

Minister of Energy
and Natural Resources



Ministre de l'Énergie et
des Ressources naturelles

Ottawa, Canada K1A 0E4

November 9, 2023

Yves Giroux
Office of the Parliamentary Budget Office
PBO-DPB@parl.gc.ca

Dear Yves Giroux:

Thank you for your correspondence of October 27, 2023, regarding IR0716 on carbon capture, utilization and storage (CCUS), as well as IR0717 on the list of projects—either planned, proposed or currently operating—in hydrogen production or hydrogen transformation to ammonia.

It is my pleasure to provide you with information on the majority of the items that you requested under both IR0716 and IR0717. The information we are providing for IR0716 for CCUS projects can be found in Enclosure 1, and the information for IR0717 for hydrogen projects can be found in Enclosure 2.

As discussed with officials from the Office of the Parliamentary Budget Officer, both lists provided in Enclosure 1 and Enclosure 2 are exhaustive as of November 3, 2023. They have been compiled, and updated regularly, by officials in my Department from:

- public sources such as project announcements;
- knowledge-sharing reporting from the Government of Alberta;
- other existing databases such as from Wood Mackenzie;
- confidential project applications to government programs such as the Energy Innovation Program, Clean Fuels Fund, and Strategic Innovation Fund – Net-Zero Accelerator;
- confidential project applications shared by Emissions Reduction Alberta and Alberta Innovates, who are trusted partners of Natural Resources Canada;
- information voluntarily provided to officials in my Department from project proponents, including confidential information provided through non-disclosure agreements.

All information provided at this stage is based on data gathered from the sources listed above and contains no analysis to derive estimates. Any information that is not known or not available has been left blank. In the case of CCUS projects, for additional infrastructure

Canada

needs specifically, the table includes all known additional infrastructure but may be missing some infrastructure.

For low-carbon hydrogen production projects that are deriving their hydrogen from natural gas and using CCUS, we have provided all information related to the hydrogen production aspects in Enclosure 2 and all the information related to CCUS in Enclosure 1.

Enclosure 1 – CCUS Projects

The CCUS project list includes information for nearly 90 projects, of which 7 are operating and the remainder are either announced, under early construction, not yet public, or under development. The information is all derived from confidential submissions. The following information and its inclusion in this response are as follows:

- Company name – *available, not included due to confidentiality considerations;*
- Location of the project – *available, not included due to confidentiality considerations;*
- Annual amount of CO₂ captured (Mt) – *available and included for 77 projects;*
- Annual net emission reductions (Mt) – *available and included for 3 projects;*
- Sector (i.e., power/heat facilities, natural gas processing, biofuels, etc.) – *available and included;*
- Fate of the carbon (i.e., dedicated storage, enhanced oil recovery, etc.) – *available and included for 50 projects;*
- Project type, that is, whether it falls under – *available and included for 87 projects:*
 - investment in equipment to capture CO₂ in direct air capture projects;
 - investment in equipment to capture CO₂ in all other CCUS projects;
 - investment in equipment for transportation, storage and use.
- For each project, we ask for the annual profile from 2020 onwards of:
 - Amount of CO₂ captured (Mt) – *available and included for 77 projects;*
 - Capital Expenses (CAPEX) broken down into the categories associated with – *included, available partially for 54 projects:*
 - Capture;
 - Transportation, sequestration/storage, and/or use;
 - All other CCUS.
 - Operating Expenses (OPEX) broken down into the OPEX associated with capture, transportation, sequestration, use and all other CCUS projects – *included partially for 3 projects, otherwise not available;*
 - Expected public support incentives – *available and included;*
 - Are there any additional infrastructure needs required for the project to proceed. If so, the requirements and the profile of the additional infrastructure needs (CAPEX and OPEX) – *included partially for 10 projects as available;*
 - If the project is for use, what will be the share of CO₂ for use (%) and the share of CO₂ for storage (%) – *included for 45 projects;*

- If re-release is possible, what portion of used CO₂ do you expect to remain permanently sequestered (%) – *not included as not available*;
- Proportion of dual use heat and/or power equipment and water use equipment – *not included as not available*.

The table includes one tab that contains all projects, with those operating clearly indicated. For confidentiality reasons, the project and company names have been removed.

Enclosure 2 – Hydrogen Projects

We include information for over 100 projects, of which 12 are operating and the remainder are either announced, under early consideration, not yet public, or under development.

