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Submission Number: NND.001.00677

Submission Of: Geoffrey John Miell

Your Details

Email address:

Phone:

Preferred means of contact: Email

What is your submission based on? I am making this submission based on my personal situation

What was your personal situation in relation to the 2019-20 Bushfires?

Where do you live? Lithgow (C)

Your Submission

In your experience, what areas of the bushfire emergency response worked well?

In your experience, what areas of the bushfire emergency response didn't work well?

In your experience, what needs to change to improve arrangements for preparation, mitigation, response and recovery coordination for national natural disaster arrangements in Australia?

Is there anything else you would like to tell the Royal Commission?

Please see my attached Submission

Do you agree to your submission being published? Yes I agree to my submission being published in my name

Supporting material provided:

Submission-Geoff_Miell.pdf

Submission to the Australian Royal Commission into
National Natural Disaster Arrangements

Where on Earth is humanity heading: Pliocene or Miocene climate?

On 17 November 2018, Professor H. J. Schellnhuber CBE, then Director Emeritus of the Potsdam Institute for Climate Impact Research, Member of the Pontifical Academy of Sciences, and Member of the German Advisory Council on Global Change, presented his Aurelio Peccei Lecture in Rome, Italy, titled “Climate, Complexity, Conversion”.¹ At the beginning of his lecture, Professor Schellnhuber refers to a co-authored scientific paper titled *Trajectories of the Earth System in the Anthropocene*² that he described as a “**landmark paper**” and a “**game-changer**”. From about time interval **0:23:23 through to 0:26:45**, Professor Schellnhuber outlines two (2) Earth climate state possibilities that **humanity could experience within this century**, dependent upon the global human-induced greenhouse gas (GHG) emission trajectory path that ensues within this decade (i.e. the 2020s), namely Options:

- A. A harsher climate state paradigm may be like in the **Mid-Pliocene age**, that occurred **3–4 million years ago**, where atmospheric CO₂ levels were in the range of **400–450 parts per million (ppm)**, mean global temperatures were **+2.0–3.0°C** (above pre-industrial age), and sea levels were **+10–22m higher than today** (stabilised over centuries), but requires humanity to rapidly reduce human-induced global GHG emissions now (i.e. >50% reduction by 2030, and to zero by 2050).³
- B. The alternative highly undesirable climate state may be like in the **Mid-Miocene age**, that occurred **15–17 million years ago**, atmospheric CO₂ levels were in the range of **300–500 ppm**, mean global temperatures were **+4.0–5.0°C**, and sea levels were **+10–60m higher** (stabilised over centuries), **which is likely with our current global GHG emissions trajectory**.

Humanity and human civilisation might adapt to Option A – Mid-Pliocene climate like conditions, but human civilisation (as we know it) is highly likely to collapse in Option B – Mid-Miocene climate like conditions, with a global population likely declining below one billion people before 2100.⁴

A 1°C global mean temperature rise (above pre-industrial age) means the emergence of dangerous climatic conditions; 2°C means the onset of “*extremely dangerous*” climatic conditions; 3°C means “*outright chaos*”; and 4°C means “*incompatible with organised global community*”.⁵

Humanity must stop emitting GHGs: >50% reduction by 2030; zero before 2050.

¹ *Keynote Debate Can the Climate Emergency Action Plan lead to Collective Action_ (50 Years CoR)*, from time interval **0:05:31 to 0:40:20**, Club of Rome, <https://www.youtube.com/watch?v=OK2XLeGmHtE>

² *Trajectories of the Earth System in the Anthropocene*, by Will Steffen, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, Anthony D. Barnosky, Sarah E. Cornell, Michel Crucifix, Jonathan F. Donges, Ingo Fetzer, Steven J. Lade, Marten Scheffer, Richarda Winkelmann, and **Hans Joachim Schellnhuber**, published in the *Proceedings of the National Academy of Sciences of the United States of America* (PNAS), vol. 115, no. 33, pp8252-8259, online on 6 Aug 2018, <http://www.pnas.org/cgi/doi/10.1073/pnas.1810141115>

³ *Existential climate-related security risk: A scenario approach*, by David Spratt and Ian Dunlop, published by Breakthrough – National Centre for Climate Restoration, May 2019 (updated 11 June 2019), <https://www.breakthroughonline.org.au/papers>

⁴ <http://www.climatecoded.org/2019/08/at-4c-of-warming-would-billion-people.html>

⁵ *Ibid.* 1, presentation by Ian T. Dunlop from about time interval **1:32:55 through to 1:42:20**

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1.5°C temperature rise likely to be reached around 2030

On 14 February 2020, David Spratt, Research Director at Breakthrough – National Centre for Climate Restoration, made a presentation to the opening plenary, “The New Climate Reality Check”, at the National Climate Emergency Summit 2020 at the Melbourne Town Hall.⁶ Spratt highlighted that the world has a short-run problem, where a 1.5°C temperature rise above pre-industrial age is likely to be just a decade away, as a consequence of past GHG emissions already in the atmosphere.

