Australian National University

24 June 2020

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Independent report:
Thermal coal demand and future emissions from the Carmichael Coal Mine

I am an Associate Professor at the Crawford School of Public Policy, Australian National University (ANU). My expertise is in energy economics, with my research having a particular focus on energy demand analysis. I have published in leading journals including *American Economic Journal: Macroeconomics*, *Nature Climate Change*, *Nature Geoscience*, *Energy Economics*, *The Energy Journal*, and *Energy Policy*. At ANU I teach two postgraduate courses: IDEC8089 Energy Economics and IDEC8029 Issues in Applied Microeconomics. I hold a PhD in Economics from the Australian National University.

This report is based on knowledge arising from my training, study, and experience, together with evidence from peer-reviewed literature and other sources. I have made relevant enquiries and have not withheld any matters of significance that are before me. I have read and complied with the Harmonised Expert Witness Code of Conduct and agree to be bound by it.

I attach a short CV and a copy of the instructions provided to me for this independent expert report by Ariane Wilkinson, Senior Lawyer, Environmental Justice Australia.

My work address is: Crawford School of Public Policy, Crawford Building, 132 Lennox Crossing, Acton ACT 2601.

Sincerely,

Paul Burke

Responses to questions

a) What are the factors governing global thermal coal demand and consumption?

The quantity of global thermal coal consumption is determined by both demand-side and supply-side factors.

Key factors that influence the demand for thermal coal include:

1. Rates of economic growth, particularly in large thermal coal consuming countries such as China and India.

2. The degree of competition from other energy sources, including renewables and natural gas.

3. The stringency of environmental policies related to thermal coal use.

Key factors for the supply of thermal coal include:

1. The opening of new thermal coal mines and decisions about how much thermal coal to extract and take to market.

2. Environmental and other policies affecting thermal coal mining.

3. Factors affecting the transport of thermal coal to final markets.

The price of thermal coal is determined by supply and demand in regional markets. Larger supply quantities, for example due to the opening of a new thermal coal mine, are associated with a lowering in the price of thermal coal, all else equal. A lower price induces a higher quantity of thermal coal consumption.

b) Assuming global policy settings are a factor, how relevant is the *Paris Agreement* to the global policy setting for global thermal coal consumption?

The Paris Agreement is highly relevant to the future of global thermal coal use, with parties agreeing to the objective of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (UNFCCC, 2015). To achieve a stabilisation of warming at any level of temperature increase requires global emissions to fall to zero in net terms. The Paris Agreement seeks to reach "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century".

Coal is the most carbon-intensive of the fossil fuels. The capture and storage of carbon dioxide emissions from coal use has to date been limited as a result of the high costs involved and the lack of an adequate financial or legal motivation to do so in many jurisdictions. In the absence of a sizeable reduction in the costs of carbon capture and storage, the world will need to substantially reduce thermal coal use over coming decades in order to meet the objectives of the Paris Agreement.

The most important implications of the Paris Agreement for global thermal coal consumption are:

1. The enhancement of expectations that emissions from thermal coal will be subject to increasing restrictions.

2. A reduction in the social acceptability of emission-intensive projects given that they undermine the world's ability to meet the objectives of the Paris Agreement. Some financial institutions have announced that they will no longer invest in coal projects, in part due to social corporate responsibility considerations related to the Paris Agreement.

The emergence of cost-competitive alternatives to thermal coal, including solar and wind power, has increased the general expectation of a bleak medium- to long-term outlook for the commodity. A viable pathway exists towards a largely decarbonised global electricity system that does not use thermal coal.

c) What would compliance with the aims of the *Paris Agreement* (to keep global warming well below 2°C and pursue efforts to keep global warming below 1.5°C) mean for global thermal coal consumption?

Compliance with the aims of the Paris Agreement would almost certainly involve a large reduction in global thermal coal use. This is because substitution away from thermal coal is one of the low-hanging fruits when it comes to reducing global greenhouse gas emissions. It is highly likely that it will be cheaper to use alternative primary energy sources than it will be to use thermal coal and capture and store the emissions.

