Oil and Gas Sector Emissions:
Subsidies and emissions reduction goals

The case of the oil sands sub-sector and CCUS subsidies

A submission to the Standing Committee on
Environment and Sustainable Development

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Standing Committee on Environment and Sustainable Development
House of Commons
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Re: Oil sands subsector and CCUS subsidies

INTRODUCTION

The focus of this submission is on proposed subsidies to support large-scale deployment of CCUS technology in the oil sands industry. I consider the merits of the proposal by examining it in the context of Canada's climate predicament.

Canada's over-riding goal is to achieve very deep emissions reductions within an extremely short period of time. This submission explains the exigency of the timeline and why it is so brief and unforgiving. The year 2030 is the date that sets the immediate, crucial goal. Our capacity to make very deep emissions reductions within the next nine years (both in terms of Canada's domestic emissions and global emissions) should be the decisive criterion in this Committee's study of the merits, or shortcomings, of this subsidy proposal.

The objective of proposed large-scale CCUS deployment is to facilitate the continued expansion of oil production for another 10 years and maintain high production levels through to 2050. In promoting subsidized CCUS, the government makes no commitment that there will be any *reduction in Canada's oil production levels.*

OIL SANDS PRODUCTION, EMISSIONS, AND CCUS TECHNOLOGY

The promise is that CCUS technology will enable our emissions-intensive oil industry to continue to expand and to maintain high production levels for another 30 years, while we use technology to "remove" and sequester the massive volumes of CO_2 that are presently released into the atmosphere during the oil sands extraction process. *Canada's Energy Future 2020* promotes CCUS as a technological pathway for "deep decarbonization" of oil sands production:

> *CCUS offers an opportunity to capture CO_2 for geological storage and utilization. … CCUS is already in use in the oil sands. The Shell Quest CCS facility, in operation since 2015, has been able to store over four million tonnes of CO_2 from the Scotford bitumen upgrader. Approximately 35% of the facility's annual CO_2 emissions have been successfully captured and stored by this technology. CCUS could be combined with cogeneration, or direct air capture, for additional reductions and/or use opportunities".*[1]
>
> — *Canada's Energy Future 2020*, November 24, 2020, p.81 (emphasis added)

The promised reliance on CCUS to achieve decarbonization of the oil sands industry relates solely to decarbonizing the oil sands production process inside Canada. It is true CCUS has the

potential (if it were adopted on a very large scale in Canada's oil sands industry and if it were economically viable and scalable) to lower emissions that are released into the atmosphere during bitumen extraction and processing activities *within Canada*. But those emissions represent less than 15% of the total emissions associated with every barrel of oil we produce.

No amount of further technological improvements in the oil sands industry, not even large-scale adoption of CCUS at all oil sands production sites, will significantly lower the total amount of emissions that will be released into the atmosphere from oil sourced from Canada's oil sands. Over 85% of the life-cycle emissions occur *after the extraction process is completed*, after we export our oil, when it is burned as fuel in cars and trucks ("downstream emissions") and released into the atmosphere as tailpipe emissions.

There is no existing technology that can "remove" those downstream emissions from the atmosphere once they are released. "Direct air removal" technologies do not exist, except in very small-scale experimental forms.

Total life-cycle emissions for all types of oil produced around the world range from a low of about 450 kg CO_2 per barrel up to a high end of about 650 kg CO_2 per barrel. Canadian oil sands are at the higher end of that range, above 550 kg CO_2 per barrel.[2] Given that oil sands extraction emissions average 80 kg CO_2 per barrel[3], they account for less than 15% of the total life-cycle emissions released by each barrel we produce.

The downstream emissions, which are about 6 times larger than the amount of the domestic emissions we propose to "capture", do not get counted in our national emissions, and we do not include them in setting Canada's emissions reduction targets. Yet the scientific evidence is clear that cumulative global emissions are driving the warming of the atmosphere. That includes the substantial share of the downstream emissions attributed to our exported oil. The fact that we do not "count" them does not halt the warming.

