- Generators get dispatched from lowest cost to highest cost to meet demand. The price setting plant is the highest cost plant dispatched

**Before exit of low marginal cost plan:**
The wholesale spot price for the half hour trading interval is $47 per MWh (illustrative!)

**After exit:** The wholesale spot price for the half hour trading interval is $54 per MWh (illustrative!)