Expert Letter: Review of Druce and Mulder reports

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1. Introduction

In December 2023, two economists – Richard Druce and Machiel Mulder – wrote documents concerning how oil and gas markets may react to certain actions of Shell plc. Shell submitted these two items (hereafter: 'the Druce report'[1] and 'the Mulder letter'[2]) as procedural documents in the appeal phase in the Court Case Milieudefensie c.s. v Shell plc.

As requested by Milieudefensie, we are writing this letter to respond (see the Appendix for our brief biographies). Both Druce and Mulder refer to documents that we previously authored or co-authored, making it important to us to address their critiques.

In particular, our previous expert letter, referred to as Erickson *et al.* (2022),[3] is a central focus of Druce's critique. In that letter, which we wrote with additional authors, we outlined several channels through which the judicial imposition of the Reduction Obligation (RO) on Shell may reduce global greenhouse gas (GHG) emissions.[4] These channels included the increased risk and associated cost of capital for oil and gas projects, additional legal restrictions imposed by courts influenced by the Shell RO, and additional governmental restrictions on fossil fuel supply owing to a strengthening global norm in favor of restricting fossil fuels.[5]

Most of our letter focused, however, on a fourth channel for reducing net GHG emissions, which we called the price effect,[6] and which is the sole channel for reducing GHG emissions addressed by the Druce report and Mulder letter. As we described in Erickson *et al.* (2022), the price effect is characterized by the following causal chain:

(a) Pursuant to the judicial imposition of the RO, Shell must reduce its supply of oil and gas;
(b) The reduction in oil and gas supply from Shell decreases the aggregate supply of oil and gas in the respective (global or regional) markets for these fuels;
(c) The reduction in aggregate oil and gas supply, all else equal, raises the equilibrium price for these fuels, inducing a contraction in consumption; and
(d) Given the lower volumes of oil and gas consumed at the new equilibrium price, the global volume of GHGs emitted from the combustion of fossil fuels is reduced.

The Druce report reproduces this causal chain, commenting on each step. Nothing in either the Druce report nor the Mulder letter challenges this basic logic, however. Furthermore, as we will show in the

[1] Druce, Richard. Expert Report of Richard Druce. 15 December 2023.
[2] Mulder, Machiel. Analysis of sections in the judgment related to the Mulder report. 13 December 2023. Translated from Dutch to English via translation software.
[3] Erickson, Peter, Fergus Green, Cathrine Hagem, and Steve Pye. The likely effect of Shell's Reduction Obligation on oil and gas markets and greenhouse gas emissions. September 2022.
[4] The court ruled Shell's emissions must be reduced 45% by 2030. Milieudefensie et al. v. RDS, ¶ 4.1.4
[5] These three channels for reducing greenhouse gas emissions were neither disputed nor accounted for in either the Druce report or the Mulder letter.
[6] All four channels in Erickson *et al.* 2022 would likely affect prices, but our discussion of the "price effect" focused on the most direct route by which oil and gas prices would increase: Shell reducing its oil and gas supply in response to the RO.

remainder of our letter, neither Druce nor Mulder has demonstrated that the RO will fail to reduce GHG emissions.

Our letter begins below with one important, overarching finding about the Druce report and the Mulder letter. After that, we move to reviewing several claims of the Druce report in detail. We close with a short summary and some overarching conclusions.

2. Neither Druce nor Mulder disputes that the Reduction Obligation could contribute to a reduction in global oil and gas consumption

Druce and Mulder both acknowledge that, to the extent that the RO increases the price of fossil fuels, the consumption of fossil fuels will decrease. What they dispute is the size of the reduction.

Druce reviews the price effect at length, offering detailed arguments on each step of Erickson *et al.*'s "causal chain" outlined in the Introduction under (a) to (d). He asserts, without quantification, that the successive steps in the chain cause "little, if any, change in aggregate supply",[7] that "only a part of any reduction in aggregate supply would translate into a reduction in consumption",[8] and that "some of that reduction [in aggregate consumption] will be due to users switching to other fuels".[9] However, just because Druce believes something to be "small" or "minimal" does not mean it is factually zero or unimportant.

In his letter, Mulder re-asserts his previous claims, arguing that any reduction in Shell's oil and gas operations would "often" be absorbed by another partner company, as such re-absorption is "possible and common", and that it is "not obvious" that government owners of the oil and gas resources would choose to leave these licenses or resources unused.[10] However, just because it is "possible" that the actions of other operators besides Shell could undo some (unquantified) amount of the net emissions benefit of the RO does not mean that the RO would not be effective at reducing global GHG emissions.

In other words, even as they downplay the effects of the RO, neither Druce nor Mulder disputes that some amount of reduction in consumption and emissions is possible as a result of the price effect induced by the RO. This is not surprising, as the price effect is a bedrock principle of economics. As we said in our 2022 letter, "This relationship between supply and demand, via price, is so basic, so widely understood (including by Shell's own experts), that the burden of proof for claiming otherwise should rest firmly with anyone wishing to assert the contrary."[11] Neither Druce nor Mulder has done so, and so their critiques should be understood as debating the scale of the reduction in oil and gas consumption.

Overall, Erickson *et al.* (2022) laid out a number of pathways for how fulfilling the RO could increase the price of oil and gas (while perhaps also decreasing the price of low-carbon alternatives) and therefore, in turn, reduce the carbon dioxide (CO_2) and other GHG emissions associated with these fuels. Since any of these pathways for reducing supply of oil or gas – "whether at the point of extraction or at the point of sale"[12] – would increase the price to consumers, there remains no serious debate "that there will be less oil and gas consumed than would otherwise be the case".[13]

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[7] Druce report, ¶ 11(B), "Any business operations that Shell divests would continue to operate in the same markets with new ownership, causing little, if any, change in aggregate supply."
[8] Druce report, ¶ 31
[9] Druce report, ¶ 34..
[10] Mulder letter, page 2.
[11] Erickson *et al.* 2022, page 3.
[12] Erickson *et al.* 2022, page 2
[13] Erickson *et al.* 2022, page 3.

We now turn to evaluating specific critiques of how the price effect would work "in practice",[14] including showing how mistakes and mischaracterizations by Druce undermine his claims that the effects of the RO would be minimal.

3. Druce's argument that the RO does not *require* reductions in Shell's oil and gas production is irrelevant, because reducing production is a valid way to contribute to meeting the RO

Druce attempts to dispute link (a) in the causal chain outlined in the Introduction above by arguing that the RO does not "require a reduction in production of oil and gas products." This critique about what is "required" or not is best directed at Shell itself, since the company itself raised the issue of the company reducing its production in order to comply with the RO,[15] and to which Erickson *et al.* (2022) was responding. Furthermore, another focus of Druce's critique – Erickson (2020)[16] – focused on production in response to Shell's additional economics consultant Machiel Mulder[17] doing so.