It is important to note that *all* emissions would need to be captured by the second half of this Century to be consistent with the goal of stabilising the global climate at an average temperature increase of well below 2°C. Most of the world's remaining fossil fuel resources would need to remain in the ground (IPCC, 2018).

The International Energy Agency's *World Energy Outlook* is a leading source of energy-sector analysis. The *World Energy Outlook 2019* includes a 'Sustainable Development Scenario' calibrated to the Paris Agreement objective of keeping the increase in global average temperature to "well below 2°C … and pursuing efforts to limit [it] to 1.5°C". Under this scenario it is estimated that global use of steam coal would decline by 65% over 2018–2040, to only about 1.5 billion tonnes of coal equivalent per annum.[1] This is a large decline.

d) Is global thermal coal consumption currently increasing, staying constant, or falling?

As of 2018, global use of steam coal was still increasing, although slowly. The following table presents data from the International Energy Agency's *Coal Information 2019*. The average growth rate over 2010–2018 was 0.7% per annum.

Demand for coal has since fallen.[2] For 2019, BP data suggest that total global consumption of coal (including metallurgical coal) fell by 0.6%. A decline in global coal use in 2019 is also confirmed by data from the International Energy Agency's Global Energy Review 2020. In 2020, the COVID-19 recession has seen demand for coal fall sharply, with the International Energy Agency expecting an 8% decline in global coal use for the year. The expected decline is larger than the expected fall in global energy use (6%). A particularly large decline is expected for thermal coal.

[1] Steam coal is defined by the International Energy Agency (2019) as: "coal that is mainly used for heat production or steam-raising in power plants and, to a lesser extent, in industry. Typically, steam coal is not of sufficient quality for steel making. Coal of this quality is also commonly known as thermal coal."

[2] The statistics in this paragraph are for data in energy-equivalent terms.

World steam coal consumption by year

Year	billion per annum
2000	3.38
2005	4.53
2010	5.61
2016	5.71
2017	5.84
2018	5.94

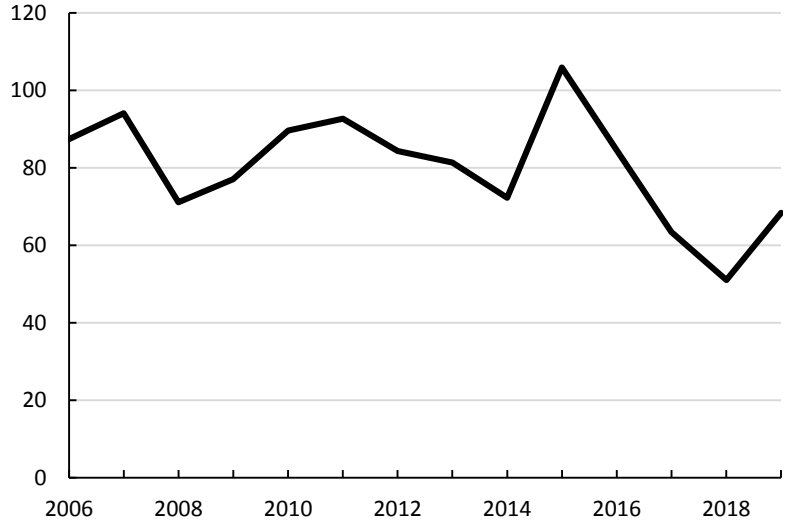
Note: The unit is billion tonnes of steam coal rather than billion tonnes of coal equivalent. Available data for 2018 are 'projected'. Source: International Energy Agency.

e) Is the global rate of construction of thermal coal power stations currently increasing, staying constant, or falling?

According to data from the Global Coal Plant Tracker, annual additions of new coal-fired electricity generation capacity in gigawatts (GW) have generally been trending down, with some fluctuations. The data are shown in the following Figure, and indicate that the annual flow of new coal-fired capacity additions declined by 35% over 2015–2019:

New coal-fired capacity additions, world total

Unit: gigawatts per year



Source: Global Coal Plant Tracker.

It is important to note that some coal-fired capacity is also retired every year. Capacity retirements are displaying an increasing trend. In terms of annual *net* capacity additions, the data indicate a fall of about 50% over 2015–2019, which is large.

f) According to basic economic theory what effect, if any, would an increase of 60 million tonnes per annum (Mtpa) in the supply of thermal coal have on global thermal coal prices and consumption, all other things remaining equal?