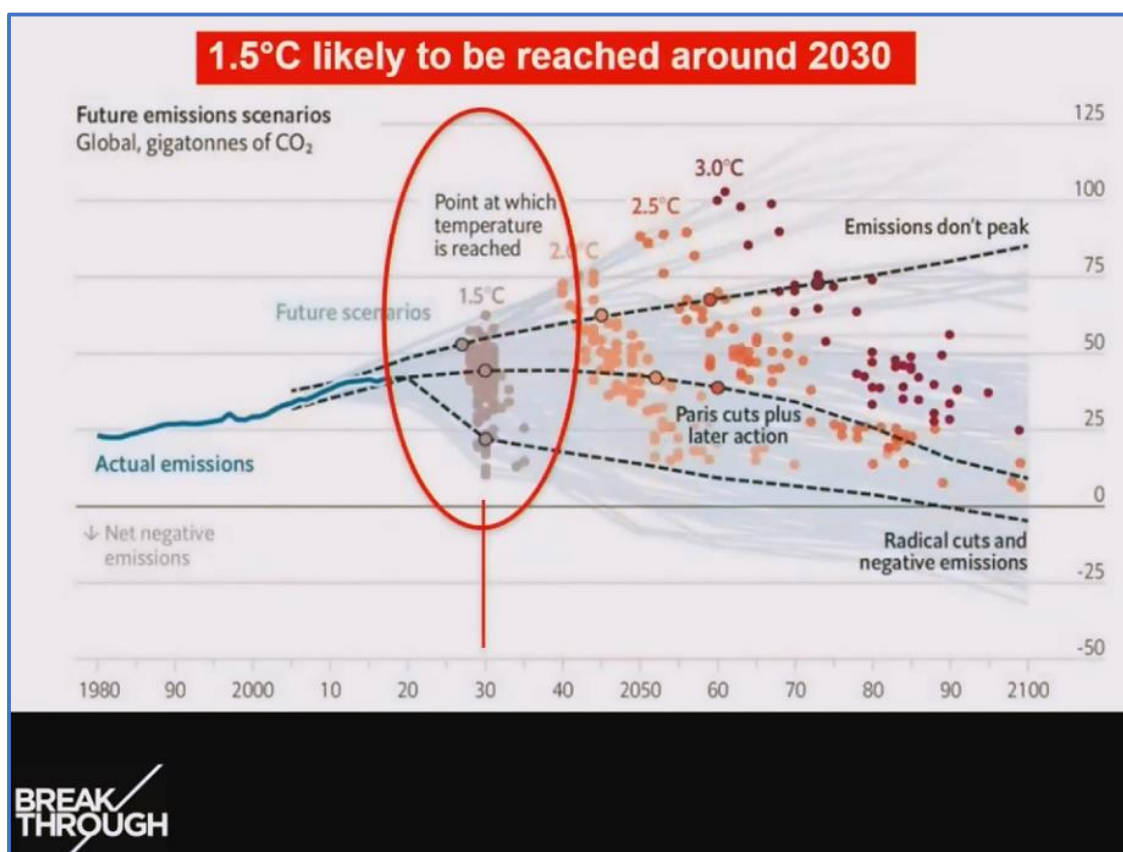


Figure 1: Future emissions scenarios, temperature rise and timings up to 2100⁷

1.5°C is dangerous, close at hand (see Figure 1 above), and now practically impossible to avoid, as there is no carbon budget remaining for 1.5°C.

To stay below 2°C, itself far from safe, requires global emissions to be more than cut in half in the next ten years, and much more in the high-emitting rich nations like Australia.

Climate disruption is now an existential threat to our civilisation as we know it today. This is an emergency requiring everyone making climate the primary priority of economics and politics, because slow, incremental change now means we are losing.

Australia must prepare for the consequences of an inevitable 1.5°C rise by 2030.

⁶ <https://www.climateemergencysummit.org/full-program/>

⁷ <http://www.climatecodered.org/2020/02/a-climate-reality-update-at-2020.html>

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New energy solutions must compensate for global post- 'peak oil'

Emergency services vehicles are currently dependent on an adequate supply of petroleum-based liquid fuels to function. Disruptions/interruptions to liquid fuel supplies risks a critical reduction in current emergency service preparedness, resilience and operational capability to respond to the impacts of natural disasters.

Pre COVID-19, evidence indicated global supplies of petroleum oil are likely to peak soon (i.e. 2020s), then begin a sustained decline. New energy solutions must take up the energy supply slack as the transition away from petroleum-based fuels progresses.

Per *BP Statistical Review of World Energy 2019*, from pages 14 and 16, **the world's top ten oil producing countries in 2018** were as indicated in the table below:⁸

Rank	Country	2018 Oil Production – Annualised Average (x10 ⁶ barrels / day)	Global Share (%)	Proved Reserves- to-Production At end-2018 (years)
–	World	94.718 (▲ +2.4%)	100.0	50.0
1	USA	15.311 (▲ +16.6%)	16.2	11.0
2	Saudi Arabia	12.287 (– +3.3%)	13.0	66.4
3	Russian Federation	11.438 (▲ +1.6%)	12.1	25.4
4	Canada	5.208 (▲ +8.5%)	5.5	88.3
5	Iran	4.715 (▼ -6.1%)	5.0	90.4
6	Iraq	4.614 (▲ +1.8%)	4.9	87.4
7	United Arab Emirates	3.942 (– +0.8%)	4.2	68.0
8	China	3.798 (▼ -1.3%)	4.0	18.7
9	Kuwait	3.049 (– +1.6%)	3.2	91.2
10	Brazil	2.683 (– -1.4%)	2.8	13.7

Includes crude oil, shale oil, oil sands and natural gas liquids (NGLs). Excludes liquid fuels from other sources such as biomass, coal-to-liquids (CTLs) and gas-to-liquids (GTLs).