Regardless, reduced production is clearly one way of complying with the RO, since the Ruling itself encourages a reduction in production: "A consequence of this significant obligation may be that RDS will forgo new investments in the extraction of fossil fuels and/or will limit its production of fossil resources."[18] As long as reducing production is one means of complying with the RO, then the effects of doing so will be relevant. Druce's argument here should be discarded.

Furthermore, it is not just a reduction in oil or gas production (meaning, here, extraction) that would affect the final price to consumers, but any number of activities undertaken to comply with the RO, whether they reduce supply "at the point of sale" or in-between extraction and sale. Indeed, Shell is a major, integrated oil and gas company that produces and purchases petroleum (both oil and gas), transports it around the world, refines and processes it, and sells it to final customers. The company has about US$ 200 billion worth of physical assets, including onshore and offshore oil and gas drilling and production equipment; refineries; oil and LNG tankers; storage facilities; and sales facilities.[19] Constraints or increases in costs anywhere along the extensive process of producing and selling oil and gas could increase the price to final consumers. In other words, link (a) of Erickson *et al.*'s (2022) causal chain stands, regardless of whether one is looking broadly at all supply (from point of extraction to point of final sale) or simply oil and gas extraction.

4. Druce ignores how Shell could invest in clean energy, while being too confident in his findings on how Shell or other "rational" actors will respond to the RO

Druce attempts to undermine step (b) in the causal chain by arguing that any reduction in oil and gas activity by Shell would be taken up by other oil and gas firms. He argues that Shell's "factors of production", most notably capital (the stock of equipment and structures, intellectual property, monetary assets), labour, (people), and land (oil and gas resources) would be redeployed to other firms

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[14] Druce report, ¶ 11: "the RO would not contribute to a reduction in global GHG emissions in practice".
[15] Shell Statement of Appeal, para 3.2.19 of the unofficial English translation of the Dutch original. We understand this is para 3.2.20(d) of the Dutch original.
[16] Erickson, Peter. Review of Mulder *et al.* December 11, 2020.
[17] 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).
[18] Milieudefensie *et al.* v. RDS, ¶ 4.4.39
[19] See "Property, Plant, and Equipment" in Shell's audited Consolidated Balance Sheet, Shell Annual Report and Accounts 2022 page 239, with additional detail on carrying value on page 253.

to maintain constant oil and gas production, unless such other firms "are unable or unwilling to produce or sell the same volumes at the same price."[20] Druce maintains that this is how "rational" actors would behave, and that his findings are "robust".[21]

However, he cannot come to this conclusion with any certainty, as mischaracterizations and omissions in his report make clear.

Most notably, Druce's logic ignores how Shell's capital and other factors of production could be re-deployed to activities *besides* oil and gas production. For example, Druce considers it likely that Shell would divest some existing business operations or entire business units in response to the RO, earning proceeds on the sales.[22] But Druce ignores how these proceeds could be re-invested by Shell in other business operations, such as clean energy, which would further help reduce global GHG emissions by increasing the supply (and decreasing the price) of alternatives to fossil fuels. Indeed, Shell already has business operations devoted to renewable energy production and electric vehicle charging.[23] And yet, Druce excludes this possibility. By ignoring how Shell may re-deploy its own capital, Druce is not taking a comprehensive view of business decision-making, casting doubt on how "rational", and "robust" is his characterization of Shell's response to the RO.

Druce's error is not limited to financial capital. Other factors of production, including labor and land, could likewise be redeployed to other business areas besides oil and gas production. For example, skills held by workers in the oil and gas industry are relatively easy to transfer to low-carbon energy business areas, including carbon capture and storage, hydrogen, and wind energy.[24] It is not at all assured – let alone the only "rational" option as implied by Druce – that professionals affected by divestment of Shell's oil and gas assets would continue to work in oil and gas. Even the land itself may have other uses besides oil and gas, such as the re-deployment of older oil and gas reservoirs as sites for underground carbon storage.

In summary, Druce underplays how factors of production could move away from oil and gas. Instead, he focuses on how likely these assets are to maintain oil and gas production. But here, also, he is too confident in his opinion.

One of Druce's lines of critique is that our prior work ignored how land and other factors of production would be maintained by other companies (besides Shell) in the oil and gas industry. But Druce misreads our analyses. In fact, Erickson *et al.* (2022), Erickson (2020), Erickson and Lazarus (2018)[25], and other studies did consider how a company reducing its supply would affect the "the availability of factors of production for use by other operators."[26]

Previous work by Erickson on the effects of reducing oil and gas production used a transparent economic model – in effect, a single equation – to estimate the price effect. The equation, which

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[20] Druce report, ¶ 53.
[21] Druce report, ¶ 26 ("rational") and ¶ 28 ("robust").
[22] Druce report, ¶ 57(C).
[23] See, for example: Shell Energy Transition Strategy 2021, pp 15-19. Vigeveno, Huibert. Prepared remarks at Shell Capital Markets Day, p 34-38. https://www.shell.com/investors/investor-presentations/capital-markets-day-2023.html. 14 June, 2023.
[24] See, for example, Fantaguzzi, Ignacio, Christopher Handscomb, Iyad Sheikh, and Aly Torres. Talent squeeze: Planning for the energy sector's talent transition. 1 February, 2024. https://www.mckinsey.com/industries/oil-and-gas/our-insights/talent-squeeze-planning-for-the-energy-sectors-talent-transition
[25] Erickson, Peter, and Michael Lazarus. "Would constraining US fossil fuel production affect global CO_2 emissions? A case study of US leasing policy". *Climatic Change* 150: 29-42. 2018. See also Erickson, Peter, Georgia Piggot, and Michael Lazarus. "Limiting fossil fuel production as the next big step in climate policy." *Nature Climate Change 8: 1037-1043.* 2018.
[26] Druce report, ¶ 55.

translates a change in oil production to a change in oil consumption, uses just two inputs: the elasticity of supply and the elasticity of demand.[27] In Erickson and co-authors' work – as well as work by other researchers coming to similar conclusions[28] – these elasticities are taken from statistical studies on how real-world changes in supply (regardless of the type of actor restricting supply) or demand have affected price in the oil and gas market. What Druce ignores is that those underlying studies automatically account for how factors of production may move, since the studies are based on observations of numerous actual events in which – just as Druce asserts – factors of production may be mobile. Naturally, none of those past studies could be perfectly analogous to the present RO. But that does not mean that the "expectation that the RO would reduce supply" is unreasonable, as Druce contends, nor that Erickson et al.'s conclusions were not based on a consideration of "empirical" data.