Let us be realistic, too, about the share of upstream emissions that can be captured and how quickly that can be achieved. According to the CER, between 2015 and 2019 a cumulative 4 million tonnes (Mt) of CO_2 were captured by the Quest CCUS facility. In fact, during the same four-year period, a cumulative total of 300 Mt (about 80 Mt a year) was released into the atmosphere by oil sands facilities in Alberta. The single Quest project, which cost $1.35 billion (two-thirds of that taxpayers' money), sequestered a little over 1% of the total. Significantly, it only captures 35% of the emissions at the Shell operation.

Even if CCUS were adopted on a very large scale in the oil sands, it will be another decade or more before it begins to appreciably reduce the existing annual amount of our "upstream emissions". New CCUS projects will take years to complete. Given that Canada's oil production is projected to grow 19% by 2032 above the 2019 level, downstream emissions from our oil exports will continue to increase. At least to the early 2030s, any cuts to our domestic emissions achieved by CCUS will be offset by higher downstream emissions.

The only possible way to abate the much larger "downstream" share of our emissions from oil would be in the event that envisioned "direct air emission removal" technologies are eventually developed and prove scalable and economically viable. That is pure conjecture.

RELYING ON NON-EXISTENT TECHNOLOGIES IS A DANGEROUS TRAP

Canadian climate scientist Kirsten Zickfeld filed a written submission to this Committee on May 17, 2021, during your hearings on Bill C-12, addressing the risks posed by building a climate plan that relies heavily on future "emissions removal" technologies: https://www.ourcommons.ca/Content/Committee/432/ENVI/Brief/BR11354997/br-external/ZickfeldKirsten-e.pdf.

Kirsten Zickfeld was a lead author on the IPCC 2018 report. In a footnote (note 6) to her submission, Zickfeld cites a helpful article, *Beyond "Net-Zero": A Case for Separate Targets for Emissions Reduction and Negative Emissions*, Duncan P. McLaren, et al., Front. Clim., 21 August 2019.[4] The McLaren article provides a comprehensive look at the risks of betting our children's future on the contingencies of future emissions removal technologies and explains why the prescribed target for actual reductions of emissions should be separate from a target that specifies the volume of "emissions removals".

Three of the world's leading climate scientists warned in April 2021 that the concept of "net-zero emissions", if it is used to justify the continued high-levels of oil, coal, and natural gas use, is "a dangerous trap": April 22, 2021, *Climate scientists: concept of net-zero is a dangerous trap*, James Dyke, Robert Watson, and Wolfgang Knorr (https://theconversation.com/climate-scientists-concept-of-net-zero-is-a-dangerous-trap-157368). Their article is an indication of the growing alarm among climate scientists that the term "net-zero" is becoming a mask for plans to continue expanding oil and natural gas production for another 20 or 30 years. The risks of undue reliance on future "engineered carbon removals" is also discussed in a recent article by Marc Lee, *Dangerous Distractions: Canada's carbon emissions and the pathway to net-zero* (C.C.P.A. June 2021).[5]

THE IEA'S "NET-ZERO BY 2050 SCENARIO" (MAY 18, 2021)

On May 18, 2021, the International Energy Agency (IEA)[6] warned in its report *Net-Zero by 2050: A Roadmap for the Global Energy Sector* that to have a realistic chance of keeping the increased warming of the earth's atmosphere to less than 1.5°C, global oil consumption must decline 50% below the 2019 level by 2040. That would require cutting oil use worldwide from 98 million bpd (the 2019 level) down to 44 million bpd within the next 20 years. In its most recent annual report *World Energy Outlook 2021* released October 12, 2021, the IEA provides a further comprehensive analysis. The top line of Figure A below shows the decline in global oil consumption that will be required to be consistent with limiting the global temperature increase to 1.5°C (with a 50% probability of meeting that goal).

The IEA's Stated Policies Scenario ("STEPS") projects the expected future path of oil demand over the next 30 years based *on existing energy policies*. In 2019, world oil production reached 98 million bpd, the highest level ever. As a result of the severe economic impact of the Covid-19 pandemic, oil consumption dropped to 91.3 million bpd in 2020.The STEPS scenario counts the benefit of all promised new carbon-reduction measures that have already been announced by governments and this scenario *assumes* all the announced future measures will be fully implemented. Based on that assumption, STEPS reflects the pathway we are presently following.

