Bylong Coal Project

Expert Review

Institute for Energy Economics and Financial Analysis
IEEFA.org

June 2018

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Acknowledgement

IEEFA has been engaged by EDO NSW on behalf of the Bylong Valley Protection Alliance to prepare this expert report. The authors acknowledge that we have read the Expert Witness Code of Conduct in Schedule 7 of the *Uniform Civil Procedure Rules 2005* (NSW) and that we agree to be bound by it.

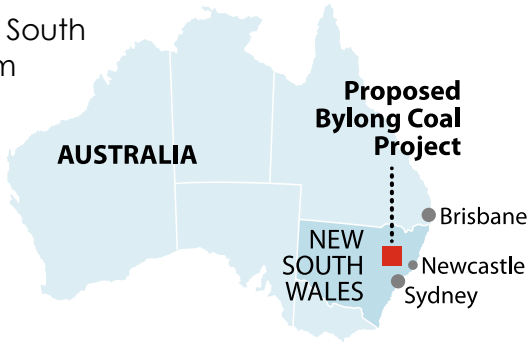
Executive Summary

KEPCO's proposed Bylong Coal Project, conceived in a previous energy era, is now outdated because of significant energy policy changes in South Korea. These changes reflect an energy transformation happening globally as increasingly cheap renewable energy technology undermines the business model for coal-fired power plants that Bylong Coal is seeking to supply.

IEEFA brings the following key points to the attention of the Department of Planning and Environment and the Independent Planning Commission:

In IEEFA's opinion, the development of the Bylong Coal Project is not necessary to meet projected demand for coal.

- The clear change in direction on energy policy by the South Korean government significantly impacts the long-term economic viability of the Bylong Coal Project in terms of the amount of coal that can be placed into the market and for how long. This calls into question whether the economic benefits of the project outweigh its social, cultural and environmental impacts and hence whether it can be justified on economic grounds.



- KEPCO's letter of support for the project fails to consider the significant change in the long-term outlook for coal demand in South Korea that has taken place since the election of a new government in 2017. The April 2018 appointment of a new KEPCO CEO by the government could see a reassessment of strategy resulting in a shift toward renewables and away from coal.

- South Korea's new energy plan calls for less reliance on imported coal and nuclear and more on renewable energy and liquefied natural gas (LNG)-fired power generation. Renewables will provide 20% of the nation's electricity by 2030 (up from 6.7%) and coal's share of the power mix is to fall from 45.3% in 2017 to 36.1% by 2030.

- The government aims to encourage a switch from coal to LNG and renewables with increased taxes on coal. The coal consumption tax was increased 20% to US$34/tonne from April 2018, adding to the existing carbon pollution price. Further tax changes to reduce coal consumption are being considered. Four existing coal-fired power plants are to be converted to LNG and two proposed new coal-fired plants will also likely be converted. South Korean LNG demand has been re-forecast upwards.

- Provincial governments also intend to reduce coal consumption. South Chungcheong Province, home to the majority of South Korea's coal-fired power plants, has declared its intention to reduce reliance on coal to zero by 2050.

- South Korea's efforts are driven partly by air pollution concerns. In April 2018, the Organisation for Economic Cooperation and Development (OECD) reported that South Korea has the worst air quality of any economically advanced nation. In 2017,

older coal-fired power plants were temporarily closed to make good on an election promise to improve air quality. A similar move has been made now in 2018 with operations at five older plants suspended from March until June.

- South Korea's build-out of renewable energy capacity is well under way. KEPCO itself is increasing its focus on renewable energy in South Korea; the company's new CEO is expected to increase this focus further. KEPCO has taken steps this year to enhance transmission links to connect renewable generation hotspots with load centres.

- The influential International Energy Agency (IEA) has taken the significant changes in South Korean energy policy landscape into account in its latest World Energy Outlook report (2017), noting the following:

  > *"We see Korean coal imports dropping by nearly 50% to less than 60 Mtce [million tonnes coal equivalent] in 2040."*

- It is clear why KEPCO would continue to maintain that the Bylong Coal Project has strategic importance, maintaining this position in an effort to achieve all planning approvals so that KEPCO can sell the project if and when the company concludes that the Bylong Coal Project is no longer a strategic priority.

In IEEFA's opinion, the coal price forecasts relied upon in the project's Economic Impact Assessment (EIA) are neither reasonable nor reliable.

- The Economic Impact Assessment (EIA) prepared for the Bylong Coal Project uses a 2014 coal price forecast provided by Wood Mackenzie as the basis of its assessment of the value of coal and economic benefit. In its January 2018 response to the Planning Assessment Commission's comments on the EIA, the Bylong Coal Project again cites this 2014 forecast and the Centre for International Economics (CIE) peer review, which assumed the implied price of A$90 to A$100/t used in the EIA. The Bylong Coal Project also references a 2015 medium- to long-term export thermal coal price forecast of A$97/t to A$117/t, sourced from the New South Wales (NSW) Department of Trade and Investment and quoted by the CIE in its peer review. In the time that has passed since these studies and forecasts were made, the seaborne thermal coal market outlook has changed materially, rendering these studies and forecasts out of date.

- The IEA's 2017 World Energy Outlook report acknowledges that the great majority of future investment in electricity generation infrastructure will be in renewable energy technology, with significant declines in coal-fired power investment. The IEA also sees global coal trade declining, with both 2025 and 2040 thermal coal trade volumes below those of 2016 under its New Policies Scenario. Under the same scenario, 2025 global coal consumption is 120 Mtce less than the peak world coal consumption in 2014. Under the IEA's Sustainable Development Scenario, whereby the Paris signatories take the path toward climate stabilisation and reduced air pollution, global thermal coal trade volumes plummet 28% by 2025 and 59% by 2040 compared to 2016.

- An up-to-date consensus Newcastle benchmark thermal coal forecast, compiled by KPMG, predicts benchmark thermal coal prices dropping to US$65/t in the long term. This is equivalent to A$86/t, below the range cited by the Bylong Coal Project.

- Bylong coal quality is below the industry standard due to its lower energy content and would therefore be sold at a discount to the US$65/t benchmark. Furthermore, one third of the coal to be mined in the open-cut operation has a high ash content (22%), which would attract an even lower price. This does not appear to have been taken into account in the EIA. April 2018 saw a sudden, significant decrease in the value of lower-energy, high-ash coal driven by import bans at some Chinese ports.

- The Bylong Coal Project proponent seeks to cover the possibility of changes in coal price forecasts by highlighting the fact that sensitivity analyses were performed that included scenarios where coal prices may be 20% or 30% higher or lower than forecast. IEEFA would note that, for it to be effective, such analyses should be performed on an accurate, up-to-date coal price forecast. Performing a sensitivity analysis on out-of-date figures will not produce reliable results.

- The out-of-date price forecasts and lower-quality coal raise further doubts over the benefits of the Bylong Coal Project and whether it can be justified economically.

In IEEFA's opinion, there are further doubts over the benefits of the proposal.

- The use of out-of-date coal price assumptions means that the predicted benefits to NSW in royalties paid are likely inaccurate. With coal price forecasts now significantly lower than they were in 2014/15, actual royalties paid are likely to be significantly lower than the A$290m (present value) stated by the Bylong Coal Project.

- KEPCO also maintains that A$302m (present value) in corporate taxes will be paid over the life of the project. However, there is significant doubt over this figure as the modelling that produced it does not consider the debt that would inevitably be used to fund the proposal. There has been no consideration in the Bylong Coal Project's submissions of the funding structure of the proposal and how this may affect its economic benefit. The assessment ignores the impact of the likely high level of project and corporate debt used to fund the project. This debt would lead to significant, ongoing tax-deductible interest payments, which in turn would significantly reduce profits and corporate tax payable, such that actual corporate taxes paid would be significantly lower than the projected A$302m (present value). Where coal prices are lower than expected under the Bylong Coal Project's out-of-date forecast, profits and corporate tax payable will be even further reduced.