Pre the COVID-19 crisis, the world's top five oil producers represented more than one-half (51.7%) of global share and the top ten represented more than two-thirds (70.8%).

In 2018, USA, Canada, Iraq and the Russian Federation were oil producers at pre-peak (i.e. still increasing production year-by-year). Saudi Arabia, Kuwait, UAE and Brazil were at peak (i.e. production was on a bumpy plateau). Iran's production dropped due to the oil embargo. China's oil production has declined since 2015.

Many oil producing countries are now 'post-peak', including Australia, which peaked in year-2000,⁹ and has declined since then, producing only 0.3% global share (in 2018) yet consumes 1.1% global share.¹⁰ More than 90% of Australia's transport liquid fuels and crude oil for transport are now imported.¹¹

⁸ *BP Statistical Review of World Energy– 68th Edition*, BP, Jun 2019, <http://www.bp.com/statisticalreview>

⁹ *Australian Fuel Security Review ignores peak oil in China 2015 (part 1)*, *Crude Oil Peak*, 29 Apr 2019, Fig 1, <https://crudeoilpeak.info/australian-fuel-security-review-ignores-peak-oil-in-china-2015-part-1>

¹⁰ *Ibid.* 8, pages 16 & 20

¹¹ *Australia's Liquid Fuel Security: Part 2*, prepared by John Blackburn AO, NRMA, Feb 2014, <https://www.aph.gov.au/DocumentStore.ashx?id=677ff8dd-ce35-40ee-9af8-bfec1e43d125&subId=301736>

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Since about 2012, Australia has not complied with the International Energy Agency's (IEA's) 90-day petroleum fuel stockholding requirement.¹² **From 2010 to October 2019, Australia's in-country petroleum stockholding consumption covers for:**

- **Crude oil:** from 21 to 32 days;¹³
- **Diesel fuel:** from 10 to 22 days;¹⁴
- **Turbine (jet) fuel:** from 13 to 30 days;¹⁵ and
- **Gasoline (petrol) fuel:** from 15 to 28 days.¹⁶

World 'conventional' crude oil production has plateaued since about 2005.¹⁷

US 'unconventional' shale oil is a light oil, not easily converted to diesel, which is the most important transportation fuel, nowadays.¹⁸ It's also ill-suited for producing aviation turbine (jet) fuel and higher-octane grades of gasoline fuels for high-performance vehicles, unless extensively blended with "heavy" crude oils.¹⁹

A balancing act is occurring between declining and growing oil producing countries. The whole system will peak when US shale oil peaks (in the Permian Basin) because of geology, lack of finances to sustain unprofitable enterprises as a consequence of low crude oil prices due to low demand, and/or other factors.

Prior to the COVID-19 crisis, oilfield companies were taking the unprecedented step of scrapping entire fleets of fracking equipment, responding to the downturn in shale drilling that has been steep and fast.²⁰

Global 'peak oil' supply is inevitable – exactly when is the question. There are too many wrong investment decisions for petroleum-dependent infrastructure being made – Australia is ill-prepared for any serious disruptions to Australia's petroleum fuel supplies and ultimately, for when global petroleum-based liquid fuel supplies begin an inevitable sustained decline (i.e. a post- 'peak oil' world).

The sooner Australia rapidly reduces its dependency on petroleum-based fuels by transitioning to battery-electric and hydrogen-fuel-cell-electric vehicles, and electrified rail, powered from renewable energy, the more energy secure Australia will be.

Humanity must leave petroleum oil before oil leaves us.

¹² **Australia's oil consumption highly vulnerable to events in the Middle East**, *Crude Oil Peak*, 12 Jan 2020, Figure 2, <https://crudeoilpeak.info/australias-oil-consumption-highly-vulnerable-to-events-in-the-middle-east>

¹³ *Ibid.* 12, Figure 10

¹⁴ *Ibid.* 12, Figure 16

¹⁵ *Ibid.* 12, Figure 14

¹⁶ *Ibid.* 12, Figure 11

¹⁷ **2005-2018 Conventional crude production on a bumpy plateau – with a little help from Iraq**, *Crude Oil Peak*, 26 Aug 2019, <https://crudeoilpeak.info/2005-2018-conventional-crude-production-on-a-bumpy-plateau-with-a-little-help-from-iraq>

¹⁸ <https://www.cnn.com/2018/04/17/shale-oil-has-a-refining-problem-and-morgan-stanley-smells-opportunity.html>

¹⁹ <https://www.desmogblog.com/2018/04/24/octane-surprising-reason-shale-oil-makes-poor-fuel-high-tech-cars-and-trucks>

²⁰ **Frackers Scrap Idled Equipment Amid Shale Drilling Pullback**, by David Wethe, *Bloomberg*, 30 Oct 2019, <https://www.bloomberg.com/news/articles/2019-10-30/frackers-scrap-idled-equipment-amid-pullback-in-shale-drilling>

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Global conventional oil and gas discoveries are lowest in 70 years

Conventional oil and gas discoveries have fallen to their lowest level in 70 years. Discoveries aren't even close to keeping pace with the loss of conventional resources. According to Rystad Energy (see Figure 2 below), the current resource replacement ratio for conventional oil is only 16 percent – or alternatively put, **only one barrel out of every six consumed is being replaced with new resources.**