Under the STEPS Scenario, global oil demand will move back up to 98 million bpd by 2023 and rise to 103 million bpd by 2030 or soon after and flatline at that level to 2050.

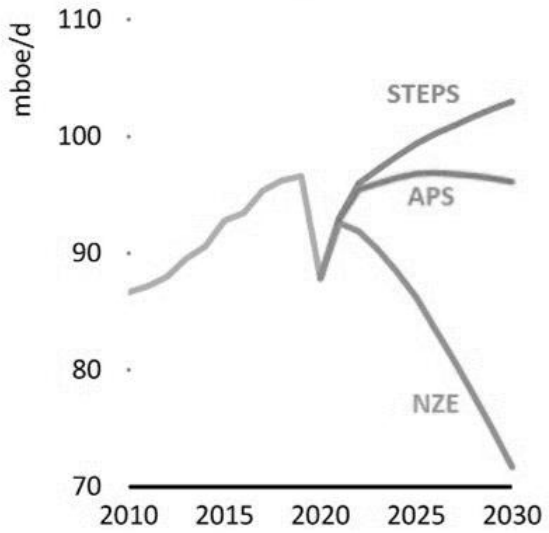
Figure A: IEA Net-Zero by 2050 Scenario: projections (in millions bpd)

	2019	2020	2030	2040	2050
Net-Zero by 2050 Scenario			72	44	24
Stated Policies Scenario	97.9	91.3	103.0	103.0	103.0
Announced Pledges			96.1		76.7

Sources: ***Net-Zero by 2050: A Roadmap for the Global Energy Sector*****, IEA, May 18, 2021; World Energy Outlook 2021, October 12, 2021, Figure 5.3, p. 214.**

In sharp contrast to that, the IEA's Net-Zero by 2050 Scenario (NZE) requires that global production decline to 24 million bpd by 2050. To limit the release of any further substantial emissions from burning oil as a transportation fuel, 70% of the remaining 24 million bpd of oil production by 2050 will have to be used in applications where *the fuel is not combusted and so does not result in any direct CO_2 emissions* (i.e., used to produce chemical feedstocks, lubricants, and asphalt). By 2050, oil must have very limited use as a transportation fuel except for aviation.

Figure B: Projected Oil Demand to 2050



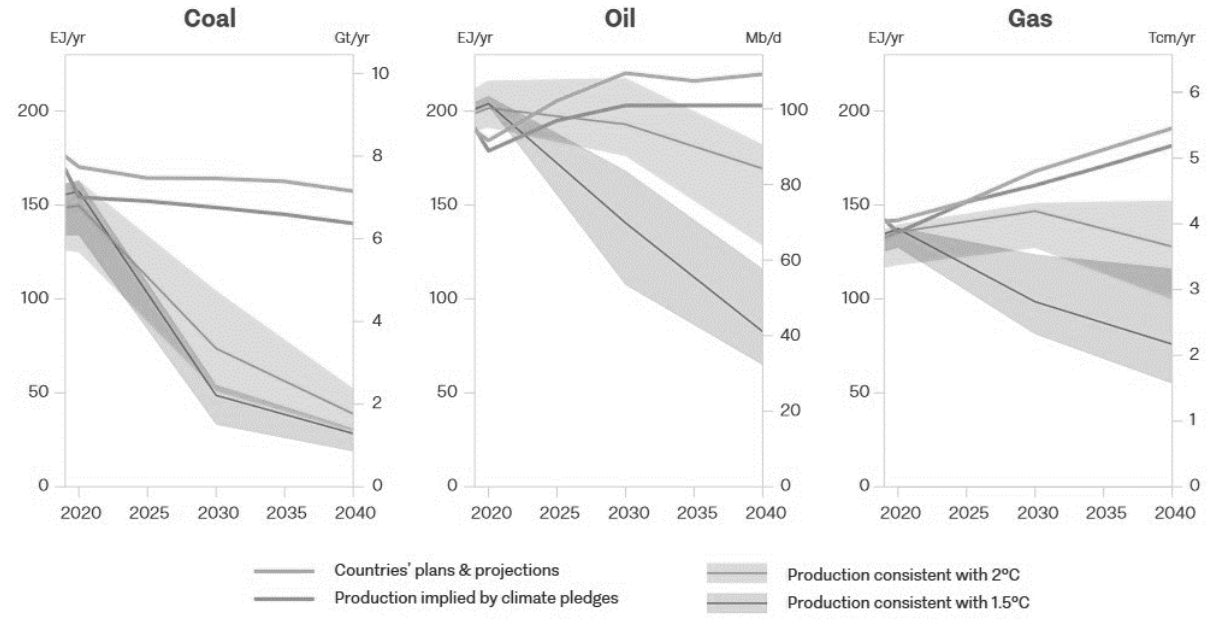
Source: ***World Energy Outlook 2021*****, October 12, 2021, Figure 5.3, page 214.**

