

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

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1.1 Natural Gas

Natural gas projections and forecasts from the Australian Energy Market Operator (AEMO) were provided separately for eastern and south-eastern Australia (AEMO 2019b) and Western Australia (WA) (AEMO 2018b) due to the division in Australia's major power systems between the National Electricity Market in the eastern and south-eastern seaboard and the Wholesale Electricity Market in Western Australia (AEMO 2018b). Differences between the gas resources in the west (being largely conventional) and the east and south-east coast (being unconventional) also make the model assumptions for each region simpler. To provide gas projections for the whole of Australia we combined the east and south-east Australian projections with the WA projections. Gas consumption rather than production are provided because production projections were not available for all scenarios and there was higher uncertainty in production projections due to its dependency on gas reserve adequacy – especially on the east and south-east coast (AEMO 2018b).

Annual gas consumption projections for the east and west coast were provided for three scenarios that differed slightly, but were sufficient comparable to be combined for our projection purposes. On the west coast total gas consumption projections were based on three scenarios that included alternative base, high and low economic growth futures (AEMO 2018b). On the east and south-east coast projections were based on neutral, fast change and slow change alternative future scenarios (AEMO 2019a). The base scenario was similar to the neutral scenario, the high economic growth scenario was similar to the fast change scenario and the low economic growth scenario was similar to the slow change scenario. Hence, the annual total gas consumption projections from the three scenarios on the west coast (see Table 30 in Appendix A4 of AEMO 2018b) were added to the annual projections from the comparable scenarios for the east and south-east coast (see Figure 5 in AEMO 2019b). The scenario descriptions that follow will focus on the neutral, slow and fast change scenarios (AEMO 2019b, 2019a), but we acknowledge that there were some differences between the scenarios developed for the two geographically distinct regions (AEMO 2018b, 2019b). Additionally, because projections on the west coast were only available up to 2028 we limit the projection data up to this time despite east and south-east coast projections being available up to 2038 (AEMO 2019b).

The scenarios used in the total gas consumption projections were conceived by the AEMO (in consultation with consultants and stakeholders) to identify the requirements for optimal power system development under a range of different futures (AEMO 2019b). The neutral scenario was developed based on extrapolations of current trends and policies while the faster and slower change scenarios explore different rates of change in the energy sector affected by the timing of existing coal-powered generator retirements, changes in the cost competitiveness of new utility renewable energy generation, levels of energy decentralisation of power generation (i.e. smaller localised grids) and economic/population growth experienced in Australia. The neutral scenario projection shows relatively low, but stable consumption from 2019-2024 and consumption increases from 2025-to the end of the projection period as more coal-fired generation is expected to retire resulting in a slight

increase in gas-powered electricity generation and was as a projected increase in exports (Figure 1). There is little difference in projected consumption between the neutral and fast change projections until 2026. This is due to limited infrastructure being constructed for LNG export on the east coast and a projected stronger role for energy storage to complement intermittent renewable energy (Figure 1). After 2026 projections in the fast change scenario increase due to domestic population and economic drivers. Projected consumption in the slow change scenario are lower than the other scenarios largely due to the economic and population projections in the east and west (AEMO 2018b, 2019b). However, the divergence from the neutral and fast change scenarios is not large (Figure 1). This is partly due to similar demands for natural gas from the mining sector in WA being assumed in all scenarios because of the nine major committed mining and mineral processing projects that are due to commence over the outlook period (Figure 1).

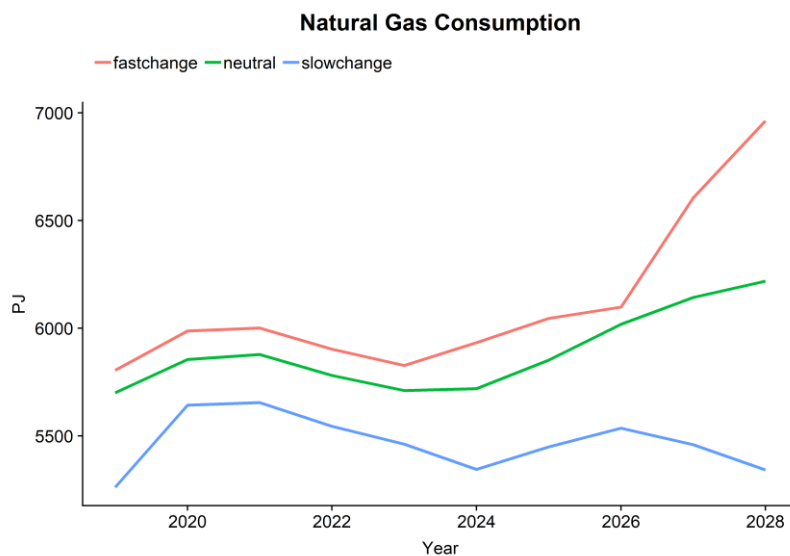


Figure 1 Gas consumption forecast in all scenarios for Eastern and South-Eastern Australia

