Energy Information and Analysis Branch

Date: June 20, 2023

ENERGY FUTURE 2023 REPORT FROM THE CANADA ENERGY REGULATOR-SUMMARY BULLETS

- Canada's Energy Future 2023 (EF2023) is the latest long-term energy outlook from the Canada Energy Regulator. EF2023 explores how possible energy futures might unfold for Canadians over the long term at the request of Honourable Jonathan Wilkinson, Minister of Natural Resources. It covers supply and demand dynamics across all commodities and provinces.

- EF2023 focuses on achieving net-zero emissions by 2050. The analysis models the Canadian energy system in a global context where the world limits global temp increases to 1.5C.

- EF2023 considers three scenarios:
  - Global Net Zero-This scenario assumes Canada meets net zero emission by 2050 and does so in a global context where the rest of the world is taking ambitious measures to limit global temperatures to 1.5C. In effect, a net zero planet.
  - Canada Net-Zero-This scenario assumes Canada still meets the targets for 2050 but the pace of climate action globally is slower than in the Global Net-Zero scenario.
  - Current Measures (Business as usual)-This scenario considers only the measures currently in place domestically and assumes limited future action globally. Modeled on policies currently in place (as of March 2023).

- In addition to the three main scenarios in EF2023, there are five 'What if" cases in this report that explore some uncertainties on the pathway to net-zero:
  - What if the technologies to enable wide-scale adoption of hydrogen are costly?
  - What if small modular reactor (SMR) technology matures less quickly and is more costly?
  - What if direct air capture (DAC) technology matures more quickly and is less costly?
  - What if carbon capture, utilization, and storage (CCUS) technology does not mature as quickly and is more costly?
  - What if electricity vehicle charging patterns result in higher peak electricity demand?

- Modeling exercise is focused on Canadian energy system at the national level. For the two net zero scenarios it includes policies that have been announced but not yet implemented. The report relied on International Energy Agency Net Zero by 2050 for inputs and assumption on global energy systems.

- Analysis doesn't consider affordability impacts of transition for consumers and assumes there are no constraints in adoption of technologies.

- In both net-zero scenarios, the types of energy Canadians use changes dramatically, including using a lot more electricity and reduced fossil fuels. The energy mix is more diversified than today. The electricity system is assumed to decarbonize by 2035 and is the backbone of the net-zero scenarios.

- Primary demand-the total amount of energy used in Canada falls in both net-zero scenarios as a result of declining fossil fuel use. Natural gas demand declines in the net-zero scenarios and increases in the current measures scenario.

- In all three scenarios, energy use increases in the near term. In the long term, energy use falls in both net-zero scenarios.

- In both net-zero scenarios fuel switching is essential to achieve net-zero. Heat pump use increases for residential and commercial uses but some gas and oil furnaces remain.

- Emerging technologies such as Hydrogen and Carbon Capture Utilisation and Storage, nature-based solutions play a key role in net zero scenarios in the industrial sector.

- The transportation sector sees an increased use of electric vehicles and reducing emissions from ICE vehicles in all scenarios.

- Canada's oil and natural gas industry significantly reduce its emissions in both net-zero scenarios, and while production declines, the pace of global climate action determines by how much. Energy use in the oil and gas sectors grows in all three scenarios in the near term.

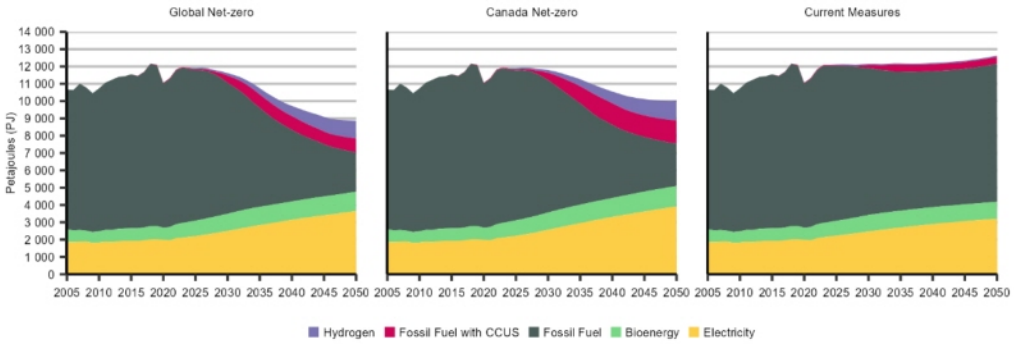
- Distinction in the net-zero scenarios for Canada-prices of Oil & Gas in the global Net-Zero scenario are significantly lower than today. In the Canada net-zero scenario where global demand for commodities is higher than in the global net-zero scenario, the global demand is supportive of higher prices. This creates an incentive for Canadian O&G producers to mitigate emissions from their production.

- Reaching net-zero is driven by increasingly strong climate policies in Canada across all sectors to limit and reduce emissions.

Canada's Energy Future 2023 provides scenarios describing three potential Canadian futures:

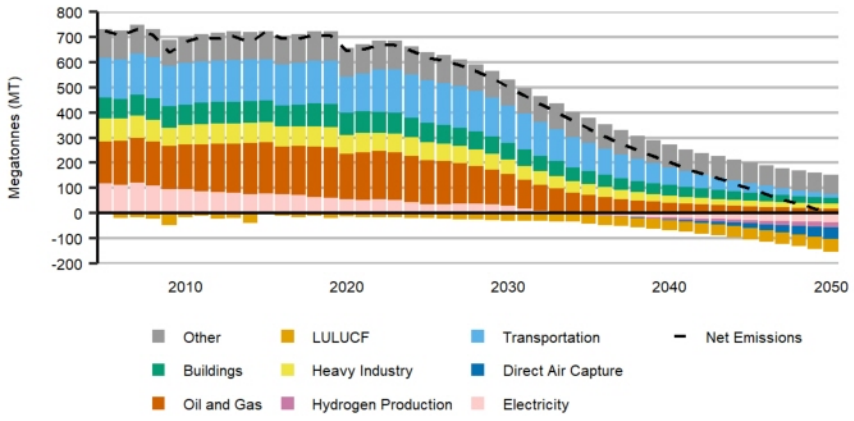
- Global Net-zero Scenario: Canada achieves net-zero emissions by 2050 and the rest of the world reduces emissions enough to limit global warming to 1.5°C;
- Canada Net-zero Scenario: Canada achieves net-zero by 2050, but the rest of the world moves more slowly. This results in weaker technological improvements/cost reductions, making Canada's path to net zero more costly;
- Current Measures Scenario: Assumes climate action in Canada is limited to measures in place today and global action is limited to current national commitments.