- The lower quality of the coal located at the Bylong Coal Project would attract a lower price than the industry standard benchmark and result in reduced royalties payable as well as lower profitability and corporate tax payable.

Introduction

The Bylong Coal Project is owned by KEPCO Bylong Australia Pty Ltd, a subsidiary of KEPCO—the South Korean state-owned electricity utility. The project proposal involves open cut and underground mining at a site 55 kilometres northeast of Mudgee, NSW.

The Bylong Coal Project maintains that up to 6.5 million tonnes (Mt) of run of mine (ROM) coal will be recovered annually for a period of approximately 25 years. In fact, the project would only produce 6.5Mt ROM for three years out of the total 25-year project life. The average ROM output would be 5.7Mt/year according to figures disclosed in the project's Economic Impact Assessment (EIA).[1] Total product coal for sale would average 3.9Mt/year.

The proposal's 25-year lifespan would take the project into the 2040s, exposing it to the inevitability of a significantly different global energy market that will develop over the next two decades. With the cost of renewable energy declining fast and energy storage technologies such as batteries becoming financially viable at a rapid pace, the project will exist through a time when coal-fired electricity generation is increasingly obsolete. This will clearly have implications for coal demand and prices.

The prospect of declining global coal demand, a trend now developing in South Korea itself, will also clearly have implications for the royalties and tax that will be paid to the state and federal governments. Coal price forecasts have already dropped significantly since the Bylong Coal Project's EIA was developed. There are clear implications for the amount of royalties that would be paid and the level of profits to which corporation tax would be applied. IEEFA also notes that half the net benefits to Australia are in the form of corporate taxes, but this forecast ignores the implications of normal multi-national company practice of using high levels of debt in overseas entities. Interest on debt reduces profits and hence the amount of corporate tax payable.

Rapidly transitioning electricity markets mean that there are, in IEEFA's opinion, significant doubts as to the need for a new export thermal coal mine in NSW and over the price that coal from such a project would realise in the coming decades. This calls into question whether the economic benefits of the project really outweigh its impacts as claimed in Bylong Coal's EIA.

[1] Bylong Coal Project EIS – Appendix AE: Economic Impact Assessment

Bylong Coal Project: 'Strategically Important?'

As part of its response to the then Planning Assessment Commission (PAC) review of the Bylong Coal Project, KEPCO submitted a letter of support highlighting the strategic importance of the project and the increase in coal consumption in South Korea over the previous decade.

> *"Korea Electric Power Corporation (KEPCO) seeks to specifically address the issue of long-term demand for coal that will originate from the Project…the company trusts that future demand will play an important role in the energy requirements over the next decade…It is strategically important to KEPCO to have diverse and suitable sources of coal."*[2]

IEEFA would note that past coal consumption is irrelevant to the strategic importance of the Bylong Coal Project proposal to KEPCO. It is coal consumption trends going forward that are key. Events in South Korea since the Bylong Coal Project was first proposed have undermined the long-term outlook for thermal coal demand, significantly reducing the importance of the Bylong Coal Project to South Korea and KEPCO.

South Korea: New Government, New Energy Priorities

KEPCO's letter of 4 January 2018 fails to take into account the significant change in long-term coal demand outlook in South Korea that has taken place since President Moon Jae-in was elected in 2017.

The new government's long-term plan for the South Korean electricity system was released a month prior to KEPCO's letter of support in December 2017. The plan calls for dramatically reduced reliance on coal and nuclear and a boost to renewable energy and liquefied natural gas (LNG)-fired power generation, which the Australian government's Export Finance and Insurance Corporation (EFIC) noted was good for the Australian LNG industry but bad for Australian thermal coal.[3] Any company, state-owned or otherwise, seeking to import thermal coal into South Korea, will be impacted by this change of direction by the South Korean government.

Under the plan, renewables will provide 20% of the nation's electricity by 2030 (up from 6.7%) and renewable energy capacity is to be expanded from 11.3 gigawatts (GW) to 58.5 GW by that date,[4] a new investment program of approximately US$100 billion (bn). Over the same period, coal's share of the power mix is to fall from 45.3% in 2017 to 36.1%. KEPCO states in its letter of support for the project that coal-fired power currently represents 40% of electricity generation but it fails to disclose that the South Korean government's policy will see this decline going forward.[5] Forecast electricity demand also was reduced, to 100.5 GW at 2030 from 113.4 GW in the previous electricity demand forecast due to significant focus on energy productivity initiatives.

The South Korean government aims to encourage a switch from coal to LNG and renewables with increased taxes on coal. Coal consumption taxes were increased 20% to

[2] Bylong Coal Project – Kepco Response to PAC Appendix C: Letter of Support from KEPCO Korea dated 4 January 2018
[3] https://www.efic.gov.au/resources-news/news-events/world-risk-developments/2017/world-risk-developments-july-2017/south-korea-new-energy-policy-good-for-australian-lng-but-not-coal/
[4] https://www.reuters.com/article/us-southkorea-energy-policy/south-korea-finalizes-energy-plan-to-boost-renewable-power-generation-idUSKBN1EN0KT
[5] Bylong Coal Project – Kepco Response to PAC Appendix C: Letter of Support from KEPCO Korea

US$34/t from April 2018 and further tax changes to reduce coal consumption are being considered.[6] The coal tax is in addition to South Korea's carbon price, which was introduced in 2015 via a cap-and-trade system that currently prices carbon at around US$20/t.

Furthermore, four existing coal-fired power plants are to be converted to run on LNG. Plans to build new coal-fired power plants are now under review and it is expected that two of the proposed new plants will instead proceed as LNG-fired plants.[7]

According to the South Korean government's new 2030 energy plan, LNG's share of the generation mix will increase from 16.9% to 18.8% as reliance on coal and nuclear declines.[8] The nation is taking steps to diversify its sources of LNG imports and increase storage capacity as demand for the fuel increases. Additional gas infrastructure investment is planned to reach US$5.5bn by 2031.[9] In a reversal of previous forecasts, which anticipated declining LNG demand, the new plan to reduce reliance on coal means that LNG demand has now been re-forecast upward. By 2031, total LNG demand across domestic, industrial and electricity generation is forecast to reach 40.5Mt, up 11% from the 2018 forecast demand of 36.5Mt.[10]

In addition to the national government, provincial governments in South Korea are also taking measures to reduce reliance on coal.

South Chungcheong province, also known as Chungnam, is home to the majority of South Korea's coal-fired power plants yet the province has declared a vision to reduce reliance on coal to zero by 2050 whilst rapidly scaling up renewable energy capacity.[11]

As well as concerns about carbon emissions, South Korea's increasing efforts to reduce coal consumption are driven by air pollution concerns. In April 2018, the Organisation for Economic Cooperation and Development (OECD) reported that South Korea has the worst air quality of any economically advanced nation.[12] Air pollution was a hot topic in the 2017 presidential election with both leading candidates presenting policies designed to lower coal consumption in order to address air quality concerns.[13]

One of President Moon's first actions after his election was to temporarily close older coal-fired power plants to make good on his election promise to improve air quality. A similar measure has been taken in 2018 with five older plants suspended from March until June.[14]

