Job creation through transformational climate investments:

Assessing the impact of proposed climate investments in Canada

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VIVICresearch

Introduction[1]

Vivic Research was retained to estimate the potential employment impacts of the proposed investments in *Spending What it Takes: Transformational climate investments for long-term prosperity in Canada* (henceforth "the report"), published by Climate Action Network Canada and the Canadian Centre for Policy Alternatives. In this report, we describe the methodology used to generate these estimates and present our results.

Methodology

INPUT-OUTPUT MODELS

To estimate the potential employment effects of the proposed investments, we used an input-output (I-O) model of the Canadian economy. These models have been used to estimate the employment effects of climate investments in several other countries, including the United States (Garrett-Peltier, 2017), Germany, Brazil, Indonesia, Korea, and South Africa (Pollin et al., 2015), France (Quirion, 2013), and Greece (Stamopoulos et al., 2021). Input-output models build a complete model of an economy by mapping the production relations between all sectors of the economy. From this map, estimates of the impact of investing in one sector of the economy on other sectors and the economy as a whole can be produced. Statistics Canada combines these estimates with sector-level estimates of labour productivity to estimate the employment impacts of investments in each sector of the economy (Statistics Canada, 2022). We use these figures to estimate the employment impacts of the proposed investments.

A full description of input-output models is beyond the scope of this report but we will briefly describe their benefits and drawbacks for estimating employment impacts (for a more complete discussion, see Pollin et al., 2015). I-O models and computable general equilibrium (CGE) models are the most common methods used for this purpose. I-O models are simpler, more transparent, and less data-intensive than CGE models. CGE models further take into account price dynamics, making them more sensitive to dynamic effects, but also more reliant on assumptions about how prices will change in response to changes in the economy. Following research in other countries, we think an I-O approach is appropriate, however, three assumptions must be noted.

First, I-O models are linear models. If they predict that a 1% investment in a sector will create 100 jobs, then, by definition, they predict that a 10% investment would create 1000 jobs – they do not account for possible economies of scale. Next, I-O models also assume that prices and the production structure are fixed. For example, they do not consider that an investment in domestic manufacturing capacity may reduce reliance on imported manufactured goods in the future. I-O models are thus best suited for estimating short-term effects. With these assumptions in mind, we now describe our methodology in greater detail.

[1] This report was authored by Silas Xuereb and Inez Hillel of Vivic Research.

ESTIMATION STRATEGY

We employ the method used by Garrett-Peltier (2015) to estimate the net employment impacts of the proposed investments in the report using an I-O model. The net effect of the proposed investments (total of $286.8 billion) is the total jobs that could be created by the proposed investments less the total jobs that could be created (or maintained) through spending the $286.8B on other priorities, lower debt and less tax revenue. The proposed investments in the report are funded by reallocating spending from these other priorities, creating new taxes, and taking on debt. New taxes and debt are modeled as reduced spending across the economy (Quirion, 2013). The reallocations include eliminating fossil fuel subsidies[2] and the Carbon Capture, Utilization and Storage (CCUS) tax credit, and repurposing money currently allocated to the Canada Infrastructure Bank (CIB).[3] Table 1 lists the proposed investments in the report and the assumed funding.

Table 1. Total proposed investments and proposed funding over 5 years.

Proposed investment	**Amount ($B)**	**Proposed funding**	**Amount ($B)**
Supporting Indigenous-led climate action	25.0	Canada Infrastructure Bank	27.0
Building a clean electricity grid	20.0	Eliminate the CCUS	8.6
Making homes and buildings more efficient	66.5	Tax on oil and gas	5.0
Public transportation	40.0	Eliminate all fossil fuel subsidies	50.0
Growing food sustainably	4.0	New taxes and debt	196.2
Supporting good jobs (especially in solar, wind and the care economy)	80.0		
Climate adaptation	25.0		
Supporting global climate action	5.3		
Protecting and restoring nature	21.0		
Total	**286.8**	**Total**	**286.8**

Next, we estimated the jobs that could be created each year through the proposed investments in the report and the proposed funding. We allocated each investment to a sector

[2] We assume Canada provides about $10B in public finance that subsidizes fossil fuel companies each year (Corkal & Gass, 2020).

[3] We apply the 2023 Alternative Federal Budget's suggestion to repurpose money currently allocated to the Canada Infrastructure Bank to invest in public renewable energy infrastructure and public transit systems. We account for the PBO's finding that the CIB is expected to underspend its $35B budget by $19B (Nahornick, 2021) by assuming that $19B can be spent on the report's proposed investments without reallocation while the remaining $8B is reallocated from spending on renewable energy infrastructure, home retrofits and transit ($8B has already been spent).