Standard economic theory would suggest that an increase of 60 million tonnes per annum (Mtpa) in the supply of thermal coal would involve an outward shift in the supply curve for thermal coal.[3] This would place downward pressure on the price of thermal coal and lead

[3] This and the following discussion will refer to thermal coal measured in energy-equivalent terms, e.g. tonnes of coal equivalent.

to an increase in the quantity of thermal coal consumption in both the short run and the long run. The increase in consumption would be less than 60 Mtpa because the downward pressure on the price of thermal coal would reduce the quantity of thermal coal supplied from other mines.

The above description uses conventional supply and demand analysis. It allows the price and annual quantity of thermal coal to vary, but assumes that other factors remain equal. The size of the effect is discussed further in (h) below.

g) According to basic economic theory what effect, if any, would an increase of 108 million tonnes per annum (Mtpa) in the supply of thermal coal have on global thermal coal prices and consumption, all other things remaining equal?

Standard economic theory would suggest that an increase of 108 million tonnes per annum (Mtpa) in the supply of thermal coal would have larger effects than an increase of 60 Mtpa. Specifically, it would involve an outward shift in the supply curve for thermal coal, placing downward pressure on the price. This would lead to an increase in the quantity of thermal coal consumption in both the short run and the long run. The increase would be less than 108 Mtpa because the downward pressure on the price of thermal coal would reduce the quantity of thermal coal that is supplied from other mines.

The above description uses conventional supply and demand analysis. It allows the price and annual quantity of thermal coal to vary, but assumes all other factors remain equal. The size of the effect is discussed further in (h).

h) In your opinion, how likely is it that the production of coal from the Carmichael Coal Mine and Rail Infrastructure Project, authorised under EPBC Approval 2010/5736, would offset an equivalent amount of coal production from other mines in the global coal market, leading to no greater production and subsequent emissions?

Effects on thermal coal consumption

It is extremely unlikely that production of thermal coal from the Carmichael Coal Mine would result in no increase in overall global consumption of thermal coal. The supply of thermal coal from the mine would lead to an outward shift in the supply curve and a reduction in the market price of thermal coal, all else equal. This would result in additional consumption of thermal coal relative to the counterfactual without the mine.

The increase in annual consumption of thermal coal would be expected to be less than the annual output of the project. This is because the reduction in the price of thermal coal caused by the mine's output would lead to a reduction in the quantity of thermal coal supplied from other mines.

To have zero influence on global thermal coal consumption, standard economic theory would suggest that at least one of the following must hold:

- ***The supply curve for thermal coal must be perfectly elastic***, which would mean that a new project would not place downward pressure on the price of thermal coal. This is implausible – the supply curve for thermal coal is almost certain to be generally upward sloping, meaning that higher prices generally induce higher quantities to be supplied.[4]

  or

[4] See, for instance, Wood Mackenzie Ltd.'s estimates of fossil fuel supply curves (PDF link).

- ***The demand curve for thermal coal must be perfectly inelastic***, meaning that a lower thermal coal price would not lead to an increased quantity of thermal coal use. This is also implausible – it is known that the demand curve for thermal coal is generally downward sloping, meaning that more thermal coal is used at lower prices.[5]

There is ample evidence that prices for and consumption of energy products are indeed influenced by market supply. As an example, the increased extraction of natural gas in the United States in recent years has led to a reduction in the price of natural gas in the United States and in linked markets, leading to an increase in natural gas use (U.S. Energy Information Administration, 2019). The same principle applies for new coal mines.

The Global Trade and Environment Model-CSIRO (GTEM-C) model uses the following price elasticities for coal (Yeh et al., 2016):

- Demand: –0.5.
- Long-run supply: 1.0.

