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Implications of oil extraction from the Great Australian Bight for Paris Agreement long-term goal

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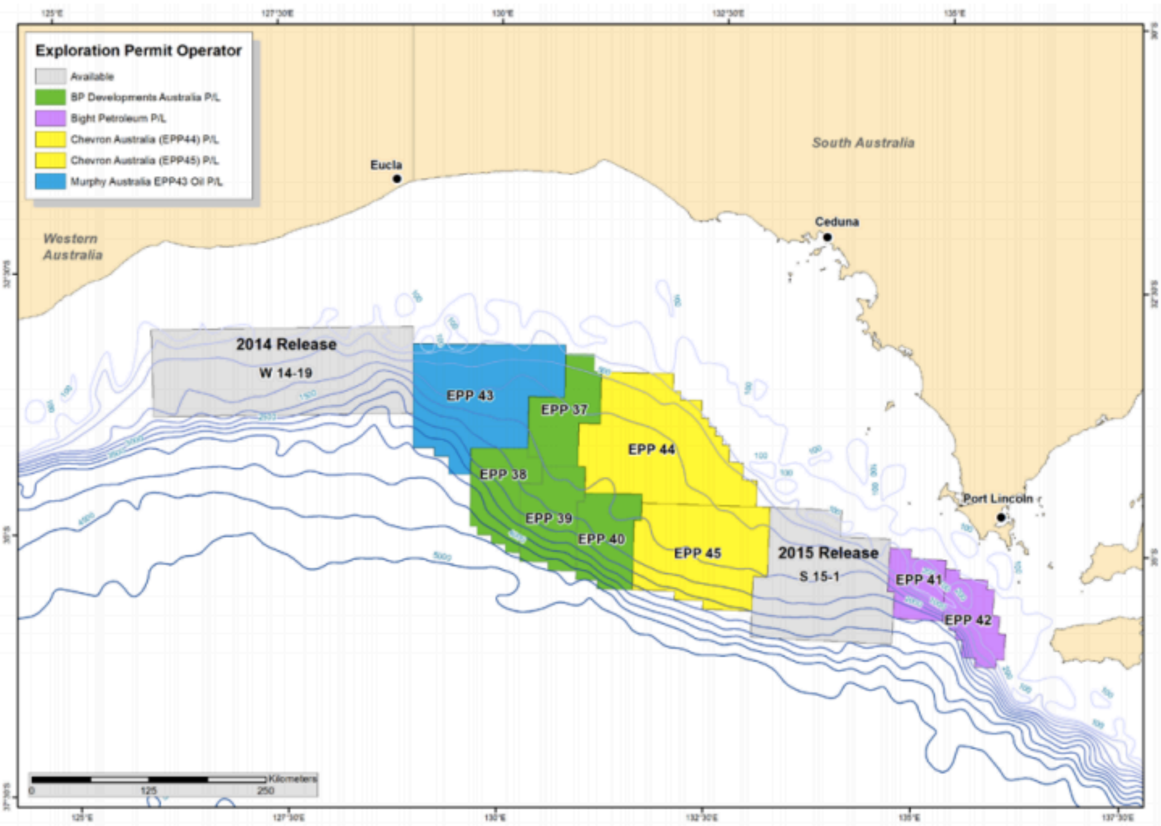
Background

A number of oil companies including BP, Statoil, Bight Petroleum, Santos and Chevron, are currently planning oil exploration wells in the deep waters of the Great Australian Bight.

The Australian Government has issued nine oil exploration licences (EPP 37-45) to these companies (see map below).



The most advanced project, the BP/Statoil joint venture, will spend well in excess of AUD$1bn exploring the region for oil over the next two years, drilling four exploratory wells.

BP/Statoil holds four of the nine exploration licences. BP proposes to drill the exploratory wells in deep water, one at a depth of 2,200m. The drilling area has water depths between 1000m and 2500m.

