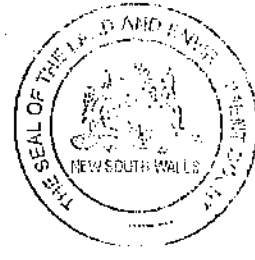


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JOINT REPORT OF CLIMATE CHANGE EXPERTS

(DR BRIAN FISHER AND PROFESSOR WILL STEFFEN)

COURT DETAILS

Court Land and Environment Court of New South Wales
 Class 1
 Case number 2017/383563

TITLE OF PROCEEDINGS

Applicant **Gloucester Resources Limited ACN 114 162 597**
 First Respondent **Minister for Planning**
 Second Respondent **Groundswell Gloucester Inc. INC1300990**

PREPARATION DETAILS

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**IN THE LAND AND ENVIRONMENT COURT OF NSW
CASE NUMBER 2017/00383563**

GLOUCESTER RESOURCES LIMITED

First Applicant

v

MINISTER FOR PLANNING

First Respondent

and

GROUNDSWELL GLOUCESTER INC

Second Respondent

**JOINT MEMORANDUM BY EXPERT WITNESSES
WILL STEFFEN AND BRIAN FISHER**

6 JULY 2018

INTRODUCTION

1. This Memorandum records matters of agreement and disagreement relating to climate change issues as identified and discussed by expert witnesses, Professor Will Steffen and Dr Brian Fisher, in these proceedings by email between 2 and 6 July 2018. It was not possible for the experts to meet face-to-face because of Professor Steffen's travel commitments. Professor Steffen is currently in remote parts of South America and extremely difficult to contact.
2. Expert witnesses:
 - Engaged by the First Applicant: Dr Brian Fisher
 - Engaged by the Second Respondent: Professor Will Steffen

The experts confirm that each of them has read the other relevant expert report in these proceedings, as follows:

- Expert Report of Brian Fisher dated 29 June 2018 (*Fisher Report*)
- Expert Report of Will Steffen dated 12 June 2018 (*Steffen Report*)

MATTERS AGREED

3. The experts agreed on the statements set out in paragraphs 4 to 8 below.

Authorities on climate change

4. The IPCC is a good authority on climate change matters.
5. In the Australian context, the CSIRO and the Bureau of Meteorology are also good authorities.
6. The peer reviewed literature, on which IPCC reports are based, provides a fundamental source of information on climate change.

Paris Agreement

7. Australia's target under the Paris Agreement was determined by the Australian Government.

Politics and economics

8. There are many discussions around the social and economic implications of climate change.

MATTER PARTIALLY AGREED

9. Apportioning a global carbon budget to countries and/or sectors is a matter for politics and economics. Professor Steffen only agrees with this statement if the following clause is added after the word 'economics', 'so long as the global carbon budget for the desired temperature limit is respected'.

ISSUES IN DISPUTE

10. The experts identified a fundamental area of disagreement in respect of the approach to achieving emissions reductions as set out in paragraph 13 below and followed by statements of opinion on specific points of difference.
11. Specifically, Professor Steffen and Dr Fisher remain in disagreement regarding interpretation of the carbon budget concept and in respect of the importance of economically efficient emissions reductions.

Fundamental difference of opinion

12. The experts recognised that the fundamental difference of opinion between them relates to the economic, environmental and social importance of achieving efficiency in emissions reductions, as well as to the overriding necessity to achieve the Paris Agreement targets for limiting temperature rise.

First Applicant's Expert:

13. The economic, social and environmental rationales for banning individual developments of Australian coking coal mines on the basis of carbon emissions is poor.
14. From an economic perspective, there is strong projected demand for coking coal as large countries such as India industrialise and intensify their steel use. There are limited substitutes for coking coal in steel making owing to constraints on scrap steel and commerciality. Therefore, if coking coal demand is not met from Australian mines, investment will flow to other large coal producers, with mines developed in countries such as India and Indonesia. These impacts would be detrimental to the Australian economy.
15. The capital flight associated with developments flowing to other countries would likely also have negative environmental consequences from an emissions perspective.
16. From a social standpoint, local benefits such as direct and indirect employment associated with the construction and ongoing operation of the Project need to be taken into account and weighed against the uncertain long-term impacts of carbon emissions produced by the mine.
17. The size of the global abatement task calls for making emissions reductions where they count most and generate the least economic and social harm. Focus needs to be applied to achieving meaningful emissions reductions from large sources where it is cost-effective and alternative technologies can be brought to bear.
18. Achieving abatement at least cost is critical. If Australia were to ban production and exports of coking coal and iron ore (both raw materials are overwhelmingly used to produce steel), it would destabilise our economy, substantially cut employment, and remove a major source of government revenue. These consequences would have multiple flow-on effects including for Australia's capacity to innovate, and to adopt new clean technologies that allow

decarbonisation while sustaining everyday activities. Resilience to climate change and capacity to adapt are also core principles written into the Paris Agreement.