The IEA's "Net-Zero by 2050" Scenario requires that to stay on a pathway to 1.5°C global oil production must decline to 72 million bpd by 2030, a 25% reduction below the 2019 level. Canada plans to continue *increasing* our oil production to 2032 (a projected 19% increase). The complete divide between the present intentions of our governments and what human beings need to do within the next nine years is depicted in Figure B. It shows the path of oil demand under each of the IEA's three Scenarios. The top blue line of the above graph ("STEPS") depicts the

IEA's most recent projection indicating the rising pathway of global oil production between now and 2030, based on the current plans of Canada and the world's other oil producing countries. The sharply declining green line ("NZE") shows the magnitude of the cuts in overall world oil production needed by 2030 to give us a 50-50 chance of being able to limit global heating to less than 1.5°C.

On October 20, 2021, the UN Environmental Programme and the Stockholm Environmental Institute released their *Production Gap Report 2021*,[7] which confirmed the "*discrepancy between the global levels of fossil fuel production implied by governments' plans and projections and the levels consistent with the Paris Agreement goals (namely limiting warming to well below 2°C and pursuing efforts to limit the temperature increase to 1.5°C)."* The report covers coal, oil, and natural gas production in 15 major producers, which in the aggregate account for 75% of all global fossil fuel extraction (including U.S., Saudi Arabia, UAE, Canada, Brazil, and Russia).

Figure C: Projected coal, oil, and gas use to 2050



Source: *Production Gap Report,* October 20, 2021, Figure 2.2 at page 16.

In the case of Canada, the *Production Gap Report* specifically relies on the *Canada's Energy Future 2020* report released November 24, 2020. The report's overall conclusion is that "the world's governments plan to produce more than twice the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C". In the case of oil production, it states:

> *Nations are, in aggregate, planning on producing around 40 million barrels per day (Mb/d) more oil than would be consistent with the median 1.5°C pathway in 2030 (with a range of 26-56 Mb/d). This excess is roughly equivalent to half of current global oil production.*
>
> — *Production Gap Report*, October 20, 2021, p. 15-16

CANADA'S OIL PRODUCTION

The CER's new "Evolving Policies Scenario"[8] released on December 9, 2021, which assumes the world will adopt "steadily more ambitious climate policies", shows Canada's oil production will continue growing until 2032, when it is projected to peak at 5.8 million bpd, about 900,000 bpd above the 2019 level. More than 80% of that expansion (an increase of 793,000 bpd) is expected to occur as early as 2026. The Evolving Scenario shows a slight decline that begins in the years after 2032, but Canada's total production by 2050 will still be at the relatively high level of 4.8 million bpd – only about 2% less than it was in 2019. Canada's production shows no significant reduction over the next 30 years. The CER 2021 report gives this succinct summary of the outlook for Canada's oil production between now and 2050:

> *From 2019 to 2032, crude oil production increases 19%. Between 2032 and 2050 production decreases by 19%.*
>
> — *Canada's Energy Future 2021,* December 9, 2021, page 40

On December 14, 2021, four of Canada's leading experts on climate policy and oil production published an article[9] containing a devastating indictment of the irresponsible character of the CER's projections: see Kathryn Harrison (UBC), Mark Jaccard (Simon Fraser University), Nicholas Rivers, (University of Ottawa), and Angela Carter (University of Waterloo). The four authors observe that the CER's most recent report published on December 9, 2021, "offers reassurance" that "Canadian crude oil production levels are resilient through to 2050":