Gas consumption forecasts are driven by Australian population growth (which appear to be consistent with the difference series/scenarios provided by the ABS in the Australian population growth projection section of this report), the economy which is quantified as global and domestic growth, levels of energy efficiency, fuel switching (from electric to gas), the price of gas, carbon emission trajectories (based on coal-powered energy facility retirement and levels of renewable energy investment), generator and battery cost trajectories are also drivers (AEMO 2019a) as well as commodities prices and the growth and development of usage categories including Mining, Mineral processing and other major industry users such as ammonia, fertiliser producers (AEMO 2018b). In all scenarios residential appliances are assumed to be switching from gas to electricity in the future – which will decrease residential demand. Climate change is also projected to increase by 0.5 degree C by the end of the forecast period, which will reduce the demand for gas heating in winter (AEMO 2018b). On average the AEMO model projects a reduction of 25 PJ for every 1 degree C increase in average temperature (AEMO 2018b). Although it is not explicitly incorporated, weather variability is expected to somewhat affect demand for gas-powered generation of production (AEMO 2018b). One the west coast, it was suggested that lower than expected wind speeds and extended cloud cover could lead to lower electricity generation and an increase in gas-powered electricity generation (AEMO 2018b). However, this suggested impact is contradicted on the east and south-east coast as electricity storage technology that complements intermittent renewable energy generation is expected to lower

demand for gas-powered generation (AEMO 2019b). Interactions with other sectors include population growth, the local and global economy and competing energy sectors i.e. renewables, (hydro, wind and solar) and infrastructure construction, mining, mineral processing and ammonia and fertiliser industries.

No explicit initiative is taken or suggested in response to the projections for the east and south-east of Australia, but there is some emphasis on gas producers needing to assess the adequacy of their supply to meet the projected demands (AEMO 2019b). Additionally, the report notes the recent legislation put in place by the Australian government to secure the supply of gas for the domestic market by restricting producers’ abilities to export gas (AEMO 2018a). Initiatives suggested to increase demand for gas in WA included, the use of gas in processing lithium and other energy intensive metal resources. It is noted that a Regional Development Australia (RDA) case for WA as a “Lithium Valley” is being mounted (AEMO 2018b). Additionally, stricter regulations on sulphur oxide and particulate matter emissions from the international shipping sector will become effective in 2020 so the use of gas as a marine fuel could grow in response to this. In line with this a “Green Corridor” Joint Industry Project is also noted as this project involves converting all marine support vessels, carrying iron ore and coal on the Australia-China trade route, to gas in the next 5 years.

1.2 Oil

According to the Bureau of Resources and Energy Economics (BREE) oil production, consumption and imports (including crude oil, condensate and liquefied petroleum gas (LPG) production) are projected to decline by 4.4 per cent a year from 786 petajoules in 2014–15 to 161 petajoules in 2049–50 (BREE 2014). It is assumed that producers will develop a small proportion of the resource base each year in response to price signals, while existing and future reserves will deplete as the oil is extracted, resulting in lower future production. The production of naturally occurring LPG is projected to increase at an average annual rate of 0.3% to 104 petajoules in 2049–50, but crude oil production continues to decline (Figure 2). Australia is a net importer of crude oil and condensate and with consumption forecasted to rise slightly, imports are expected to increase by 2.4% to 2049-50 (Figure 2).

