

A contribution to
An analysis of medium to long-term impacts on the Australian Oceans

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1.1 Carbon Capture and Storage

Carbon Capture and Storage (CCS) is a geo-engineering negative emission technology. It involves capturing greenhouse gases (in particular CO₂), transporting them to an appropriate site and storing them permanently. The storage is essentially geological (injection in deep saline formations) or done in conjunction with enhanced oil recovery process, either onshore or offshore.

Although it is at an early industrial stage, the technology is proven and available at commercial scale. The risk of accidental release is low and according to the IPCC it is likely that 99% of CO₂ stored in a suitable reservoir will remain stored for at least 1000 years (Greig et al., 2016; Metz et al., 2005).

CCS is of particular interest for Australia, where fossil fuels are abundant and cost competitive. CCS allows for the continuous use of these sources of energy, without the associated emissions. In addition, it provides for a period of negative emission, necessary to reach carbon neutrality, to meet the targets of the Paris Agreement (Greig et al., 2016). Global projections of capture and storage (Figure 1) are based on net carbon emission requirements. They are presented by the International Energy Agency (IEA) according to two scenarios, the 2°C Scenario (2DS) and the Beyond 2°C Scenario (B2DS). Hence the projections rely on global CO₂ emissions projections and are related to other alternative sustainable technologies (McCulloch et al., 2016), such as renewable energy (Figure 2). While these projections rely on the Paris Agreement requirements, CCS suffers from a lack of policy support. Costs are expected very high and financial incentives are needed to support the implementation of the technology (Honegger & Reiner, 2018).

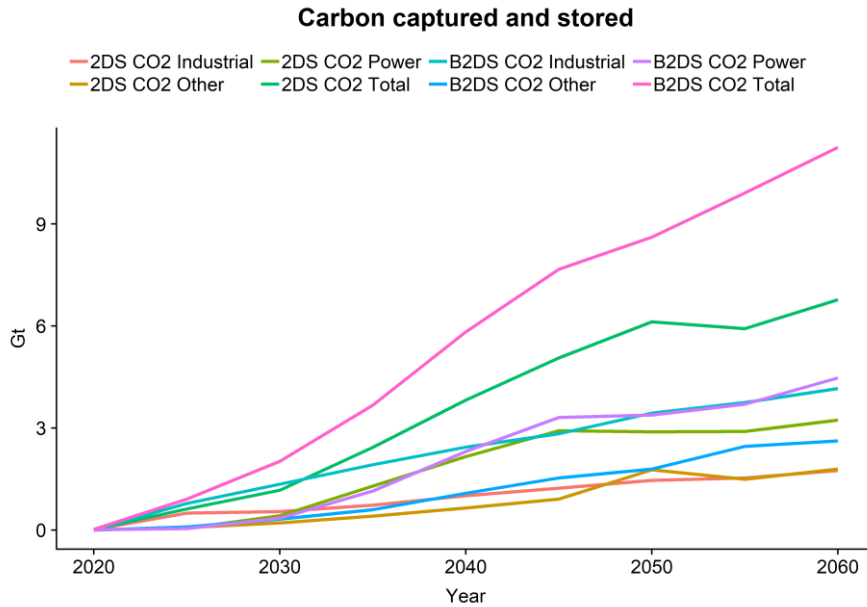


Figure 1. Global CO2 captured and stored, according to 2DS and B2DS scenarios (Source: <https://www.iea.org/topics/ccsarchive/>)