We also note that Druce did not put forward his own estimate of the elasticity of supply, except perhaps to suggest that the supply curve for oil may best be characterized as flat, that is, neither upwards sloping nor downwards sloping.[29] But that is a preposterous suggestion. As Prest et al. (2023) have observed, a perfectly flat supply curve is "implausible because it would imply that the price of oil is a constant value that is unaffected by fluctuations in demand.[30]" In other words, Druce is asking the reader to believe the impossible: that the elasticity of supply is infinite; that – contrary to standard economic models – market forces will have no role to play in determining global oil supply for the next several decades.[31]

Druce does offer an estimate of an average elasticity of demand for crude oil, -0.16, which he describes as being "highly inelastic"[32], and which he justifies in part by arguing that there is a "limited range of available substitutes" for oil.[33] Due to this inelastic supply, Druce argues that the effect of any reduction in Shell's supply on consumption would be "at most a small fraction of Shell's reduction in supply."[34] However, Druce misrepresents how a change in supply translates into a change in consumption. Contrary to Druce's implied logic, any time that supply and demand elasticities are about equal in magnitude – *regardless* of how elastic – a reduction in supply will translate to about half as much (0.5) of a change in consumption.[35] And since Druce's own research shows estimates of the elasticities of supply that are similarly inelastic (in the range of 0.16) to his average estimate of

[27] As published in Erickson and Lazarus (2014), this is Δ Consumption / Δ Production ~= Ed / (Ed – Es), where Ed is the elasticity of demand and Es is the elasticity of supply. Erickson, Peter and Michael Lazarus. "Impact of the Keystone XL pipeline on global oil markets and greenhouse gas emissions." *Nature Climate Change* 4(9). August 2014.

[28] Prest, Brian C, Harrison Fell, Deborah Gordon, and TJ Conway. Estimating the Emissions Reductions from Supply-side Fossil Fuel Interventions. July 2023.

[29] Druce report A.3.3.2 (¶ 290-291)

[30] Prest, Brian C, Harrison Fell, Deborah Gordon, and TJ Conway. Estimating the Emissions Reductions from Supply-side Fossil Fuel Interventions. July 2023. Footnote 1, page 2.

[31] Conventional models contend that, in the long term, the price of oil will be very much determined by market forces: namely, how much consumers will pay for oil (demand) and how much it costs suppliers to provide oil (supply). Specifically, in the long run, the theory is that the price of oil will tend towards the cost of extracting oil higher up on the supply curve where it meets the demand curve, i.e. the cost of extracting the long-run "marginal" barrel, even as other factors, such as the social costs of major oil exporting regions, will also play important roles. See, for example, Dale, Spencer, and Bassam Fattouh. "Peak Oil Demand and Long-Run Oil Prices". Oxford Institute for Energy Studies. January 2018.

[32] Druce report, ¶ 260.

[33] Druce report, ¶ 93.

[34] Druce report, ¶ 93.

[35] This follows directly from the geometry of supply and demand curves. When the curves have the same slopes (with opposite signs, since each slopes the opposite direct), then a shift in either curve will move the intersection point, or the equilibrium consumption level, by half as much. This is detailed in countless economics textbooks, and in equation form in Erickson and Lazarus (2014).

the elasticity of demand,[36] a ratio of about 0.5 cannot easily be dismissed, and is certainly not a "small fraction". Furthermore, some economists believe that in the long-term, supply and demand elasticities may have roughly equal magnitude,[37] suggesting that a ratio of about 0.5 is a real possibility.

Druce is also incorrect when he asserts that a prior result by Erickson and Lazarus (2018) "that each barrel left undeveloped in one region will lead to 0.2 to 0.6 barrels not consumed globally" is "irrelevant" because it was concerned solely with a *territorial* (not company-specific) policy that would not allow for the re-deployment of land or factors of production[38]. First, as described above, Erickson and co-authors derived the 0.2 to 0.6 range using real-world, empirical elasticities that automatically consider redeployment of capital.

Second, the leasing policy under consideration in Erickson and Lazarus (2018) was not a nation- (or even state-) wide restriction, it was a restriction on a particular ownership class: lands owned by the federal government. Federal lands (including federal waters) represent a minority of resource ownership of oil and gas extraction in the United States, and ownership is often "patchwork", meaning that factors of production – perhaps even access to the same underlying geologic formations – could indeed move to other, even geographically adjacent, ownership classes, such as private land or land owned by U.S. states.

Lastly, as Druce points out, we agree that "there is a difference between restricting extraction in a given territorial area and restricting production by an individual company." But as discussed in Erickson *et al.* (2022), there remain ample reasons to believe that a company-level restriction, like its territorial counterpart, would also lead to higher prices. That is because any friction, whether increased costs or delay, at any stage between the point of extraction and the point of final sale, could push prices higher than they otherwise would be. Even under historically "normal" circumstances, transaction costs would likely abound in the transfer of numerous assets from Shell – a vertically integrated company that controls large portions of global oil and gas supply – to other, often less-integrated, companies.[39] In the case of Shell selling these assets *as a result of the RO*, additional, new frictions may emerge, as potential buyers of Shell's assets will rationally update their expectations about the accelerating pace of the energy transition away from fossil fuels,[40] perhaps demanding extra concessions or lower sales prices as a result of the new, perceived risk. If transaction costs or extra

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[36] Druce's own data show how supply and demand elasticities could be of roughly equal magnitude. For example, if the elasticity of demand were -0.16 as Druce contends, and the elasticity of supply were 0.16, then the reduction in consumption would be half (0.5) as much as the reduction in supply. A long run elasticity of supply of 0.16 is well within the range in Druce's Table A.19, and is actually *larger* than the most recent study (0.09 to 0.13) in that table.

[37] Several economists believe that in the long-term, supply and demand elasticities may have roughly equal magnitude. See Prest *et al.* 2023, or Fæhn, Taran *et al.* "Climate Policies in a Fossil Fuel Producing Country: Demand versus Supply Side Policies", *Energy Journal 38 (1)*, 2017.

[38] Druce report, ¶ 80.

[39] Druce also argues, in a separate section (Druce report section 7, ¶ 143-156), that transfers of assets to other companies will tend to be to companies with higher GHG emissions intensities. But here Druce confuses average emissions intensity across the global oil industry with the emissions intensity of the marginal producers that could replace Shell. If, as Druce argues elsewhere, it is OPEC (and, especially, Saudi Arabia) that would replace nearly all of Shell's avoided production, then GHG emissions may decrease further, as OPEC countries (especially Saudi Arabia) tend to be relatively low GHG-intensity producers.

[40] For example, prospective buyers of Shell's assets may come to believe the world is aligning with oil and gas demand more consistent with countries' newly announced climate goals (e.g., the IEA's Announced Pledges Scenario) or the IEA's Net Zero Emissions by 2050 scenario, than with the slower pace of transition implied by previously enacted climate policies (e.g., the IEA's Stated Policies Scenario, as argued by Druce ¶57A).

demands were to slow down the process of asset transfer, or cause some assets not to be transferred, then oil and gas supply would be diminished.

