Australian National University

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Committee Secretary, *Future of Australia's Steel Industry*
Senate Standing Committees on Economics
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Dear Committee,

The Future of Australia's Steel Industry

In relation to the above Senate Committee re-adopted for the 45th Parliament, we would like to address comments to your terms of reference, namely concerning "the future sustainability of Australia's strategically vital steel industry and its supply chain".

We are a group of academics with interests in renewable energy and its application to industry. Dr John Pye, Prof Wojciech Lipinski and Dr Joe Coventry are members of the Australian National University Solar Thermal Group, and work on improving the cost and efficiency of solar thermal concentrating technology for both electricity production with storage as well as on alternative applications of this technology in industry. Prof Geoff Brooks is a collaborator at Swinburne University of Technology, and is a leading Australian metallurgist who is actively researching techniques for solar thermal energy to be applied to steel production thereby to lower the resulting greenhouse gas emissions. Prof Gus Nathan is a collaborator from the University of the Adelaide through our ARENA-funded Australian Solar Thermal Research Initiative (ASTRI), and also leads an ARENA-funded project to develop pathways to introduce concentrated solar energy into the Bayer Alumina process.

We note the Interim Report of the Committee (dated Dec 2016), and its emphasis on (1) the decline of the Australian steel industry from its peak output of ~9 Mt/y in 1998 to its present ~5 Mt/y today, and (2) the difficulties faced by, and potential closure of, Arrium Ltd.

We would like to put forward another perspective on the world steel industry, however, and we believe it may warrant renewed enthusiasm for our local steel industry and a future competitive edge.

Emissions intensity of the steel industry

IEA Energy Technology Perspectives 2016 data shows[1] that, of all the industry sectors in 2013, iron and steel uses easily more coal than any other industry sector, with total annual energy consumption of 35 EJ/y, of which 27 EJ/y comes from coal. Globally dominant blast furnace technology, such as that used at Arrium Ltd, emits of the order of 2.8 tCO2e/t of steel produced, with the result that the iron and steel industry alone produces 5% of the world greenhouse gas emissions[2]. This is despite ~50-70% of iron and steel already being recycled at the end of its life[3].

We would argue that, as countries around the world, including Australia, seek to decrease their emissions in an effort limit climate change impacts (and to meet the COP21 targets of the present government), the projected emissions from iron and steel production are going to become increasingly problematic, and their mitigation will result in significant investment.

1 IEA, 2016. *Energy Technology Perspectives 2016*. http://www.iea.org/etp. All accessed 16 Feb 2016.
2 Columbia Climate Centre, 2012. *Mitigating Iron and Steel Emissions.* https://is.gd/tcMBjl.
3 UN Environment Program, 2011. *Recycling Rates of Metals* https://is.gd/AFRAuh.

A major opportunity for Australia

Australia has huge reserves of coal, natural gas and iron ore. Our continent as a whole also has the highest average direct-beam solar radiation in the world. Furthermore, areas such as the Pilbara, where large amounts of ore are extracted, have amongst the highest localised solar radiation resource in the world[4].

We propose that Australia should consider investing in research to put our unique combination of iron ore deposits, coal and gas deposits and our world-class solar resource together to good use[5]. We should research and develop **next-generation techniques for production of iron with greatly reduced greenhouse emissions**. One approach already available is Direct Reduction of Iron[6], which uses natural gas in place of coal, and offers emission reductions of up to 50%. This process, or others like it, could be 'solarised', ensuring that fossil fuels are used only for their chemistry, not as an energy source in the process. This would allow even further emission reductions, allowing iron and steel to remain relevant and competitive in a greatly carbon-constrained future. Another approach is the hydrogen reduction path being developed at the University of Utah[7]. Yet another approach is through the use of syngas, which can be generated sustainably, such as with technology for solar gasification as currently developed by our ASTRI team.

In this future scenario, Australia would be **uniquely positioned with its combination of access to fossil fuels, sunlight and iron ore**. Where other countries might currently have an advantage because of lower costs of labour, we would argue that as the requirements for reduced environmental emissions gradually become more stringent, our natural resources advantage will play an increasing role in our ability to compete.

We believe that, alongside the other incentives required to sustain our local iron and steel industry, the Australian Government should look to establish programs to support this research and development work, in collaboration with technology companies, universities and CSIRO.

Prof Geoff Brooks at Swinburne University of Technology has already advanced some early research on this topic, and has identified a process with potential emission reductions of 20-30% already[8]. Work towards this **'grand challenge' for Australian industry**, to competitively produce iron and steel with dramatically lowered carbon emissions over the longer term, could achieve far more if it were well funded and actively pursued as part of the national agenda[9].

Perhaps, in seeking to develop forms of financial support to sustain the troubled iron and steel industry in Australia, the Government could consider incorporating some incentives for BlueScope, Arrium, and associated companies to work with researchers to expand our technology and capability in this exciting emerging field.

We would be very happy to answer any further questions that arise from the deliberations of the committee.

Yours sincerely,

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4 SolarGIS, 2016. Direct Normal Irradiation (World Map). https://is.gd/LIJYQF.
5 R Bader and W Lipinski, 2017. *Solar Thermal Processing* (book chapt). doi:10.1016/B978-0-08-100516-3.00018-6
6 Institute for Industrial Productivity, *Direct Reduced Iron*, https://is.gd/nEgvhM
7 DQ Fan et al, 2016. *Metall. Mater. Trans. B.* **47**, 3489-3500. doi:10.1007/s11663-016-0797-4
8 G Brooks, 2016 *The next solar revolution could replace fossil fuels in mining* (Conversation) https://is.gd/HGxQa8.
9 Please see attachment, *Prospects of future concentrated solar thermal markets in Australia and beyond.*