These elasticities imply that new coal mines would lead to an increase in coal consumption, consistent with the above discussion. Different modelling exercises use different elasticity estimates, with for example Burniaux and Chateau (2014) using a larger long-run supply elasticity. Nevertheless there is a high level of confidence that the elasticities are such that the effect of a new thermal coal mine on global thermal coal use would not be zero. Due to the improving competitiveness of substitutes for thermal coal, we should expect thermal coal demand to be increasingly price elastic over time. This process increases the expected effect of a new thermal coal mine on total thermal coal consumption.

Based on the analysis of Burke and Liao (2015) and evidence on the long-run price elasticity of demand for another key energy commodity, natural gas (Burke and Yang 2016), a best estimate of the current long-run price elasticity of thermal coal demand would be about –1. Using the long-run price elasticity of coal supply of +1 from the GTEM-C model, one would expect that the increase in global thermal coal use from a new mine would equal approximately 50% of the output of the mine itself.[6]

It should be emphasised that there will always be uncertainty around the exact extent to which global thermal coal output is expected to increase due to the output from a new mine, although the effect is highly unlikely to be zero. Richter et al. (2018) ran simulations of a version of the COALMOD-World model for scenarios in which Australia unilaterally introduces either an export tax or production tax on steam coal. They concluded that the reduction in global steam coal production would be about 23–34% of the reduction in Australia steam coal production (see their Table 1). While their scenarios did not focus on the Carmichael Coal Mine, they are relevant for illustrating the types of effects on global coal consumption that one would expect from shocks to Australian thermal coal supply.

In summary, conventional economic theory would suggest that the opening of a new thermal coal mine would lead to a number of effects relative to the counterfactual:

1. A reduction in the price of thermal coal.

2. Increased overall production and consumption of thermal coal.

[5] See the estimates of Burke and Liao (2015) on the price elasticity of coal demand in China.
[6] See Erickson and Lazarus (2014) for the formula used for this calculation.

3. A reduction in the output of thermal coal from other coal mines (in aggregate). This effect would be smaller than the increased output from the new coal mine.

4. An increase in global thermal coal consumption that is equal to approximately 23–50% of the output of the new mine. This number is highly unlikely to be zero.

5. Reduced use of energy substitutes, including natural gas and renewables.

Effects on greenhouse gas emissions

Coal from the Carmichael Coal Mine is reported to have lower emissions per unit of energy relative to the average for exports of thermal coal from Indonesia or relative to India's domestic supply of thermal coal (Readfearn, 2017). However it would reportedly have higher emissions per unit of energy than the average for Australia's existing thermal coal exports and relative to the averages for thermal coal exports from countries such as South Africa, Colombia, and Russia.

The *market substitution assumption* is that a new coal mine would lead to no increase in overall greenhouse gas emissions, as coal from the mine would displace coal from other sources, including some lower-quality coal. This is implausible in the case of the Carmichael Coal Mine – it is much more likely that the extraction of coal from the mine would lead to a net increase in emissions. There are seven key reasons for this:

1. **Price effect:** The new supply would lead to a lowering in the price of thermal coal. This would lead to an increase in the overall global quantity of thermal coal that is consumed relative to the counterfactual in which the mine is not developed, as discussed above.

2. **Displacement of energy sources with lower emissions:** While coal from the Carmichael Coal Mine may displace the use of some lower-quality coal, this would not be on a 1:1 basis. This is because a share of the displacement would instead be borne by other energy types, including renewables, natural gas, and also higher-quality thermal coal. These other energy types have lower emissions intensities. Because renewable energy technologies are improving every year, over time the marginal alternative for coal from the Carmichael Coal Mine is increasingly likely to be a low- rather than high-carbon source.

3. **Signalling effect:** In the absence of substantial progress in carbon capture and storage, use of thermal coal needs to be rapidly reined in if the objectives of the Paris Agreement are to be met. The opening of a large new thermal coal mine would mean that both Australia and the project participants are acting in a way that is inconsistent with the Paris Agreement. This would undermine the credibility of the Paris Agreement and encourage others to likewise pursue emission-intensive projects. This may lead to a larger increase in coal use than the magnitudes discussed above.

4. **Emissions in project development:** The process of project development, including site clearance, would itself result in emissions. Fewer such emissions would be released if thermal coal were instead extracted from existing mines. There are numerous existing thermal coal mines, and the overall need for thermal coal mines is limited given that total thermal coal extraction needs to decline sharply if the objectives of the Paris Agreement are to be met.