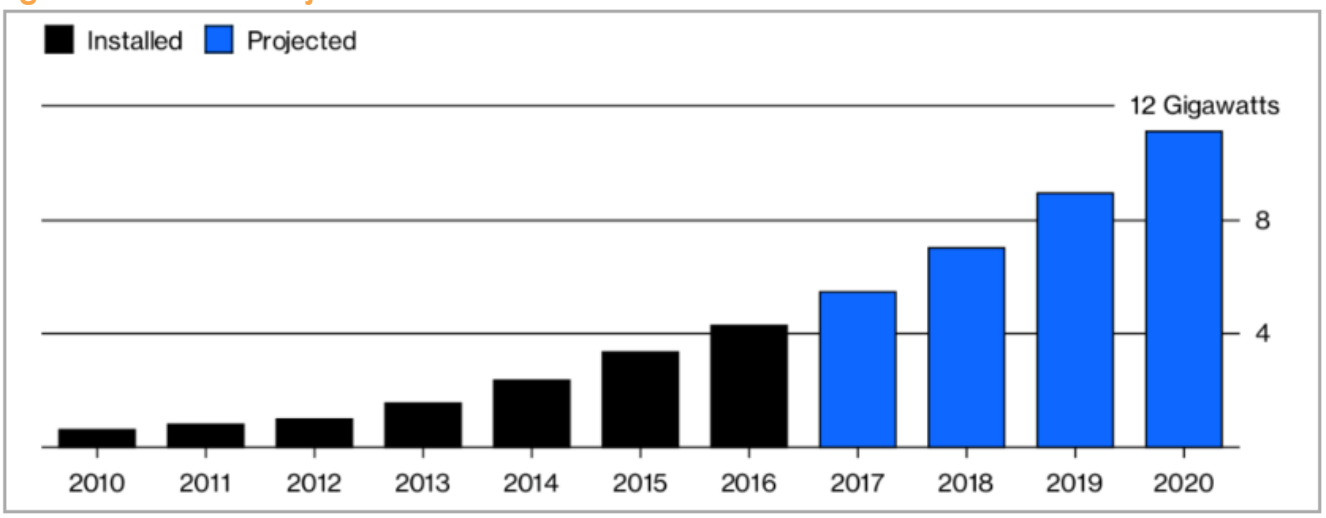
South Korea's Renewables Build-Out is Under Way

South Korea's build-out of renewable energy capacity sufficient to generate 20% of the nation's electricity by 2030 is well under way. The year 2017 saw annual solar PV capacity additions in South Korea increase to 1.1 GW.[15] This was driven by strengthening government

[6] https://www.platts.com/latest-news/natural-gas/seoul/s-korea-unveils-power-mix-plan-for-2030-focused-27897602
[7] https://www.reuters.com/article/us-southkorea-energy-policy/south-korea-plans-shift-to-renewables-but-coal-nuclear-to-remain-strong-idUSKBN1E80FZ
[8] https://www.platts.com/latest-news/natural-gas/seoul/s-korea-unveils-power-mix-plan-for-2030-focused-27897602
[9] https://af.reuters.com/article/africaTech/idAFL4N1RI1OU
[10] https://www.platts.com/latest-news/natural-gas/singapore/s-korea-revises-up-lng-demand-forecasts-on-plan-27952043
[11] http://news.joins.com/article/22462957
[12] http://www.koreatimes.co.kr/www/nation/2017/09/281_236682.html
[13] https://www.bloomberg.com/news/articles/2017-05-08/smog-over-seoul-on-election-day-will-be-new-president-s-to-clear
[14] https://www.hellenicshippingnews.com/south-korean-kogas-apr-lng-sales-mark-biggest-increase-in-17-months/
[15] http://irena.org/publications/2018/Mar/Renewable-Capacity-Statistics-2018

support and the introduction of reverse auctions. By 2020, the rate of installation is expected to reach 2 GW/year.[16]

Figure 1: Actual and Projected South Korean Solar PV Installations to 2020



Source: Bloomberg Businessweek, Bloomberg New Energy Finance, Korea Energy Agency

South Korea's capital city will install 1 GW of solar by 2022. The 'Solar City Seoul' project will involve the investment of US$1.6bn.[17] Meanwhile, in March 2018, the Korea Energy Agency signed a memorandum of understanding with Masdar—Abu Dhabi's future energy company. The aim is to develop a strategic partnership to support solar, wind, waste-to-energy and energy storage projects.[18] With its long coastline, offshore wind will also play an important role in South Korea's energy future. As offshore wind costs continue to drop around the world, South Korea recently inaugurated its first offshore wind farm off the coast of Jeju Island.[19]

KEPCO Moving into Renewable Energy

KEPCO has had interests in wind farms located in China since 2005 but more recently has stepped up its renewable energy investments. In 2016, KEPCO began construction of the Chitose solar PV plant in Japan and acquired a 30 MW solar plant in Colorado.[20] The following year, the company began construction of the Fujeij wind farm in Jordan.[21] In March 2018 KEPCO increased its stake in U.S. renewables when it acquired 309 MW across three solar plants in California from Recurrent Energy, a subsidiary of Canadian Solar.[22] The size of this latest renewables infrastructure investment supports our view of a step-change in ambition and strategic shift.

[16] https://www.bloomberg.com/news/articles/2017-12-08/south-korea-makes-renewable-energy-push
[17] https://www.pv-tech.org/news/seoul-ar-city
[18] https://www.pv-tech.org/news/masdar-and-korea-energy-agency-to-collaborate-on-solar-floating-pv-and-ener
[19] https://www.offshorewind.biz/2017/11/17/south-koreas-first-commercial-offshore-wind-farm-goes-live/
[20] https://www.reuters.com/article/us-kepco-carlyle-group/south-koreas-kepco-buys-colorado-solar-power-plant-from-carlyle-group-idUSKCN11303E
[21] https://www.windpowermonthly.com/article/1419410/financial-close-89mw-al-fujeij
[22] http://english.yonhapnews.co.kr/news/2018/03/30/0200000000AEN20180330009600320.html

In addition to renewables investment overseas, KEPCO is ramping up interest domestically. The previous government announced in late 2016 that KEPCO would invest US$3bn in domestic renewable energy across 2017 and 2018 as part of a plan to boost renewable energy generation, a plan that has since been replaced with an even more ambitious one by the new government.[23]

KEPCO is already investing in the rapidly growing energy storage sector and South Korea is set to be a key growth market in this segment with policies mandating that certain commercial and industrial companies install energy storage capacity. This move suits South Korea given it is a major manufacturer of batteries for energy storage from companies such as LG Chem and Samsung SDI.[24]

Following the release of the new plan, Korean energy companies announced an increase in R&D spending for 2018, focusing on renewable energy and nuclear safety. KEPCO plans to spend US$400m on developing solar and wind technology in line with the new government targets and to push an international "supergrid" connecting South Korea, Mongolia, China and Japan that can transmit renewable energy from a 2 GW solar and wind complex in Mongolia.[25]

In April 2018, KEPCO announced the appointment of a new CEO, Kim Jong-kap, who will lead the company for the next three years. It is expected that he will focus on further shifting KEPCO toward renewable energy whilst addressing the company's operating losses.[26]

KEPCO also appointed a new president of its engineering and construction (KEPCO E&C) unit in 2018. In his inauguration speech, Lee Bae-soo said:

> *"In order to respond to national energy conversion policies, we will strengthen our investment and commercialization capacities for the new energy business such as renewable energy"*[27]

The year 2018 has already seen KEPCO take steps to prepare South Korea for increasing reliance on renewable energy. In February it was announced that KEPCO had commissioned GE to build a new 4 GW high-voltage transmission link between Seoul and the east of the country.[28] Enhanced transmission links are required to connect renewable generation hotspots with load centres such as major cities.