> *However, CER's report fails to examine a path to reduce greenhouse gas emissions to net-zero by 2050, consistent with the Canadian and international goal. In so doing, CER has understated risks to Canada's economy and failed to inform looming policy decisions".*
>
> — "Canada's Energy Regulator turns a blind eye to dangerous global warming", December 14, 2021 (emphasis added)

Earlier, on July 8, 2021, twenty-one Canadian energy economists and climate scientists, all deeply informed about Canada's oil projections and the emissions implications of continued production increases, sent a letter[10] to the Prime Minister urging that the government instruct the CER to develop a scenario that will inform Canadians what production levels over the next 30 years would be safely aligned with an effective global effort to stay within the 1.5°C warming threshold: *"Specifically, we urge you to mandate the CER model scenarios consistent with the IEA's Net Zero by 2050 report."* The scenarios have still not been produced.

AN UNFORGIVING DEADLINE FOR EMISSIONS REDUCTIONS

The *UN Emissions Gap Report 2021* released on October 26, 2021,[11] confronts us with the reality that, with only nine years remaining, the world's largest emitting countries are not remotely on track to achieve the very deep emissions reductions that are required by 2030 to avoid the gravest impacts of climate breakdown. It was not until December 2015, when the Paris Agreement was negotiated, that countries, including Canada, agreed "*to pursue efforts to limit the temperature*

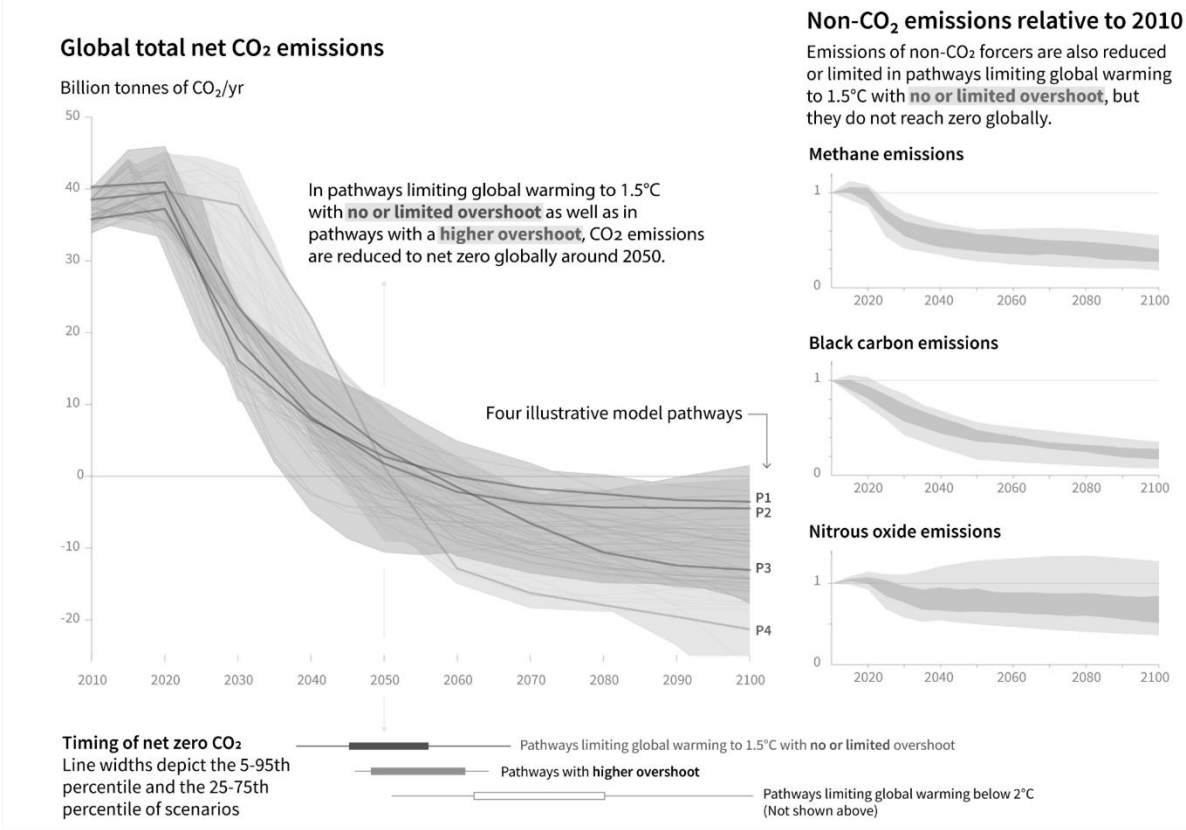
increase to 1.5°C." Recognizing that the newly stated 1.5°C goal would require much deeper and faster changes in energy policy, the parties to the Paris Agreement in 2015 requested that the IPCC prepare a study on the impacts of warming to 1.5°C and on the measures needed to meet that goal. Three years later, on October 7, 2018, the *IPCC Special Report on Global Warming to 1.5°C* was published. It provided the results of comprehensive research about the magnitude of the emissions reductions that would be required to keep the warming increase to 1.5°C.

