Investment Tax Credit for Carbon Capture, Utilization, and Storage

Consultation Response

Megan R. Bailey,[1] Blake Shaffer,[2] Jennifer Winter[3]

The University of Calgary, School of Public Policy

This document is in response to the open consultation process on the proposed federal CCUS investment tax credit (ITC). We provide a framework, from an academic perspective (employing theory and empirical evidence from economics and public policy analysis), that can be applied to craft legislation, using the government's responses from other stakeholders. Using this framework, we provide comments and recommendations for the design and magnitude of the CCUS ITC, given the government's stated goals and other potential reasons for the policy related to the markets for CCUS.[4]

In particular, we recommend the government consider whether a CCUS ITC is the best use of public resources, given barriers to CCUS adoption. If the government does pursue a CCUS ITC, we recommend the government use known or suspected market failures and other issues with CCUS adoption to guide the ITC's magnitude, as well as design features to avoid problems such as double-counting of emissions reductions.

The stated goal of the CCUS ITC is to facilitate emissions reductions (specifically, 15 megatonnes of CO_2 per year). Additionally, Budget 2021 outlines that the tax credit should support CCUS-related businesses and jobs. Finally, Budget 2021 describes independent support for CCUS (over $319 million to Natural Resources Canada), and the call for consultation on the proposed CCUS ITC refers to the need for CCUS investment to facilitate CCUS R&D.[5]

---

[1] Corresponding author, Assistant Professor at the Haskayne School of Business and the School of Public Policy, University of Calgary, megan.bailey@ucalgary.ca

[2] Assistant Professor, the Department of Economics and the School of Public Policy, University of Calgary

[3] Associate Professor, the Department of Economics and Scientific Director of the Energy and Environmental Policy research division at the School of Public Policy, University of Calgary

[4] We are responding to the call for consultation open until Sept. 7, 2021, found here: https://www.canada.ca/en/department-finance/programs/consultations/2021/investment-tax-credit-carbon-capture-utilization-storage.html This version contains some small corrections from the submitted version. We acknowledge that this response has benefitted from useful conversations with Silvia Rozario.

[5] The CCUS policies in the Budget 2021 can be found here: https://www.budget.gc.ca/2021/report-rapport/p2-en.html#114

Reducing emissions

First-best policy for incentivizing and achieving greenhouse gas (GHG) emissions reductions includes market-based tools that reward marginal emissions reductions, including carbon taxes, cap-and-trade systems, and subsidies for emissions reductions.[6,7] Notably, the federal government has already established such policy through the Greenhouse Gas Pollution Pricing Act.[8] Negative emissions technologies or measures such as CCUS could be included in a carbon pricing system through issuance of tax credits, emissions allowance permits or subsidies for emissions removal, if they are not already included via emitters' accounting and verification of emissions. Incentives should be based on marginal emissions reductions as per the social cost of carbon (SCC).[9] The SCC is a measure of the future climate damages of an additional tonne of emissions, or the benefit of reducing emissions by one tonne.

Investment tax credits (ITCs), therefore, are not first-best policy tools for emissions reductions. In general, economists recommend that policies be crafted to directly and cost effectively address specific market failures and that one policy be used for one market failure. Use of an ITC implies there is some issue with relevant markets for investment that lead to underinvestment (perhaps for a specific technology or suite of technologies). Even if not appropriate for emissions reductions, a CCUS ITC may be justified by a number of additional market failures affecting firms' adoption of this technology. (However, it may not be the first-best policy for addressing these issues.) In particular:

1. <u>Project cost structure</u>

CCUS technology requires large upfront investments above and beyond the project costs for greenfield and brownfield projects.[10] Technology with such costs is inherently more risky for firms than technology with lower upfront costs, due to the potential inability to recover sunk costs with future revenue. Therefore, firms will generally have higher financing costs for CCUS technology than prospective alternatives with lower upfront costs; this leads to a larger needed return for these investments (IEA and NEA, 2020).