In net zero scenarios, the amount of energy in Canada derived from fossil fuels (gray below) decreases substantially by 2050



In these scenarios, polluting devices like internal combustion vehicles, natural gas boilers and even industrial equipment are replaced with electrical devices (e.g. heat pumps), causing electricity usage to more than double

- In the Net Zero scenarios, the electricity sector becomes net negatives by 2035 with increased deployment of Bioenergy with Carbon Capture and Storage (BECCS)
- Buildings, transport, oil and gas, and heavy industry begin seeing meaningful emissions cuts around 2030 but are still positive in 2050.
- Land Use, Land-Use Change and Forestry (LULUCF) is expected to grow as a source of net negative emissions, joined by direct air capture and hydrogen production around 2040



Comparing EF2023 to CleanBC Modeling for British Columbia	
EF2023	**CleanBC**
Reaches net zero by 2050	Even in scenarios with greater policy stringency after 2030 (e.g. increasing carbon tax), CleanBC will fall 31% short of net zero by 2050 without additional measures
Wind is the largest source of new electricity generation (20% of total by 2050)	Wind is the largest source of new electricity generation (26% of total by 2050)
Nuclear generation grows from 0 GWh in 2030 to 15,000 GWh in 2050 (12% of all electricity)	No role for nuclear by 2050

Page 005 of 125 to/à Page 045 of 125

Withheld pursuant to/removed as

s.13

Wynes, Seth ENV:EX

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To: Dale, Daniel ENV:EX
Cc: Kadowaki, Ryan ENV:EX
Subject: RE: Info Note - Canada's Energy Future 2023
Attachments: CER Info Note Draft_SW_20230704_Draft 4.docx

Hi Dan,

Here are my edits back for the info note. Let me know what still needs work!

Cheers,

Seth

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BRITISH COLUMBIA

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Great. Tomorrow is my flex day but I think I'll be able to finish all of this when I come to work Tuesday.

Have a great long weekend!

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There are a few things I'd fix up with more time but I have a couple other things to do before end of day so I will leave it there.

Cheers,

Seth

From: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Sent: Tuesday, June 27, 2023 11:45 AM
To: Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

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Wynes, Seth ENV:EX

From: Dale, Daniel ENV:EX
Sent: June 20, 2023 12:46 PM
To: El Hannach, Mohamed ENV:EX; Wynes, Seth ENV:EX
Cc: Kadowaki, Ryan ENV:EX
Subject: Info Note - Canada's Energy Future 2023
Attachments: 377527_IN_IEA_Roadmap.docx; WEO 2022 Transition Note - Oct 28.docx

Hi Mohamed, Seth

I'm wondering if you could both spend some time this week unpacking the CER's latest release of the Canada's Energy Future report and put together information notes (IN) on the key findings from this report. Mohamed, your note should focus on what this report is saying as it relates to the BC oil and gas sector and the 2030 emissions cap work. What is the future for oil and gas in a net zero environment? What jurisdictions are hardest hit? How do the CER results compare to B.C. results (different assumptions will be used so you'll need to be clear on that). You can compare against the Navius oil and gas cap run as needed. I've taken a very quick look and have picked out one finding that I think others will want to know about:

- The CER has 8.64bcf/d of BC natural gas production in 2030 under their Canada Net Zero scenario. In the Current Measures scenario, production is 8.62bcf/d. Production peaks in 2031 under Canada Net Zero but does not peak under Current Measures. The Canada Net Zero Scenario includes the federal oil and gas cap policy, while the Current Measures scenario does not.

Seth, your note should be broader (and lighter on the oil and gas details) and focus more generally on the what the scenarios are saying about the path to net zero by 2050. What sectors reduce emissions on what timelines? What technologies are deployed? What's the role of DAC?/BECCS? And importantly, how do the CER's scenarios compare to what is happening and/or modelled to happen in B.C. under CleanBC? If you would like to compare the CER's results against B.C's model results, I would use the latest CleanBC run (2022-10-31 results)

These CER reports usually contain a ton of information and I find the data appendix to be quite helpful when looking for key stats to pull out.

I don't think either of you have had the opportunity to write an info note before (template is on the right hand side of this intranet page) but general guidance is to write concisely, be clear on the scenarios/assumptions if needed, and to focus on the key points that are likely relevant to policy makers. I've attached a few examples of notes that I've written that synthesize other large reports and you can find additional IN examples in the briefing notes folder here. If you can keep it to two pages that would be great but it's not a strict requirement. Typically, IN's go through many rounds of edits before they are finalized so just expect that. Ryan and I can work with you to tighten up the content once you have drafts.

If you are able to get something to us by Friday that would be awesome.

And let me know if you have any questions.

-Dan

BRITISH COLUMBIA

Daniel Dale
Senior Economic Analyst
Clean BC Implementation | Climate Action Secretariat
Ministry of Environment and Climate Change Strategy
236.478.1917 | daniel.dale@gov.bc.ca

Wynes, Seth ENV:EX

From: Dale, Daniel ENV:EX
Sent: June 23, 2023 11:26 AM
To: Dale, Daniel ENV:EX; Wynes, Seth ENV:EX
Subject: Conversation with Dale, Daniel ENV:EX

Dale, Daniel ENV:EX 11:12 AM:

Hey Seth, for Q1, we actually discussed this as a branch a couple months ago. General consensus is that it's fine to message others on skype when they are in meetings but don't always expect an immediate response.

Wynes, Seth ENV:EX 11:12 AM:

Okay great to have a branch norm!

Dale, Daniel ENV:EX 11:14 AM:

For Q2 are you meaning whether the note should influence thinking or if it should be more factual?

Wynes, Seth ENV:EX 11:16 AM:

s.13

Dale, Daniel ENV:EX 11:22 AM:

got it, ok, great question. In general, your primary audience is the name at the top of the note (typically ADM, DM, or Minister). It's true that notes get shared widely and even though the temptation would be to provide more technical details for the benefit of analysts, the content should pretty much always be geared towards decision makers who just need to know the key points.

Dale, Daniel ENV:EX 11:24 AM:

There is further nuance between what you would write for an ADM, DM, or Minister but that's the kind of thing that you'll just pick up on with time. s.13
s.13

Dale, Daniel ENV:EX 11:25 AM:

Also, thanks for sending your CER note over. I need to duck out for an appointment shortly, but I will get you comments as soon as I can (including who the note is for)

Wynes, Seth ENV:EX 11:26 AM:

Haha I was just going to ask if this note will actually get used and by whom

Wynes, Seth ENV:EX 11:26 AM:

Great, looking forward to it

Wynes, Seth ENV:EX 11:26 AM:

thanks for those helpful answers!

Wynes, Seth ENV:EX

From: Wynes, Seth ENV:EX
Sent: June 22, 2023 1:12 PM
To: Dale, Daniel ENV:EX; Wynes, Seth ENV:EX
Subject: Conversation with Dale, Daniel ENV:EX

Wynes, Seth ENV:EX 12:53 PM:

Hi Dan - should I keep all figures and tables in an Appendix for this CER info note? The WEO Transition Note you sent along does have them in the text, whereas the template implies that there should only be bullets and tables

Dale, Daniel ENV:EX 12:56 PM:

Either option is fine, but I'd lean towards putting them in an appendix. Typically figures end up in the appendix simply because they take up too much space in the body of the note.