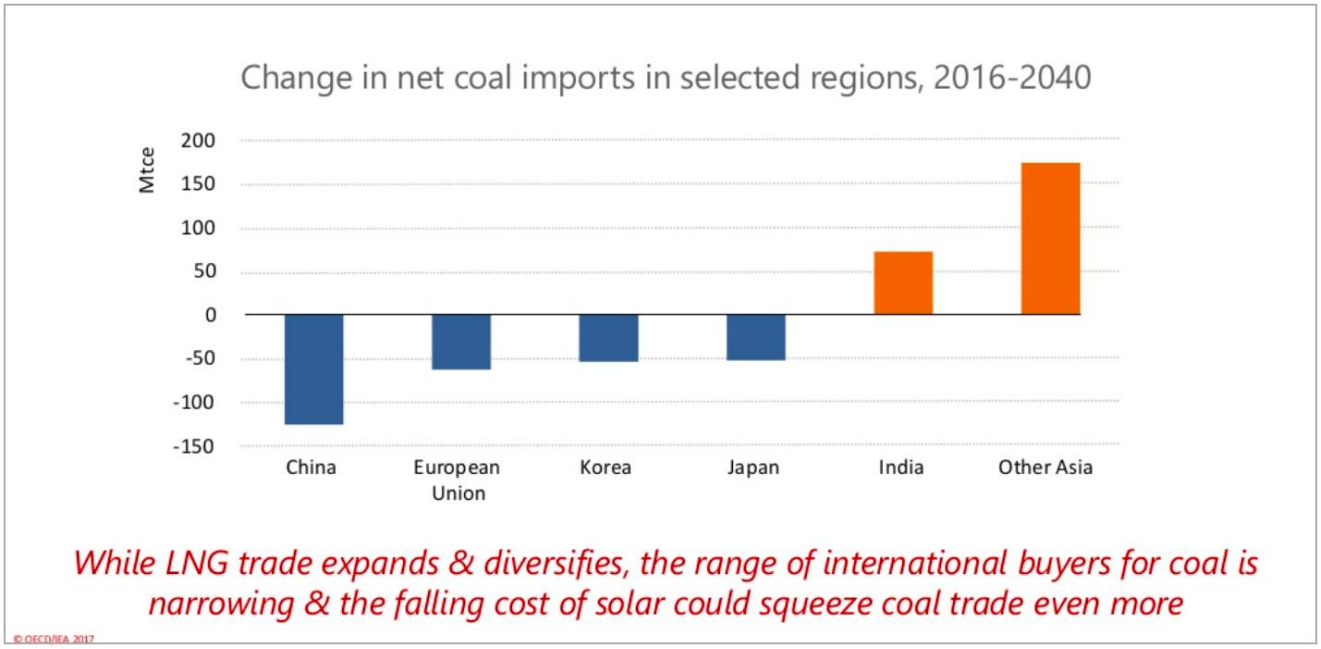
IEA Forecasts Plummeting Korean Coal Imports

The influential International Energy Agency (IEA) has taken the significant changes in the South Korean energy policy landscape into account in its latest World Energy Outlook report from 2017. Noting the government's intention to reduce the nation's coal consumption and increase reliance on renewables and natural gas, the IEA made the highly significant statement that:

[23] http://pulsenews.co.kr/view.php?year=2016&no=895229
[24] https://www.energy-storage.news/news/ihs-markit-40-of-energy-storage-pipeline-is-co-located-with-solar-pv - .WtltLU0v78E.twitter
[25] http://english.yonhapnews.co.kr/news/2018/01/25/0200000000AEN20180125005200320.html
[26] http://www.theinvestor.co.kr/view.php?ud=20180411000566
[27] http://www.businesskorea.co.kr/news/articleView.html?idxno=20592
[28] https://www.greentechmedia.com/articles/read/south-korea-strengthens-grid-to-take-more-renewables - gs.9VBN2XI

"we see Korean coal imports dropping by nearly 50% to less than 60 Mtce [million tonnes coal equivalent] in 2040".[29]

Figure 2: IEA Forecast of Change in Net Coal Imports to 2040 – Korean Imports Decline from 115 Mtce to under 60 Mtce



Source: IEA 2017, New Policies Scenario

IEA: Achieving the Paris Climate Agreement Target

In 2017, the IEA collaborated with the International Renewable Energy Agency and published a report entitled 'Perspectives for the Energy Transition'. In this report, the IEA modelled a scenario called 66% 2ºC—whereby global policies are set to give a 66% chance that the Paris climate agreement target "to limit the rise in global average temperature to well below 2°C from pre-industrial levels" is met.

If the global community puts in place the policies required to give a good chance of hitting the Paris target, as the signatories (including Australia and South Korea) committed to, the IEA sees the following outlook for coal.

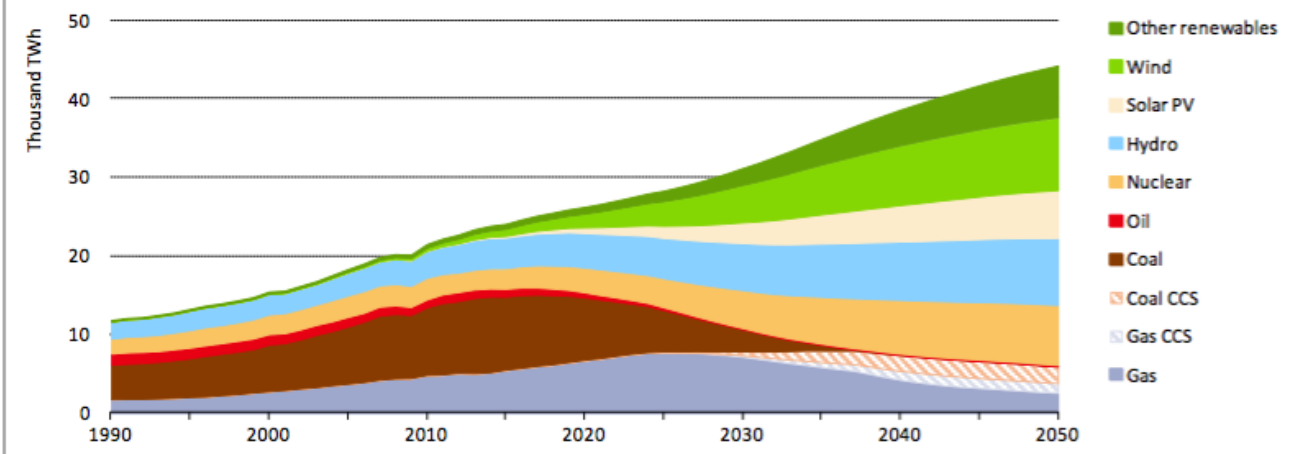
The decline of coal use in the power generation sector would be rapid—coal use in this segment would be 80% below today's level by 2050. By that date, several G20 countries would have a close-to-zero carbon electricity system. Of the remaining coal-fired power plants in 2050, most would have to be paired with carbon capture and storage (CCS) technology without which coal use would have to be reduced even further. The IEA notes that its assumed role for CCS "comes against the background of a limited number of large-scale CCS projects to date."[30]

[29] IEA: World Energy Outlook 2017, p. 226
[30] IEA: Chapter 2 of Perspectives for the energy transition – investment needs for a low-carbon energy system ©OECD/IEA 2017, p. 76

IEEFA would note that CCS technology is unproven and has been left behind by the rapid advance of renewables technology in terms of efficiency and cost. The Kemper CCS plant in the U.S. is a classic example of the current status of CCS technology. This was the world's most ambitious CCS project before being scrapped after falling three years behind schedule and running well over budget at a cost of US$7.5bn.[31]

To reach the targets agreed to at Paris, the least-efficient coal-fired power plants would need to be phased out by 2030 in most regions, with many of these plants retired before reaching the end of their technical lifetime. Existing highly efficient coal-fired plants would need to be almost completely eliminated by 2040 in the IEA's 66% 2°C Scenario. Global electricity generation would be dominated by non-carbon emitting sources by 2050 (see Figure 3).