5. **Transportation to final markets:** Any emissions advantage of thermal coal from the Carmichael Coal Mine *vis-à-vis* the lowest-quality thermal coal in overseas markets is reduced by the emissions involved in transporting the coal from the

Galilee Basin to final markets. These emissions should be considered as part of the overall emissions footprint of the Carmichael Coal Mine project.

6. **Opening of the Galilee Basin:** Development of infrastructure for the Carmichael Coal Mine and Rail Infrastructure Project would reduce costs faced in developing other coal mines in the Galilee Basin. If other mines are developed, this would exacerbate the emissions implications of the initial project. A full impact analysis of the initial project would need to consider these flow-on implications.

7. **Diversion of resources from low-emissions projects:** The development of the Carmichael Coal Mine and Rail Infrastructure Project would be likely to divert labour and capital from other projects, including projects that are lower-emission in nature (including some renewables projects). This would slow the transition to a lower-carbon energy system. Queensland is rich in low-carbon energy opportunities.

For these reasons, it is highly likely that extraction of thermal coal from the Carmichael Coal Mine would lead to a net increase in global emissions when evaluated against the counterfactual without the mine. This is a much more suitable starting assumption than an assumption of zero net emissions from the project.

i) In your opinion, how likely is it that the total production of coal from the Carmichael Coal Mine and Rail Infrastructure Project, as well as two proposed neighbouring mines in the Galilee Basin – the Macmines Austasia's China Stone project approved for an output[7] of 38Mtpa and the Hyde Park Coal Mine with a proposed output[8] of 10Mtpa, would offset an equivalent amount of coal production from other mines in the global coal market, leading to no greater production and subsequent emissions?

In my opinion it is highly unlikely that the development of these three mines and the rail infrastructure project would be offset by an equivalent reduction in coal production from other mines, leading to no greater production and subsequent emissions. The reasons for this conclusion are as detailed in response to (h). The development of the neighbouring mines in the Galilee Basin would lead to additional net emissions relative to a scenario in which the neighbouring mines are not developed.

The basic principles stand that emissions from coal mining are a flow-on from the initial extraction of coal, and that it is highly unlikely that a coal mine's output would result in a fully proportionate displacement of production from other mines.

[7] http://statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinatedprojects/completed-projects/china-stone-coal-project.html.
[8] https://www.hydeparkcoal.com.au/project.

Attachment 1: Short CV

PAUL BURKE

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EDUCATION

PhD in Economics, Australian National University (ANU), 2010

Bachelor of Agricultural Economics (Honours I, University Medal), University of Sydney, 2003

RESEARCH FIELDS

Environmental economics; energy economics; transport economics; development economics; Asia-Pacific economies

PUBLICATIONS

Journal articles

Burke, Paul J. and Do, Thang N. In press. 'Greening Asia's economic development.' *Asian Economic Policy Review*.

Best, Rohan, Burke, Paul J., and Jotzo, Frank. In press. 'Carbon pricing efficacy: Cross-country evidence.' *Environmental and Resource Economics*.

Do, Thang N., Burke, Paul J., Baldwin, Kenneth G.H., and Nguyen, Chinh The. In press. 'Underlying drivers and barriers for solar photovoltaics diffusion: The case of Vietnam.' *Energy Policy*.

Best, Rohan and Burke, Paul J. In press. 'Energy mix persistence and the effect of carbon pricing.' *Australian Journal of Agricultural and Resource Economics*.

Best, Rohan and Burke, Paul J. In press. 'Is there regional lock-in of unemployment rates in Australia?' *Australian Journal of Labour Economics*.

Nishitateno, Shuhei and Burke, Paul J. In press. 'Have vehicle registration restrictions improved urban air quality in Japan?' *Contemporary Economic Policy*.

Best, Rohan, Burke, Paul J., and Nishitateno, Shuhei. 2019. 'Evaluating the effectiveness of Australia's Small-scale Renewable Energy Scheme for rooftop solar.' *Energy Economics* 84, 104475.