Wynes, Seth ENV:EX 12:57 PM:

Gotcha. And are you looking for that strict 2 page limit or 3 is fine?

Dale, Daniel ENV:EX 12:59 PM:

3 is fine - different people will give different advice across govt, but my experience has been that there is a lot more flexibility in style/content of notes than you'd initially think

Wynes, Seth ENV:EX 1:00 PM:

great, thanks!

From: Dale, Daniel ENV:EX (Daniel.Dale@gov.bc.ca)
To: El Hannach, Mohamed ENV:EX (Mohamed.ElHannach@gov.bc.ca); Wynes, Seth ENV:EX (Seth.Wynes@gov.bc.ca)
Cc: Kadowaki, Ryan ENV:EX (Ryan.Kadowaki@gov.bc.ca)
Subject: Info Note - Canada's Energy Future 2023
Sent: 06/20/2023 19:46:06
Attachments: image001.jpg, 377527_IN_IEA_Roadmap.docx, WEO 2022 Transition Note - Oct 28.docx
Message Body:

Hi Mohamed, Seth

I'm wondering if you could both spend some time this week unpacking the CER's latest release of the Canada?'s Energy Future report and put together information notes (IN) on the key findings from this report. Mohamed, your note should focus on what this report is saying as it relates to the BC oil and gas sector and the 2030 emissions cap work. What is the future for oil and gas in a net zero environment? What jurisdictions are hardest hit? How do the CER results compare to B.C. results (different assumptions will be used so you'll need to be clear on that). You can compare against the Navius oil and gas cap run as needed. I've taken a very quick look and have picked out one finding that I think others will want to know about:

- The CER has 8.64bcf/d of BC natural gas production in 2030 under their Canada Net Zero scenario. In the Current Measures scenario, production is 8.62bcf/d. Production peaks in 2031 under Canada Net Zero but does not peak under Current Measures. The Canada Net Zero Scenario includes the federal oil and gas cap policy, while the Current Measures scenario does not.

Seth, your note should be broader (and lighter on the oil and gas details) and focus more generally on the what the scenarios are saying about the path to net zero by 2050. What sectors reduce emissions on what timelines? What technologies are deployed? What's the role of DAC?/BECCS? And importantly, how do the CER's scenarios compare to what is happening and/or modelled to happen in B.C. under CleanBC? If you would like to compare the CER's results against B.C's model results, I would use the latest CleanBC run (2022-10-31 results)

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I don't think either of you have had the opportunity to write an info note before (template is on the right hand side of this intranet page) but general guidance is to write concisely, be clear on the scenarios/assumptions if needed, and to focus on the key points that are likely relevant to policy makers. I've attached a few examples of notes that I've written that synthesize other large reports and you can find additional IN examples in the briefing notes folder here. If you can keep it to two pages that would be great but it's not a strict requirement. Typically, IN's go through many rounds of edits before they are finalized so just expect that. Ryan and I can work with you to tighten up the content once you have drafts.

If you are able to get something to us by Friday that would be awesome.

And let me know if you have any questions.

-Dan

Daniel Dale

Senior Economic Analyst

Clean BC Implementation | Climate Action Secretariat

Ministry of Environment and Climate Change Strategy

236.478.1917 | daniel.dale@gov.bc.ca

MINISTRY/MINISTRIES: ENV

ISSUE: World Energy Outlook 2022 Summary

Discussion:

- The International Energy Agency's (IEA) 2022 World Energy Outlook (WEO) provides a forecast for global energy supply and demand through to 2050 under three different policy scenarios:
    1) The current policies scenario **(STEPS)** considers policies implemented today and has a 50% likelihood that global warming stays below 2.5 degrees in 2100;
    2) The announced pledges scenario **(APS)** assumes all aspirational targets announced by governments are met and has a 50% likelihood that warming stays below 1.7 degrees; and
    3) A net zero scenario **(NZE)** that has a 50% likelihood of keeping warming below 1.4 degrees.
- Considerable uncertainty in international energy markets is a backdrop to the analysis, but the WEO is clear that a long-term transition away from fossil fuels underway. All scenarios see peaks in demand for oil, coal and natural gas.
- Lasting responses to Russia's invasion of Ukraine lie in reducing fossil fuel dependency and there is greater alignment now than ever between economic, climate, and security priorities.
    - In the near term, Europe is expected to increase LNG imports from the Middle East, Africa, and Eastern United States, draw on gas in storage and implement demand side measures.
    - In the longer term, Europe is expected to accelerate its transition to clean energy and a portion of Russian fossil fuels will be directed to Asia.
- Under STEPS, demand for oil peaks in the mid-2030s and declines slightly to 2050. Demand growth in aviation, shipping, heavy trucking, and petrochemicals is more than offset by reduced oil use in personal transport, principally because of light duty electric vehicles. Under APS and NZE, oil is replaced with other liquid fuel types (biofuels, hydrogen, hydrogen derived fuels) and electricity.
    - Under the NZE pathway, electric and fuel cell powered heavy trucks make-up 35% of new heavy duty vehicle sales by 2030, which is aligned with Canada's and B.C.'s commitments.
- All scenarios see the share of electricity in global final energy consumption rising. By 2050, electricity demand is 75% higher than today in the STEPS, 120% higher in APS and 150% in the NZE Scenario. Global electricity demand is expected to grow under all scenarios worldwide.
    - Space heating and cooling is a major driver of electricity demand growth. Under NZE, high efficiency heat pumps are the primary technology choice.
- Prospects for hydrogen, renewable natural gas, and other low-emission gaseous fuels in industry, transport, and buildings look bright under all scenarios, but must be paired with government action to set environmental standards and ensure reliable long-term demand.
- Coal demand saw an uptick in 2021 and early 2022 as the global economy recovered from Covid-19. Record gas prices resulted in gas-to-coal switching in some markets, including the EU. However, by and large, short-run demand has not driven investment in new coal-powered assets. The IEA forecasts coal demand to wane in the next few years and continue trending downward. Long term prospects are strongly tied to global climate ambition.

