Review of Mulder *et al.* 2020

Peter Erickson, Senior Scientist, Stockholm Environment Institute (U.S. Center)
December 11, 2020

In November 2020, three researchers at the University of Groningen's Centre for Energy Economics Research (CEER) published a report exploring whether a reduction in oil and gas extraction by Royal Dutch Shell (Shell) would reduce global oil and gas consumption. Their report, "Bedrijfsspecifieke beperking in exploratie en productie en het effect op het wereldwijde verbruik van fossiele energie: Een analyse toegespitst op de positie van Shell", was carried out at Shell's request, as part of legal proceedings initiated by Milieudefensie (Friends of the Earth Netherlands), and with Shell's financial support. The report was published on the University of Groningen's web site[1].

The report contains findings that are important for understanding the relationship between global oil and gas production and consumption, as well as some assertions that are misleading and not supported by their evidence. This memo describes my observations about these findings and issues.

My qualifications and experience are detailed in my C.V., attached here as an appendix. In particular, I have published scientific articles on the relationship between oil and gas extraction and global climate change in several peer-reviewed scientific journals, including *Nature*[2], *Nature Energy*[3], *Nature Climate Change*[4], and *Climatic Change*[5]. In addition, I have been a co-author of the *Production Gap Report*, which describes how oil and gas must phase down to meet climate goals[6]. I received no financial support from Milieudefensie, or from other parties associated with the legal proceedings, to write this review.

Throughout this critique, I will refer to the CEER paper according to normal scientific convention, as Mulder *et al*.

1 Mulder *et al.* acknowledge that restrictions to oil and gas supply can affect price and, in turn, consumption

In section 4.4 (page 69) of their report, the authors describe the dynamics of how a decrease in oil or gas supply (a "supply disruption") can increase prices and, in turn, decrease consumption. As described in their report, a decrease in supply leads to a decrease in consumption whenever other producers are not able to compensate for all the avoided supply. This "partial compensation" occurs "when other producers can only produce more at higher costs, while consumers are price-sensitive." "In such a situation," the authors write, "the new market balance will be characterised by lower volumes and higher prices."

I agree with this statement, and it is supported by historical reviews of oil and gas prices[7,8]. The connections between supply restrictions, prices, and consumption levels is important, because if reducing supply leads to "lower volumes", then the carbon dioxide emissions from combusting those volumes of oil and gas must also be lower, since each barrel of oil or cubic meter of gas contains carbon that, once burned, is released to the atmosphere as carbon dioxide (CO_2)[9]. Numerous scientific articles have shown how restricting fossil fuel supply increases fossil fuel prices and, in turn, reduces global CO_2 emissions, relative to what would have occurred without the supply restriction[4,10–13]. This occurs because, as described above, an increase in price of a fossil fuel leads to lower consumption of that fuel, and lower consumption means less resulting CO_2 emissions from burning that fuel.

2 Despite acknowledging the connection between reduced oil and gas supply and prices, Mulder *et al.* use misleading evidence to downplay the effect of supply restrictions

Mulder *et al*. introduce figures that they use to downplay the connection between reduced oil and gas supply and prices. These examples are misleading, and upon closer examination, fail to demonstrate what the authors are seeking to show.

For example, the authors introduce Figure 4.3, which shows the gas price in the Netherlands over time (page 71). They assert that Figure 4.3 shows "that a temporary price increase occurred after the announced production limitation, which disappeared after some time." However, it is not possible to determine from the figure whether the price increase "disappeared after some time". Any effect on prices must be measured relative to a counter-factual scenario of what would have happened otherwise *without* the production limitation that occurred in 2012, not just looking at how the price changed from one year to the next after 2012. It is entirely possible that the price in later years (e.g., 2014 and 2015) would have been even *lower* if not for the production limitation back in 2012, and therefore that, contrary to the authors' assertions, that the production limitation did indeed have an enduring effect.

Furthermore, the authors make another error in comparing the size of the gas price increase in 2012 to the size of other price increases in later years. ("Measured over a period of a few years, this price effect is minimal compared to other effects on the gas price"). The size of "other effects on the gas price" due to factors (here, air temperature and corresponding demand for gas heating) *other* than production limitations does not invalidate the existence of the price increase in 2012 or its relationship to the production limitation. Whether other factors (beyond production limitations) *also* affect price is irrelevant. This is therefore a logical flaw in Mulder *et al.*'s argument: just because the effect of a production limitation is small compared to other effects does not mean it does not exist. What is important here is that, as the authors acknowledge, prices did increase, not the authors' subjective characterization of the effects as "no significant price effects", and of gas prices being "hardly influenced." Crucially, if the prices increase, then, because consumers are price-sensitive[14,15], it is also true that consumption decreases, as well as that the producers not affected by the restrictions were higher cost (see argument #1, above).