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Jayasuriya, Dinuk S. and Burke, Paul J. 2013. 'Female parliamentarians and economic growth: Evidence from a large panel.' *Applied Economics Letters* 20(3), 304–307.

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Book reviews

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CONSULTING PROJECTS (samples)

Energy for Economic Growth Project, DFID, 2016–2017 [Team Participant]

Enhancing ASEAN Minerals Trade and Investment, Regional Economic Policy Support Facility (REPSF), ASEAN Secretariat (AusAID-funded), 2005 [Lead consultant, via Mekong Economics]

TEACHING

Lecturer, ANU: IDEC8089 *Energy Economics* (Master/PhD), 2019– (each year)

Lecturer, ANU: IDEC8029 *Issues in Applied Microeconomics* (Master), 2018– (each year)

Lecturer, ANU: IDEC8053 *Environmental Economics* (Master/PhD), 2013–2017 (each year)

Lecturer, ANU: IDEC8016 *Microeconomic Analysis and Policy* (Master), 2011–2015 (each year)

EMPLOYMENT

Associate Professor, Arndt-Corden Department of Economics, Crawford School of Public Policy, ANU, Jan 19–

Fellow, Arndt-Corden Department of Economics, Crawford School of Public Policy, ANU, Jan 14–Dec 18

Research Fellow, Arndt-Corden Department of Economics, Crawford School of Public Policy, ANU, Jun 10–Dec 13

Research Assistant, Fenner School of Environment and Society, ANU, Jan 08–May 10

Research Assistant, Research School of Social Sciences (RSSS), ANU, Jan–Feb 09

Teaching Assistant, Crawford School of Public Policy, ANU, Feb–Jun 08

Economist and **Projects Director**, Mekong Economics Ltd, Vietnam, Nov 04–Dec 05, Oct–Dec 06

Economist, Ministry of Finance and Planning, Government of Tonga, Jan–Sep 06

Attachment 2: Request for independent expert report (including update)

Environmental Justice Australia

5 February 2020

Associate Professor Paul Burke
Crawford School of Public Policy
Australian National University

By email: paul.j.burke@anu.edu.au

CONFIDENTIAL AND PRIVILEGED

Dear Associate Professor Burke,

Re: Independent expert report

1. We act for Ms Claire Galvin from Cairns, Queensland.

2. Our client wishes to retain your services to provide an independent expert report on matters relevant to your area of expertise.

3. The matter concerns whether new information, if considered by the Minister for the Environment, would have led to them not granting the approval of the Carmichael Coal Mine under the *Environmental Protection and Biodiversity Conservation Act 1999*.

4. The task we would like to ask you to undertake, as an independent expert, is to:
   - review the relevant information contained in the attached Expert Evidence Practice note; and
   - provide your expert opinion, in the form of a written report, in response to each of the questions at paragraph 10 below.

Your duty as an expert

5. Please read the attached Federal Court of Australia's *Expert Evidence Practice Note* and Annexure A to it, which is the *Harmonised Expert Witness Code of Conduct* ('**Expert Witness Code of Conduct**'). Please ensure that you prepare your report in accordance with the Expert Evidence Practice Note and that you familiarise yourself with and abide by the Expert Witness Code of Conduct.

6. The manner in which you present the information in your report is a matter for you, provided the material is presented in a form which is clear for a court, should the matter become litigious.

7. In order for your report to be admissible as expert evidence, in the event that this matter becomes litigious, it must comply with the enclosed Expert Evidence Practice note, including the Expert Witness Code of Conduct. Please ensure that your report is consistent with the Expert Witness Code of Conduct and contains each of the items identified in paragraph 3 of that Code.

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8. Please include in your report a description of your qualifications and experience, including any relevant publications or research. It is acceptable for this to be done by way of attaching a current curriculum vitae. In outlining your experience we would request that you detail any particular knowledge, experience or qualifications you have in relation to the questions.

9. We request that you provide us with a draft of your report for review before finalising it. We emphasise that the purpose of this is not to influence the conclusions or recommendations you make, but to ensure that the language and expression of the report is clear and complies with the formal legal requirements of an expert report.