In summary, Druce is too confident in his particular view of how capital would be redeployed by Shell and other oil and gas firms in response to the RO, ignoring obvious ways that capital re-deployment could lead to emission declines. Druce also ignores the real-world empirical data that underpins the abovementioned 0.2 to 0.6 range and the corresponding relevance for the assessment of the effects of the RO, as well as the many frictions that could occur in the supply chain when complying with the RO that would lead to higher prices of oil and gas.

Druce's specific case studies also have flaws, which we turn to next.

5. Druce misuses economic tools and data to downplay the relationship between Shell's own supply and aggregate, global supply

To substantiate his claim that the effect of link (b) in the causal chain would be minimal – specifically, that there is "no reason to expect lower supply from Shell to reduce aggregate supply"[41] – Druce presents two case studies. Both of these case studies, which Druce refers to as being "empirical",[42] have major methodological flaws.

Druce's first case study for link (b) in the causal chain looks at how oil and gas fields have changed ownership in the past in four separate geographies.[43] He shows how oil or gas production at already-producing fields may increase, stay the same, or decrease in the months following a change in ownership and then applies statistical tests to the data, arguing that these tests show the changes to be insignificant.[44] For a statistical test to have any meaning, however, it must be set up with equations, variables, and data that correctly correspond to the question at hand.

However, Druce makes two errors that render his statistical tests irrelevant to evaluating the effectiveness of the RO. First, and most critically, Druce specifically looks only at data from already-producing fields. But Shell's future oil and gas production – indeed, any company's future production – will depend primarily on how it develops new resources that *have not yet started producing.*[45] So, while Druce's test is set up to detect how one operator would manage an already-producing field in the near-term (less than 36 months) compared to how the prior owner operated it, it ignores what are very likely the largest volumes of oil and gas that will be, over time, subject to the RO – those coming from new investments.[46]

Second, and related to the first point, Druce selects his examples already knowing there was a change in ownership from one oil and gas firm to another, and where both firms are doing so voluntarily based on "commercial decisions by the outgoing / incoming operator."[47] But this may not be a very relevant comparison to the Shell case, because it does not consider the possibility that one or both of the selling firm (Shell) and the buying firm may be operating under additional decision criteria besides oil and

[41] Druce report, section heading 4.2.
[42] As described above, Druce has no special claim to being "empirical" here. As explained in the text, prior studies by Erickson and co-authors, plus others, use a model that is parameterized with elasticities of supply and demand based on empirical studies.
[43] Druce report, Appendix A1.
[44] Druce rightly states he cannot rely on "visual inspection alone". Druce report, ¶ 188
[45] As Druce's Figure A.4 illustration shows, most of a field's cumulative production occurs in the first few years of operation, with production then declining rapidly each year. Accordingly, to maintain future production levels, firms must be constantly developing new fields.
[46] New fields were also the subject of the Erickson and Lazarus (2018) US leasing research discussed in the prior section.
[47] Druce report, ¶ 184.

gas production levels. For example, as Druce describes, "companies buying or selling oil and gas fields ... will account for current and likely future decarbonisation policies and commitments. Production after a transfer in ownership therefore reflects commercial decisions by the new owners, given contemporaneous expectations of the future consequences of decarbonisation trends".[48] Indeed, one reason that the RO could be expected to reduce oil and gas production is that *other firms* may also expect limits on production, therefore reducing the potential pool of buyers for Shell's assets.

Druce's second case study concerns Shell's divestment of UK petrol stations, in which he shows that changes in fuel consumption after change in ownership of a set of retail petrol stations were not statistically significant. Here, Druce similarly misuses economic tools and data.

First, his petrol station data do not actually measure total sales volume, they only measure "average sales volumes per petrol station."[49] Accordingly, Druce cannot conclude anything about whether divestment affected total petrol sales in the region. For example, consider the possibility that, after divestment, a petrol station was converted to selling only low-carbon fuels, e.g. electricity, and so was no longer a petrol station.[50] Overall petrol sales could decline, regardless of changes in average sales volumes at the remaining petrol stations, and yet Druce's analysis would not be able to detect this. This is a critical oversight, because Druce's analysis therefore tells us nothing about the effect of a potential way that Shell comply with the RO, by converting its substantial existing inventory of retail petrol stations to fueling electric vehicles.

Second, even considering the major data flaw noted above, Druce's method is also limited by looking at only 18 months of fuel consumption patterns after the sale of petrol stations. That time window leaves little time for residents to respond to any prospective reduction in petrol availability by making many of changes that would materially reduce petrol consumption in the long term, such as purchasing a more efficient, including electric, vehicle or changing where and how they travel, live, and work to reduce overall travel.

In both cases, Druce's case studies provide very limited snapshots that offer little, if any, robust insights into how the Shell RO would play out. Most critically, his methods ignore the possibility that assets, whether divested or retained by Shell, could be put to very different uses (or face a potential pool of buyers who perceive oil and gas assets as much riskier) than previously envisioned by Shell, so his results are biased from the start to show little effect. Both cases were also focused on periods of less than three years, a period far too short to evaluate the long-term effects of the RO, which would play out over many years (e.g., to 2030 or beyond).[51]

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[48] Druce report, ¶ 67.

[49] As Druce states in footnote 181, the petrol station data he uses "only provides average sales volumes *per petrol station*, rather than total sales volumes. The average sales volumes may *fail to capture the impact from changes in the number of petrol stations operating in an area*" (emphasis added). Furthermore, the data he cites only pertains to a sample of petrol stations sampled by the UK government, not all stations, further weakening the use of these data for his purposes.

[50] Druce says in footnote 181 that "all 27 petrol stations appear to remain open after the divestment, suggesting this limitation of the data has little bearing on my analysis in practice." But he provides no data to support that the petrol stations remained open, continuing to sell petrol without interruption. Furthermore, even if the 27 petrol stations did remain open, that does not address the problem that his data only report averages of sampled stations, because other stations besides those sampled could have opened or closed, again making his averages worthless for assessing total sales volumes at the level of detail he is claiming.

[51] The RO specifies that Shell's emissions must be reduced 45% by 2030 (Court ruling, ¶ 4.1.4), with the Court ruling further specifying that Shell must "do its part" towards net zero emissions by 2050 (¶ 4.4.36).

6. Logical errors and methodological flaws limit the usefulness of Druce's case studies concerning OPEC and Enron.

Just as Druce cited specific examples intended to challenge link (b) of the causal chain, he also develops two case studies to challenge link (c), concerning how much of a reduction in aggregate supply of oil or gas translates into an increase in price. And, as with his other critiques, Druce downplays the likely effects with subjective opinions that, if they are backed up with quantitative estimates at all, are done so with analyses that are extremely limited or methodologically flawed.