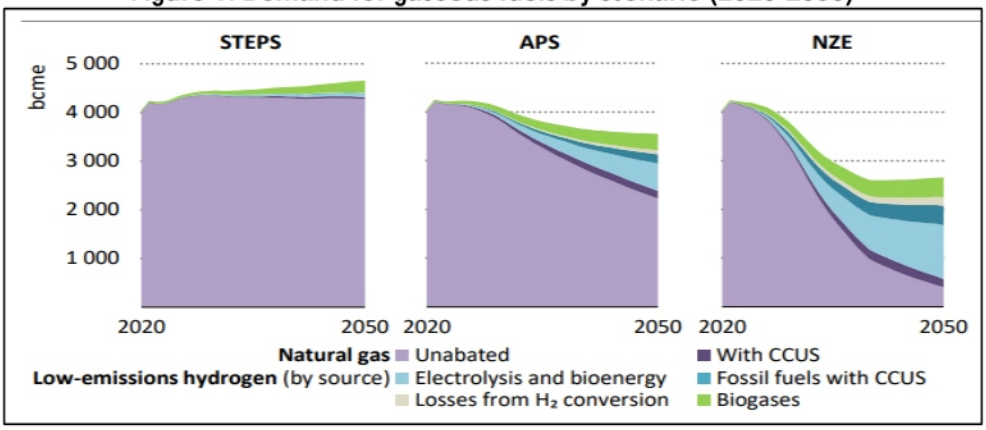
Natural Gas and LNG Analysis:

- For the first time, the IEA forecasts fossil natural gas demand to peak under STEPS. Global demand rises by less than 5% between 2021 and 2030 and then remains flat (Figure 1). The outlook for gas is dampened by continued growth of renewables and other zero emissions options (e.g. nuclear).
    - Momentum behind demand growth for natural gas in developing economies has slowed, notably in China, South Asia, and Southeast Asia. High and volatile gas prices have shifted

the prospects of coal-to-gas switching projects largely in favour of clean energy projects and have dented the credentials of gas as a transition fuel.

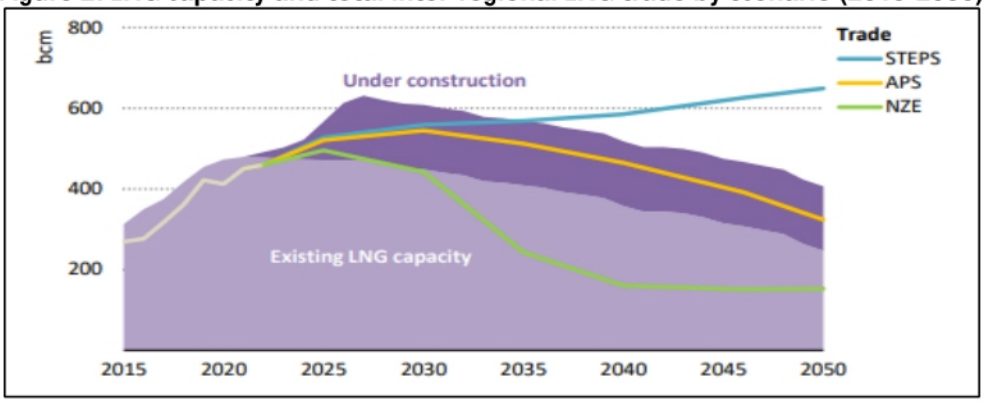
- A structural shift away from gas is underway in Europe, and in the U.S., the Inflation Reduction Act is forecast to reduce gas demand in part through heat pump deployment.

Figure 1: Demand for gaseous fuels by scenario (2020-2050)



- A global shift away from Russian gas means that LNG trade becomes even more important to overall gas security. However, the overall outlook for LNG is regionally distinct and highly dependent on the emissions scenario.
  - Under STEPS, LNG trade increases between 2021 and 2050. Under APS and NZE, LNG trade peaks before 2030 and declines to 2050 (Figure 2). No new LNG infrastructure is needed under APS and NZE.
  - In Canada, under STEPS, unconventional natural gas production is forecast to increase by 4.84bcf/d between 2021 and 2030. 40% of this production is expected to be exported as LNG, which is equivalent to a plant the size of LNG Canada Phase 1 only.

Figure 2: LNG capacity and total inter-regional LNG trade by scenario (2015-2050)



- Uncertainty around the future of LNG creates a challenging investment landscape for new projects. Most potential suppliers are looking for long term offtake agreements, which purchasers are averse to because near-term demand is unlikely to be sustained into the 2030s.
  - Under these market conditions, project economics become very challenging. The IEA highlights that of 23 recently commissioned LNG projects worldwide, LNG Canada requires the highest spot prices to recoup capital under 10 year contract supply periods.
  - LNG projects with long payback periods increase the risk of these projects turning into stranded assets

From: Hop Wo, Hilary ENV:EX (Hilary.HopWo@gov.bc.ca)
To: Kadowaki, Ryan ENV:EX (Ryan.Kadowaki@gov.bc.ca)
Cc: Dale, Daniel ENV:EX (Daniel.Dale@gov.bc.ca)
Subject: RE: Canada's Energy Future INs
Sent: 06/20/2023 19:15:15
Attachments: image001.png
Message Body:

Sounds great, and two different notes as a writing exercise sounds fine (with cliff link between). Please check with Jack about Seth's time (though as this isn't time sensitive don't think it's an issue), and with Hurrian and maybe other Jack about whether we are duplicating effort anywhere.

From: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Sent: Tuesday, June 20, 2023 12:07 PM
To: Hop Wo, Hilary ENV:EX <Hilary.HopWo@gov.bc.ca>
Cc: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Subject: Canada's Energy Future INs

Hi Hilary,

Dan had a good idea for a piece of work for Seth and Mohamed. The new Canada's Energy Future Report has been released and contains some surprising results. O&G in particular stands out. We're proposing for Seth to draft an IN on the report results more generally and for Mohamed to draft one focusing on O&G. Alternatively, we could just have one note but a deeper dive into O&G seems warranted. The notes would include commentary on how these forecasts compare to CleanBC modelling. Any concerns with us assigning these?

Thanks,

Ryan

Ryan Kadowaki

(he/him)

Senior Economic Advisor | Climate Action Secretariat

Ministry of Environment & Climate Change Strategy

Tel: 778-698-4790 | Email: ryan.kadowaki@gov.bc.ca

CLIMATE ACTION SECRETARIAT

A CLEAN, COMPETITIVE, CLIMATE-READY B.C.

From: Hop Wo, Hilary ENV:EX (Hilary.HopWo@gov.bc.ca)
To: Hudson, James ENV:EX (James.Hudson@gov.bc.ca); Turner, Jennifer ENV:EX (Jennifer.Turner@gov.bc.ca); Kadowaki, Ryan ENV:EX (Ryan.Kadowaki@gov.bc.ca); Davis, Ryan 1 ENV:EX (Ryan.1.Davis@gov.bc.ca)
Subject: Re: CER 2023 Energy Futures report
Sent: 06/21/2023 13:33:03
Message Body:

Mohamed and Seth are going to be doing notes on this. One general, one OG focused.