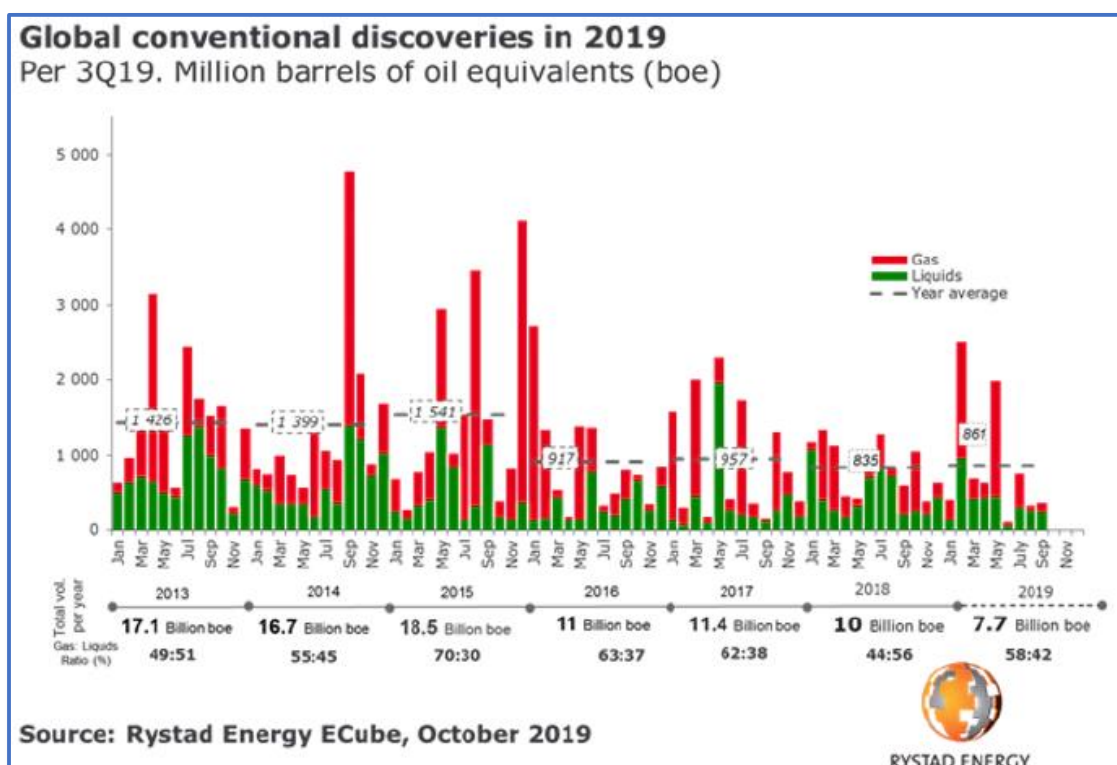


Figure 2: Global conventional oil and gas discoveries, 2013 to Sep 2019²¹

Shale gas and tight oil from low permeability reservoirs have provided a resurgence for US oil and gas production. Tight oil has allowed US oil production to more than double from its 2005 lows, and shale gas has similarly enabled a major increase in US gas production. However, the nature of these reservoirs is that they decline rapidly, such that production from individual wells falls 70-90% in the first three years, and field declines without new drilling typically range 20-40% per year. Continual investment in new drilling is therefore required to avoid steep production declines.²²

Given that the world consumed circa 35 billion barrels of oil per year, before the COVID-19 crisis, it's suggested **you would need to be a supreme optimist to think that the oil and gas industries have a bright future.**

²¹ Rystad: Oil and gas resource replacement ratio lowest in decades, *Oil & Gas Journal*, 9 Oct 2019, <https://www.ogj.com/exploration-development/reserves/article/14068305/rystad-oil-and-gas-resource-replacement-ratio-lowest-in-decades>

²² *Shale Reality Check: Drilling Into the U.S. Government's Rosy Projections for Shale Gas & Tight Oil Production Through 2050*, by J. David Hughes, Post Carbon Institute, Feb 2018, page 158, http://www.postcarbon.org/wp-content/uploads/2018/02/Hughes_Shale-Reality-Check_Winter-2018.pdf

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Ghawar: the world's largest and best oil field is in production decline

Saudi Arabia's (and the world's) single largest and best oil field, Ghawar, (see Figure 3 below) was estimated to be producing at levels generally above 5 million barrels of oil per day (Mb/d) between 1993 and 2008. After 2009, production declined below 5 Mb/d, and after 2016 fell further, below 4 Mb/d, with levels at around 3.8 Mb/d in 2018.