While BP has not indicated how much oil it believes may be in its prospects, Bight Petroleum Limited, another, significantly smaller, company prospecting in the region - with two of the prospects - suggests there may be recoverable reserves of 9bn barrels in its two licence areas alone.[1] This estimate is, of course, likely to be much lower than the total of the nine permit areas.

Summary of findings

- **Even assuming the partial figure of Bight Petroleum's 9bn barrels of oil from two out of nine permit areas, if exploited and burnt, this would amount to about three gigatonnes of CO2. For comparison, these 9bn barrels, when burnt, would produce the equivalent of nearly eight times Australia's 2013 annual CO2 emissions from fossil fuels - coal, oil and gas.**
- **Oil resources globally far exceed the volumes consistent with limiting warming below 2°C, and are far above those consistent with the 1.5°C limit in the Paris Agreement.**
- **Adding additional oil reserves to the world energy system, as proposed by BP and others in the Great Australian Bight, is inconsistent with the global temperature and emission limits from the Paris agreement.**
- **Given this, as the world moves to implement the Paris Agreement, additional oil reserves, such as exploited through the very expensive, deep water production from the Great Australian Bight, would probably become stranded assets, with possibly significant implications for and risks to shareholders. Investment in such a production appears fully inconsistent with the world holding warming well below 2°C and limiting warming to 1.5°C, as agreed under the Paris Agreement.**
- **The legally binding provisions of the Paris Agreement include that all parties together move towards zero global emissions of greenhouse gases in the second half of the 21st-century, consistent with the best available science and the 1.5°C limit in the agreement. This means that, globally, CO2 emissions from fossil fuel combustion would need to be reduced to zero by around 2050 to adhere to the 1.5°C limit, and only a decade later should warming only be held to below 2°C with a likely chance. This also means that Australia would also need to be planning to reduce its fossil fuel related CO2 emissions to zero on this timeframe, by mid-century.**
- **The presently-available estimate of a fraction of the oil stocks in the Great Australian Bight indicate that they are equivalent to nearly eight times the nation's current annual CO2 emission from fossil fuel combustion, and to about one third or more of Australia's remaining CO2 emissions budget to 2050.**

Australian oil reserves and the carbon budget

At the climate conference (COP21) in December 2015, 195 countries, including Australia, adopted the Paris Agreement, agreeing to hold global warming well below 2°C and to

[1] see http://www.bightpetroleum.com/14830/2d-drill-leads-resource-estimates.htm

pursue efforts to keep to warming to 1.5°C above pre-industrial levels. This will become legally binding once ratified by 55 governments, representing at least 55% of global emissions.

To achieve this, the science, as assessed, for example, in the IPCC's Fifth Assessment Report, tells us that globally, greenhouse emissions need to be at zero in the second half of the century. Carbon dioxide emissions from fossil fuel combustion (coal, oil and gas) and cement need to be at zero earlier, by around 2050 for a 1.5°C limit, and at zero a decade later for the 2°C limit (Rogelj, Schaeffer, & Hare, 2015).

If these temperature limits are to be met, the amount of carbon that can be emitted to the atmosphere is very limited (Rogelj et al., 2016). The most recent, state-of-the-art assessment indicates that from 2015 to 2100 only 470-1020 billion tonnes of carbon dioxide[2] (gigatonnes of CO_2 or $GtCO_2$) can be emitted to the atmosphere globally, to stay under 2°C warming with a likely (greater than 66%) chance. This limit would be lower for 1.5°C (Rogelj et al., 2016).

To stay under 2°C, less than about 560 gigatonnes of CO_2 from oil can be released between 2010 and 2100, and likely significantly less if the 1.5˚C limit in the Paris agreement is to be met.

The Great Australian Bight oil volumes are estimated to be at least around 9 billion (bn) barrels (estimate for only two of the nine exploration areas), which, if burned, equals about three gigatonnes of CO_2.