The first-best solution to this issue is the use of contracts that guarantee enough revenue to justify investment costs, including long-term contracts, which may or may not need to be facilitated by government. This allows firms to have a guaranteed revenue stream to recuperate upfront costs over an acceptable time frame. Investment tax credits can also resolve this issue, depending on the magnitude and timing of the credits that firms receive compared to project costs. However, if the value of the

---

[6] "First-best" policy is policy that maximizes social welfare. This involves maximizing social net benefits from a policy change, total benefits minus costs. Market-based policies are first-best for addressing climate change if their stringency (the tax rate in a carbon tax system, emissions cap in a cap-and-trade system, or subsidy rate for reducing emissions) reflects the marginal external damages from GHG emissions, because they minimize the cost of achieving emissions reductions (Montgomery, 1972). An aspect of maximizing social welfare through policy is choosing policy that minimizes market distortions.

[7] "Carbon" and "emissions" used throughout this document refer to greenhouse gas in CO_2-equivalent units.

[8] https://laws-lois.justice.gc.ca/eng/acts/G-11.55/page-1.html

[9] The SCC is an evolving metric. We recommend the latest estimates from Carleton and Greenstone (2021).

[10] Greenfield projects are those that are new facilities, whereas brownfield projects are investments adding to existing facilities. In the case of CCUS, greenfield would be a new facility with integrated CCUS technology; brownfield would be an investment to add CCUS to an existing facility.

technology—its future revenue stream—is from emissions reduction, an ITC is an upfront subsidy for emissions reductions in lieu of marginal pricing. This warrants a number of considerations:

A. The subsidy should be based on the emissions reductions achieved by the investment, not its cost. The calculation of expected emissions reductions must involve some projections and include the expected value of emissions reductions over time (from the SCC). Compared to carbon pricing, this imposes an information burden on the government to determine appropriate compensation. (If an ITC is resolving other market failures, the value of that should also be included in the subsidy. We discuss in more detail below.)
B. Does the federal government want to use a subsidy instead of a tax for emissions reductions from certain technologies? This involves a budgetary trade-off as well as potential accounting costs, as per (A) above. Additionally, technology-specific subsidies are less likely to be as cost effective as technology-neutral policy.
C. We note that many emissions-intensive and trade-exposed sectors already receive an implicit subsidy through federal or provincial output-based pricing systems or free allocation of emissions permits in cap-and-trade systems. There are potential interactions between these subsidies and a CCUS ITC that should be considered.
D. There is the potential for firms (and governments) to double-count emissions reductions, if firms in sectors already in the scope of a carbon pricing scheme are eligible for an ITC, and appropriate tracking/accounting measures are not put in place to prevent double-counting. Given the existence of the federal carbon price system, it is unclear whether an ITC for CCUS will achieve additional emissions reductions, though it will involve increased public cost.
E. Depending on a firm's pre-existing tax liability, there may be an upper limit to the magnitude of tax credit firms can claim. This upper limit may or may not allow an ITC to provide enough value to firms to resolve the investment's cost recovery requirements. Or, firms may choose to enter tax equity partnerships to claim an ITC over their full investment. This can raise the investment cost for firms (Aldy, 2013).
F. The "picking winners" problem: Subsidizing specific emissions-reduction technologies can be less cost effective than allowing firms to choose their own emissions abatement and negative emissions activities, depending on what firms would pursue under carbon pricing and correction of all other market failures (Fankhauser et al., 2010). Technology-specific support has the potential to also alter innovation incentives away from those that would lead to the suite of socially optimal technologies (Bailey, 2020).
G. A difference between private and public discount rates (due to differences in private and public actors' time value of money and opportunity costs) implies that an upfront subsidy provides more value to producers than it costs to the government, particularly for investments that have a long payback period (Newell et al., 2019).
H. Will an upfront subsidy such as an ITC actually reward emissions reductions? As discussed above, policy not directly connected to the market failure or desired social outcome of interest has the potential to create distorted incentives and outcomes (Newell et al., 2019). In the case of an ITC, unless investment and emissions reductions are linked, the policy could reward investment and fail to achieve desired emissions reductions.

2. Policy uncertainty

If a firm's revenue for a given investment is tied to public policy (for example, credits for emissions reductions from CCUS are tied to a carbon pricing system), uncertainty over the existence or stringency of the policy leads to uncertainty over revenue tied to the investment (Fellows et al., 2021). In economics, this is an example of the "hold-up" problem, in which the return on investment can be subject to future negotiations or policy changes (Hermalin and Katz, 2009). Contracts that guarantee enough revenue to justify investment costs, including long-term contracts, are considered the first-best solution for the hold-up problem (Rogerson, 1992). However, when the problem arises from policy uncertainty, contracts might need to take a particular form, such as public-private contracts.[11] This of course could have federal budgetary implications.