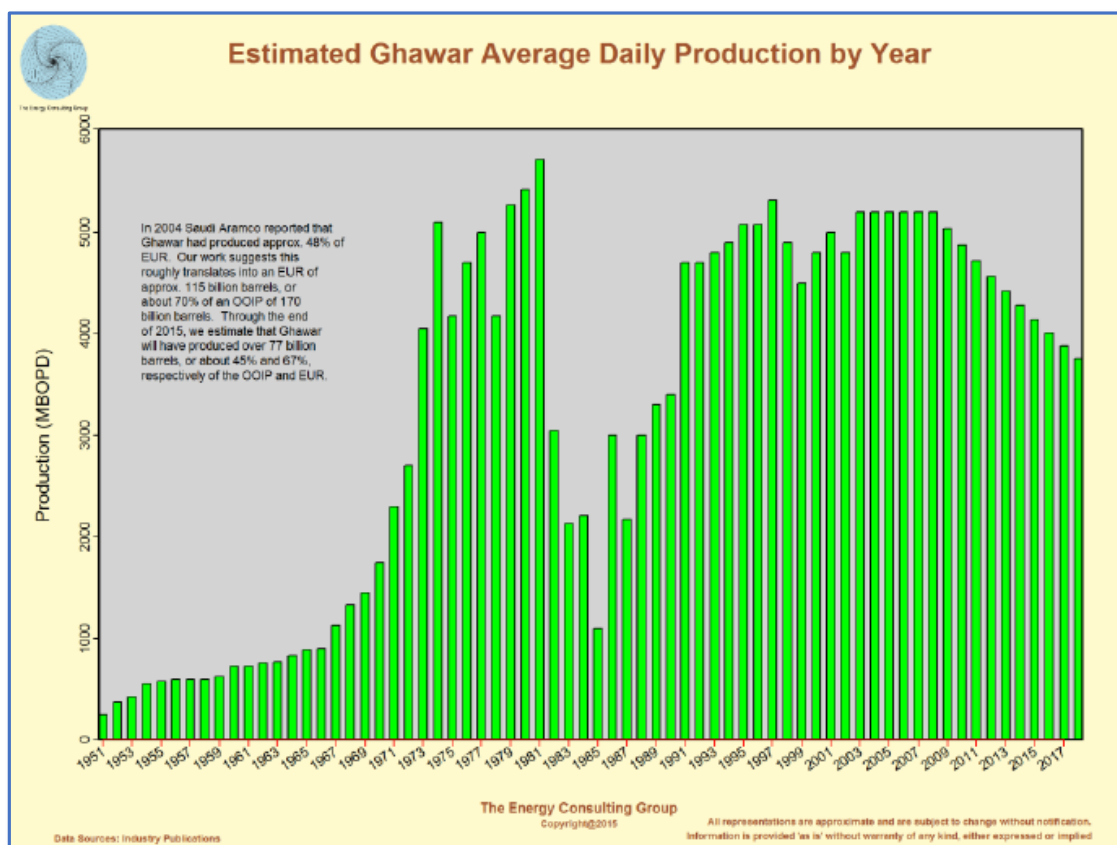


Figure 3: Estimated Ghawar average daily production by year, 1951 to 2018²³

This means Ghawar has already peaked and future production is set to decline further. The remaining state-owned Saudi Aramco oil fields: Shaybah, Khurais, Safaniyah, Zuluf, and others; will need to increase production (after the COVID-19 crisis ends and oil demand likely increases) to offset Ghawar's likely continuing production decline.

Ghawar's Light Arab crude has an API of 34 with a sulphur content of 1.9-2.2% by weight (which the nearby Abqaiq refinery plant must remove). Much of US shale oil is very light and extra light (API >40). Therefore, much of US shale oil cannot replace Ghawar oil production directly. Unlike Saudi Arabia, the US is **not** a swing producer that can quickly (i.e. within 30 days) ramp up production, due to US shale oil legacy decline rates limiting any further production growth.

At some point soon, Saudi Arabian oil production will likely begin a sustained decline that will likely have global supply consequences.

²³ **The Attacks on Abqaiq and Peak oil in Ghawar**, *Crude Oil Peak*, 1 Oct 2019, <https://crudeoilpeak.info/the-attacks-on-abqaiq-and-peak-oil-in-ghawar>

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COVID-19 delivers another blow to embattled US shale oil producers

Figure 4 below shows that US tight (shale) oil production ramped-up when oil prices were around US\$100 per barrel but peaked in March 2015 and then declined as oil prices dropped to US\$50 per barrel. Production began recovery in September 2016 but almost half of the production, mainly from Bakken, Eagle Ford, Niobrara and Anadarko, has already peaked again in October 2019. The other half of the production, from the Permian (in Texas) is still growing but monthly growth rates have declined from 180 kb/d in mid-2018 to 40 kb/d now. Recent data are preliminary.