Figure 3: Global electricity generation by source in the 66% 2°C Scenario



Note: TWh = terawatt-hours; CCS = carbon capture and storage.

Key message • The power generation mix undergoes a dramatic transformation to one based on renewables, nuclear and CCS, with unabated coal phased out and natural gas on the decline.

Source: IEA

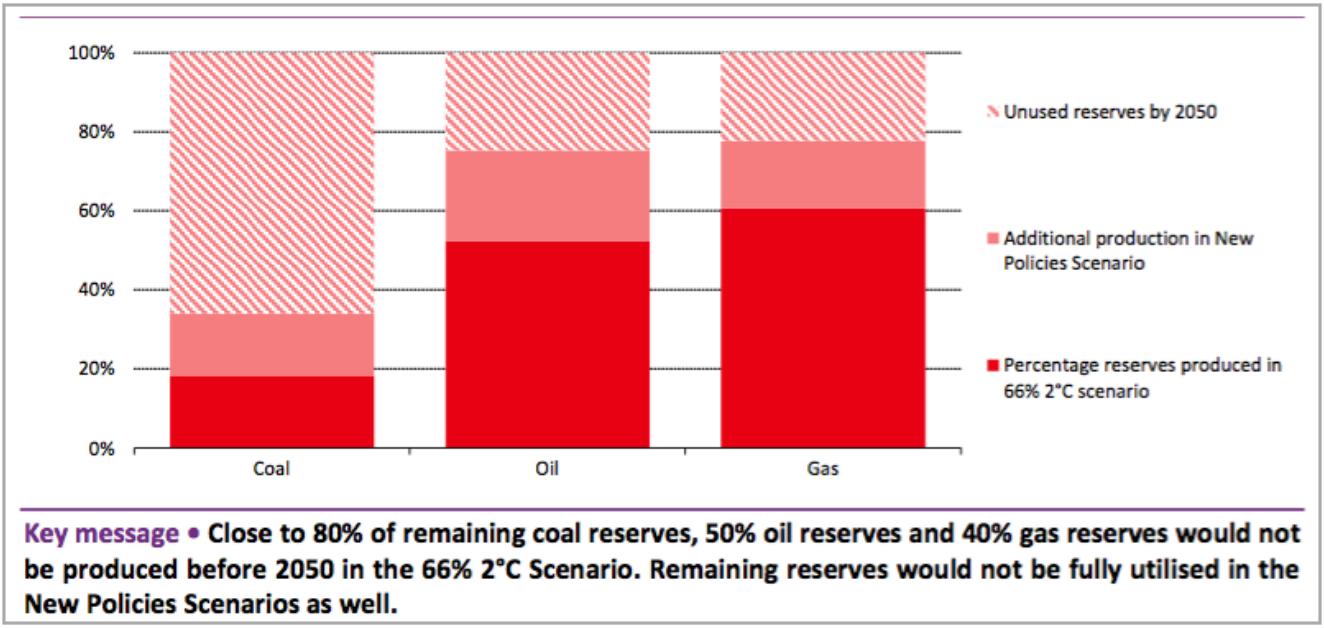
As a result, coal consumption would drop by more than 65% by 2050 from 2014 levels. More than 80% of current thermal and coking coal reserves would have to be considered "unburnable"[32] (see Figure 4).

In this scenario, around one quarter of coal mine production capacity would close before exhausting their reserves. Assuming the international community makes the necessary policy changes to hit the Paris agreement target, any new coal mines beginning operations from here on face being closed before the end of their planned life.

[31] https://www.greentechmedia.com/articles/read/carbon-capture-suffers-a-huge-setback-as-kemper-plant-suspends-work-gs.4FpkKYM

[32] IEA: Chapter 2 of Perspectives for the energy transition – investment needs for a low-carbon energy system ©OECD/IEA 2017, p. 107

Figure 4: Proportion of fossil fuel reserves produced in the 66% 2°C and New Policies Scenarios, 2015 - 2050



Source: IEA

Bylong Coal Project Is No Longer Strategically Important

In its letter of support for the Bylong Coal Project, KEPCO states that it imported 78Mt of coal in 2016[33]--clearly this figure is set to decline significantly if the IEA's forecasts play out. KEPCO also states that coal consumption in South Korea rose 39% in the 10 years to 2016.[34] However, what has happened in the past is a misrepresentation of the future—the company fails to point out that coal consumption is set to decline going forward. It is future coal consumption that is relevant to the Bylong Coal Project.

Regardless of whether the global community meets its commitment to the Paris agreement, it is hard to see how the Bylong Coal Project could be considered "strategically important" to Korea, and therefore to state-owned KEPCO, if that nation's coal imports are expected to decline so significantly over the next two decades. With a 25-year lifespan, the Bylong Coal Project is intended to still be operating in 2040—when almost half its market will have disappeared according to the IEA's latest forecast.

Despite all indications to the contrary, KEPCO has maintained that the Bylong Coal Project remains strategically important. It is clear why the company would continue to hold this position—proceeding with this position in an effort to achieve all planning approvals would give KEPCO the option of selling the project if and when the company concludes that it is no longer a strategic priority.

In IEEFA's opinion, the clear change in direction set out in South Korea's new energy policy means that the development of the Bylong Coal Project is not necessary to meet projected declining South Korean demand for thermal coal.

[33] Bylong Coal Project – Kepco Response to PAC Appendix C: Letter of Support from KEPCO Korea
[34] Bylong Coal Project – Kepco Response to PAC Appendix C: Letter of Support from KEPCO Korea

The change in direction on energy policy by the South Korean government, recognising the energy transition that is occurring globally, significantly undermines the long-term economic viability of the Bylong Coal Project in terms of the amount of coal that can be placed into the market and for how long. This casts doubt on the project's economic benefits and calls into question whether those benefits outweigh its social, cultural and environmental impacts and hence whether it can be justified on economic grounds.

Coal Price Forecasts and Coal Quality

The prediction of a significant decline in South Korean coal imports is part of what, in IEEFA's view, is a permanent, structural decline in the global seaborne thermal coal market. Declining demand for imports will have an impact on coal prices, the outlook of which has changed appreciably since the Bylong Coal Project was envisaged.

Bylong Coal Project's Price Forecast Assumptions Are Clearly Out of Date

The EIA prepared for the Bylong Coal Project by Gillespie Economics uses a 2014 coal price forecast provided by Wood Mackenzie as the basis of its assessment of the value of coal and economic benefit.[35] However, the details of this forecast are not disclosed - the forecast prices are not stated.

IEEFA would note that it is very difficult to properly evaluate the EIA of the mine without knowing the future coal price forecasts assumed in the study. Such assumptions are clearly fundamental to any economic assessment of a proposed coal mine, especially given the recent price volatility of the seaborne thermal coal market.

In its January 2018 Response to the then Planning Assessment Commission's comments on the EIA, the Bylong Coal Project again references the 2014 Wood Mackenzie forecast and reiterates the peer review by the Centre for International Economics (CIE), which assumed an implied price of A$90 to A$100/t was used in the EIA. The Bylong Coal Project also references a 2015 medium to long term export thermal coal price forecast of A$97 to A$117/t, sourced from the NSW Department of Trade and Investment and quoted by CIE in its peer review.[36]

These forecasts date from just three or four years ago but significantly, in the time that has passed since these studies and forecasts were made, the seaborne thermal coal market outlook has changed materially, making them clearly out-of-date. We reference an up-to-date thermal coal price forecast below to highlight this (see 'Recent Price Forecasts Are Well Below the Prices Cited by the Bylong Coal Project' section below).