As with resolving the large upfront cost problem, an ITC is a viable policy choice for resolving firms' concerns with policy uncertainty. Considerations are identical to those above.

3. Market failures in the finance market for CCUS technology

The above two issues, the large upfront costs of CCUS projects and uncertainty regarding future climate policy, impact the ability of firms to recuperate the costs of a CCUS investment. Therefore, they also impact firms' ability to obtain financing for CCUS projects. Prospective lenders may not be willing to finance CCUS due their relatively high probability of economic loss. Or, they may require high interest rates or other undesirable terms that increase costs or otherwise make financing unattractive for firms. If unresolved, these issues increase the cost of the project even more, increasing the revenue requirement for CCUS investments to be financially viable for firms.

Independent of these issues, there may exist failures in the market for finance of CCUS-like projects. As a baseline, credit markets suffer from asymmetric information (borrows have more information about their ability to pay back loans, for example, than lenders). This leads to adverse selection (the pool of borrowers attracted by a given set of financial terms have, on average, a greater risk of default than is acceptable for lenders to give those terms to the entire pool) and, potentially, credit rationing (supply of credit is less than demand at a given set of terms). Depending on the severity of credit rationing for a set of socially desirable projects, government intervention in the form of loan guarantees or other credit programs can increase welfare (Bachas et al., 2020; Gale, 1990; Stiglitz and Weiss, 1981). In credit markets for CCUS projects, information asymmetry may be particularly acute. Lenders may have little, if any, background knowledge on CCUS or other carbon abatement technologies, or relevant policies that support the technology. Obtaining credible information (or verification of borrowers' information) on factors relevant to the expected returns of the project may be particularly costly.[12]

Relatedly, the technology is still developing; there are only 26 operating commercial carbon capture and storage facilities, worldwide (Global CCS Institute, 2020). Information is still being generated for prospective CCUS adopters and their financiers. The lack of information about the technology directly

[11] Note that policy uncertainty is a general problem for any carbon pricing scheme that cannot be guaranteed for a long time. Any measures or policy formats that lock in carbon pricing will benefit not only firms considering investment in CCUS but all abatement efforts that involve large investments or are otherwise long-term in nature.
[12] For example, imperfect information led to the Saskatchewan Boundary Dam coal-fired power plant facing unexpected high costs for its carbon capture system, the first post-combustion carbon capture system in the world, in the early years of its operation (Leo, 2018; Romeo, 2019).

impacts its economic risk and also finance costs. First-best solutions to such information limitations would involve directly addressing them and may include facilitation of third-party verification or public funding of demonstration projects with important outcome metrics for lenders. Federal credit programs may be good second-best options. While an ITC would allow firms to partially or completely avoid the finance market for CCUS investments, a subsidy for adoption of technology that would not otherwise be adopted under correction of credit market failures (assuming the other issues listed above were also corrected), may be socially inefficient.

Supporting CCUS businesses and jobs

An issue that is important to consider is the economy-wide or general-equilibrium effects of an ITC for CCUS development. The ITC makes investment in CCUS relatively more attractive compared to other, alternative investment opportunities. This reallocates capital and labour from other sectors of the economy. Reallocations such as these—absent any pre-existing market failure—can lower overall productivity (Restuccia, 2019). This results in either higher prices for other goods or lower incomes, or some combination of the two. So while an ITC supports CCUS development and employment, it may indirectly increase the cost of labour and capital for businesses elsewhere in the economy. This effect is small and unlikely to be noticeable, but it exists nonetheless.

Incentivizing CCUS R&D

Public funding for early-stage research and development of technology is an established first-best policy choice for overcoming innovators' hesitancy to conduct research that can have large positive externalities (knowledge spillovers) to others (National Academies of Sciences, Engineering, and Medicine (NAS), 2016). With respect to CCUS, the government has already planned such funding for CCUS, through its specific CCUS research RDD budget for Natural Resources Canada.