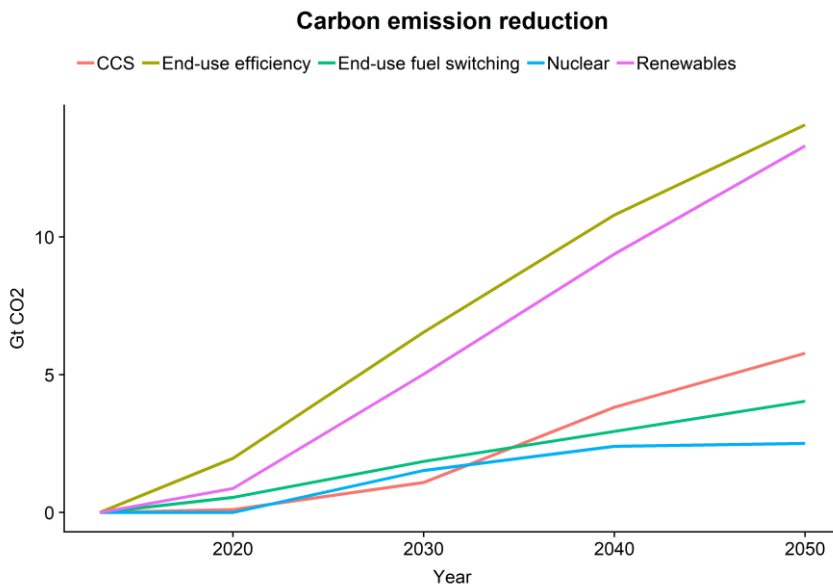


Figure 2. Global carbon emission reduction projection

With only 0.3 % of the world's population Australia contributed for 1.3% of the world's greenhouse gases emissions with 550 Mt in 2017 (Commonwealth Of Australia, 2017). In Australia, CCS appears to be the lowest cost option to reduce net carbon emission and meet the targets of the Paris agreement. In this regard, appropriate investment from government and industry is necessary promptly for a commercial deployment of CCS in the medium term (past 2019) with a widespread deployment by 2050 (Greig et al., 2016). So far, there are no large-scale commercial CCS projects, although there have been some demonstration projects (e.g. Otway project), and there are some proposed projects including CarbonNet (Bass Strait) and Gorgon (NWShelf). It is unknown whether the Australian government will support these proposals through to full operation. (Jim Greenwood, personal communication)

1 References

- Bashitialshaaer, R., Persson, K. M., & Aljaradin, M. (2011). Estimated Future Salinity in the Arabian Gulf, the Mediterranean Sea and the Red Sea Consequences of Brine Discharge from Desalination, 3(1), 133–140.
- BREE. (2012). *Australian Energy Technology Assessment*.
- Bureau of Resources and Energy Economics. (2014). Australian Energy Projections to 2049-50. *BREE*. [https://doi.org/ISBN 978-1-921812-79-8](https://doi.org/ISBN%20978-1-921812-79-8) (Print) ISBN 978-1-921812-78-1 (Online)
- Commonwealth Of Australia. (2017). *Review of Climate Change Policies*.
- Darre, N. C., & Toor, G. S. (2018). Desalination of Water: a Review. *Current Pollution Reports*. <https://doi.org/10.1007/s40726-018-0085-9>
- Ernst and Young and Associes. (2016). *Ocean energies, moving towards competitiveness: a market overview*.
- Fischetti, M. (2007). Fresh from the Sea. *Scientific American*, 297(3), 118–119. <https://doi.org/10.1038/scientificamerican0907-118>
- Greig, C., Bongers, G., Stott, C., & Byrom, S. (2016). *Energy Security and Prosperity in Australia: A Roadmap for CCS*.
- Griffin, D., & Hemer, M. (2010). Ocean power for Australia - Waves, tides and ocean currents. In *OCEANS'10 IEEE Sydney, OCEANSSYD 2010*. <https://doi.org/10.1109/OCEANSSYD.2010.5603609>
- Hemer, M., Pitman, T., McInnes, K. L., & Rosebrock, U. (2018). *The Australian Wave Energy Atlas Project Overview and Final Report*.
- Hemer, M. A., & Griffin, D. A. (2010). The wave energy resource along Australia's Southern margin. *Journal of Renewable and Sustainable Energy*. <https://doi.org/10.1063/1.3464753>
- Honegger, M., & Reiner, D. (2018). The political economy of negative emissions technologies: consequences for international policy design. *Climate Policy*. <https://doi.org/10.1080/14693062.2017.1413322>
- IEA. (2018). *Renewables 2018; Analysis and Forecasts to 2023*.
- Jones, E., Qadir, M., van Vliet, M. T. H., Smakhtin, V., & Kang, S. (2019). The state of desalination and brine production: A global outlook. *Science of The Total Environment*, 657, 1343–1356. <https://doi.org/10.1016/J.SCITOTENV.2018.12.076>
- Manasseh, R., McInnes, K. L., & Hemer, M. A. (2017). Pioneering developments of marine renewable energy in Australia. *The International Journal of Ocean and Climate Systems*. <https://doi.org/10.1177/1759313116684525>
- McCulloch, S., Keeling, S., Malischek, R., & Stanley, T. (2016). *20 Years of Carbon Capture and Storage - Accelerating Future Deployment*. International Energy Agency. <https://doi.org/10.1787/9789264267800-en>
- Metz, B., Davidson, O., de Coninck, H., Loos, M., & Meyer, L. (2005). *Carbone Dioxide Capture and Storage*.
- Roberts, D. A., Johnston, E. L., & Knott, N. A. (2010). Impacts of desalination plant discharges on the marine environment: A critical review of published studies. *Water Research*, 44(18), 5117–5128. <https://doi.org/10.1016/J.WATRES.2010.04.036>
- Teske, S., Dominish, E., Ison, N., & Maras, K. (2016). *100% Renewable Energy for Australia - Decarbonising Australia's Energy Sector within one Generation*.

WSAA. (2010). *Implications of population growth in Australia on urban water resources.*