10. *Questions*
    a) What are the factors governing global thermal coal demand and consumption?
    b) Assuming global policy settings are a factor, how relevant is the *Paris Agreement* to the global policy setting for global thermal coal consumption?
    c) What would compliance with the aims of the *Paris Agreement* (to keep global warming well below 2°C and pursue efforts to keep global warming below 1.5°C) mean for global thermal coal consumption?
    d) Is global thermal coal consumption currently increasing, staying constant, or falling?
    e) Is the global rate of construction of thermal coal power stations currently increasing, staying constant, or falling?
    f) According to basic economic theory what effect, if any, would an increase of 60 million tonnes per annum (**Mtpa**) in the supply of thermal coal have on global thermal coal prices and consumption, all other things remaining equal?
    g) According to basic economic theory what effect, if any, would an increase of 138 Mtpa in the supply of thermal coal have on global thermal coal prices and consumption, all other things remaining equal?
    h) In your opinion, how likely is it that the production of coal from the Carmichael Coal Mine and Rail Infrastructure Project, authorised under EPBC Approval 2010/5736, would offset an equivalent amount of coal production from other mines in the global coal market, leading to no greater production and subsequent emissions?

11. Please contact me if you require any further assistance or information for the preparation of your report.

12. Unfortunately our client is not in a position to offer expert fees. We are hoping you will consider providing this expert report on a pro bono basis.

13. Our client would like to receive your expert report by **Friday the 28th of February 2020.** This timing is negotiable based on your availability.

Yours sincerely,

Ariane Wilkinson
Senior Lawyer
Attachment - Expert Evidence Practice Note

Environmental Justice Australia

20 May 2020

Associate Professor Paul Burke
Crawford School of Public Policy
Australian National University

By email: paul.j.burke@anu.edu.au

CONFIDENTIAL AND PRIVILEGED

Dear Associate Professor Burke,

Re: Independent expert report

1. We act for Ms Claire Galvin from Cairns, Queensland.

2. We refer to our letter of instruction to you of 5 February 2020.

3. We wish to vary the amount of coal put to you in question (g) at paragraph 10 of our letter of instruction of 5 February 2020, and seek an amended response from you in your final report. The new question (g) is at paragraph 7 of this letter.

4. We also ask that you respond to an additional question (i), set out at paragraph 8 of this letter.

Your duty as an expert

5. As stated in the letter of instruction of 5 February 2020, please read the attached Federal Court of Australia's *Expert Evidence Practice Note* and Annexure A to it, which is the *Harmonised Expert Witness Code of Conduct* ('**Expert Witness Code of Conduct**'). Please ensure that you prepare your report in accordance with the Expert Evidence Practice Note and that you familiarise yourself with, and abide by, the Expert Witness Code of Conduct.

6. In order for your report to be admissible as expert evidence, in the event that this matter becomes litigious, it must comply with the enclosed Expert Evidence Practice note, including the Expert Witness Code of Conduct. Please ensure that your report is consistent with the Expert Witness Code of Conduct and contains each of the items identified in paragraph 3 of that Code.

7. **Amended question** – Please read paragraph 10(g) of our letter dated 5 February 2020 as referring to an increase of 108 Mtpa instead of 138 MtPa, as set out below -

   "(g) According to basic economic theory what effect, if any, would an increase of 108 million tonnes per annum (**Mtpa**) in the supply of thermal coal have on global thermal coal prices and consumption, all other things remaining equal?"

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8. **Additional question** - In addition to the questions set out in paragraph 10 (a) – (h) of our letter of 5 February 2020, we also have a further question (i) which is:

> "(i) In your opinion, how likely is it that the total production of coal from the Carmichael Coal Mine and Rail Infrastructure Project, as well as two proposed neighbouring mines in the Galilee Basin – the Macmines Austasia's China Stone project approved for an output of 38Mtpa[1] and the Hyde Park Coal Mine with a proposed output of 10Mtpa[2], would offset an equivalent amount of coal production from other mines in the global coal market, leading to no greater production and subsequent emissions?"

9. Please contact me if you require any further assistance or information for the finalisation of your report.

Yours sincerely,

Ariane Wilkinson

Senior Lawyer

Attachment - Expert Evidence Practice Note