The justification for public support for technology adoption is less clear and is case-specific (NAS, 2016). For example, one reason for technology adoption subsidies could be to advance socially desirable technology to a point at which its cost is more affordable for firms or consumers. Such a policy may be correcting a market in which the supply side has intertemporal knowledge spillovers, "learning-by-doing" effects, economies of scale, or other features that lead to efficiency gains that may not, at present, be profitable for producers. However, such features are very technology-specific, and it cannot be assumed that any given technological production process has them. Indeed, they have not arisen or not been large in contexts in which scholars have anticipated them, such as installation of solar PV (Bollinger and Gillingham, 2019).

A similar justification for technology adoption subsidies is that adoption may spur upstream innovation. Studies on this are in their infancy, however; Gerarden (2018) is one of the few.

Summing up

In light of the above, we recommend:

- The government examine whether a CCUS tax credit is the best policy to achieve its goals, particularly its main stated goal for this policy: emissions reduction.
    - Since emissions reductions are most cost effective when facilitated by a carbon price, we recommend the government consider ways that negative emissions technologies (including CCUS) will be able to participate in its carbon pricing system already established.
    - For example, can emitters already reduce their carbon tax liability with the use of CCUS and other negative emissions technology? Or, could a credit scheme for negative emissions technologies be added to the system?[13] Development of Canada-wide and international offset markets would help in this regard.
- Are there market failures in markets relevant to firms who are candidates for using or benefitting from others' use of CCUS? Or, are there other issues that are preventing firms from adopting it and similar technology that could be efficiently resolved from public intervention?
    - We note that long-term contracts for revenue from investments like CCUS may resolve two of the most likely issues, the risk inherent in investments with high upfront costs and uncertainty over relevant future policy. The government could facilitate such long-term contracts. Precedent for this has been set by the use of power procurement agreements and contracts-for-differences in electricity markets.
    - Taking steps to resolve uncertainty over future carbon pricing over, at least, the financial life of investments such as CCUS will benefit not only prospective investors but all other firms subject to carbon pricing, as it opens the door to emissions abatement and negative emissions options that would otherwise be unprofitable for firms. The Net Zero Accountability Act provides some certainty. Ideally, the government would pass durable policy or create mechanisms that lock-in financial certainty of climate policy for firms, even if policy changes.[14]
    - Market for finance for investments such as CCUS can suffer from their own failures. These failures should be remedied specifically. As suggested above, if investors are lacking information about negative emissions technology (or adequate verification of borrowers' information), the government can play a role in facilitating credible information to lenders.
- Not pursue a CCUS ITC to advance the upstream state of the technology (and lower its cost), as there is not clear academic evidence on this relationship. Using an ITC to help overcome hurdles created by adoption-level efficiency gains from learning-by-doing, economies of scale, etc. should be supported by evidence of these for CCUS.

Key questions to help guide thinking on the points above are: Why aren't firms currently planning to adopt CCUS? What barriers stand in their way?

---

[13] The California Low Carbon Fuel Standard established such a credit system: https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-credit-generation-opportunities

[14] For example, Beugin and Shaffer (2021) propose an approach using a public-private partnership in which the Canada Infrastructure Bank bears the risk of future climate policy stringency.

Even if an ITC is not the first-best policy choice for addressing emissions abatement or other issues/market failures associated with CCUS adoption, it still may provide net social benefits. This is true if the aggregate expected benefits from the policy exceed the aggregate expected costs. The points below can inform the calculation of each.

If the government *does* pursue an ITC for CCUS to address any of the above issues/market failures (or other issues not addressed in this comment), we recommend the following design features and subsidy magnitude. Ideally, a tax credit to encourage adoption of decarbonization technology should be set equal in magnitude to the sum of the externalities and other market failures it resolves.

- Take steps to avoid firms' ability to double-count emissions reductions via CCUS investments in the ITC program, and federal or provincial carbon pricing systems. Specifically, address any interaction with an output-based pricing system or cap-and-trade system.
- Make the ITC as technology-generic as possible to avoid issues with "picking winners".
- Consider the implications of whether firms are eligible for an ITC before or after construction. While the cost structure of CCUS investments may require pre- (or at least early-) construction subsidies, this may distort firms' incentives to ensure the success or quality of the project. However, if ITCs are granted later in the project development phase, not only might this fail to address issues with project cost structure and policy uncertainty, but it may require the government to be involved in ex-ante project review, a potentially costly process for which government resources may not be best qualified (Aldy, 2013; Newell et al., 2019).
- Use the following as guidance for the amount of ITC available to firms, on a per-project basis:
    - Emissions reductions, valued at the SCC, anticipated to be achieved by the project (unless instead this is rewarded by carbon pricing). Note again the computational challenges involved in estimating this.
    - The value of reduction of any local negative externalities
    - The upfront subsidy needed to overcome the risk that comes from large upfront costs and policy uncertainty[15]
    - The marginal value of the project in terms of positive innovation spillovers to other firms or society at large, via
        - Upstream technological improvement/cost reductions (if suspected in this case)
        - Adoption-level learning-by-doing, economies of scale, etc.