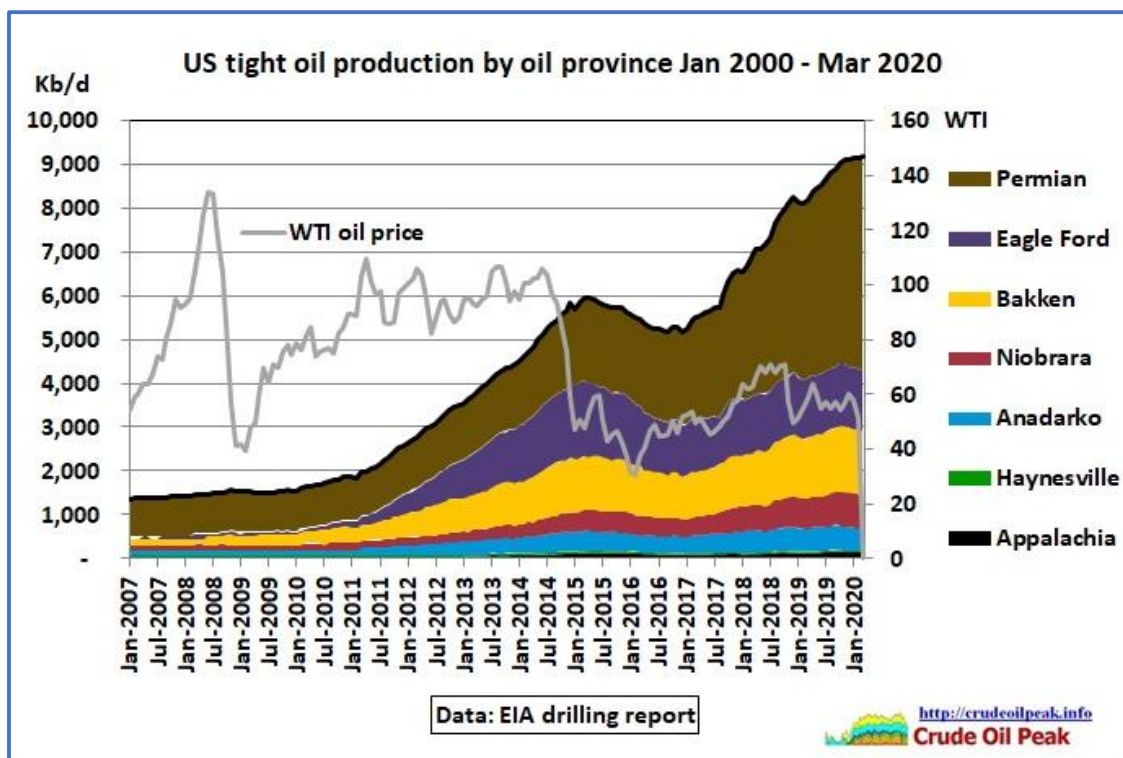


Figure 4: US tight oil production by oil province – Jan 2007 to Mar 2020²⁴

US tight oil producers were already facing a tough 2020, but effects of the COVID-19 crisis on world economies is putting them under even more financial stress. Amid an oversupply of oil and gas, and an oil price-war stoked by Russia and Saudi Arabia, plus cuts to spending to appease investors over dismal returns, greater challenges are being imposed on a business sector where many firms are already saddled with debt.²⁵

Since the 2008 oil price shock, a problem has emerged that **oil prices must be both affordable to consumers AND high enough for the oil industry to be profitable to survive** while the transition to low-emissions solutions progresses. The COVID-19 crisis is battering global economies and financial systems riddled with accumulated debt incurred during the high oil price period and after the end of the low-cost oil era.

²⁴ Impact of Corona Virus similar to some earlier peak oil scenarios, *Crude Oil Peak*, 10 Mar 2020, <https://crudeoilpeak.info/impact-of-corona-virus-similar-to-some-earlier-peak-oil-scenarios>

²⁵ Coronavirus May Kill Our Fracking Fever Dream, by Bethany McLean, *The New York Times*, 10 Apr 2020, <https://www.nytimes.com/2020/04/10/opinion/coronavirus-texas-fracking-layoffs.html>

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Alternative road transport energy solutions to displace petroleum

Per the European environment group Transport & Environment (see Figure 5 below), **battery-electric vehicles (BEVs) are at least three times more energy efficient when compared with hydrogen-fuel-cell-electric vehicles (HFCEVs)**, due to significant energy losses. Power-to-liquid hydrocarbon fuel internal combustion engine vehicles (P2L-ICEVs) are even less energy efficient.