Druce's first case study about link (c), a prospective increase in global oil price, concerns the Organization of the Petroleum Exporting Countries (OPEC), and "OPEC+", an extended coalition of OPEC with additional producing countries, such as Russia.

As Druce observes, OPEC exists in part to manage oil production levels (among its members) and, in so doing, influence global oil prices. Druce uses this fact to assert that "OPEC+ countries would compensate for reductions in production from Shell's assets, avoiding changes in oil prices.[52]" This is an extraordinary claim. Just because OPEC+ has some ability (not absolute ability) to influence oil prices, does not mean that in any given situation it either *will* or *can* do so,[53] let alone that it will or can hold global oil prices constant for the entire time span (multiple years or even decades) that the effects of the Court ruling will be felt.

Of course, OPEC does have some ability to influence production levels to benefit OPEC members. But the role the organization would play in the long term, especially under a decarbonizing economy, is far from clear, as there are many ways that oil markets could evolve. For example, OPEC could be quite content with decreased production from non-OPEC sources, as the resulting higher prices would benefit OPEC members. There are also other possibilities. One close observer of Middle East geopolitics has suggested that OPEC could take on a role of allocating its "producers with equitable shares of a shrinking global oil market in the best interests of exporters and the global climate,"[54] an outcome that would seem to be compatible with the RO on Shell. Of course, that possibility is in no way assured either, but the huge uncertainty about the future actions of OPEC suggest considerable caution when interpreting Druce's opinions concerning the organization.[55]

Druce's second case study concerns Enron. In this case study, Druce examines the exit of energy trader Enron from the oil trading market. Druce presents this case study as an example of how Shell "selling less oil and gas products purchased from third parties" would have minimal impact.[56]

However, it is not clear Enron's oil operations are analogous to Shell's. For crude oil, Enron was primarily engaged in wholesale commodity trading, without significant production or retail operations for liquid product.[57] Enron had few physical assets related to its crude business marketing activities.[58] Shell, on the other hand, is a major upstream producer, refiner, and retailer. The "third party" products

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[52] Druce report, ¶ 101.

[53] As one of Druce's sources concludes, "OPEC's ability to dampen price volatility is limited by the difficulty to precisely estimate the size of shocks to demand and supply, as well as potential execution errors in implementing production decisions." Almutairi, Hossa *et al.* Oil Market Stabilization: The Performance of OPEC and Its Allies. Page 18.

[54] See Krane, Jim. "Climate Strategy for Producer Countries: The Case of Saudi Arabia." In *The Political Economy of the Middle East.* Springer. 2020.

[55] We note that Druce's argument that "would compensate for reductions in production from Shell's assets" is equivalent to assuming that the oil supply curve is flat, or infinitely elastic, which is implausible, as we described in the text.

[56] Druce report, ¶109.

[57] Enron Annual Report 2000, pages 21 (income table) and 23 (wholesale services table).

[58] For example, the Enron Annual Report 2000 lists no property, plants, or equipment specific to crude oil. Enron Corp. and Subsidiaries Consolidated Balance Sheet, page 32.

purchased by Shell enter the company's physical flow of product: third-party crude oil is refined at Shell refineries and sold at Shell retail sites, and third-party refined product (e.g. petrol) is also sold by Shell.[59]

One way to gauge the difference between Enron and Shell's oil marketing activities is to look at the income each company received from sales of oil and gas. In 2000, Enron reported income of about $1 per barrel for each barrel of oil or gas (in units of "barrels of oil equivalent") it traded,[60] which was far less than 10% of the wholesale oil and gas prices at the time. This low income per barrel supports the idea that Enron was primarily engaged in trading commodity and futures contracts rather than physical assets. By contrast, in 2022, Shell reported income amounting to about $86 for each barrel of oil (and much more for gas) it handled, which averages well over 80% of the wholesale crude oil market. Clearly, Shell was providing much more value to the oil market, because, unlike Enron, it was producing, refining, transporting, and selling oil. In other words, Shell's integrated, physical activities are many times more important to oil markets than were Enron's limited trading activities, and it is therefore not surprising that markets could better adapt to the loss of Enron than to the loss of Shell's products, barrel per barrel.[61]

Despite failing to demonstrate that the Enron example is analogous to any of Shell's business activities, Druce concludes "The minimal impact Enron's collapse had on the oil trading market suggests that if Shell were to reduce its sales of third party energy to reduce the Scope 3 emissions that Shell reports, there would also be a minimal effect." This is an extraordinary logical leap. Shell's sale of "third-party energy", specifically oil and oil-derived products, occurs at retail sites throughout the world. Enron had few, if any, assets related to crude oil or its equivalent retail products.

There are also other flaws in Druce's analysis that limit its applicability. Namely, Druce presents a chart of "bid-ask spreads" in the oil market between 2000 and 2004, using visual inspection to conclude that the Enron collapse in December 2001 had "had no apparent, enduring impact."[62] He attempts to bolster this conclusion with references to other experts, but he never quantifies the actual effect (either from his own analysis or others'), only referring to it as "minimal".

As Druce himself has stated, a more appropriate method for analyzing the effect of a discrete policy or event, like the Enron collapse, is to analyze the effect over time relative to a counterfactual scenario where the event did not occur.[63] Druce does not do this, and if any of the sources he cites did such an analysis, he does not say so.

In summary, Druce's unsupported leaps of logic severely limit the usefulness of his OPEC and Enron case studies.

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[59] For a diagram of this process, see Shell Annual Report and Accounts 2022, page 96.

[60] This was from an income of $2.26 billion for its wholesale energy business, which reported handling about 2.1 billion barrels of oil and gas (in units of barrels of oil equivalent, or boe): 1.7 billion boe of gas, and 0.4 billion boe of oil. Source: Enron Annual Report 2000.

[61] We note that Shell excludes "paper trades that do not result in physical product delivery" from its Scope 3 GHG emission calculations (Shell Sustainability Report 2022, page 76). This means that the types of commodity and future contracts primarily traded by Enron and the physical trading that Shell does, are largely distinct processes, with distinct GHG emissions effects that would be additive to each other. Using largely paper trades to characterize Shell's physical trading, as done by Druce, is methodologically unsound.

[62] Druce report, ¶112.

[63] Druce discusses counterfactual analysis in ¶ 243,

7. Druce misrepresents how gas and coal compete, especially in a decarbonizing economy. Lowering the supply of gas helps renewable energy grow and take hold.

For the last step of the causal chain, link (d), Druce argues that any reduced gas use would largely be displaced by coal. He describes a case study concerning the supply of gas to Europe during the Ukraine-Russia war, and performs a literature review, both of which cause him to conclude that reducing gas consumption would not reduce GHG emissions.

First, it is likely that the interruption of gas supplies from Russia to Europe during Russia's aggression in Ukraine contributed to a brief and limited increase in coal combustion in Europe. Second, coal does release more CO_2 than gas when combusted. However, neither of these observations mean the extraordinary, unplanned interruption in gas supply to Europe will not decrease European or global GHG emissions.