[15] As soon as project cost is guiding the magnitude of an available ITC, the government should consider how design features, such as whether the ITC varies with cost, could create distortions in cost reporting or firm conversion of variable costs into eligible capital costs. See Newell et al. (2019) Sections 3.3.

References

Aldy, J.E., 2013. A Preliminary Assessment of the American Recovery and Reinvestment Act's Clean Energy Package. Review of Environmental Economics and Policy 7, 136–155. https://doi.org/10.1093/reep/res014

Bachas, N., Kim, O.S., Yannelis, C., 2020. Loan guarantees and credit supply. Journal of Financial Economics. https://doi.org/10.1016/j.jfineco.2020.08.008

Bailey, M., 2020. What Do We Lose by Picking Winners? The Role of Technology-specific Clean Energy Incentives in Induced Innovation. Working Paper.

Beugin, D., Shaffer, B., 2021. The Climate Policy Certainty Gap and How to Fill It. C.D. Howe Institute.

Bollinger, B., Gillingham, K., 2019. Learning-by-Doing in Solar Photovoltaic Installations. Working Paper.

Carleton, T., Greenstone, M., 2021. Updating the United States Government's Social Cost of Carbon. University of Chicago, Becker Friedman Institute for Economics Working Paper.

Fankhauser, S., Hepburn, C., Park, J., 2010. Combining multiple climate policy instruments: how not to do it. Climate Change Economics 1, 209–225.

Fellows, G.K., Goodday, V., Winter, J., 2021. A Review of Barriers to Full Scale Deployment of Emissions Reduction Technologies. The School of Public Policy Publications 14.

Gale, W.G., 1990. Federal lending and the market for credit. Journal of Public Economics 42, 177–193. https://doi.org/10.1016/0047-2727(90)90011-6

Gerarden, T., 2018. Demanding innovation: The impact of consumer subsidies on solar panel production costs. Working Paper.

Global CCS Institute, 2020. Global Status of CCS Report 2020. https://www.globalccsinstitute.com/wp-content/uploads/2020/11/Global-Status-of-CCS-Report-2020_FINAL.pdf

Hermalin, B.E., Katz, M.L., 2009. Information and the hold-up problem. The RAND Journal of Economics 40, 405–423.

IEA, NEA, 2020. Projected Costs of Generating Electricity: 2020 Edition.

Leo, G., 2018. SaskPower looking for help to fix "high cost" Boundary Dam carbon capture flaw. CBC News.

Montgomery, W.D., 1972. Markets in licenses and efficient pollution control programs. Journal of Economic Theory 5, 395–418. https://doi.org/10.1016/0022-0531(72)90049-X

National Academies of Sciences, Engineering, and Medicine (NAS), 2016. Appendix C: The Role of Research, Learning, and Technology Deployment in Clean Energy Innovation, in: The Power of Change: Innovation for Development and Deployment of Increasingly Clean Electric Power Technologies. The National Academies Press, Washington, DC. https://doi.org/10.17226/21712

Newell, R.G., Pizer, W.A., Raimi, D., 2019. U.S. federal government subsidies for clean energy: Design choices and implications. Energy Economics 80, 831–841. https://doi.org/10.1016/j.eneco.2019.02.018

Restuccia, D., 2019. Misallocation and aggregate productivity across time and space. Canadian Journal of Economics/Revue canadienne d'économique 52, 5–32.

Rogerson, W.P., 1992. Contractual solutions to the hold-up problem. The Review of Economic Studies 59, 777–793.

Romeo, J., 2019. The Pursuit and Advancement of Carbon Capture and Storage. POWER.

Stiglitz, J.E., Weiss, A., 1981. Credit Rationing in Markets with Imperfect Information. The American Economic Review 71, 393–410.