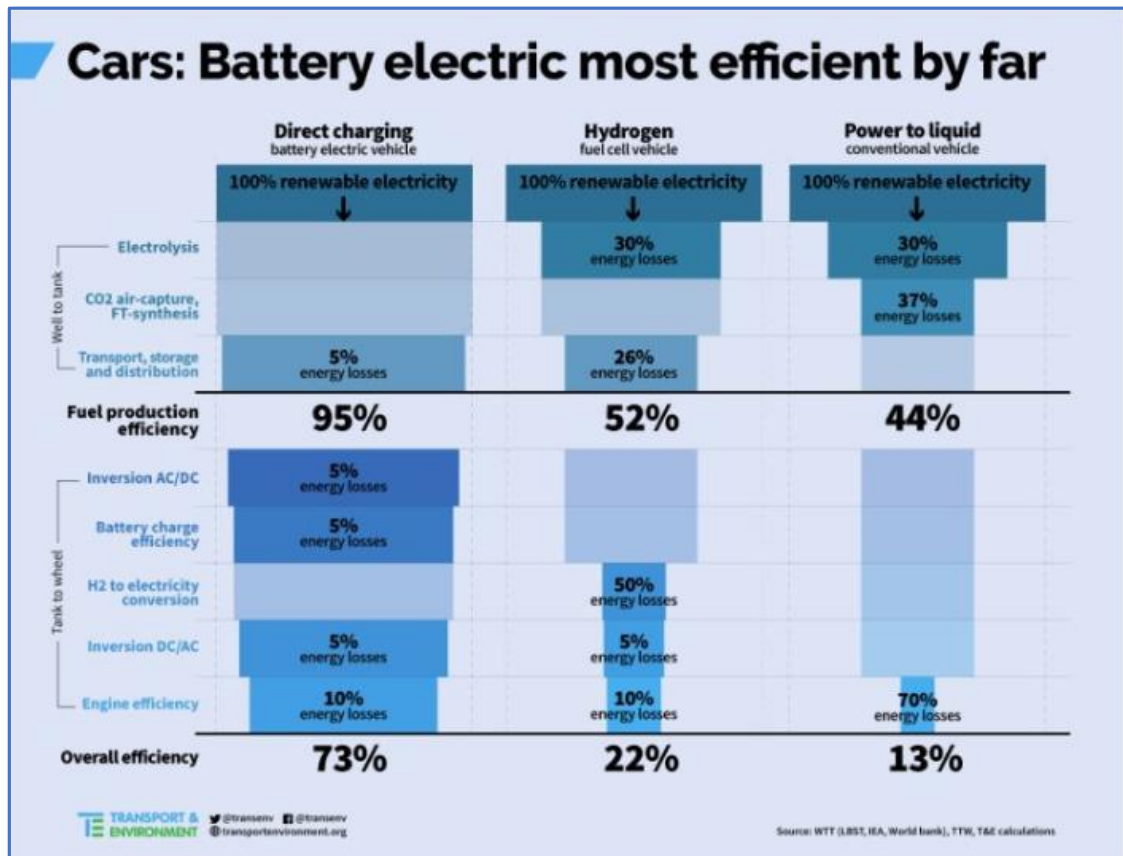


Figure 5: Energy efficiency comparison for BEVs vs HFCEVs vs P2L-ICEVs²⁶

A physical evaluation of key characteristics of liquid transportation fuels across the domains of physics, chemistry, biology, and economics, highlights the deficiencies that preclude biomass from becoming a primary energy source and biofuels from replacing petroleum as a national-scale transportation fuel.

Biofuels do more to harm the causes of national and global security than to help them.²⁷

²⁶ Transport & Environment on Twitter: “Electric vs hydrogen cars?”, Transport & Environment, 22 Aug 2017, <https://twitter.com/transenv/status/899976235794788352?lang=en>

²⁷ *Twenty-First Century Snake Oil: Why the United States Should Reject Biofuels as Part of a Rational National Security Energy Strategy*, by Captain T. A. “Ike” Kiefer, Waterloo Institute for Complexity & Innovation (WICI), Jan 2013, <https://uwaterloo.ca/complexity-innovation/sites/ca.complexity-innovation/files/uploads/files/keifer-snake-oil31.pdf>

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Personal Experiences and Disruptions

Like many during the 2019-20 bushfire crisis, I've personally experienced months of smoke (and dust from drought ravaged areas further west), to varying degrees. Where I live in Lithgow, on some of these days, the smoke was so thick that, in my estimation, the visibility was down to less than 1 km. On some days, the smoke was so pervasive that the smell of it infiltrated into my residence, and made sleeping uncomfortable on some nights – it's a wonder that the house smoke alarms did not sound.

I've since noted that I seem to have acquired low-level respiratory congestion and coughing, particularly first thing in the morning, that I suspect is as a result of the chronic exposure to months of varying levels of smoke and dust. Recently, the symptoms appear to be gradually easing. One of my neighbours has mentioned recently to me that he also has been experiencing some respiratory coughing that he thinks is related to the smoke.

In the early hours of the morning of 23 December 2019, the town water supply to my residence temporarily ceased, with water pressure gradually restored from around midday of the same day. The minutes to the Lithgow City Council's business papers for the Extra-Ordinary Meeting of Council on 13 January 2020, reports on page 8, that:

Over the weekend of 21-22 December 2019, demand on the water system was high due to firefighting efforts in the Lithgow area which placed increased pressure on the network and resulted in a number of water breaks and leaking hydrants. On the morning of 23 December 2019, the main supply to the reservoirs from the Oakey Park Water Treatment Plant burst which resulted in a large loss of water and drained the 2 major service reservoirs. Council drew water from the Fish River Water Supply to maintain supplies. Over the next 24 hours, the system refilled and the water service was resumed to all customers.²⁸

The bushfires on the weekend of 21-23 December 2019 destroyed critical rail infrastructure between Lithgow and Mt Victoria, NSW. All rail services over this section were suspended for weeks. Freight rail services resumed some weeks later and then were suspended again when a landslip to the track between Leura and Katoomba occurred in February 2020. Diesel-powered passenger rail services, including the so-called 'Bathurst Bullet' and XPT services have since resumed, but apparently electric-powered rail passenger services have not been available for more than 17 weeks (and counting), with these services being replaced by buses. A recent article suggests the Blue Mountains rail line could be fully restored by mid-2020.²⁹ The disrupted rail services for Lithgow has discouraged me from using them this year.

Is this the so-called "new normal" we must endure? Should we expect catastrophic wildfires, water shortages, and/or major storm damage that occur every few years, disrupting critical infrastructure that cost tens of billions of dollars to fix every time? Is our society sufficiently resilient to sustain escalating environmental onslaughts?

²⁸ <http://council.lithgow.com/business-papers-for-extraordinary-meeting-of-council-13-january-2020/>

²⁹ **Blue Mountains train line could be fully restored by mid 2020**, by Rachel Chamberlain, *Western Advocate*, 21 Apr 2020, <https://www.westernadvocate.com.au/story/6729741/blue-mountains-train-line-could-be-fully-restored-by-mid-2020/>

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Conclusion

Oil is a finite liquid fuel / energy resource. Until the COVID-19 crisis, humanity was consuming oil reserves on a global scale at an enormous and unprecedented rate. Per *BP Statistical Review of World Energy 2019*, in 2018, **global proved reserves-to-production was estimated at 50.0 years**, and this indicator has been in decline year-on-year over the last decade, meaning **new oil discoveries appear insufficient to fully replace our ongoing consumption.**

Many crude oil producing countries, including Australia, have already passed peak production. Ever fewer pre-peak production countries must increase their annual production continually to compensate for many other countries with declining production.