As Druce notes, there are multiple factors that help determine whether, on balance, a reduction in gas supply (and any corresponding reduction in gas consumption) will yield a net, overall reduction in GHG emissions. In particular, a decrease in gas supply would be accommodated by at least three overlapping effects: (1) reduced overall energy consumption, which would help reduce GHG emissions; (2) switching fuel supplies from gas to higher-carbon gas substitutes (such as coal), which would increase emissions and (3) switching from gas to lower-carbon energy (such as renewables), which would reduce emissions. The relative balance of these three effects determines whether the net, overall effect would be to increase or decrease GHG emissions.

Druce's argument focuses mainly on the one effect that would increase emissions: the switch from gas to coal. Indeed, switching to coal in Europe was possible in the immediate term because coal-fired power plants and supply *already existed*, and so could be put to immediate use generating power.

But that is only part of the story. It takes time for energy systems to adapt, change plans, and build new infrastructure in response to a shock like the Ukraine war. In fact, the interruption to Russian gas markets has already led to a surge in construction of renewables in Europe, as Europe pursues its RePowerEU plan focused on increasing renewable energy.[64]

The surge in renewables is not confined to Europe, either. The constraints on gas supply resulting from Russia's invasion of Ukraine have led to increases in renewables worldwide. As the IEA has found, "Fossil fuel supply disruptions have underlined the energy security benefits of domestically generated renewable electricity, leading many countries to strengthen policies supporting renewables."[65] In other words, not only did the war interrupt gas supply to Europe, "confidence around the world was shaken in the ability of natural gas to act as a reliable and affordable fuel," a situation that IEA expects will cut into global gas demand for decades to come, and contribute to a long-term global increase in renewables.[66]

These expectations by the IEA are matched by more general modeling (not specific to the Russia-Ukraine war) about how constraints on gas supply will affect net GHG emissions. Modelling studies have consistently found that, while gas competes with coal in the near term, in the medium to long term, gas competes much more with renewables than with coal. As a result, constraints on gas supply and resulting higher gas prices – while they may, under certain circumstances, lead to small increases

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[64] RePowerEU Plan : Joint European action on renewable energy and energy efficiency. https://www.iea.org/policies/15691-repowereu-plan-joint-european-action-on-renewable-energy-and-energy-efficiency

[65] IEA *Renewables 2022: Analysis and Forecasts to 2027*. Page 10.

[66] IEA *World Energy Outlook 2023*. Page 77.

in net emissions in the near term due to increased coal use – inevitably lead to decreased net GHG emissions in the medium to long term due to the resulting reduced energy consumption and increased use of low-carbon renewables.[67]

In summary, Druce presents an extraordinarily myopic and limited view of how reductions in gas supply and consumption can play out over time and space. Contrary to his flawed logic, decreases in gas supply and consumption are likely to lead to net reductions in GHG emissions over the medium to long term.

8. The potential for other oil and gas producers to be more GHG-intensive than Shell is a minor issue, and smaller than Druce contends

Our last observation about Druce's critique of the price effect concerns the GHG intensity of oil and gas producers other than Shell. Here, Druce points out that Erickson *et al.* (2022) did not discuss how operators taking over oil and gas production from Shell might operate at a higher emissions intensity, citing evidence that Shell has relatively low emissions intensity compared with most other operators.

However, even if some of Shell's assets were to be taken over by more emissions-intensive operators (what Druce calls the "Producer Substitution Effect"), it does not follow that the RO's effect on global emissions would thereby be nullified, let alone reversed. For such a reversal to happen, the increased emissions from other producers would have to be larger than the sum of: (1) *all of the other* reductions in emissions arising from the price effect; and (2), reductions arising from the additional factors (e.g. increased risk and cost of capital) noted in Erickson *et al.* (2022). Druce has not provided any theory or evidence to suggest that the producer substitution effect would be greater than the sum of these two sets of factors.

Other researchers have investigated the balance of these various factors. One recent study involving experts both in economics and GHG emissions intensity of oil and gas concluded that, in general, the degree of variation in the emissions intensity of production is too small for producer substitution to dominate the overall reduction in consumption and emissions resulting from supply restrictions.[68]

Moreover, Druce confuses average emissions intensity across the global oil industry with the emissions intensity of the marginal producers that could replace Shell. If, as Druce argues, it is OPEC (especially Saudi Arabia) that would replace nearly all of Shell's avoided production, then GHG emissions would tend to decrease further, as OPEC countries tend to be relatively low GHG-intensity producers.[69]

In summary, Erickson *et al.* 2022 did not address the GHG emissions intensity of oil and gas producers other than Shell because it is a minor factor in considering the potential GHG emissions effects of the RO. Druce has not presented compelling evidence that consideration of this producer substitution effect would reduce the overall GHG emissions benefit of the RO.

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[67] See, for example, McJeon, H., Edmonds, J., Bauer, N. et al. Limited impact on decadal-scale climate change from increased use of natural gas. Nature 514, 482–485 (2014). https://doi.org/10.1038/nature13837. See also Acemoglu, Daron, Philippe Aghion, Lint Barrage & David Hémous. Climate Change, Directed Innovation, and Energy Transition: The Long-run Consequences of the Shale Gas Revolution. NBER Working Paper 31657. September 2023.

[68] Prest *et al.* 2023 state: "In general, our central estimates find net emissions reductions regardless of the source of curtailed and substitute supply, although the magnitudes and uncertainty ranges vary considerably depending on those factors." (p.4)

[69] In Table 7.1, Druce presents data showing that Shell's average GHG emissions intensity is 3 to 4 kg CO_2e per barrel less than the global average. But OPEC's is even less GHG-intensive, averaging about 9 kg CO_2e less than the global average (Prest et al. 2023, Table 3), with Saudi Arabia being even less emissions-intensive.

9. "Supply-side" policies to limit oil and gas supply have important roles to play in meeting internationally agreed climate goals, and comparisons of the RO with a hypothetical "optimal" carbon pricing scheme are irrelevant

As the above discussion makes clear, Druce's arguments that the price effect would be "minimal" are seriously flawed. Still, as was mentioned early in this letter, Druce does acknowledge the potential for the RO to reduce global emissions. And yet, even if the global emissions did decrease, he still argues against the RO.

Druce argues that reducing global emissions via the RO would "adversely affect consumer welfare" since, on balance, such higher oil and gas prices "harm consumers".[70] This argument is clearly incomplete. First, consumers will be harmed by climate change (as well as by air pollution from burning fossil fuels), bearing large costs to welfare that Druce ignores. Second, Druce is ignoring the potential for cost reductions in low-carbon energy that could arise from the RO, and those potential benefits to consumer welfare. At the very least, a complete accounting of the costs and benefits of the RO would need to tally the very substantial climate and health benefits to consumers of avoided emissions, something that Druce does not do.