Models show we don't need new reserves of oil if we want to hold warming below 2˚C

However, this does not tell the full story: if the world is to hold warming under 2°C, energy system models show that additional reserves of oil cannot be added to the world energy system (we used the MESSAGE-IAM model – see "methodology" below). If additional reserved are added, they certainly cannot be used unless the intent is to *not* meet the Paris Agreement's temperature limits.

Endeavours to add more reserves of oil are therefore risking climate targets as well as risking investments becoming "stranded" and unable to be used if the world moves towards limiting warming to 1.5°C, as it has agreed to do under the Paris agreement. This could have negative implications for - and risks to - investors and their shareholders in the Great Australian Bight project.

The energy-economic model we used (MESSAGE) does not differentiate between oil reserves and resources, since this differentiation is fluid and hinges on the price of oil calculated internally inside the model and the extraction cost of oil. The MESSAGE model assumes a stock i.e. reserves and resources of nearly 17 Zeta joules (ZJ) of oil available today (about 3 trillion barrels, which are presently (2014) being burnt at 92 million barrels

[2] Numbers from IPCC AR5 Fifth Assessment Synthesis Report, updated with actual global emissions from 2011-2015 (Rogelj et al., 2016). The uncertainty range in "allowed" CO2 emissions is driven in this case by uncertainty in non-CO2 reductions and remaining emissions.

per day (British Petroleum, 2015), roughly equally composed of conventional and oil (see Table 1). Unconventional oil is, for example, tight oil, oil shale, ultra-deep (offshore) fields, tar sands and bitumen and usually characterised by higher costs of extraction. Much of the Great Australian Bight oil, given its depth, would currently be described as unconventional. If fully burned, the *global oil* stock would result in around 1250 gigatonnes of CO_2, which exceeds by far the allowed CO_2 budget for *all* CO_2 emissions, which includes also emissions from coal and gas.

The policies and technologies required for a low emissions pathway will result in greater use of renewables, efficiencies, and changes in modes of production and consumption. In turn, this will result in decreasing demand for oil, coal and gas. Reduced oil demand under a well below 2°C, 1.5°C pathway, compared to a business as usual pathway, will drive down oil producer revenues. The ultimate outcome is that fewer oil stocks would be added to the system under a below 2°C pathway.

Exploited oil reserves will need to decline if the Paris Agreement goals are to be met

In the MESSAGE model, by 2100, the reserves will have dropped from 17 ZJ to less than 10 ZJ, which shows that under a 2°C-compatible climate policy, most of the oil reserves must remain in the ground and, given price levels, this primarily concerns unconventional reserves, of which very little can be extracted. Overall very few - if any - additional reserves of oil are needed, and additional reserves of oil added to the world energy system would simply create the pressure for higher emissions, since producers want to avoid stranded assets.

RESOURCES [ZJ]	2010	2100
CONVENTIONAL	8.0	0.9
UNCONVENTIONAL	8.9	8.7
TOTAL	16.9	9.6

Table 1: Global oil reserves in 2010 and 2100. Median values of 10 scenarios assuming 2°C compatible climate policy after 2020 with slightly differing assumptions regarding the remaining GHG emissions budget. Source: MESSAGE, own calculations

Whether the oil from the Great Australian Bight is conventional or unconventional oil is not a fundamental issue, since neither of the resources currently known can be fully burned under a 2˚C policy. The fate of oil producers will be decided by competition within the shrinking pool of producers providing the minor part of total global reserves that can realistically still be exploited profitably under 2°C policies.

The message from Table 1, in combination with the remaining, oil-related CO_2 budget, is that under a climate policy in line with 2°C, demand for oil can be "over-fulfilled" from already known reserves. Prospecting new sources of oil is not necessary, especially if the oil from them would be very expensive – like it is the case for deep-water offshore wells.

Even one small part of the Great Australian Bight oil[3] would amount to three gigatonnes of CO_2. For illustration, this is about the same amount as a third of Australia's emissions allowances under a 2˚C carbon budget between now and 2050.