The *IPCC Special Report on Global Warming to 1.5°C*

One core finding reported in the *Special Report*[12] was that all releases of CO_2 into the atmosphere must reach "net-zero" by 2050 to give us a 66% chance of reaching the 1.5°C goal. "Net-zero" means that, beyond 2050, no additional CO_2 can be safely added to the *cumulative* amount of CO_2 that by then will already have been released into the atmosphere.

A second core finding was that to give us a realistic chance to achieve the goal of net-zero by 2050, the annual level of global emissions must be reduced 50% below the 2018 level by 2030. The *Summary for Policy Makers* includes this helpful graph, which depicts the massive cuts required to avoid a catastrophic outcome, reproduced here as Figure D**:**

Figure D: Global emissions pathways



Source: IPCC Special Report on Global Warming of 1.5°C, figure SPM.3a.

The total annual level of global emissions is given on the vertical axis of the graph, measured in billions of tonnes of carbon dioxide per year ($GtCO_2$). The global total shown for 2020 is a little over 40 $GtCO_2$.

Carbon dioxide (CO_2) emissions are represented on the main graph on the left. Total greenhouse gas emissions in 2019 were 51.5 $GtCO_2eq$. CO_2 accounts for most human caused GHG emissions, more than 70% of the total (the other approximate 30% of human caused emissions comprise methane and other GHGs).

Four mitigation pathways are highlighted, which are identified as P.1, P.2, P.3. and P.4. Each offers a different combination of energy policy, technologies, and land use strategies to achieve the hoped-for "net-zero" outcome by 2050. Importantly, each of the depicted pathways relies on deploying Carbon Dioxide Removal methods (CDR) to a different degree.

P.1 is described in the report as a mitigation plan aimed to reach "net-zero" by 2050 with minimal reliance on CDR technology. The *Summary Report* says this about the P.1 pathway: "Afforestation is the only CDR considered; neither fossil fuels with CCS nor BECCS are used" (emphasis added). "Afforestation" refers to large-scale projects that plant new forests and expand existing forest cover, and includes other changes to land use, restoration of wetlands, and changes in agriculture that would enhance the natural capacity of the earth's surface to absorb carbon from the atmosphere. P.1 does not depend on future large-scale deployment of other envisioned future CDR technologies, such as BECCS or other direct air removal schemes. Under P.1, CO_2 emissions decline to 20 $GtCO_2$ by 2030.

If we fail to meet the 2030 target, or choose not to, our last resort will be to attempt later to use CDR technologies on a very large scale to remove the accumulated "residual emissions" from the atmosphere.

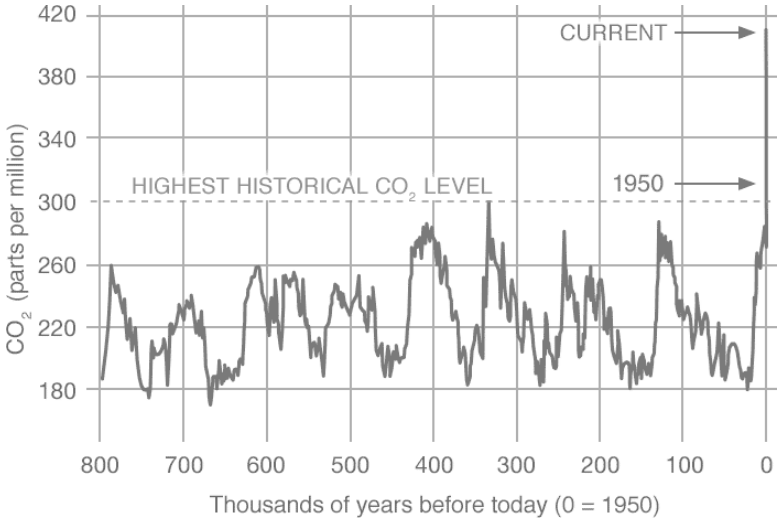
The significance of the atmospheric carbon concentration level