Seaborne Thermal Coal in Structural Decline

In the years since the above coal price forecasts were made the global seaborne coal market has changed significantly, entering structural decline in IEEFA's view. The following events are notable:

- Since the date of the Wood Mackenzie forecast, it has become clear that 2014 was the peak year of global coal consumption.[37]

- In 2015 almost all nations, including Australia and South Korea, signed the Paris climate agreement, committing to limit global temperature increase to below two degrees Celsius at least, with efforts to limit the increase to 1.5 degrees Celsius.

[35] Bylong Coal Project EIS – Appendix AE: Economic Impact Assessment, p. 33
[36] Response to PAC Comments on the Economic Impact Assessment (Appendix W)
[37] https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/coal/coal-consumption.html

- Central banks, led by the Bank of England, have started to warn of the potentially huge impacts of climate change on the financial system.[38] [39] The Task Force on Climate-related Financial Disclosures was set up to develop standards for disclosure of climate-related financial information by companies.[40]

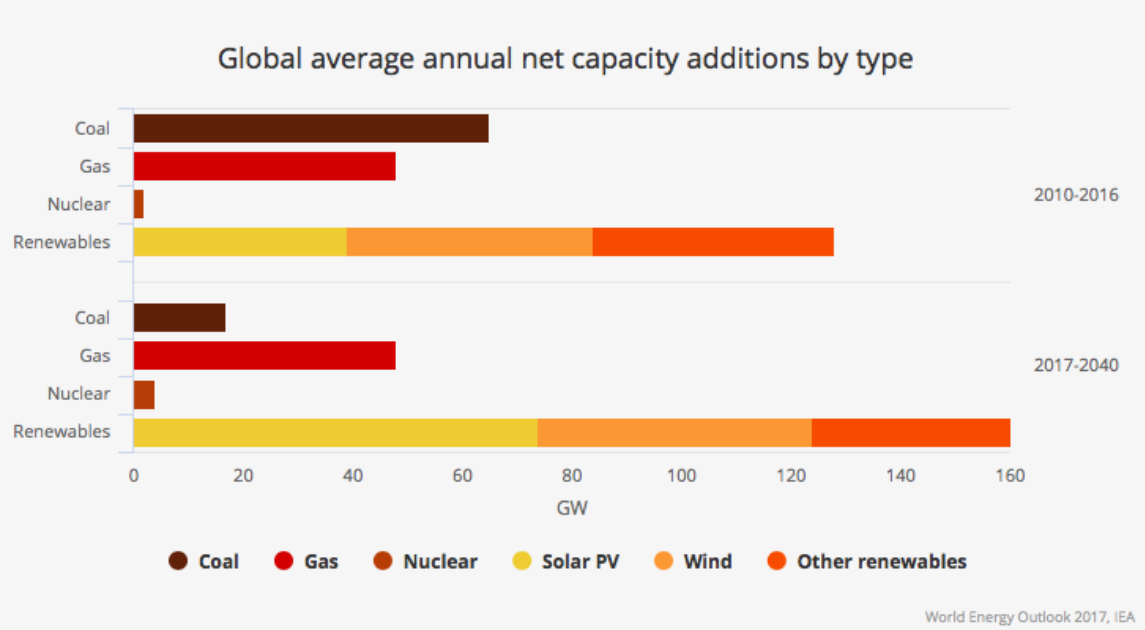
- Finance is increasingly moving away from coal; banks are progressively reducing lending to coal mines and coal-fired power plants. RBS became the latest global financial major to move away from coal in May 2018.[41]

- Insurance companies are increasingly refusing to cover coal projects.[42]

- Bank of America Merrill Lynch in April 2018[43] forecast a halving of U.S. solar costs by the mid-2020s; this double digit annual deflation of renewable energy costs will see renewables out-compete coal-fired power going forward.[44]

- The IEA now accepts that the great majority of future investment in electricity generation infrastructure will be in renewable energy technology, with significant decline in coal-fired power investment (see Figure 5).

Figure 5: IEA Actual and Forecast Annual Net Capacity Additions



Source: IEA World Energy Outlook 2017

- In its latest World Energy Outlook report for 2017, the IEA forecasts that the global thermal coal trade is headed downward, with both 2025 and 2040 volumes below the

[38] https://www.bankofengland.co.uk/-/media/boe/files/speech/2018/a-transition-in-thinking-and-action-speech-by-mark-carney.pdf
[39] https://www.bloomberg.com/view/articles/2018-04-13/global-warming-is-a-central-bank-issue
[40] https://www.fsb-tcfd.org/publications/final-recommendations-report/
[41] https://www.reuters.com/article/us-rbs-strategy-fossil-fuels/rbs-to-stop-financing-new-coal-plants-oil-sands-or-arctic-oil-projects-idUSKCN1IU155
[42] https://www.ft.com/content/7ec63f34-f20c-11e7-ac08-07c3086a2625
[43] Bank of America Merrill Lynch, Research Note on First Solar Inc, 18 April 2018
[44] http://www.afr.com/news/coal-cant-compete-in-renewablesrich-grid-says-snowy-hydros-paul-broad-20180522-h10doj

level of 2016 under the central New Policies and the Sustainable Development scenarios.[45] Under the latter scenario, which tracks a path toward achieving climate stabilisation, reduced air pollution and universal access to modern energy, global thermal coal trade volumes plummet 28% by 2025 and 59% by 2040. Thermal coal demand for power generation drops by 75% in 2040 from 2016 levels under this scenario.

- Under its 66% 2°C Scenario, whereby policies are set globally in order to successfully limit global warming to 2°C in line with the Paris climate agreement, coal use in the power generation sector would be 80% below today's level by 2050.

The material changes in the global thermal coal market over the past few years have led to significant declines in coal price forecasts. This is well illustrated by Appendix I to this report, which compares the IEA's 2015 thermal coal price forecasts (which was referenced by the Bylong Coal Project's response to the CIE peer review, prepared by Gillespie Economics)[46], to the 2017 version of the same chart. A significant decline in forecast prices is apparent.

As such, price forecasts from 2014 and 2015 cannot be relied upon for an accurate economic assessment of a thermal coal mining project. The Bylong Coal Project has failed to make the necessary update to its coal price forecasts despite a significant change in outlook for the global seaborne coal market since 2014.

Recent Price Forecasts Are Below the Prices Cited by Bylong Coal Project Reports

International financial services firm KPMG collates coal price forecasts from brokers and research databases on a quarterly basis. The resulting publicly available reports[47] disclose an average price forecast for the following four years and also an average long-term price forecast. As such, the reports provide an unbiased consensus view of coal price forecasts built on individual submissions from commodity analysts and researchers.

The most recent consensus Newcastle benchmark thermal coal forecast for March/April 2018 forecasts that thermal coal prices will drop to US$65/t in the long term (See Figure 6). This is equivalent to A$86/t, below the range cited by the Bylong Coal Project. It is the long-term forecast that is most relevant given the planned 25-year life of the mine proposal and that saleable coal won't be available until 2022 even if the project were to proceed..

The IEA, under its 66% 2°C Scenario (see page 10), forecasts that imported thermal coal prices would fall to US$66/t (A$88/t) by 2020 and US$55/t (A$73/t) by 2040.

The Bylong Coal Project attempts to cover the possibility of changes in coal price by bringing attention to the fact that sensitivity analyses were performed that included scenarios where coal prices may be 20% or 30% higher or lower than forecast.[48]

IEEFA would note that, for it to be effective, any such sensitivity analysis needs to be performed using an accurate, up-to-date coal price forecast. Performing a sensitivity analysis on out-of-date figures does not produce reliable results.