For the case of hydrogen projects under IR0717, the following information and its inclusion in this response are as follows:

- Project name – *included*;
- Company name – *included*;
- Location of the project – *included*;
- Status of the project – *included*;
- Project type, hydrogen production or hydrogen conversion to ammonia – *included for 101 projects*;
- Technology: natural gas with CCUS, electrolysis, others – *included for 123 projects*;
- The type of electricity source for electrolysis; if renewable, the type of renewable – *included for 63 of 87 electrolysis projects*;
- For projects using electrolysis, type of electrolysis technology (Alkaline, proton exchange membrane electrolysis, solid oxide electrolysis cells) – *not included*;
- For projects using natural gas with CCUS, the rate of CCUS – *included for 9 of 24 projects*;
- Additional infrastructure needs required for the project to proceed, and if so, profile of additional infrastructure needs (CAPEX and OPEX) – *not available*;
- CAPEX – *included for 83 projects; please see notes below*;
- Expected public support incentives – *included for 27 projects*;
- Anticipated start of construction – *not available*;
- Actual or anticipated start date of operation – *included for 67 projects*;
- OPEX – *included for 1 project*;
- Proportion of dual use heat/and or power equipment and water use equipment – *not available*.

The table includes two tabs: the first is for announced or under development projects the Department is aware of, while the second is for operating low-carbon hydrogen production

projects. We have noted the areas where there are discrepancies in the data, such as sources that provide divergent figures.

The information provided in both enclosures is the most up to date known by my Department at this point in time. In many cases, announced projects may be at an early stage and certain details you have asked for, such as CAPEX, may not yet have been determined by the proponents. Furthermore, the CAPEX provided are uncertain, with an accuracy of -50%/+100%. Some projects are also expected to be multi-phased, with phases coming online at different times and not all information for all phases available at this time. The low-carbon hydrogen and CCUS sectors are dynamic, and proponents change project information regularly as this emerging market develops.

Information related to OPEX is not included as it is not available. The majority of hydrogen projects are not likely to have estimated OPEX themselves, given their early stage of development.

Moreover, we are unable to provide information related to the proportion of dual use heat and/or power equipment and water use equipment, as well as the portion of CO₂ that we expect to remain permanently sequestered.

With regard to your request to list expected public support incentives, we note that all of the electrolysis and natural gas with CCUS projects in the announced or under consideration project tab are expected to be eligible to apply for the Clean Hydrogen Investment Tax Credit. As details of this credit are currently under development—including details related to how projects will be calculating their projects' lifecycle carbon intensity, or whether they will be able to achieve the credit's wage and labour provisions—we are currently unable to determine the level of credit (40%, 25%, 15%, or none) that each project would receive, if they were to apply. The same would apply for CCUS projects with respect to the CCUS Investment Tax Credit.

Similarly, many of these projects may be eligible to apply to the other tax credits announced in Budget 2023, to cover certain areas of equipment they expect to use in their facility. This includes:

- the Clean Electricity Investment Tax Credit or Clean Technology Tax Credit, which could provide up to 30% credit on electricity generation systems used for electrolysis, such as wind or solar; and
- the Clean Technology Manufacturing Credit, which could provide up to 30% for new machinery to manufacture technologies, including manufacturing of electrolyzers.

As with the Clean Hydrogen Investment Tax Credit, levels of potential support of each of these tax credits to each of the projects submitted to you has not been calculated, with

details still to be finalized and as projects will decide how best to utilize any of the available tax credits.

Some of the projects may also be eligible to receive credits generated via Canada's *Clean Fuel Regulations*. These regulations require fossil-based transportation fuels to reduce carbon intensity by 15% (compared to 2016) by 2030. The regulations establish a credit market for regulated parties (producers and importers). Credits are proportional to the carbon intensity of the hydrogen that is used. The following uses of hydrogen could create *Clean Fuel Regulations* credits:

- hydrogen used as a fuel or feedstock in the production of liquid fossil fuels;
- hydrogen used as a fuel or feedstock at a low-carbon intensity fuel production facility;
- hydrogen used as a fuel in stationary applications (e.g., hydrogen injected in natural gas pipelines). This use of hydrogen creates gaseous credits, which can only be used by regulated parties to satisfy up to 10% of their annual obligations; and
- hydrogen supplied for use in transportation (e.g., refuelling hydrogen fuel-cell vehicles).

I trust that you will find this information helpful.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Jonathan Wilkinson', written in a cursive style.

The Honourable Jonathan Wilkinson, P.C., M.P.
(he/him/il)

Enclosures: (2)