The *atmospheric carbon concentration level* is the metric that explains why the timeline to arrest the further expansion of oil production – and to achieve deep cuts in our consumption of oil, coal, and natural gas – is brief and unforgiving. It records the rising concentration of CO_2 and other GHGs in the upper atmosphere that are driving the heating of the earth's atmosphere, measured in parts per million (ppm).

The most recent measurements of the atmospheric carbon concentration level warn us of the unforgiving timeline we face. Each year the atmospheric CO_2 concentration follows a cycle. April and May are the high points of the year, September the low. *But the annual averages are moving up every year*. Eight years ago, in 2013, the annual average was 395.3 ppm. The annual average for 2020 was 413.2 ppm CO_2. In May 2021, the monthly average recorded at Mauna Loa reached 419 ppm. The monthly averages in April and May are a harbinger of where we are going.

Figure E represents the long-term record for the atmospheric carbon concentration over the past 800,000 years. It places our predicament in context:

Figure E: Atmospheric carbon concentration level (proxy measurements)



Source: US National Aeronautics and Space Administration (NASA)

During the past 12,000 years from the end of the last Ice Age until the advent of the industrial age, the atmospheric carbon concentration was stable at about 280 ppm. By 1958, it was 315 ppm. Since then, it has risen by another 90 ppm. The rate of annual increase has been accelerating, reflecting the persistent annual growth in volume of global emissions from burning coal, oil, and natural gas. In the 1960s, the rate of growth of the atmospheric carbon concentration level was about 0.6 ppm per year. Just a decade ago in 2008 and 2009 the annual increases ranged between 1.59 ppm and 2.02 ppm. It is now rising at an average of 2.5 ppm every year.

To stay within the 2°C warming threshold, the atmospheric carbon concentration level must be kept below 450 ppm. The threshold for 1.5°C is 430 ppm. At the present rate of increase, which is now about 2.5 ppm every year, the atmospheric carbon concentration level will exceed 450 ppm CO_2 by about 2035. It is on track to rise above 430 ppm CO_2 by the end of this decade. We are in a race to reduce the magnitude of the annual increases in the atmospheric carbon concentration. If we do not act now, it will continue to rise about 2.5 ppm every year for another nine years, and on into the next decade.

The evidence shows that even if the annual level of global emissions could be massively reduced by 2030 our predicament is that additional CO_2 emissions, albeit in gradually declining amounts, will continue to be released every year for another 20 or 30 years after that – until the world's energy systems altogether cease to be overwhelmingly dependent on carbon-based fuels.

CONCLUSION

We are often told by energy economists and Ministers that under the Paris Agreement (and under the terms of the UN Framework Agreement on Climate Change that defines what emissions

countries are obliged to count in their national emissions accounting) Canada has no legal responsibility to "count" our "downstream" emissions as part of our formal national emissions.

But the accounting rules are not an answer to the problem we face. The scientific evidence is clear that cumulative global emissions are driving the warming of the atmosphere. That includes the substantial share of the downstream emissions attributed to our exported oil. There is no existing technology that can "remove" them from the atmosphere once they are released. The fact that we do not "count" them does not halt the warming.