For the Pacific OECD (PAO) region, which comprises Japan, Australia and New Zealand, the MESSAGE model projects a CO_2 emissions budget of 42 Gt CO_2 for the period 2010 – 2050. The majority of the PAO region's emissions come from Japan with its large population, so that Australia gets only a small fraction of the regions CO_2 emissions budget.

According to the World Development Indicators, in 2010 Australia was the source of 23.5 % of CO_2 emissions in the PAO region[4]. Assuming that this share stays constant, Australia has a CO_2 emissions budget of about 9.7 Gt CO_2 between 2010 and 2050, ignoring any equity considerations that would reduce it. The additional carbon introduced into the Australian energy system by the 9 bn barrels in just two prospects in the Great Australian Bight's nine prospects of oil reserves assumed here, should they enter production, is about a third of this budget. This share increases with a lower global temperature stabilisation target and therefore lower budget for Australia, and if the actual reserves in the Great Australian Bight are larger than known today.

Of course it is likely that the oil from the Bight would not all be burned in Australia. Emissions from the burning of any exported oil from these reserves would be counted in countries where they are burned. But given Australia is party to the Paris Agreement, allowing this exploration to go ahead flies in the face of that agreement.

Annual fossil fuel CO_2 emissions for Australia have to drop from about 0.4 Gt CO_2 per year in 2013 to close to zero by 2050. The at least 9 bn barrels of oil estimated in the Great Australian Bight would amount to about three gigatonnes of CO_2, equivalent to nearly eight times the 2013 yearly emissions.

In other words, this fraction of the Great Australian Bight exploration programme, should it all be burned in Australia, represents sufficient carbon to bust the remaining Australian carbon budget by more than a third on its own, without consideration of fuel imports and all the other fossil fuel projects presently under development.

Methodology

Oil is mainly used as fuel in the transport sector and is difficult to substitute compared to other fossil fuels in other sectors in the short to medium term (Kriegler et al., 2014). Integrated Assessment Models (IAMs) integrate our current knowledge of the economy,

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3 ie, the Bight Petroleum's estimated 9bn barrels for its two of the nine prospects

4 http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators

energy systems and the climate in order to assess the implications of climate policy and explicitly evaluate trade-offs between different energy sources (Bauer et al., 2015). One of these models, the MESSAGE-IAM[5] delivers, inter alia, cost-optimal extraction pathways for different types of fossil fuels given a certain climate stabilization target – the latter being for example an estimate of the "Climate budget" of remaining emissions to stay under the Paris agreement warming limits.

Compared to other literature sources, the energy content of the remaining resources and reserves assumed in MESSAGE is rather on the low end of the spectrum. Other sources like the Global Energy Assessment state larger numbers (Rogner et al., 2012).

The scenarios we used for this analysis allow a global budget for CO_2-emissions of 1430 Gt CO_2 for the period 2010 – 2050 (median value). This value is higher than than reported e.g. in the IPCC's Fifth Assessment report (IPCC, 2014), since they explicitly take into account a delay until 2020 in the onset of climate policy consistent with a temperature target of limiting warming below 2°C with a likely chance. Some of the higher emissions from the first half of the century, and indeed from the last few decades, need to be compensated through CO_2-removal in the second half of the century by technologies like Bioenergy with Carbon Capture and Storage (BECCS). Both the delay in policy and the assumed widespread availability of BECCS lead to a relatively high emissions budget in the first half of the century.

As a consequence, for temperature limits such as 2° and 1.5°C, the carbon budget to 2050 can be higher than the one over the entire century, as is confirmed by comparing the 2010-2050 budget of 1430 Gt CO2 above with the recent assessment (IPCC AR5 WGIII) of the results of many different models, with a remaining budget from 2015 until 2100 of 470 to 1020 gigatonnes CO2 (Rogelj et al. 2016), with this range including results from the MESSAGE model.

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[5] http://www.iiasa.ac.at/web/home/research/researchPrograms/Energy/MESSAGE.en.html

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