More importantly, there is an increasing recognition that just as oil and gas prices could be too high, prices could also be too *low*, thereby undermining the transition away from fossil fuels to low-carbon energy. This situation could arise if oil and gas producers do not reduce supply at a pace similar to the rapid declines in demand necessary to meet the 1.5°C goal.[71] In that circumstance, oil and gas would be over-supplied, and prices would fall to very low levels. This, in turn, would lock in fossil fuels, make it more difficult for low-carbon energy to compete, and undermine the global cooperation needed to meet 1.5°C.

This type of outcome has been explored in great depth by researchers, including the International Energy Agency (IEA). The IEA has found that over-supply of oil and gas could risk "pushing the 1.5°C goal out of reach"[72], and so the organization has explored efforts to restrict oil and gas supply. In its Special Report, *The Oil and Gas Industry in Net Zero Transitions*, the IEA has called on oil and gas producers to stop investment in new oil and gas projects (especially long lead-time projects) and to be prepared to wind down (or shut in) oil and gas fields before the end of their technical lifetimes.[73] The IEA sees these efforts as part of a cooperative global effort to limit warming to 1.5°C.

Other researchers have come to similar conclusions as the IEA, describing how restrictions to oil and gas supply – implemented as policy restrictions on producers or producer-countries – would help support meeting internationally agreed climate goals,[74] including by keeping prices from going too low. One way to think about limits on fossil fuel supply is that they help constrain emissions "leakage" that can result when policies focused on reducing fossil fuel demand in one region (or set of regions) cause price declines that encourage increased consumption in other regions.[75] In all cases, efforts to restrict supply are important complements to reductions in demand. By contrast, no serious climate change policymakers have proposed that supply-side efforts be the *sole* focus of climate policy, and

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[70] Druce report, ¶ 169.

[71] See, for example, Achakulwisut, Erickson *et al.* "Global fossil fuel reduction pathways under different climate mitigation strategies and ambitions". *Nature Communications* 14. September 2023. IEA *World Energy Outlook 2023.*

[72] IEA 2023. *Oil and gas in net zero transitions*, page 33.

[73] IEA 2023, section 3.6.3, page 149.

[74] See, for example, Prest, Brian C. *Partners, Not Rivals: The Power of Parallel Supply-Side and Demand-Side Climate Policy.* April 2022. Additional references on the complementary nature of supply- and demand-side policies, including ones that we co-authored, were listed in Erickson 2020 and Erickson *et al.* 2022.

[75] See, for example, Prest 2022.

so research that evaluates limits on fossil fuel supply as the single global policy regime – including the conclusions and report referenced by Druce[76] – are of little value.

Instead of limits on fossil fuel extraction, Druce clearly prefers financial incentives, or carbon pricing, such as emissions trading or emissions taxes, and he highlights some theoretical advantages of these policies when applied across entire industries or economies.[77] Indeed, as Druce implies, policies that provide flexibility in terms of *where* (across the world, or between sectors) and *when* emissions are reduced can provide theoretical efficiency benefits.[78] Importantly, however, these benefits require scale (large geographic coverage, ideally the entire globe) to materialize. Accordingly, if real-world constraints limit the scale or stringency of policy adoption, then carbon pricing – and especially carbon pricing *alone* – can no longer can be considered the optimum climate policy that Druce implies.

Druce is not being realistic about the feasibility of his preferred policy option. A large body of academic literature — spanning multiple social science disciplines — has discussed the institutional and political feasibility constraints that severely limit the willingness and capacity of governments to enact, implement and/or sustain (in the faces of pressures for policy reversal) even *weak, national (or sub-national)* carbon pricing schemes, let alone *stringent, global* schemes yielding high carbon prices with universal geographic and sectoral coverage.[79]

Notably, one of the main feasibility constraints identified in this literature is the power of carbon-dependent industries that would stand to lose from such a policy.[80] Such industries, being large, powerful and few in number, have strong incentives to obstruct government efforts to enact stringent carbon pricing laws.[81] Such obstruction has occurred directly (e.g., through lobbying, campaign contributions, "revolving door" relationships, etc.) and/or indirectly (through employee relations and public relations activities aimed at mobilizing opposition to such policies among workers and the wider public).[82,83]

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[76] Druce para 167, including reference in footnote 149 to Boer et al. (2023), "Not All Energy Transitions Are Alike: Disentangling the Effects of Demand- and Supply-Side Policies on Future Oil Prices".

[77] Druce report, sections 2.4 and 8.1.

[78] By *efficiency* here, we mean *cost-effectiveness* in the sense of achieving a given reduction in GHG emissions at the lowest possible cost, which is the conception of efficiency that we interpret Druce as adopting in section 8 of his report.

[79] See, e.g., Rabe, Barry G. 2018. *Can We Price Carbon?* Cambridge, MA.: The MIT Press; Levi, Sebastian, Christian Flachsland, and Michael Jakob. 2020. "Political Economy Determinants of Carbon Pricing." *Global Environmental Politics* 20(2): 128–56; Kuch, Declan. 2015. *The Rise and Fall of Carbon Emissions Trading*. Basingstoke, UK: Palgrave Macmillan; Jenkins, Jesse D. 2014. "Political Economy Constraints on Carbon Pricing Policies: What Are the Implications for Economic Efficiency, Environmental Efficacy, and Climate Policy Design?" *Energy Policy* 69: 467–77.

[80] Carton, Wim. 2017. "Dancing to the Rhythms of the Fossil Fuel Landscape: Landscape Inertia and the Temporal Limits to Market-Based Climate Policy." *Antipode* 49(1): 43–61; Markussen, Peter, and Gert Tinggaard Svendsen. 2005. "Industry Lobbying and the Political Economy of GHG Trade in the European Union." *Energy Policy* 33(2): 245–55; Mildenberger, Matto. 2020. *Carbon Captured: How Business and Labor Control Climate Politics*. Cambridge, MA.: The MIT Press.

[81] Jenkins, Jesse D. 2014. "Political Economy Constraints on Carbon Pricing Policies: What Are the Implications for Economic Efficiency, Environmental Efficacy, and Climate Policy Design?" *Energy Policy* 69: 467–77;

[82] See, e.g., Mildenberger, Matto. 2020. *Carbon Captured: How Business and Labor Control Climate Politics*. Cambridge, MA.: The MIT Press; Stokes, Leah C. 2020. *Short Circuiting Policy: Interest Groups and the Battle Over Clean Energy and Climate Policy in the American States*. New York: Oxford University Press.