Get Outlook for iOS

From: Hudson, James ENV:EX <James.Hudson@gov.bc.ca>
Sent: Tuesday, June 20, 2023 10:15:42 PM
To: Hop Wo, Hilary ENV:EX <Hilary.HopWo@gov.bc.ca>; Turner, Jennifer ENV:EX <Jennifer.Turner@gov.bc.ca>; Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>; Davis, Ryan 1 ENV:EX <Ryan.1.Davis@gov.bc.ca>
Subject: fyi: CER 2023 Energy Futures report

Sending from my phone - please share with others.

Canada Energy Regulator released their 2023 net-zero scenario report...

https://apps2.cer-rec.gc.ca/energy-future/?page=landing&&mainSelection=&&yearId=&&sector=&&unit=&&view=&&baseYear=&&compareYear=&&noCompare=&&priceSource=&&scenarios=&&provinces=&&provinceOrder=&&sources=&&sourceOrder=

From: Wynes, Seth ENV:EX (Seth.Wynes@gov.bc.ca)
To: Dale, Daniel ENV:EX (Daniel.Dale@gov.bc.ca)
Cc: Kadowaki, Ryan ENV:EX (Ryan.Kadowaki@gov.bc.ca)
Subject: RE: Info Note - Canada's Energy Future 2023
Sent: 07/04/2023 23:14:17
Attachments: image001.jpg, CER Info Note Draft_SW_20230704_Draft 4.docx
Message Body:

Hi Dan,

Here are my edits back for the info note. Let me know what still needs work!

Cheers,

Seth

From: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Sent: Thursday, June 29, 2023 3:42 PM
To: Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Hi Seth,

This is looking great. I haven't worried about formatting at this stage, but we'll come to that in the final round of edits. Typically Appendices are just added to the same document, so I've copied everything into one document.

I think the ways you have presented the net zero scenarios works well and the edits you made look good. I've done of bit of editing myself, but mostly just in the key facts section. Have a look through and don't be alarmed at how many edits get made to these notes – it is typical for the final version to look nothing like the first version. Also, feel free to edit my edits.

If we could get this wrapped up by Tuesday that would be great.

-Dan

From: Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Sent: Wednesday, June 28, 2023 3:52 PM
To: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Hi Dan and Ryan,

Pleased find my latest revised draft attached here. I've tried to focus my edits on adding more content relevant for BC and more details on the evolution of the energy mix.

Dan you suggested s.13
s.13

s.13 Let me know which you'd like and I can streamline the paper to focus on it.

I've added an appendix with some figures and the table. Let me know if you like them (I had to do a little editing to make BC versions presentable) as I added more than necessary to give you the freedom to choose between them. Also note that I'm not sure how the appendix should be formatted.

There are a few things I'd fix up with more time but I have a couple other things to do before end of day so I will leave it there.

Cheers,

Seth

From: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Sent: Tuesday, June 27, 2023 11:45 AM
To: Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Sorry my fault :| Forgot to attach the document…

From: Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Sent: Tuesday, June 27, 2023 11:44 AM
To: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Hi Dan,

Great I can get to work quickly. You mentioned comments – is it saved somewhere on the drive? I'm not seeing an attachment.

Thanks,

Seth

From: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Sent: Tuesday, June 27, 2023 11:34 AM
To: Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Hi Seth,

Thanks for the note. This is a great start and it reads well. Ryan and I have provided a number of comments within and I think the main takeaway is to s.13
s.13

Let's keep the momentum going on this and try to get edits done in a couple of days. There are times where this kind of IN would be expected on a 1-2 day timeline so it's good practice to write fairly quickly.

Also, this note can be prepared for Jeremy (ADM).

Thanks,

Dan

From: Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Sent: Friday, June 23, 2023 10:49 AM
To: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Hi Dan and Ryan,

I've attached my first draft of the info note. This was fun to work on – looking forward to seeing how I can improve it!

Cheers,

Seth

From: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Sent: Tuesday, June 20, 2023 12:46 PM
To: El Hannach, Mohamed ENV:EX <Mohamed.ElHannach@gov.bc.ca>; Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: Info Note - Canada's Energy Future 2023

Hi Mohamed, Seth

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If you are able to get something to us by Friday that would be awesome.

And let me know if you have any questions.

-Dan

Daniel Dale

Senior Economic Analyst

Clean BC Implementation | Climate Action Secretariat

Ministry of Environment and Climate Change Strategy

236.478.1917 | daniel.dale@gov.bc.ca

Page 090 of 125 to/à Page 109 of 125

Withheld pursuant to/removed as

s.13

From: Dale, Daniel ENV:EX (Daniel.Dale@gov.bc.ca)
To: Kadowaki, Ryan ENV:EX (Ryan.Kadowaki@gov.bc.ca); El Hannach, Mohamed ENV:EX (Mohamed.ElHannach@gov.bc.ca)
Subject: RE: Info Note - Canada's Energy Future 2023
Sent: 06/27/2023 19:31:54
Attachments: image001.png, image002.png, image003.png, image004.jpg, Cliffnumber_IN_2023_Oil and Gas in CER2023 Report-RK DD.docx
Message Body:

Hi Mohamed,

Thanks for this. I've added some comments as well. I generally agree with Ryan's comment and have added some of my own to the note.

There is still a decent amount to do on this and Ryan's point on distilling the key ideas and focusing on the "so what?" of the report is probably the main thing to keep in mind - when I am editing I like to put myself in the Minister's shoes to try and appreciate what is actually important and what is just unnecessary detail etc.

If you get a second version of this ready to go in week's time, that would be great.

Thanks,

Dan

From: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Sent: Monday, June 26, 2023 3:46 PM
To: El Hannach, Mohamed ENV:EX <Mohamed.ElHannach@gov.bc.ca>; Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Hi Mohamed,

Thanks for the start on this. It's always a fine line in these notes between not wanting to assume the reader knows things but also not getting too into the weeds. This can be challenging to navigate. Some comments below and attached.

-Ryan

From: El Hannach, Mohamed ENV:EX <Mohamed.ElHannach@gov.bc.ca>
Sent: Monday, June 26, 2023 12:33 PM
To: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: RE: Info Note - Canada's Energy Future 2023

Hi Dan,

I have attached a first draft of the info note.

When I get to the discussion section, I realized I should have asked about the audience of the note and the desired scope.

Should I expand more on the CER report background? How are they familiar with the LNG facilities?

I think's important to include some background context on CEF (mention it's an annual report; purpose of the report, etc). I think due to the high profile of LNG that the reader will be familiar with proposed facilities.

There are interesting comparison to make between Navius modeling and the CER report methodology. Mainly that they input assumption about oil and gas prices and LNG production rates. In out model we calculate those numbers in the model. This allow up to explore the impact of different policies on those metrics. In the CER report, LNG outputs are assumed to be different for each scenarios. Their model can predict the production of NG and the demand by different sectors (industrial, commercial, residential and transportation).

