A contribution to

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

Stephanie Contardo

CSIRO Ocean & Atmosphere, Australia

1.1 Energy projections

Australia has abundant and various mineral energy resources and a large potential for renewable energy.

The Bureau of Resource and Energy Economics provide energy projections (Bureau of Resources and Energy Economics, 2014), based on the E4cast model, a dynamic partial equilibrium model of the Australian Energy Sector. These projections are based on assumptions on population growth (source: the Australian Bureau of Statistics), economic growth (source: Australian Treasury), energy prices (source: International Energy Agency), electricity generation technologies (source: Australian Energy Technology Assessment), end use energy technology and government policies. The projections for the total energy consumed, produced and exported, are reproduced in Figure 13. The model projects energy consumption by fuel type, industry, and state or territory on an annual basis, accounting for government policies, such as Renewable Energy Target (RET) and the repeal of carbon pricing. The RET aims at encouraging the development of renewable energy projects. It is modelled in E4cast as a constraint on electricity generation.

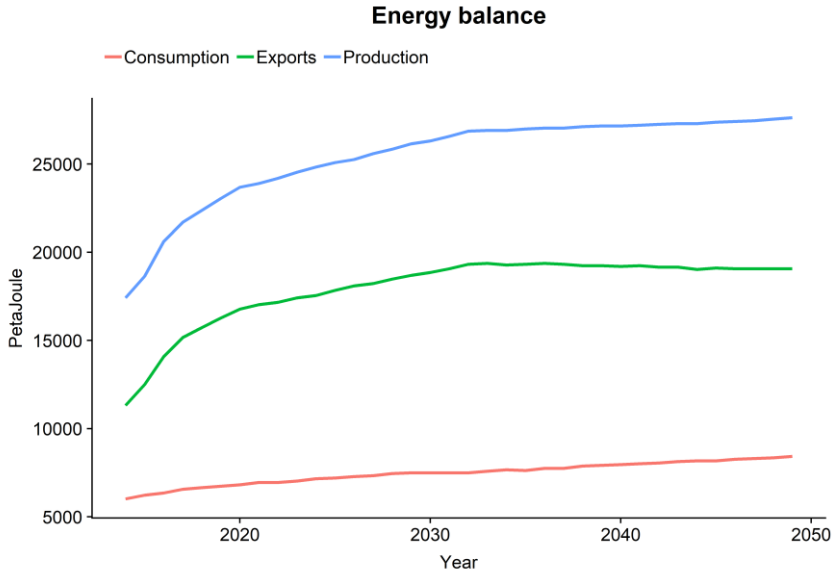

Figure 1. Australian energy balance (PJ).

Over the projection period, energy consumption is expected to keep growing but at a decreasing rate, and the source of energy should transition, with an increasing proportion of renewable. According to the BREE report, the total energy consumption is projected to increase by 42 % (i.e., about 1 % per year in average). Coal and gas are expected to provide the bulk of the energy mix, although their share declines. Renewable energy increases by 0.9% a year, driven by wind and solar energy. Electricity generation and transports remain the main users of primary energy.

The rate of growth of energy consumption is related to GDP. However, over the last 30 years, the rate of growth of energy consumption has been lower than the rate of economic growth, meaning the ratio of GDP to primary energy use is declining.

1.2 Sector-specific conceptual model

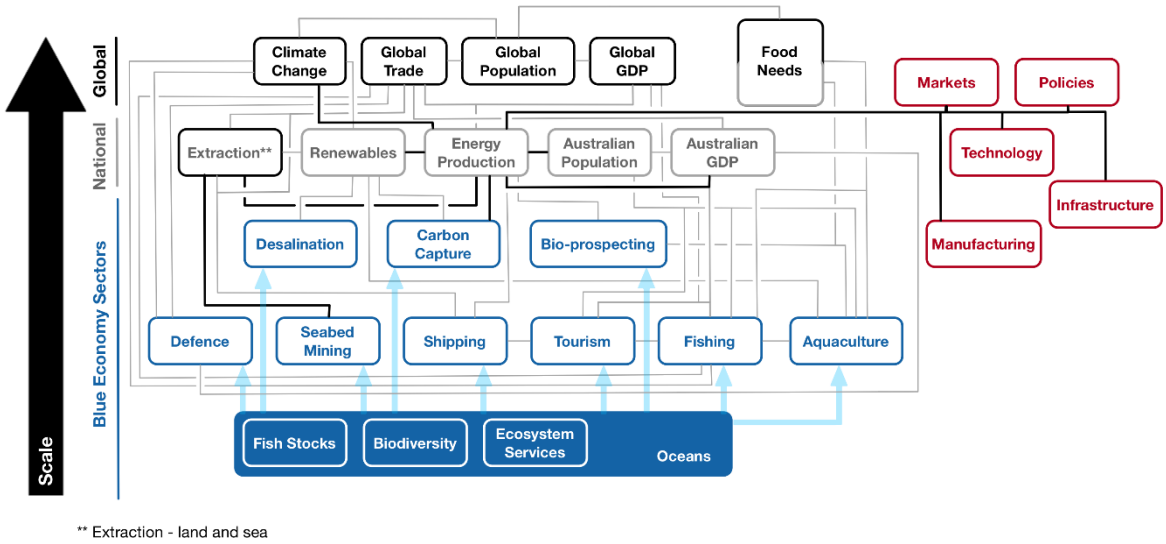

Figure 2. The initial conceptual model in Figure 1 in the main document, complemented with information about sector-specific drivers obtained from the analysis of sector projections. See main text for more information.

1.3 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 (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*.