The downstream emissions from our oil are a core problem, and they contribute directly to climate change in Canada – to the same extent as if those emissions were released in Saskatchewan or in Nova Scotia. Interestingly, the Supreme Court of Canada in its decision on March 25, 2021, in the *Greenhouse Gas Pollution Pricing Act* case, relying on the scientific evidence presented to the Court in that case, clearly and precisely acknowledges the *borderless* way emissions released in one jurisdiction will affect (and drive climate change) in all other jurisdictions. In the Carbon Pricing case, the Court was required to examine the scientific evidence presented to the Court in that case which explains why GHG emissions released within one province in Canada will impact all the other provinces. The Court concluded:

> *"It is uncontroversial that GHG emissions cause climate change. It is also an uncontested fact that the effects of climate change do not have a direct connection to the source of GHG emissions; every province's emissions contribute to climate change, the consequences of which will be borne extra-provincially across Canada and around the world"* [13]
>
> — References re *Greenhouse Gas Pollution Pricing Act*, para 187 (emphasis added)

Whether they are released by cars and trucks in Texas or Shanghai, emissions from our exported oil will contribute directly to climate breakdown in B.C. and Northern Quebec. This catastrophic outcome, which crosses all national borders, is being driven by the physics of climate change. Nothing in the national emissions accounting rules will slow that down or protect us from the consequences of the downstream emissions from our oil exports. It is no answer to say that CCUS will solve the problem. Direct air removal technologies do not exist.

The severe time constraint that limits our remaining options is indicated by the fact that the atmospheric carbon concentration level reached 413.2 ppm CO_2 in 2020. It is on track to exceed 430 ppm CO_2 by about 2028. I urge the Committee in its study of proposed subsidies for CCUS technology in the oil industry to give the deepest consideration to the fundamental problem we face. Even if rapid deployment of CCUS could achieve as much as a 20 Mt cut of our annual oil sands extraction emissions by 2030, the tragedy is that continued growth of our production levels (CER projects 19% growth by 2032) and the accompanying increase in downstream emissions will more than offset that gain. Expansion of Canada's oil production to 2032 and continued high levels of production to 2050 *is incompatible with retaining any chance to avoid a world of catastrophic climate change.*

David Gooderham

NOTES

1. *Canada's Energy Future 2020*, Canada Energy Regulator (CER), November 24, 2020: https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2020/canada-energy-futures-2020.pdf

2. *The oilsands in a carbon-constrained Canada*, Pembina Institute, Benjamin Israel et al, February 2020: https://www.pembina.org/reports/the-oilsands-in-a-carbon-constrained-canada-march-2020.pdf

3. *National Inventory Report*, April 15, 2021, pp. 55-56

4. McLaren et al: https://www.frontiersin.org/articles/10.3389/fclim.2019.00004/full

5. Marc Lee, *Dangerous Distractions*: (C.C.P.A. June 2021): https://www.policyalternatives.ca/sites/default/files/uploads/publications/BC%20Office/2021/06/CCPA%20report_Dangerous%20Distractions%20Net%20Zero.pdf…

6. *Net-Zero by 2050: A Roadmap for the Global Energy Sector*, International Energy Agency (IEA), May 18, 2021: https://iea.blob.core.windows.net/assets/4719e321-6d3d-41a2-bd6b-461ad2f850a8/NetZeroby2050-ARoadmapfortheGlobalEnergySector.pdf and *World Energy Outlook 2021*, International Energy Agency (IEA), October 12, 2021: https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf

7. UN *Production Gap Report 2021*, UN Environmental Programme and Stockholm Environmental Institute, October 20, 2021: https://productiongap.org/wp-content/uploads/2021/11/PGR2021_web_rev.pdf

8. *Canada's Energy Future 2021*, Canada Energy Regulator (CER), December 9, 2021: https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2021/canada-energy-futures-2021.pdf

9. *"Canada's energy regulator turns a blind eye to dangerous global warming"*, Kathryn Harrison, Dec.14, 2021: https://www.nationalobserver.com/2021/12/14/opinion/canadas-energy-regulator-turns-blind-eye-dangerous-global-warming

10. July 8, 2021, letter to Prime Minister, Ministers of Environment, Minister of Natural Resources, and Canada Energy Regulator: https://www.linkedin.com/pulse/canadas-energy-regulator-should-develop-net-zero-letter-mark-winfield

11. *UN Emissions Gap Report 2021*, October 26, 2021: https://www.unep.org/resources/emissions-gap-report-2021

12. *IPCC Special Report on Global Warming to 1.5°C*, October 7, 2018. The *Summary for Policy Makers* is found at: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf

13. *Reference re Greenhouse Gas Pollution Pricing Act*, 2021 SCC 11.