Mulder *et al*. make a similar mistake in their figure about oil, in Figure 4.5 (page 75). Here, they argue "that prolonged and significant interruptions in oil production do not seem to have hindered a steady increase in world oil consumption," since world oil consumption continued an upward trend. But, as for their gas analysis, here the authors confuse an increase *over time* for an increase *relative to the counterfactual scenario* of what oil consumption would have done absent the "prolonged and significant interruptions in oil production." It is entirely possible instead that the consumption of oil may have gone up even *more* had the production interruption not occurred. Oil market economists have statistical techniques to separate the price effects of oil production restrictions from the background "noise" of price effects due to other factors. Those analyses consistently show that reducing oil supply increases oil prices and reduces oil consumption[7,8,10]. Here, Mulder *et al*. are substituting their own anecdotal observations of a single figure for oil-market analysis and, as a result, drawing conclusions not supported by their evidence.

3 Instead of Mulder *et al.*'s approach, it is straight-forward to make simple, scientifically sound assumptions that allow for quantification of the net CO_2 emission benefits of restricting oil and gas supply

As I describe above, just because an effect on oil or gas consumption is small relative to other effects does not mean it is necessarily insignificant. A better approach would be to first quantify the effect of a supply restriction, and then debate the significance.

Such quantification can be done using simple economic principles and models. For example, parameters called economic elasticities can be used to estimate what fraction of a quantity of oil left undeveloped will not be compensated by other producers and will therefore result in a net reduction in oil consumption. (One study, which I co-authored, found that, for each barrel of oil left undeveloped due to a supply restriction, net global oil consumption will be reduced by 0.2 to 0.6 barrels over the long term[4].) Since each barrel of oil contains about 400 kg of CO_2,[4,9] the calculation can be very straight-forward, and presented with a range of plausible results.

4 Mulder *et al.* also argue that if Shell did not produce oil and gas from their existing licenses, other companies would. These arguments are incomplete and unconvincing.

Mulder *et al.* argue that, "Should Shell receive an injunction forcing it to reduce its activities in oil and gas production, it is therefore obvious to expect that Shell will transfer its existing licences (or participations in them) to other companies or that Shell will return them to the government concerned" and, further, that the government would "allow other companies to take over the activities, for example through an auction" (page 6).

This argument is, essentially, that it makes no difference whether Shell produces from the existing license or not, because any other producer (or government) would do the exact same thing as Shell.

This argument is incomplete and unconvincing for three reasons.

First, it is not necessarily the case that, were Shell to give up its licenses, that the governments would re-issue them. For example, Shell has been active in Denmark for over a century[16]. In early December, however, Denmark announced it will cancel all future licensing auctions, joining France, Ireland, and New Zealand, who have made similar restrictions[17]. As nations pursue efforts to align their energy policies with Paris Agreement's temperature targets, therefore reaching net zero emissions by mid-century[6], further efforts to limit oil and gas licensing may emerge, increasing the likelihood that, should licenses not be used soon – especially if returned to the issuing governments – then they may not be used at all.

Second, other companies may not be able to bring new oil and gas projects online for the same cost (or on the same timeline) as Shell. If other companies were not as cost-efficient as Shell in developing new projects, then those projects may be more vulnerable to oil price swings or other risks that could delay project completion. Indeed, one major oil consultancy indicates that Shell has costs below the industry average[18], suggesting that, were Shell to transfer its existing licenses to another firm, the (average) result could be an increase in costs.

Third, were Shell to "receive an injunction forcing it to reduce its activities in oil and gas production", or instead choose to do so voluntarily, the action could have a broader effect on risk perceptions and the investment climate for oil and gas and, therefore, indirectly reduce oil and gas production. This increase in investment risk in the sector could be transmitted through one of several channels[19], including reputational risk, litigation risk, or shareholder action, but the end result would be that the credit risk and cost of capital for the sector could increase[20]. An increase in cost of capital for new oil and gas projects would, through increase in project costs, then translate into decreases in oil or gas production, and then, through effects in oil and gas markets, to decreases in consumption and CO_2 emissions[2].

Summary

As I describe above, the Mulder *et al.* report makes some important observations about oil and gas markets. However, the authors also draw several questionable and misleading conclusions from the evidence they present.

