

## **Dendrobium Extension Project - Expert Review**

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### **Introduction**

1. I have been engaged to provide expert advice in relation to the Dendrobium Extension Project (**Project**) by the Environmental Defenders Office acting on behalf of Protect our Water Alliance. I have prepared this report in conformance with Part 31 Division 2 and the Expert Witness Code of Conduct in Schedule 7 of the *Uniform Civil Procedure Rules 2005*, and I am willing to be bound by them.
2. If it proceeds as planned, the proposed Dendrobium Extension Project will generate 237 million tonnes of carbon dioxide over its lifetime. That is equivalent to about two years of emissions for the state of New South Wales as a whole. However, by relying on a variety of misleading assumptions and inappropriate analysis, the Environmental Impact Assessment reduces the associated cost to a negligible \$100 000 for the entire life of the Project.

### **Summary**

3. The Environmental Impact Assessment of the Project proposal is deficient in several key respects, namely
  - a. the assumption that the use of metallurgical coal in steel production will continue to 2050, despite global commitments to net zero emissions by this date and the emergence of carbon-free alternatives. It is claimed in the Environmental Impact Assessment that there is currently no viable alternative to the use of metallurgical coal. However, as a result of developments in 2020, this claim is already obsolete.
  - b. the exclusion of all damage from Scope 1 emissions except that falling specifically on residents of NSW. This is inconsistent with the fundamental principles of the Paris Agreement that each jurisdiction should take responsibility

for the global effects of its own emissions. If applied generally, it would mean that no country or jurisdiction had any obligation to reduce emissions except to the extent that there was a direct benefit to the country concerned.

- c. The exclusion of Scope 3 emissions arising from the burning of the coal produced by the Project.

### **Alternative to metallurgical coal**

4. The primary alternative to the use of metallurgical coal in primary steelmaking is the production of direct reduced iron (DRI) from iron oxide using hydrogen as the reducing agent. As described by HYBRIT (2019)

In the HYBRIT concept, specially developed iron ore pellets are reduced by hydrogen gas in a so-called direct reduction process. Reduction occurs in a solid state at a lower temperature than in the blast furnace process and produces an intermediate product, sponge iron or direct reduced iron (DRI), with water vapour emitted from the top of the furnace. Water vapour can be condensed and scrubbed before reuse in the plant. Hydrogen gas is produced by electrolyzing water using renewable electricity (e.g. from hydro or wind power plants), with oxygen gas as a by-product. Hydrogen storage of sufficient capacity is used to balance between the DRI-process and the electricity grid allowing a significant amount of intermittent power generation by e.g. wind or solar power plants to be connected/to be connected to it. The sponge iron can be used as hot DRI and melted immediately in an electric arc furnace (EAF) together with recycled scrap. The DRI can also be processed into hot briquetted iron (HBI), which can be stored and shipped to another site. The crude steel from the EAF goes through a similar process as in the blast furnace based route, i.e. alloying and refining before being cast into slabs, ready for rolling and further heat treatment before shipping to customers.

5. As noted by HYBRIT (2019), the primary economic obstacle to the use of the DRI process have been the needs:
  - a. To produce hydrogen in an energy-efficient way so that it is economically justifiable/ commercially viable.
  - b. To develop an effective process to use 100% hydrogen on an industrial scale.
6. In the past year, these obstacles have become much less daunting.
7. The production of energy-efficient hydrogen has become a central part of Australia's energy strategy, notably including NSW with a strategy focused on the Port Kembla region identified in a new report from NSW Chief Scientist and Engineer.<sup>1</sup>
8. Similar developments have taken place in other states and at the Commonwealth level.
  - a. Queensland has made the production of hydrogen a central part of its Covid recovery strategy and has appointed a Minister for Hydrogen.<sup>2</sup>
  - b. Western Australia is developing a 5GW renewable energy project with the energy to be used in the production of hydrogen.<sup>3</sup>
  - c. South Australia has developed a hydrogen action plan.<sup>4</sup>
  - d. Victoria has developed a proposal to produce hydrogen from lignite (the carbon-free status of this proposal depends on advances in carbon capture and storage).<sup>5</sup>
  - e. Clean hydrogen is one of the five central elements of the Commonwealth Government's technology roadmap.<sup>6</sup>

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<sup>1</sup> <https://www.illawarramercury.com.au/story/6913583/huge-potential-for-nsw-economy-and-jobs-in-port-kembla-becoming-a-hydrogen-hub/>

<sup>2</sup> <https://www.climatecontrolnews.com.au/contracting/dedicated-minister-for-hydrogen>