19. Economic efficiency and thus social welfare are maximised when abatement occurs from the lowest cost sources. Abatement costs vary widely between countries, sectors and activities and are often project dependent. Preventing the development of the Rocky Hill Coal Project would incur greenhouse gas abatement costs approximately two orders of magnitude higher than what is currently being achieved under the Federal Government's Emissions Reduction Fund and therefore would be grossly economically inefficient and contrary to Australian society's best interests.
20. Individual project development bans in the absence of any binding legislation or international obligation (beyond the 26-28 per cent reduction Australia is already on track to meet) are economically inefficient, environmentally ineffective and socially suboptimal.

Second Respondents' Expert:

21. These points are irrelevant. There are many discussions around the social and economic implications of climate change. Strong social and economic arguments could also be made for very rapid emission reductions. My point is that to have any chance of meeting the Paris 2°C target, carbon emissions around the world need to be DECREASING rapidly and deeply; opening up and using new fossil fuel reserves or resources INCREASES carbon emissions, in conflict with what is required under the Paris Agreement. This is the scientific reality based on a comparison of the current level of fossil fuel exploitation compared to any reasonable estimate of the remaining carbon budget. There is no room for any new fossil fuel development. The challenge is to rapidly and deeply reduce emissions from existing fossil fuel industries and activities.

Carbon budget

First Applicant's Expert:

22. The IPCC was the first to adopt the concept of a 'carbon budget', published in its 2013 report and included in the section dealing with carbon 'sinks' and reservoirs. Various definitions for 'carbon budget' exist, and the definition adopted by GG Inc is particularly narrow in its reference to 'anthropogenic sources'.
23. The World Meteorological Organisation (WMO 2017) defines the global carbon budget as 'the input of CO₂ to the atmosphere by emissions from human activities, balanced by output (storage) in the carbon reservoirs on land or in the ocean'.
24. The WMO is a specialised agency of the United Nations (UN) with 191 Member States and Territories. It is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces and the resulting distribution of water resources. The WMO is a key contributor to IPCC reports.
25. The WMO (2017) states that the carbon budget can be represented by:

Emissions from fossil fuel combustion + emissions from land use change = growth in the concentration in the atmosphere + amount going (chemically and biologically) into the ocean + amount going into terrestrial vegetation and soils.

26. Hence the calculation of the carbon budget 'nets out' carbon sinks and reservoirs. In my opinion, and to the best of my understanding, Professor Steffen's definition of 'the carbon budget' contains an inverse relationship to carbon sinks and reservoirs. For instance, the greater the uptake of carbon by the natural environment, the higher the 'carbon budget' (as defined by emissions from all human sources) would be before global emissions concentrations reached a target threshold. Since carbon cycle dynamics are not constant, the carbon budget may be redefined where the amount of carbon in sinks and reservoirs is not static.
27. Given that the Earth System Models (ESMs) used by the IPCC to calculate the carbon budget account for carbon cycle dynamics (including carbon uptake through sinks and reservoirs) as identified by Professor Steffen, the carbon budget by definition is dependent on these factors.
28. There is a high degree of uncertainty surrounding future emissions projections, which vary widely depending on factors such as population, economic activity, energy use, land use patterns, technology and climate policy. Owing to the wide range of factors that contribute to assumptions about future emissions trajectories, emissions forecasts also increase in uncertainty through time. There is additional uncertainty in the translation of GHG emissions into consequences for global temperature change (IPCC 2013).
29. The carbon budget has been reviewed by various authors since the publication of the IPCC's Fifth Assessment Report, and in 2017 IIASA¹ published in *Nature Geoscience* that subsequent estimates placed the carbon budget at nearly four times what the IPCC had reported in 2014.