A closer examination of Mulder *et al*.'s evidence suggests that restricting Shell's oil and gas production would indeed help reduce global CO_2 emissions. Rather than dismiss this possibility, analysts interested in the role of Shell in meeting global climate limits should instead make credible estimates of the effect of a company reducing its oil and gas production on global emissions, using simple, transparent assumptions.

References

1. Mulder, M., Hulshof, D., Perey, P. & Rekker, L. *Bedrijfsspecifieke beperking in exploratie en productie en het effect op het wereldwijde verbruik van fossiele energie: Een analyse toegespitst op de positie van Shell*. Translated from Dutch to English via translation software 'Deep-L Pro' http://www.rug.nl/ceer/ (2020).
2. Erickson, P. *et al.* Why fossil fuel producer subsidies matter. *Nature* **578**, E1–E4 (2020).
3. Erickson, P., Down, A., Lazarus, M. & Koplow, D. Effect of subsidies to fossil fuel companies on United States crude oil production. *Nat. Energy* **2**, 891–898 (2017).
4. Erickson, P., Lazarus, M. & Piggot, G. Limiting fossil fuel production as the next big step in climate policy. *Nat. Clim. Change* **8**, 1037–1043 (2018).
5. Erickson, P. & Lazarus, M. Would constraining US fossil fuel production affect global CO2 emissions? A case study of US leasing policy. *Clim. Change* **150**, 29–42 (2018).
6. SEI, IISD, ODI, E3G & UNEP. *The Production Gap: Special Report 2020*. http://productiongap.org/ (2020).
7. Hamilton, J. D. Understanding Crude Oil Prices. *Energy J.* **30**, 179–206 (2009).
8. Caldara, D., Cavallo, M. & Iacoviello, M. Oil price elasticities and oil price fluctuations. *J. Monet. Econ.* **103**, 1–20 (2019).
9. IPCC. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. (Institute for Global Environmental Strategies (IGES) on behalf of the Intergovernmental Panel on Climate Change, 2006).
10. Fæhn, T., Hagem, C., Lindholt, L., Mæland, S. & Rosendahl, K. E. Climate policies in a fossil fuel producing country: Demand versus supply side policies. *Energy J.* **38**, (2017).
11. Asheim, G. B. *et al.* The case for a supply-side climate treaty. *Science* **365**, 325 (2019).
12. Green, F. & Denniss, R. Cutting with both arms of the scissors: the economic and political case for restrictive supply-side climate policies. *Clim. Change* **150**, 73–87 (2018).
13. Harstad, B. Buy coal! A case for supply-side environmental policy. *J. Polit. Econ.* **120**, 77–115 (2012).

14. Arora, V. Estimates of the Price Elasticities of Natural Gas Supply and Demand in the United States. https://mpra.ub.uni-muenchen.de/54232/ (2014).

15. Huntington, H. G., Barrios, J. J. & Arora, V. Review of key international demand elasticities for major industrializing economies. *Energy Policy* **133**, 110878 (2019).

16. Shell. Shell Tax Contribution Report 2018: Denmark. https://reports.shell.com/tax-contribution-report/2018/our-tax-data/europe/denmark.html (2020).

17. Reuters & Upstream Online. Denmark stops new North Sea oil and gas licensing, plans to halt extraction by 2050 | Upstream Online. *Upstream Online | Latest oil and gas news* https://www.upstreamonline.com/exploration/denmark-stops-new-north-sea-oil-and-gas-licensing-plans-to-halt-extraction-by-2050/2-1-924623 (2020).

18. Rystad Energy. BP, Eni and Shell are best-in-class amongst the Majors. https://www.rystadenergy.com/newsevents/news/press-releases/BP-Eni-Shell-best-in-class/ (2018).

19. Leaton, J. Mapping Out When and Where Climate Risk Becomes a Credit Risk. in *Ecological, Societal, and Technological Risks and the Financial Sector* (eds. Walker, T., Gramlich, D., Bitar, M. & Fardnia, P.) 69–90 (Springer International Publishing, 2020). doi:10.1007/978-3-030-38858-4_4.

20. Fattouh, B., Poudineh, R. & West, R. *Energy Transition, Uncertainty, and the Implications of Change in the Risk Preferences of Fossil Fuels Investors*. https://www.oxfordenergy.org/publications/energy-transition-uncertainty-implications-change-risk-preferences-fossil-fuels-investors/?v=7516fd43adaa (2019).