[83] While it is the case that some oil and gas industry political activity has been directed toward supporting a carbon tax, carbon tax proposals supported by the industry tend not to be *optimal* taxes set at the high level needed to display the efficient properties discussed by Druce. As discussed in an academic article by Naef, a carbon tax (set at a low rate) could benefit the oil and gas industry by, among other reasons,

world's largest oil and gas companies reducing its oil and gas supply is an irrational perturbation, and certainly no help to global warming, as other companies would automatically fill whatever void is left by Shell.

Druce and Mulder describe how this is "realistic",[87] claiming this is how energy markets work "in practice".[88]

However, their argument goes against a bedrock principle of their own profession: that a reduction in supply of a commodity increases its price and decreases consumption. Furthermore, the haphazard "case studies" that Druce presents are unfit to the question at hand, methodologically fraught, and illogical.

As we understand it, the Reduction Obligation imposed upon Shell in this case is intended to compel Shell to do its part to contribute to the internationally agreed goal of limiting warming to 1.5°C. Indeed, reducing global oil and gas supply and demand is essential to achieve these outcomes.

Furthermore, transitioning away from fossil fuels towards clean energy requires easing the path towards investments in and social uptake of low-carbon energy, while making further investments in, and perceptions of, fossil fuels less appealing. This is a realistic view of how energy markets will need to work, in practice, if one is concerned about meeting agreed climate goals. In our assessment, the RO contributes to these aims.

Druce and Mulder present opinions, sometimes lengthy ones, describing how they understand rational behavior, how they can interpret the empirical evidence, how they can tell the court what is realistic or not. But they have no special insight into the future of energy markets and, indeed, their view is extraordinarily narrow. Their opinions about the RO, and about our previous submissions to the Court on the same topic, should be disregarded in our view.

Sincerely,

Peter Erickson, Seattle, 24 February, 2024.

Fergus Green, London, 24 February 2024.

[87] See, for example, Mulder's discussion of how he knows how markets "have worked so far" and that deviations from that are not "a realistic scenario" (Mulder letter, page 5).
[88] Druce report, ¶ 11.

Given the feasibility constraints on optimal carbon pricing schemes, the real-world carbon pricing schemes that do exist tend to be far from optimal — for instance, having low prices (due to a low set tax rate or excessive supply of carbon allowances) and/or containing many exemptions and loopholes,[84] making them minimally effective at reducing emissions.[85] In summary, Druce ignores how real-world constraints limit carbon pricing, such that it cannot realistically be considered as an optimally efficient policy instrument.

Druce also ignores other critical variables in climate policy making besides *efficiency*: namely, effectiveness. Because the RO is likely to cause a reduction in global emissions (as we have argued here and in our earlier letters in these proceedings), it should be considered an *effective* emissions reduction measure, especially in light of the urgency in rapidly reducing emissions to levels that could limit warming to 1.5°C.

A final way to view Druce's advocacy for carbon pricing – and against the RO – is that he is arguing for society to pursue fewer climate policies, not more. Druce, like many economists, maintains that he knows what the best climate policies are for society: carbon pricing, or what he calls market-based instruments. But not all climate policymakers – let alone all members of the public – are economists, or share, in practice, precisely all the values of economists. As a result, other policies besides carbon pricing could be better at engaging the public and thereby better sustain the move to a low-carbon economy in the long term.[86] This Court should not get caught in the same, limiting trap as Druce. The fact that the RO imposed on Shell would complement carbon pricing can be considered a strength, not a weakness, in part because the RO helps broaden society's conception of what effective climate policy can be.

In summary, Druce's argument about the relative efficiency of different means of reducing emissions is a distraction. No single actor – this Court, Shell, a country, region or otherwise – has the ability, on its own, to implement a globally "efficient" climate policy design. Furthermore, Druce has not shown that supply-side limits could not themselves be considered effective, necessary, or efficient.

Conclusions and Summary

Druce and Mulder present a world where the energy economy is frictionless. In this world, major oil and gas assets can be transferred instantly, oil prices never change, and oil and gas sector workers move effortlessly among similar firms. In this world, consumers are not harmed by climate change as much as by threats of higher energy prices, renewables are not becoming ever more competitive with oil and gas, and any energy sources besides oil and gas are dirtier. To Druce and Mulder, one of the

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incentivizing a shift from coal to gas. Additionally or alternatively, Naef considers that the industry's stance could simply be an "image management" exercise, in which they support a policy that has limited realistic prospects of being enacted and implemented politically due to a likely backlash by consumers against tax increases. See Naef, Alain. 2024. "The Impossible Love of Fossil Fuel Companies for Carbon Taxes." *Ecological Economics* 217: 108045.

[84] Pearse, Rebecca, and Steffen Bohm. 2015. "Ten Reasons Why Carbon Markets Will Not Bring about Radical Emissions Reduction." *Carbon Management* 5(4); Cullenward, Danny, and David G. Victor. 2020. *Making Climate Policy Work*. Cambridge: Polity Press.

[85] Green, Jessica F. 2021. "Does Carbon Pricing Reduce Emissions? A Review of Ex-Post Analyses." *Environmental Research Letters* 16, 043004.

[86] Boyd, William. 2021. "The Poverty of Theory: Public Problems, Instrument Choice, and the Climate Emergency." *Columbia Journal of Environmental Law* 46(2): 399–487, at 399–400. According to Boyd, "the overly abstract theory of instrument choice that has underwritten widespread enthusiasm for emissions trading and other forms of carbon pricing over the last three decades has led to a sharply diminished view of public engagement and government problem solving", and which has "constrained our conceptions of the regulatory state and its capacity for climate action in jurisdictions around the world."

Appendix: Author biographies

Peter Erickson is an affiliated researcher with the Stockholm Environment Institute. His peer-reviewed studies on how policies, actions, or infrastructure projects increase or decrease greenhouse gas emissions have been published in major scientific journals, including *Nature*, *Nature Climate Change*, *Nature Energy*, *Environmental Research Letters*, and *Climatic Change*. His work on how oil supply affects oil markets and greenhouse gas emissions has been cited by the United States Court of Appeals for the Ninth Circuit and the United States District Court for the District of Columbia. He has served as an expert witness in several proceedings, most recently in the case of *Held. v. Montana* in the United States (Montana First Judicial District Court, 2023), where the court found him to be a "well-qualified expert" on the matter of fossil fuels and climate change. He was a co-author of the UNEP *Production Gap Report* in 2019, 2020, and 2021.

Dr Fergus Green is a Lecturer in Political Theory & Public Policy in the Department of Political Science / School of Public Policy at University College London. He works on ethical, political and governance dimensions of low-carbon transitions. His work on climate-related fossil fuel governance and politics has been published in peer-reviewed journals including *Nature Climate Change*, *Climatic Change*, *Climate Policy*, the *American Political Science Review*, and *Global Environmental Politics*. He has been a chapter co-author of UNEP's *Production Gap Report* in 2019, 2020 and 2021, and is a member of the Just Transition Expert Group of the Powering Past Coal Alliance.