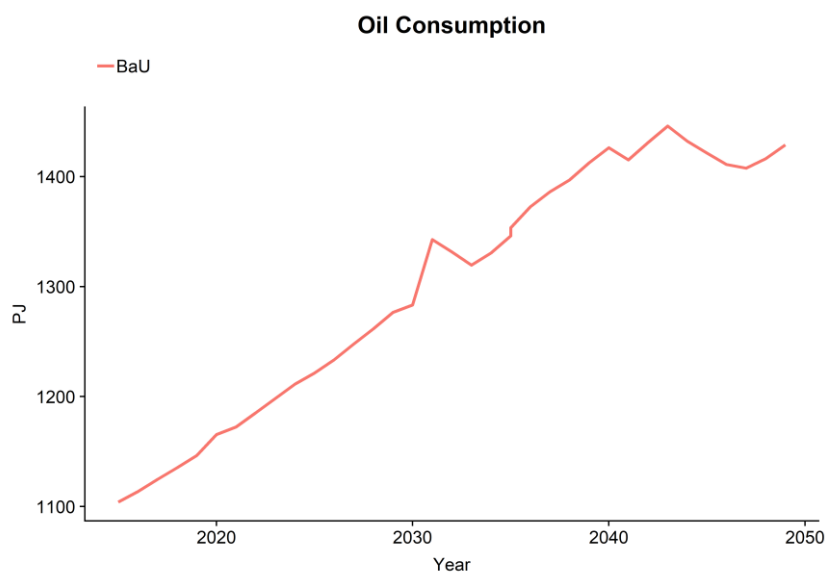
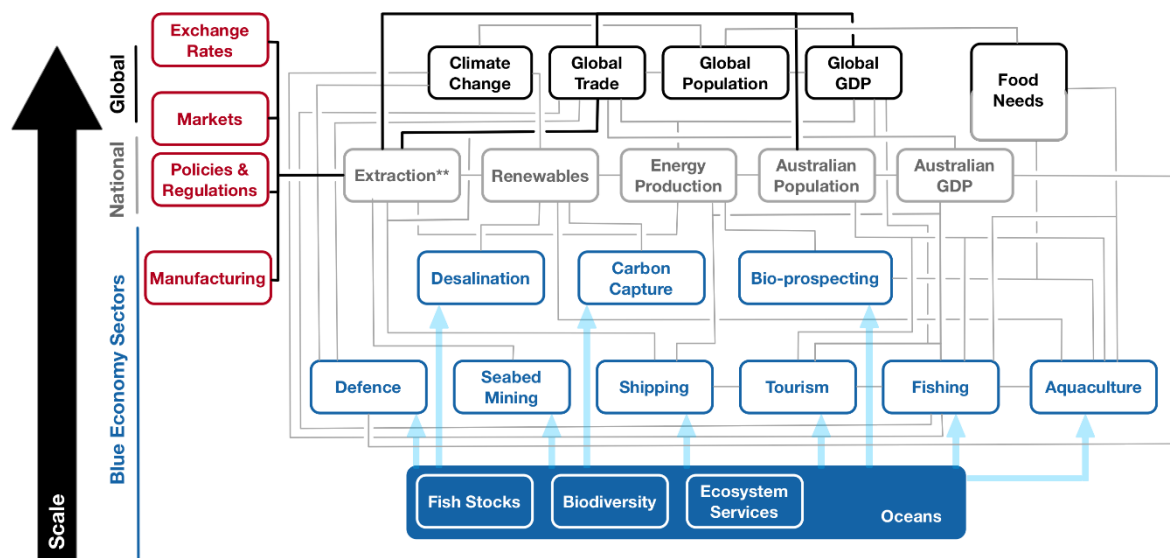


Figure 2 projections of Australian oil production, consumption and imports from 2015-2050

The oil consumption, production and imports projections were generated from the *E4cast* model that is largely driven by macro-economic assumptions consistent with the Australian Energy Market Operator (AEMO) and the Australian Treasury economic forecasts (BREE 2014). These included assumptions on Australian population growth, Australian economic growth (of 2.7%), the Australian governments renewable energy targets (RET) of 41 TWh by 2020 that is maintained in further years was assume and long-term world energy prices consistent with the International Energy Agency (IEA) 2013 World Energy Outlook Policies Scenario. Oil consumption/demand in the model was driven by population growth, energy prices, electricity generation technologies, end use energy technologies and government policies. Population growth assumptions were based on ABS projections from 2013 (see Section 0). Economic growth assumptions were based on GDP growth (see main document) and gross-state production (GSP) which represents the income and business activity for energy intensive industries (aluminium, nonferrous metals, iron and steel manufacturing). Queensland and WA were assumed to have higher GSP than other states because of their substantial mineral and energy resource base, high export and high population growth rates. Consumption projections were also influenced by key domestic policy assumptions that included the repeal of the Carbon Tax and Mineral Resource Rent. Oil imports were based on projected domestic oil production, end-use consumption and current refinery capacity. Besides population growth, and economic growth, future oil consumption is likely to depend on other form of energy production like natural gas (see Section 0), black and brown coal and renewables and energy intensive industries such as aluminium, nonferrous metals, iron and steel manufacturing.

Based on projections from all major energy sectors The BREE report concludes that gross electricity generation is projected to grow and that coal and oil will continue to supply the bulk of Australia’s energy needs. Renewable energy in projected to increase, but at a moderate rate of 0.9%. The report, suggests that if a transition to a low carbon economy is to be made then significant investment in energy supply chains is required.

1.3 Sector-specific conceptual model



** Extraction - land and sea

Figure 3. 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.

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