I wasn't sure if I should include these into the discussion and show some details about their predictions. For example I can include the results about how the natural gas demand evolved under different scenarios: the portion of industrial use of NG increases under Canada Net-Zero.

I would include this analysis.

I can also have more detailed discussion around the residential price of natural gas and how that is impacted by the different scenarios.

I would include this analysis.

In terms of comparing to Navius results about NG prices, the prices are in 2022US$ in the CER report. I am not if we have a standard way to convert them.

There's not really a standard but we'd want in Canadian dollars so might be easiest to convert to 2015$CDN?

Please let me know what do you think of the note, I can shorten or expand on different points as needed.

I would focus on distilling down ideas as much as possible. Where possible, leave out modelling details and caveats unless they jeopardize the meaning. Key facts and Discussion sections should focus on the "so what?" of the report, what is surprising, what is important from a BC context, does analysis agree/contrast with Navius, any pros/cons of their methodology?

Thanks,

Mohamed

I think these could be added as an appendix. You could add CleanBC from the Navius results to the line graph.

From: Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Sent: Tuesday, June 20, 2023 12:46 PM
To: El Hannach, Mohamed ENV:EX <Mohamed.ElHannach@gov.bc.ca>; Wynes, Seth ENV:EX <Seth.Wynes@gov.bc.ca>
Cc: Kadowaki, Ryan ENV:EX <Ryan.Kadowaki@gov.bc.ca>
Subject: Info Note - Canada's Energy Future 2023

Hi Mohamed, Seth

I'm wondering if you could both spend some time this week unpacking the CER's latest release of the Canada?'s Energy Future report and put together information notes (IN) on the key findings

from this report. Mohamed, your note should focus on what this report is saying as it relates to the BC oil and gas sector and the 2030 emissions cap work. What is the future for oil and gas in a net zero environment? What jurisdictions are hardest hit? How do the CER results compare to B.C. results (different assumptions will be used so you'll need to be clear on that). You can compare against the Navius oil and gas cap run as needed. I've taken a very quick look and have picked out one finding that I think others will want to know about:

- The CER has 8.64bcf/d of BC natural gas production in 2030 under their Canada Net Zero scenario. In the Current Measures scenario, production is 8.62bcf/d. Production peaks in 2031 under Canada Net Zero but does not peak under Current Measures. The Canada Net Zero Scenario includes the federal oil and gas cap policy, while the Current Measures scenario does not.

Seth, your note should be broader (and lighter on the oil and gas details) and focus more generally on the what the scenarios are saying about the path to net zero by 2050. What sectors reduce emissions on what timelines? What technologies are deployed? What's the role of DAC?/BECCS? And importantly, how do the CER's scenarios compare to what is happening and/or modelled to happen in B.C. under CleanBC? If you would like to compare the CER's results against B.C's model results, I would use the latest CleanBC run (2022-10-31 results)

These CER reports usually contain a ton of information and I find the data appendix to be quite helpful when looking for key stats to pull out.

I don't think either of you have had the opportunity to write an info note before (template is on the right hand side of this intranet page) but general guidance is to write concisely, be clear on the scenarios/assumptions if needed, and to focus on the key points that are likely relevant to policy makers. I've attached a few examples of notes that I've written that synthesize other large reports and you can find additional IN examples in the briefing notes folder here. If you can keep it to two pages that would be great but it's not a strict requirement. Typically, IN's go through many rounds of edits before they are finalized so just expect that. Ryan and I can work with you to tighten up the content once you have drafts.

If you are able to get something to us by Friday that would be awesome.

And let me know if you have any questions.