There are escalating indications that the US shale boom has ended. Recent data is indicating falling operating drill rig counts and investment in new production sagging.

World ‘conventional’ crude oil production has plateaued since about 2005. Escalating indicators suggest global total crude oil production is unlikely to resume to pre-COVID-19 rates once the current pandemic crisis ends.

Biofuels are unlikely to become a widespread, affordable replacement for petroleum fuels because of their poor Energy Return on Investment (EROI) and fossil fuel dependency.

Since the COVID-19 crisis, energy experts say profit margins for an increasing number of older oil wells have morphed into losses – companies cannot even cover fixed costs. Under these circumstances, it makes no sense to produce oil, and wells will have to be turned off completely – a process that’s expensive to reverse and sometimes damages wells.³⁰

Will an oil and gas glut now, that is suppressing new resource exploration and developments, quickly flip to global shortages when the COVID-19 crisis ends?

Declining oil production will create a rising energy deficiency that coal and fossil natural gas will be unable to compensate for.

An inevitable post- ‘peak oil’ world requires us to rethink the way our society operates: our transport systems; how our food is produced; how our emergency services mobilise and respond to situations; and where we work and live.

Professor Hans Joachim Schellnhuber stated:

“...climate change is now reaching the end-game, where very soon humanity must choose between taking unprecedented action, or accept that it has been left too late and bear the consequences.”³¹

³⁰ **Oil Companies on Tumbling Prices: ‘Disastrous, Devastating’**, by Clifford Krauss, *The New York Times*, 31 Mar 2020, <https://www.nytimes.com/2020/03/31/business/energy-environment/crude-oil-companies-coronavirus.html>

³¹ **What Lies Beneath: The Understatement of Existential Climate Risk**, by David Spratt & Ian Dunlop with a Foreword by Hans Joachim Schellnhuber, Breakthrough, Aug 2018, Foreword, <https://www.breakthroughonline.org.au/whatliesbeneath>

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The imperative and urgent task now for Australia, and the world, is to cut carbon emissions far more rapidly than current Paris Agreement pledges, known as Nationally Determined Contributions (NDCs), exiting the fossil fuel era and accelerating the introduction of low carbon solutions, coupled with demand reduction measures. **What's the impetus for governments, businesses and human society to take rapid, effective action? If humanity doesn't, then we risk not having markets, sustainable businesses, or an economy, due to the escalating damaging effects of dangerous climate change around the world over the next twenty to thirty years – this is an existential threat to human civilisation.**³²

Given the overwhelming scientific evidence, why are governments delaying what must be done to mitigate the escalating existential risks of dangerous climate change,^{33, 34} that if we fail to act urgently and effectively, would likely extinguish billions of people's lives in the coming decades; yet are willing to accept and promptly act on scientific advice, whatever the cost to economies and disruptions to people's lives, to mitigate non-existential risks to most of humanity from COVID-19?^{35, 36}

A rational response from Australian leaders to the disastrous 2019-20 megafires would have recognised these are another warning that the catastrophic impacts of human-induced climate change are here now, and would accept the need for emergency action.

Other Recent Submissions by this Author:

- **Submission #096** to the Australian Parliament House of Representatives Standing Committee on Environment and Energy inquiry into the **prerequisites for nuclear energy in Australia**, 9 Sep 2019³⁷
- **Submission #215 and Supplementary Submissions #215a and #215b** to the New South Wales Parliament Legislative Assembly Standing Committee on Environment and Planning inquiry into **sustainability of energy supply and resources in NSW**, 15 Sep 2019, 8 Nov 2019, 20 Mar 2020³⁸

³² *Fatal Calculations: How Economics has Underestimated Climate Damage and Encouraged Inaction*, by David Spratt and Alia Armistead with a Foreword by Ian Dunlop, Breakthrough, Apr 2020, <https://www.breakthroughonline.org.au/publications>

³³ **While we fixate on coronavirus, Earth is hurtling towards a catastrophe worse than the dinosaur extinction**, by Andrew Glikson, *The Conversation*, 3 Apr 2020, <https://theconversation.com/while-we-fixate-on-coronavirus-earth-is-hurtling-towards-a-catastrophe-worse-than-the-dinosaur-extinction-130869>

³⁴ *There is no strong, resilient Australia without deep cuts to greenhouse gas emissions: An open letter on the scientific basis for the links between climate change and bushfires in Australia*, <https://australianbushfiresandclimatechange.com>

³⁵ **Why coronavirus death rates can't be summed up in one simple number**, by Jonathan Fuller, *The Conversation*, 10 Apr 2020, <https://theconversation.com/why-coronavirus-death-rates-cant-be-summed-up-in-one-simple-number-135758>

³⁶ **Why daily death tolls have become unusually important in understanding the coronavirus pandemic**, by Nidhi Subbaraman, *Nature*, 9 Apr 2020, <https://www.nature.com/articles/d41586-020-01008-1>

³⁷ https://www.aph.gov.au/Parliamentary_Business/Committees/House/Environment_and_Energy/Nuclearenergy

³⁸ <https://www.parliament.nsw.gov.au/committees/inquiries/Pages/inquiry-details.aspx?pk=2542#tab-submissions>