[45] IEA World Energy Outlook 2017
[46] Response to Submissions – Appendix N: Gillespie Economics Response to CIE Peer Review
[47] https://home.kpmg.com/au/en/home/insights/2018/02/coal-price-fx-market-forecasts.html
[48] Bylong Coal Project – Response to PAC Review, p. 84

In IEEFA's opinion, the significant structural changes in the global seaborne thermal coal market means that the coal price forecasts relied upon in the EIA are out-of-date and therefore cannot be considered reasonable and reliable.

The out-of-date price forecasts raise further doubts over the prices that will be received for Bylong coal and hence whether the benefits of the Bylong Coal Project will outweigh its social, cultural and environmental impacts.

Figure 6: KPMG March/April 2018 Benchmark Newcastle Thermal Coal Consensus Forecast 2018 to 2022 and Long Term (US$/tonne, nominal).

Year ended 31 December	Reporting date	2018	2019	2020	2021	2022	LT (2018)
Contributor 1	23-Apr-18	95.8	87.9	77.6	76.1	n/a	67.9
Contributor 2	18-Apr-18	84.0	79.5	75.0	71.0	n/a	65.0
Contributor 3	12-Apr-18	92.0	71.0	67.0	63.0	65.0	65.6
Contributor 4	11-Apr-18	94.0	85.0	82.0	78.0	73.0	67.0
Contributor 5	9-Apr-18	85.0	75.0	75.0	n/a	n/a	n/a
Contributor 6	6-Apr-18	89.0	80.0	80.0	80.0	80.0	n/a
Contributor 7	5-Apr-18	90.0	80.0	75.0	n/a	n/a	65.0
Contributor 9	3-Apr-18	96.0	95.0	87.0	n/a	n/a	60.0
Contributor 10	1-Apr-18	90.5	87.9	83.4	n/a	n/a	n/a
Contributor 11	28-Mar-18	97.0	80.0	65.0	63.0	63.0	n/a
Contributor 12	26-Mar-18	94.0	89.0	n/a	n/a	n/a	n/a
Contributor 13	26-Mar-18	92.5	85.0	83.0	n/a	n/a	67.0
Contributor 14	26-Mar-18	77.5	70.0	70.0	70.0	70.0	65.0
Contributor 15	26-Mar-18	94.0	84.0	76.0	75.0	n/a	55.3
Contributor 17	13-Mar-18	85.0	81.0	75.0	75.0	71.0	65.0
Contributor 19	11-Mar-18	88.0	79.0	77.0	77.0	78.0	76.0
Contributor 21	1-Feb-18	88.8	71.3	n/a	n/a	n/a	n/a
Low		**77.5**	**70.0**	**65.0**	**63.0**	**63.0**	**55.3**
High		**97.0**	**95.0**	**87.0**	**80.0**	**80.0**	**76.0**
Average		**90.2**	**81.2**	**76.5**	**72.8**	**71.4**	**65.3**
Median		**90.5**	**80.0**	**76.0**	**75.0**	**71.0**	**65.0**

Source: KPMG, Thomson Research, Contributors

Lower-Grade Bylong Coal Will Fetch a Lower Price

Note that the average long-term Newcastle thermal coal price forecast of US$65/t in Figure 6 is for the industry standard grade of coal shipped out of Newcastle, assessed by Platts as 6,300 kcal/kg GAR (gross as received), 13% ash coal. S&P Global Platts is a preeminent provider of energy and commodities data and a key source of benchmark price assessments for energy markets. 6,300 kcal/kg refers to the net calorific value or heating value of the coal.

However, the lower quality of the coal located at the Bylong Coal Project would attract a lower price than the industry standard benchmark and result in reduced royalties payable as well as lower profitability and corporate tax payable.

The specific energy content of the coal at the Bylong Coal Project can be found in the *Mine Plan Justification Report* (see Figure 7). Across the project's marketable reserves, the highest specific energy content is 24.6 MJ/kg GAR (incorrectly shown as kcal/kg in Bylong Coal Project's table). This equates to 5,880 kcal/kg GAR. This is well below the benchmark of 6,300 GAR for the top grade of Australian coal. As such, this coal will attract a discount to prices quoted both in Bylong Coal Project's own forecasts and the recent KPMG compiled consensus forecast shown in Figure 6.

Figure 7: Bylong Coal Project Marketable Coal Reserves

		Proved			Probable		
Mining Method	Seam	Product Coal (Mt)	Ash (% ad)	Specific Energy (kcal/kg gar)	Product Coal (Mt)	Ash (% ad)	Specific Energy (kcal/kg gar)
OC	Glen Davis	0.1	22.0	22.4	0.8	22.0	22.4
	Ulan	8.1	22.0	22.4	0.7	22.0	22.4
	Coggan	16.0	16.0	23.9	0.1	16.0	23.9
	Subtotal	24.1	18.0	23.4	1.6	21.6	22.5
UG Area 2	Coggan	40.5	15.7	24.6	15.4	15.8	24.6
Combined OC & UG	TOTAL	**64.6**	**16.6**	**24.2**	**17.0**	**16.3**	**24.4**

Source: Bylong Coal Project EIS – Appendix E: Mine Plan Justification Report

Furthermore, one third of the marketable coal in the open cut operation has a high ash content (22%). The benchmark for the top grade of Australian thermal coal requires an ash content of no more than 16%.[49] As such, this coal would attract an even lower price. The lower value of the Bylong Coal Project's coal does not appear to have been taken into account in the EIA.

With its lower energy content and higher ash content, much of the coal at the Bylong Coal Project can be more accurately evaluated against the lower grade of Australian thermal coal that Platts assesses—5,500 kcal/kg NAR (net as received), 20% ash coal. This coal uniformly receives a lower price than higher-grade Australian coal. And even here, given its higher 22% ash content, coal from Bylong likely would net even less.

April 2018 has seen a sudden drop in the price of 5,500 kcal/kg NAR high ash coal after China made a decision to ban coal imports at some ports. This led to the value of 5,500 kcal/kg NAR high ash coal "plummeting" according to Platts[50] as this is the grade that was previously in demand by China. The price of this grade had dropped steeply to US$65/t from US$88/t just two months earlier.

[49] https://www.platts.com/IM.Platts.Content/methodologyreferences/methodologyspecs/coalmethodology.pdf
[50] http://blogs.platts.com/2018/04/20/thermal-coal-china-imports-india/

The Platts report stated that the sudden import ban has "the potential to upend the mining, shipping and marketing plans of Australian high-ash coal shippers as China has been a large customer for this type of thermal coal."

Although the ban will likely prove temporary, the trend in China's electricity market is clear. The nation is ramping up renewable energy installations at an astonishing pace and seeking to become far less reliant on coal. In the longer term, China will stop importing coal permanently, with significant negative impacts on the value of the grade of coal against which the Bylong Coal Project's production would be benchmarked.

In IEEFA's opinion, quoting coal price forecasts for the industry standard grade of Australian thermal coal gives misleading expectations as to the price that the Bylong Coal Project's coal will attract. As a lower grade of coal, the Bylong's Coal Project's coal production will sell at a discount.

On top of the out-of-date coal price forecasts, this calls into the question whether the project's benefits outweigh its impacts and hence, whether the project can be justified economically.

Benefits: 'Substantial Doubt'

In its review report, the then Planning Assessment Commission concluded that "*substantial doubt persists about the potential benefits and impacts of the Bylong Coal Project*"[51]. The following adds to doubts over whether the economic benefit of the project outweighs its impacts.

Risk That Royalties Paid Would Be Significantly Lower than Assessed

IEEFA would highlight that there are further doubts over the potential benefits of the project. The fact that the Wood Mackenzie coal price forecasts used in the EIA of the Bylong Coal Project are so out-of-date has direct impact on the calculation of royalties that would be paid to the NSW government. In its response to the PAC review, KEPCO maintained that royalties paid to the state government over the life of the mine would total A$290m[52] (present value – see Figure 8). The coal price forecast used to calculate this royalty was provided by Wood Mackenzie in 2014 and has not been disclosed by KEPCO.