-Dan

Daniel Dale

Senior Economic Analyst

Clean BC Implementation | Climate Action Secretariat

Ministry of Environment and Climate Change Strategy

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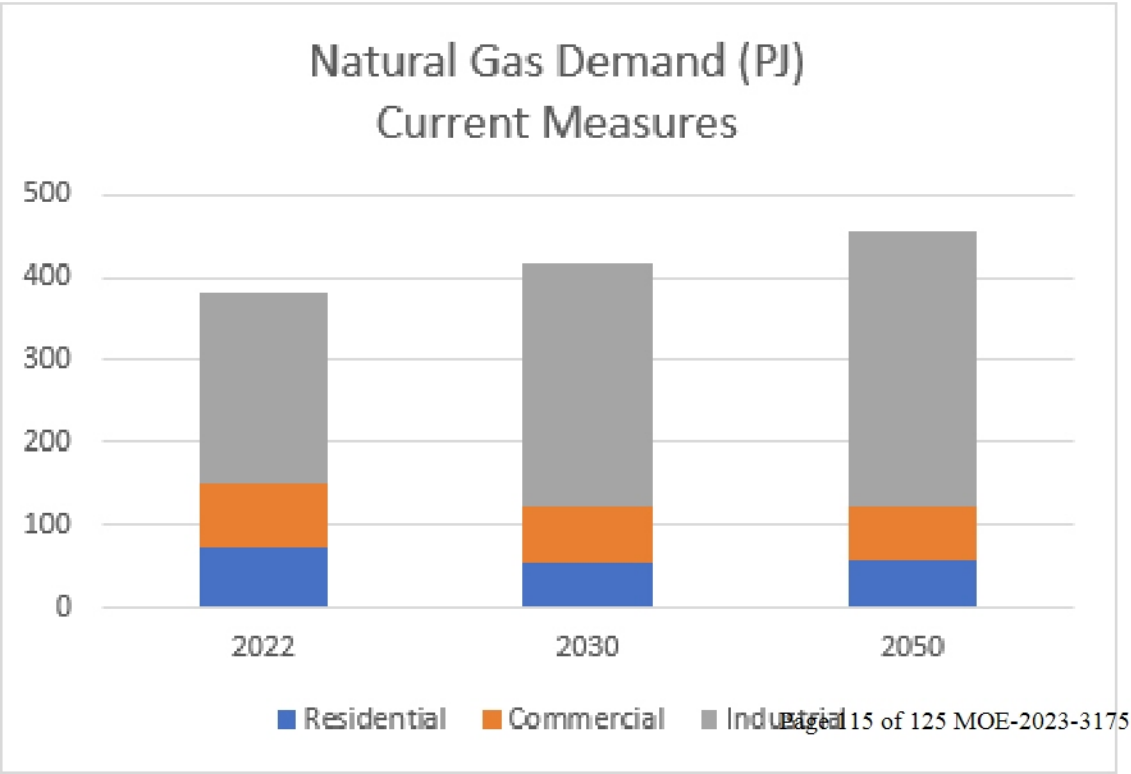
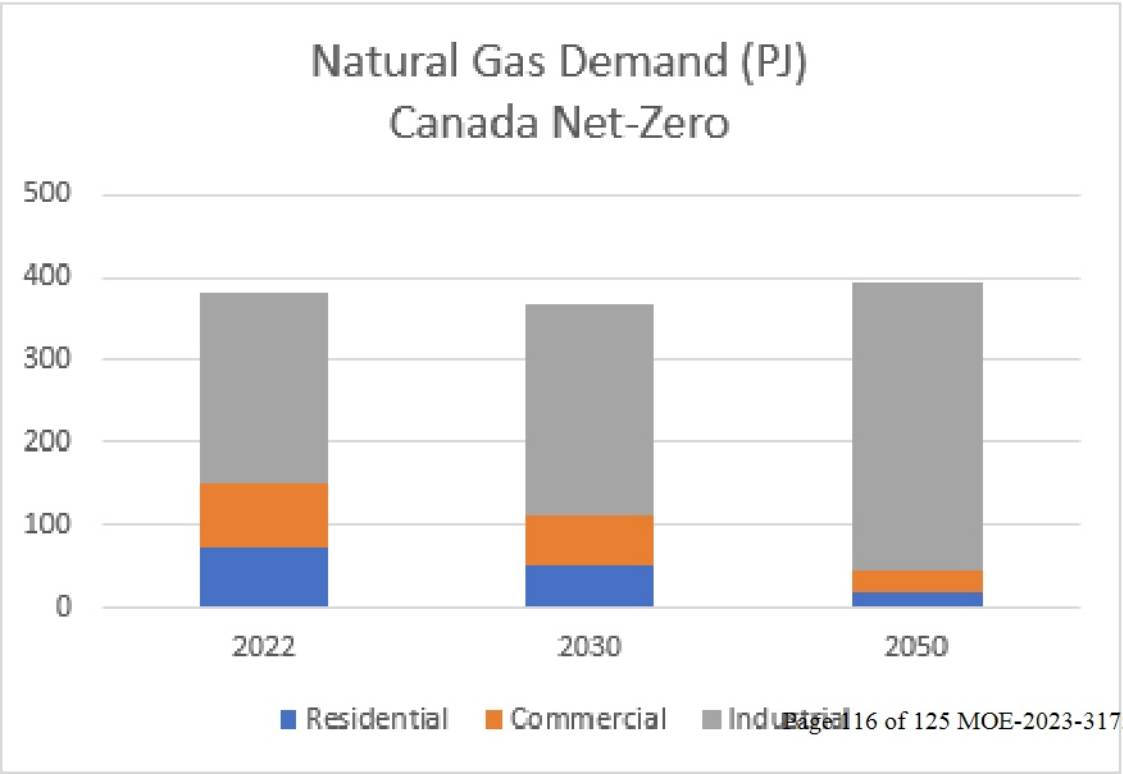
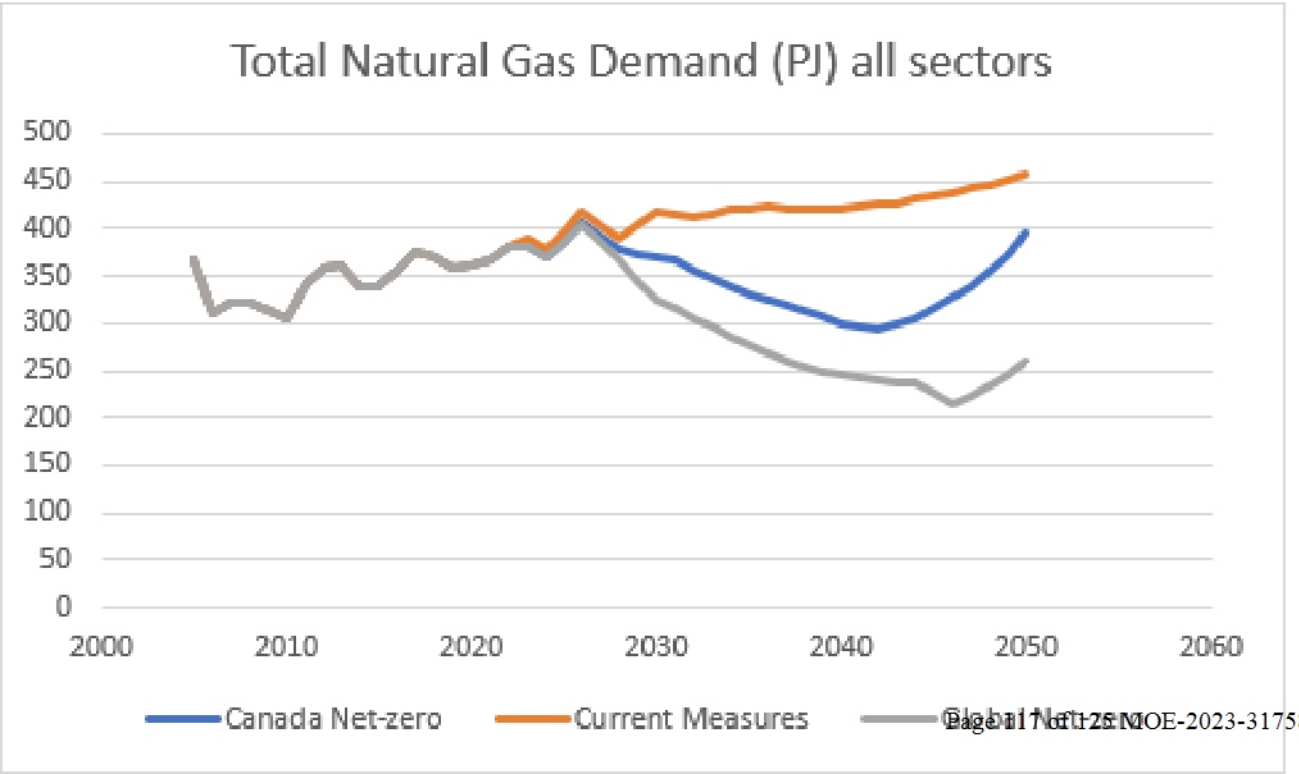

Natural Gas Demand (PJ)
Current Measures
500
400
300
200
100
0
2022
2030
2050
Residential
Commercial
Industrial


Natural Gas Demand (PJ)
Canada Net-Zero
500
400
300
200
100
0
2022
2030
2050
Residential
Commercial
Industrial


Total Natural Gas Demand (PJ) all sectors
500
450
400
350
300
250
200
150
100
50
0
2000
2010
2020
2030
2040
2050
2060
Canada Net-zero
Current Measures
Global Net-zero

Page 118 of 125 to/à Page 120 of 125

Withheld pursuant to/removed as

s.13

From: Dale, Daniel ENV:EX (Daniel.Dale@gov.bc.ca)
To: Kadowaki, Ryan ENV:EX (Ryan.Kadowaki@gov.bc.ca)
Subject: FW: CER-Canada's Energy Future 2023 Report
Sent: 06/20/2023 23:38:19
Attachments: image001.png, Energy Future 2023_Bullets.docx
Message Body:

EMLI's bullets…kind of just summarizes the executive sumamary

From: Peyman, Hurrian ENV:EX <Hurrian.Peyman@gov.bc.ca>
Sent: Tuesday, June 20, 2023 4:35 PM
To: El Hannach, Mohamed ENV:EX <Mohamed.ElHannach@gov.bc.ca>; Dale, Daniel ENV:EX <Daniel.Dale@gov.bc.ca>
Subject: FW: CER-Canada's Energy Future 2023 Report

Here's their version

From: Fradley, Adria N ENV:EX <Adria.Fradley@gov.bc.ca>
Sent: Tuesday, June 20, 2023 4:05 PM
To: Peyman, Hurrian ENV:EX <Hurrian.Peyman@gov.bc.ca>
Subject: FW: CER-Canada's Energy Future 2023 Report

Opps – hit send to fast

From: Fradley, Adria N ENV:EX
Sent: Tuesday, June 20, 2023 4:05 PM
To: Sotoudehnia, Maral ENV:EX <Maral.Sotoudehnia@gov.bc.ca>; Fleming, Chris S ENV:EX <Chris.S.Fleming@gov.bc.ca>; Hart, Shelby ENV:EX <Shelby.Hart@gov.bc.ca>; Copage, Caitlin ENV:EX <Caitlin.Copage@gov.bc.ca>
Subject: FW: CER-Canada's Energy Future 2023 Report

FYI – the last line is useful for us!

From: Urwin, Mark EMLI:EX <Mark.Urwin@gov.bc.ca>
Sent: Tuesday, June 20, 2023 3:55 PM
To: MacLaren, Les EMLI:EX <Les.MacLaren@gov.bc.ca>; Hewitt, Jeremy ENV:EX <Jeremy.Hewitt@gov.bc.ca>; Foster, Doug FIN:EX <Doug.Foster@gov.bc.ca>; Fradley, Adria N ENV:EX <Adria.Fradley@gov.bc.ca>; Gilmore, Christopher EMLI:EX <Christopher.Gilmore@gov.bc.ca>; Gosman, Nat EMLI:EX <Nathaniel.Gosman@gov.bc.ca>; Coley, Simon J EMLI:EX <Simon.Coley@gov.bc.ca>; Copage, Caitlin ENV:EX <Caitlin.Copage@gov.bc.ca>
Subject: Fwd: CER-Canada's Energy Future 2023 Report

FYI

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From: Jugpal, Inzel EMLI:EX <Inzel.Jugpal@gov.bc.ca>
Sent: Tuesday, June 20, 2023 16:42
To: EMLI Oil and Gas Division <EMOGDDL@Victoria1.gov.bc.ca>
Subject: CER-Canada's Energy Future 2023 Report

Good afternoon,

Today the Canada Energy Regulator released Canada's Energy Future 2023, a report that explores how possible energy futures that focus on how achieving net-zero emissions might unfold for Canadians https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/

Summary bullets are attached for your reference.

Inzel Jugpal (she/her)

Senior Policy Analyst, International Energy
Energy Information and Analysis Branch

Oil and Gas Division

Inzel.Jugpal@gov.bc.ca


BRITISH
COLUMBIA
Ministry of
Energy, Mines and
Low Carbon Innovation

Energy Information and Analysis Branch

Date: June 20, 2023

ENERGY FUTURE 2023 REPORT FROM THE CANADA ENERGY REGULATOR-SUMMARY BULLETS

- Canada's Energy Future 2023 (EF2023) is the latest long-term energy outlook from the Canada Energy Regulator. EF2023 explores how possible energy futures might unfold for Canadians over the long term at the request of Honourable Jonathan Wilkinson, Minister of Natural Resources. It covers supply and demand dynamics across all commodities and provinces.

- EF2023 focuses on achieving net-zero emissions by 2050. The analysis models the Canadian energy system in a global context where the world limits global temp increases to 1.5C.

- EF2023 considers three scenarios:
  - Global Net Zero-This scenario assumes Canada meets net zero emission by 2050 and does so in a global context where the rest of the world is taking ambitious measures to limit global temperatures to 1.5C. In effect, a net zero planet.
  - Canada Net-Zero-This scenario assumes Canada still meets the targets for 2050 but the pace of climate action globally is slower than in the Global Net-Zero scenario.
  - Current Measures (Business as usual)-This scenario considers only the measures currently in place domestically and assumes limited future action globally. Modeled on policies currently in place (as of March 2023).

- In addition to the three main scenarios in EF2023, there are five 'What if" cases in this report that explore some uncertainties on the pathway to net-zero:
  - What if the technologies to enable wide-scale adoption of hydrogen are costly?
  - What if small modular reactor (SMR) technology matures less quickly and is more costly?
  - What if direct air capture (DAC) technology matures more quickly and is less costly?
  - What if carbon capture, utilization, and storage (CCUS) technology does not mature as quickly and is more costly?
  - What if electricity vehicle charging patterns result in higher peak electricity demand?

- Modeling exercise is focused on Canadian energy system at the national level. For the two net zero scenarios it includes policies that have been announced but not yet implemented. The report relied on International Energy Agency Net Zero by 2050 for inputs and assumption on global energy systems.

- Analysis doesn't consider affordability impacts of transition for consumers and assumes there are no constraints in adoption of technologies.

- In both net-zero scenarios, the types of energy Canadians use changes dramatically, including using a lot more electricity and reduced fossil fuels. The energy mix is more diversified than today. The electricity system is assumed to decarbonize by 2035 and is the backbone of the net-zero scenarios.

- Primary demand-the total amount of energy used in Canada falls in both net-zero scenarios as a result of declining fossil fuel use. Natural gas demand declines in the net-zero scenarios and increases in the current measures scenario.

- In all three scenarios, energy use increases in the near term. In the long term, energy use falls in both net-zero scenarios.

- In both net-zero scenarios fuel switching is essential to achieve net-zero. Heat pump use increases for residential and commercial uses but some gas and oil furnaces remain.

- Emerging technologies such as Hydrogen and Carbon Capture Utilisation and Storage, nature-based solutions play a key role in net zero scenarios in the industrial sector.

- The transportation sector sees an increased use of electric vehicles and reducing emissions from ICE vehicles in all scenarios.

- Canada's oil and natural gas industry significantly reduce its emissions in both net-zero scenarios, and while production declines, the pace of global climate action determines by how much. Energy use in the oil and gas sectors grows in all three scenarios in the near term.

- Distinction in the net-zero scenarios for Canada-prices of Oil & Gas in the global Net-Zero scenario are significantly lower than today. In the Canada net-zero scenario where global demand for commodities is higher than in the global net-zero scenario, the global demand is supportive of higher prices. This creates an incentive for Canadian O&G producers to mitigate emissions from their production.

- Reaching net-zero is driven by increasingly strong climate policies in Canada across all sectors to limit and reduce emissions.