Second Respondents' Expert:

30. The carbon budget approach does not use 'net emissions'. Carbon cycle dynamics, which are referred to the proponent's expert report as emissions being '... (to some extent) balanced by carbon uptake in the natural environment', are already accounted for in the ESMs that are used to calculate the carbon budget. The carbon budget is based on actual emissions (not 'net emissions') of carbon dioxide from all human sources (currently about 90 per cent of these emissions of ~10 billion tonnes of carbon (as CO₂) per annum originate from the burning of fossil fuels). The IIASA study cited above is an outlier in terms of the multiple individual examples of carbon budget estimates and is not considered to be credible by the natural science research community on the basis of its poor physical science underpinning and implausible assumptions.

Country and sector targets

¹ International Institute for Applied Systems Analysis (IIASA) is an international scientific institute that conducts research into the critical issues of global environmental, economic, technological, and social change

First Applicant's Expert:

31. Whilst there are multiple theoretic approaches to allocating a carbon budget, the establishment of actual targets for emissions reductions are the domain of international agreements under the United Nations Framework Convention on Climate Change (UNFCCC), and most pertinently under the Paris Agreement. Within those agreements, there is no construct that specifies allowable sectoral emission levels.
32. As published on the official UNFCCC website, Article 2 of the Paris Agreement 2015 states:

Article 4(1). This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by: (a) 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, recognizing that this would significantly reduce the risks and impacts of climate change; (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

Article 4(2). This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

2. Articles 3, 4(1) and 4(2) of the Paris Agreement state:

Article 3. As nationally determined contributions to the global response to climate change, all Parties are to undertake and communicate ambitious efforts as defined in Articles 4, 7, 9, 10, 11 and 13 with the view to achieving the purpose of this Agreement as set out in Article 2. The efforts of all Parties will represent a progression over time, while recognizing the need to support developing country Parties for the effective implementation of this Agreement.

Article 4(1) In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

Article 4(2) Each Party shall prepare, communicate and maintain successive nationally determined contributions that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

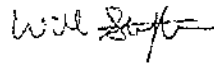
3. As partially agreed by Professor Steffen, the allocation of a carbon budget is a matter for politics and economics. Australia's Nationally Determined Contribution (NDC) under the Paris Agreement is the embodiment of the 'politics and economics' of achieving the stated aim of limiting global average temperature change.
4. Australia's international NDC or obligation under the Paris Agreement is to reduce its emissions by 26-28 per cent below 2005 levels by 2030. There are no governing structures under the Paris Agreement that pre-determine how those reductions should occur. In particular, there are no sectoral or commodity-based emissions targets or budgets and to set such targets without taking account of the marginal cost of abatement in each sector would be economically inefficient and therefore contrary to the economic wellbeing of the country.
5. As indicated within Article 3 of the Paris Agreement, the expectation is that Parties' efforts will become progressively more ambitious through time.
6. The proper forum in which to raise the level of ambition surrounding Australia's NDC is with the Federal Government. This is also true in respect of institutionalising sectoral targets, to ensure appropriate legislation is established.

Second Respondents' Expert:

7. I do not agree with this representation of the Paris Agreement. To the best of my understanding, the Agreement itself stipulates temperature (not emission reduction) targets. The precise wording of the Agreement is that it aims to '...limit global average temperature rise to well below 2°C and to pursue efforts to limit warming to 1.5°C'. The level of emission reductions required to achieve these targets is a scientific question. Here the carbon budget approach is the most scientifically robust way of determining the level of permissible emissions globally consistent with respecting the Paris temperature targets. Apportioning the remaining global carbon budget to countries and/or sectors then becomes a matter for politics and economics, but the bottom line is that the globally aggregated cumulative emissions – no matter how they are apportioned – must not add up to more than the global carbon budget if the Paris Agreement is to be met.
8. Australia's target under the Paris Agreement was determined by the Australia Government, and was not based on the scientifically robust advice given to the Government by the Climate Change Authority (CCA) in 2015 in the lead-up to the Paris meeting. It is far too weak to be consistent with the Paris targets; the CCA recommended that the target should 45-65 per cent below 2005 levels.
9. The issue is not what is Australia's right to a share of a global carbon budget; that is beside the point. In my opinion, under any interpretation of the carbon budget, carbon dioxide emissions from existing fossil-fuel based industries and activities around the world must be rapidly reduced to net zero in the next couple of decades to meet a 2°C temperature target. That is a simple, robust scientific fact. This level of emission reduction is already a massive challenge. Opening up NEW fossil fuel developments, no matter the size or end use, would INCREASE carbon emissions, not DECREASE them. This is inconsistent with what is required to meet the 2°C temperature target (to which Australia has agreed).



Brian Fisher



Will Steffen

6 July, 2018