(or sectors) of the economy. When an investment was allocated to multiple sectors (because there is no sector in the I-O tables for, say, solar energy), we created a vector of demand weights for the investment. Demand vectors for solar and wind energy, investments in public transit, and building retrofits were adapted from Pollin and colleagues (2015) and Garrett-Peltier (2015) to the Canadian context. Other demand vectors were constructed through assessing spending priorities listed in the report and its source documents (Canadian Centre for Policy Alternatives, 2022; Federation of Canadian Municipalities, 2020; Haley & Torrie, 2021). After estimating the jobs created per one million dollar investment in 2019 from the I-O multipliers table, we converted them to 2023 estimates using the average annual reduction in jobs multipliers for the preceding five years. We assume job multipliers will continue falling at this rate for the next five years.[4] For a full list of the proposed investments, the associated vectors of demand and the resulting 2023 job multipliers, see Appendix Table A1.

Finally, we estimated the net effect of the proposal as the difference between the number of jobs created through the proposed investments in the report and the number of jobs created by the proposed funding. This ensures that our results are not simply driven by increasing overall spending. Rather, potential employment creation is driven by shifting spending towards labour intensive industries. In line with previous research, we find that investments in renewable energy, public transportation, and home retrofits create more jobs than investments in the fossil fuel industry.

We estimate results using both "simple" and "total" employment multipliers. Simple multipliers include direct job creation in the sector that receives the investment, as well as indirect effects, jobs created in sectors that produce intermediate goods used in the production process of the recipient sector. Total multipliers are equal to the simple multiplier plus the induced effect. Induced effects include the jobs created across the economy due to increased demand caused by the simple effects. To capture the increased uncertainty associated with induced effects, we present simple effects as a *Low estimate* and total effects as a *High estimate.* Our results, presented in Table 2, suggest that the proposed investments could result in an average of an additional 145,900 – 176,000 jobs over the next five years, with employment increasing over time along with the proposed investments.

Table 2. Potential employment created by the proposed investments in the Spending what it takes *report.*

	Average annual additional jobs	**Additional jobs in 2023/24**	**Additional jobs in 2024/25**	**Additional jobs in 2025/26**	**Additional jobs in 2026/27**	**Additional jobs in 2027/28**
Low estimate	145,900	98,600	125,200	148,800	169,400	187,200
High estimate	176,000	119,000	151,100	179,600	204,500	225,900

[4] These assumptions are made to account for the effects of inflation. All dollar values presented in this report are in current (2023) dollars which will create less jobs over time because of inflation.

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Appendix

Table A1. Industrial composition and job per million $ investment of proposed investments in the Spending What it Takes *report.*

Industry	Residential retrofits	Building a clean electricity grid	Public transit	Supporting good jobs	Adaptation
Renewable energy[5]		0.50		0.50	
Electric power generation, transmission, and distribution		0.50			
Repair construction	0.50				0.50
Residential building construction	0.50				
Non-residential building construction					0.25
Transportation engineering construction			0.4125		0.0625
Urban transit systems			0.375		
Other transit and ground passenger transportation			0.0375		
Railroad rolling stock manufacturing			0.075		
Rail transportation			0.10		
Personal care services				0.25	
Plastic product manufacturing					
Water, sewage and other systems					0.0625
Other engineering construction					0.125
All industries except oil and gas				0.25	
Jobs/million (simple-total)	**7.63-9.76**	**4.43-6.00**	**9.92-13.17**	**9.29-11.15**	**7.19-9.42**

Note. The figures presented here are the proportion of each investment allocated to each industry. Only the five largest investments from the report are listed here (full breakdown available upon request). The other investments are largely in planning and coordination for which the industrial composition included mostly other federal government services, other aboriginal government services, education services, and technical consulting services. We assumed the investment in bilateral climate finance would not create any jobs in Canada.

[5] Renewable energy is a synthetic industry constructed by taking the average of the composition of the wind and solar energy industries from Pollin and colleagues (2015).

Table A2. Industrial composition and jobs per million $ investment of spending under the proposed funding.

Industry	CIB	CCUS	Fossil fuel subsidies	New taxes and debt
Renewable energy	0.25			
Transportation engineering construction	0.20			
Urban transit systems	0.25			
Communication engineering construction	0.15			
Repair construction	0.15			
Pipeline construction		0.20		
Industrial machinery manufacturing		0.12		
Fabricated metal manufacturing		0.12		
Electric power engineering construction		0.12		
Support activities for mining		0.24		
Architectural, engineering and related services		0.20		
Oil and gas extraction			0.50	
Oil sands extraction			0.50	
All industries				1.00
Jobs per million (simple-total)	**8.90-11.82**	**5.28-7.27**	**2.64-3.78**	**6.97-8.82**

Note. CIB – Canada Infrastructure Bank. CCUS – Carbon Capture, Usage, and Storage tax credit. CCUS weights are derived from Industrial Economics (2021).