<sup>3</sup> <https://www.wa.gov.au/organisation/department-of-jobs-tourism-science-and-innovation/western-australias-renewable-hydrogen-industry>

<sup>4</sup> <https://www.renewablesa.sa.gov.au/topic/hydrogen>

<sup>5</sup> <https://www.premier.vic.gov.au/victoria-powers-world-first-hydrogen-project>

<sup>6</sup> <https://www.industry.gov.au/data-and-publications/technology-investment-roadmap-first-low-emissions-technology-statement-2020>

9. The technology of DRI is well established, and the development of plants using hydrogen as the reducing agent is progressing rapidly.<sup>7</sup>
10. The first commercial scale plants are already under construction.<sup>8</sup>
11. The use of clean hydrogen in the production of DRI steel is still in its early stages. However, given the imperative of decarbonizing the global economy by 2050 at the latest, and the availability of both hydrogen and DRI technology, the path ahead for metallurgical coal is one of decline. In this context, the long-term projections of future sales from the Project are unlikely to be fulfilled.
12. The blast furnaces at the Port Kembla steelworks will require relining in the late 2020s if steel production is to be continued using current technology. It would be preferable to consider phasing out the use of blast furnaces and a shift to DRI technology based on clean hydrogen, which should be available in ample supply within a few years.

### **Incorrect treatment of Scope 1 emissions**

13. The Project has substantial Scope 1 emissions arising from emissions of methane in the mining process. Accounting for the social cost of these emissions under the procedures normally adopted (the imposition of a carbon price in all emissions) would greatly reduce the economic viability of the project
14. The proponent argues that environmental impacts from Scope 1 emissions should be taken into account based on the size of the NSW population and that environmental impacts occurring elsewhere in Australia (including, for example, damage to the Great Barrier Reef) or the world should be disregarded. Since NSW accounts for approximately 0.1 per cent of world population, the analysis disregards 99.9 per cent of Scope 1 and 2 emissions. Further, it disregards all Scope 3 emissions, as discussed below.

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<sup>7</sup> <https://www.theengineer.co.uk/arcelormittal-to-use-hydrogen-in-steel-production-process/>

<sup>8</sup> <https://www.spglobal.com/platts/en/market-insights/latest-news/metals/>

082820-germanys-thyssenkrupp-to-build-dri-plant-run-on-hydrogen-for-green-steel-production

15. If applied consistently in all state-level jurisdictions of a size comparable to NSW, the approach suggested by the proponents would imply that no action should be taken to mitigate climate change, unless the benefits of the mitigation action exceeded the costs by a factor of 1000 (that is, the cost was less than 0.1 per cent of the benefits). As stated in my evidence, this would, in effect, be a global suicide pact.
16. In my opinion, the correct approach, following the Paris Agreement, is to consider the environmental impacts caused by Scope 1 and Scope 2 emissions, wherever in the world those environmental impacts are incurred.

### **Exclusion of Scope 3 emissions**

17. The Environmental Impact Assessment relies heavily on the fact that the Paris Agreement assigns responsibility for carbon emissions to the point where combustion takes place. Hence, it is suggested, evaluations of coal mines need not take Scope 3 emissions into account, these being the responsibility of the steelworks.
18. If carbon emissions were properly priced, this analysis would be broadly correct. The price paid by the end-user for emissions would be reflected in reduced demand for coal, and therefore captured by the market price. However, Australia does not have a carbon price, so the effect of the suggested approach is that Scope 3 emissions, the majority of which will take place in New South Wales, are ignored.
19. The sharp line drawn between the coal mine and the steelworks where coal is burned, as far as responsibility for emissions is concerned, differs radically from the rest of the Environmental Impact Assessment, where the linkage between the two is stressed as a reason for proceeding with the Project (Executive Summary, Section 6, para 3)
20. It should also be noted that the Paris Agreement does not mean that Scope 3 emissions can be ignored with impunity. Countries complying with the Paris Agreement can impose border adjustment taxes on those failing to deliver adequate reductions in emissions. Both the European Union and the incoming Biden Administration in the United States have indicated their intention to adopt this approach, and it is likely that other countries will follow.

21. In my opinion, the likely consequence of these developments is that the environmental impacts caused by Scope 3 emissions, if not taken into account in NSW (where much of the coal will be combusted in the steelmaking process) or Australia, will be reflected in taxes imposed on Australian exports by foreign nations acting on climate change (as proposed by the US and EU), thereby reducing living standards in Australia.