In this report we have pointed out that KEPCO's coal price forecasts are out-of-date; the actual prices realized by the project are likely to be significantly below forecast, which will lead to lower royalties paid.

Furthermore, we have highlighted the fact that the quality of the Bylong Coal Project's coal is significantly lower than the industry benchmark and will therefore attract a significantly lower price. This would clearly lead to lower royalties being paid than has been indicated by the Bylong Coal Project.

The sensitivity analysis undertaken by the Bylong Coal Project to calculate royalties under different coal price scenarios was also performed based on an out-of-date coal price forecast. Performing the analysis based on current price forecasts would give lower royalties than found under Bylong's sensitivity analysis under the -30% price scenario. This calls the royalties benefit touted by the Bylong Coal Project into further doubt.

Figure 8: Suggested Net Benefit of the Bylong Coal Project

	A$m NPV
NSW Royalties *	290
Corporate Tax **	302
Other (Net)	4
Total	596
To KEPCO	213
Grand Total	809

* Using WoodMac's 2014 coal price assumption

** Ignoring project and corporate debt

Source: Bylong Coal Project, KEPCO Response to PAC Review Report – Main Report, January 2018

[51] NSW Government Planning Assessment Commission, Bylong Coal Project Review Report, 25th July 2017

[52] Bylong Coal Project: Response to PAC Review Report – Main Report, January 2018, p. IV

Unrealistic Corporate Tax Benefit Analysis Methodology

KEPCO also maintains that A$302m (present value) of corporate taxes will be paid over the life of the project (Figure 8).[53] However there is significant doubt over this figure as the modelling that produced it does not consider the funding structure of the project and how this may impact its economic benefit. As a result, the EIA ignores the effect of the inevitable high level of project and corporate debt used to fund the project.

A scenario in which no debt is taken on to fund the proposal is a highly unlikely one, almost unprecedented in multinational mining company investments in Australia. Precedent strongly suggests the project would be largely debt funded, which will lead to significant, ongoing tax-deductible interest payments with resulting significant reductions in profits and corporate tax payable.

Where coal prices are lower than expected under the Bylong Coal Project's out-of-date forecast, profits and corporate tax payable will be even further reduced. The fact that the project's coal quality is lower than the industry standard means that the proposal's coal will achieve a lower price than indicated by the Bylong Coal Project. This would have significant impacts on the project's profitability and the amount of corporate tax payable.

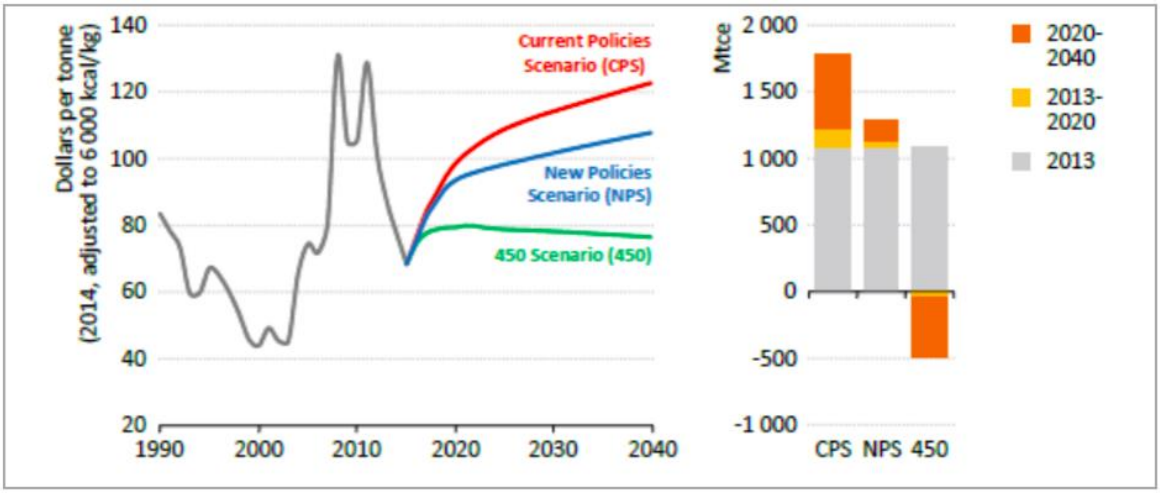
[53] Bylong Coal Project: Response to PAC Review Report – Main Report, January 2018, p. IV

Appendix I

IEA Thermal Coal Price Forecasts – Changes in Two Years

The Bylong Coal Project's response (prepared by Gillespie Economics) to the CIE peer review included the following chart from the IEA World Energy Outlook 2015.

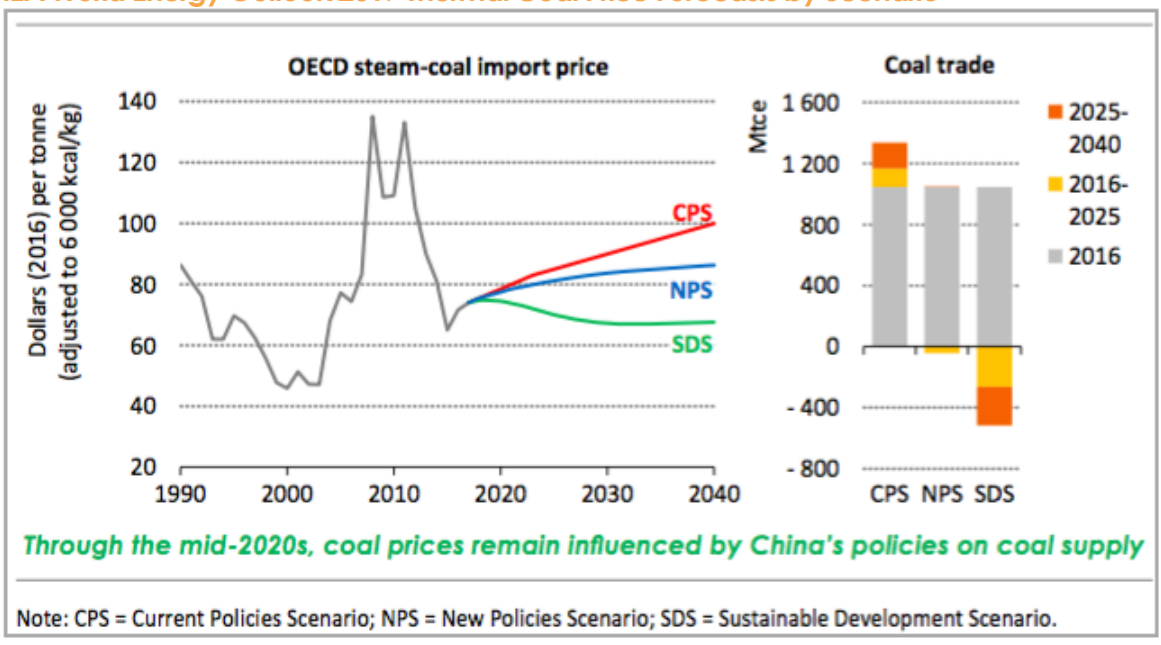
IEA World Energy Outlook 2015 Thermal Coal Price Forecasts by Scenario (Included in Gillespie Economics 2016 Response to the CIE Peer Review)



Source: Gillespie Economics, IEA World Energy Outlook 2015

The same chart from the 2017 version of the IEA's World Energy Outlook is shown below. Note that the forecasts for coal prices have declined significantly from 2015.

IEA World Energy Outlook 2017 Thermal Coal Price Forecasts by Scenario



Source: IEA World Energy Outlook 2017

Institute for Energy Economics and Financial Analysis

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Important Information