## **Conclusion**

22. The treatment of greenhouse gas emissions in the Environmental Impact Assessment is totally unsatisfactory. A proper analysis would show that the Project as planned has negative social value. As the need to decarbonise the economy becomes more pressing, it is likely that both the Dendrobium Extension Project and the blast furnace plants at Port Kembla will become stranded assets. Rather than proceeding on plans that assume a 30 year life for these assets, it would be preferable to begin planning for a transition to hydrogen-based steel production.

## **Short CV John Quiggin**

John Quiggin is an Australian Laureate Fellow in Economics and Political Science at the University of Queensland. He is prominent both as a research economist and as a commentator on Australian economic policy. He has produced nearly 1500 publications, including ten books and over 400 journal articles and book chapters, in fields including environmental economics, risk analysis, production economics, and the theory of economic growth. He has also written on policy topics including climate change, micro-economic reform, privatisation, employment policy and the management of the Murray-Darling river system.

John Quiggin has been an active contributor to Australian public debate in a wide range of media. He is a regular contributor to Australian and international policy journals, to which he also contributes review and feature articles. He frequently comments on policy issues for radio and TV. He was one of the first Australian academics to present publications on a website (now at <http://www.uq.edu.au/economics/johnquiggin>). In 2002, he commenced publication of a weblog (now at <http://johnquiggin.com>) providing daily comments on a wide range of topics.

**Date Of Birth :** 29 March 1956  
**Place Of Birth :** Adelaide, South Australia  
**Nationality :** Australian

## **Employment Record**

1978-86	Research Economist, Bureau of Agricultural Economics
1987-88	Lecturer/Senior Lecturer, Dept. of Agricultural Economics, University of Sydney.
1989-1990	Associate Professor, Agricultural Economics University of Maryland, College Park.
1991-95	Professor, Centre for Economic Policy Research, Australian National University
1996-9	Professor of Economics, James Cook University.
2000-2002	ARC Professorial Fellow, Australian National University.
2003-17	ARC Federation/Laureate Fellow (three awards), University of Queensland
2018-	Vice-Chancellors Senior Fellow, University of Queensland

## **Other Activities**

1996-2012	Opinion columnist, Australian Financial Review
1999-2005	Member, Queensland Competition Authority
2000	Inaugural Don Dunstan Visiting Professor, University of Adelaide
2011	Hinkley Visiting Chair, Johns Hopkins University
2012-2017	Member, Climate Change Authority
2016	FH Gruen Visiting Chair, Australian National University

## **Fellowships**

Fellow/Distinguished Fellow of Econometric Society, Academy of the Social Sciences in Australia, American Agricultural Economics Association, Australian Agricultural and Resource Economics Society, Economics Society of Australia

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## **Books**

Quiggin, J. (1993) *Generalized Expected Utility Theory: The Rank-Dependent Expected Utility model*, Kluwer-Nijhoff, Amsterdam.

Langmore, J. and Quiggin, J. (1994), *Work for All: Full Employment in the Nineties*, Melbourne University Press, Carlton, Victoria.

Quiggin, J. (1996), *Great Expectations: Microeconomic Reform and Australia*, Allen and Unwin, St. Leonards, NSW.

Quiggin, J. (1998), *Taxing Times: A Guide to the Tax Debate in Australia*, University of New South Wales Press, Sydney.

Chambers, R. G. and Quiggin, J. (2000), *Uncertainty, Production, Choice and Agency: The State-Contingent Approach*, Cambridge University Press, New York.

Quiggin, J. (2010), *Zombie Economics: How Dead Ideas Still Walk Among Us*, Princeton University Press, Princeton

Quiggin, J. (2010), *Economics in Two Lessons: Why Markets Work so Well and How they can Fail so Badly*, Princeton University Press, Princeton

## **Notable Journal Articles**

Quiggin, J. (1982), 'A theory of anticipated utility', *Journal of Economic Behavior and Organization* 3(4), 323–43. ]

Bleichrodt, H. and Quiggin, J. (1999), 'Life cycle preferences over consumption and health: when is cost-effectiveness analysis equivalent to cost-benefit analysis?', *Journal of Health Economics* 18, 681–708.

Quiggin, J. (2001), 'Environmental economics and the Murray–Darling river system', *Australian Journal of Agricultural and Resource Economics* 45(1), 67–94. The paper was awarded the AJARE editors' prize for 2001

Grant, S. and Quiggin, J. (2013), 'Inductive reasoning about unawareness', reasoning about unawareness', *Economic Theory*, 54(3), 717–55.

Guerdjikova, A. & Quiggin, J. (2019) 'Market selection with differential financial constraints'. *Econometrica*, 87(5) 1693-1762.