Smart Prosperity Institute

GROWING CLEAN:
INVESTMENT FLOWS IN LOW-CARBON TECHNOLOGY TO 2030

June 2019

About Smart Prosperity Institute

Smart Prosperity Institute (formerly Sustainable Prosperity) is a national research network and policy think tank based at the University of Ottawa. We deliver world-class research and work with public and private partners – all to advance practical policies and market solutions for a stronger, cleaner economy.
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CONTENTS

KEY FINDINGS

- Canadian demand for low-carbon technologies will double through 2030, compared to today's levels: the size of the clean technology investment opportunity will reach a cumulative $184 billion from 2020 to 2030
- Investment in low-carbon technologies will climb from an historical annual average of $11 billion in the pre-2020 era, to an average of $22 billion annually through 2030
- Particularly striking is the rate of growth in low-carbon technology investment, which is outstripping all Canadian investment by a factor of almost 6
- Investment flows in low-carbon technologies through to 2030 represent a sizeable domestic opportunity, allowing for growing the economy while improving environmental outcomes
- Post-2020 will see a manageable reallocation of capital spending: over the 2020-3030 time period, total capital expenditure related to new low-carbon solutions equates to 14% of total Canadian investment flows for all energy production and consumption, compared to 8% in the pre-2020 era
- Clean technologies are poised for growth, with decarbonized electricity leading the way with 54% of the $184 billion investment. Low-carbon vehicles, building efficiency & electrification, and industrial decarbonization will claim between 13% and 16% respectively, with renewable fuels representing 1% of the total investment.

OVERVIEW

As Canada pushes forward with its climate change mitigation commitments, businesses, consumers and the public sector will increasingly invest in low-carbon infrastructure and technologies. These technologies are key to supporting Canada's transition to a low-carbon economy by allowing for improved environmental outcomes while growing the economy.

While Canadian clean-technology companies recognise the expanding international market for their products, there is little information available on the growing market here in Canada.

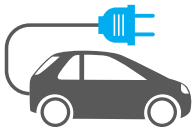
The key questions to ask are how sizeable is the investment opportunity for low-carbon technologies from 2020-2030? To what extent will Canadian investment in these technologies grow over this decade? And which clean technologies are best poised for rapid growth? **Our analysis helps identify the size of this impending domestic opportunity by providing projections of low-carbon investment flows through 2030.**

Low-carbon technology refers to any process, product or service that reduces the greenhouse gas (GHG) emissions associated with a product or an activity. These technologies can be applied and developed in every sector of the economy, from transportation to large industries. Beyond contributing to climate change mitigation, low-carbon technologies may lower energy requirements and therefore operating costs, and will allow firms to continue expanding under environmental regulatory requirements. They can also offer co-benefits such as improved productivity and air quality.

Businesses, consumers and the public sector will increasingly invest in low-carbon infrastructure and technologies.

Figure 1: Low-Carbon Technologies

Renewable fuels:
Enhanced biomass-derived fuels from plant oils (corn and wheat), cellulosic feedstock (agriculture and forest biomass), and renewable natural gas from landfills and manure.



Low-carbon vehicles:
Residential and commercial low emissions vehicles of all sorts (e.g., electric vehicles, plug-in hybrid electric vehicle), as well as GHG efficiency improvements in the existing fleet.

Building efficiency and electrification:
Improvements in the energy performance of residential and commercial buildings and their equipment.

Industrial decarbonization:
Methane abatement equipment, the use of solvents for Steam Assisted Gravity Drainage (SAGD) in the oil sands, fuel switching, energy efficiency, heat pumps, alternative process technologies, and carbon capture and storage technologies.

Decarbonized electricity:
Renewable electricity generation, solar, hydro and wind, as well as non-emitting nuclear generation.

The Canadian Clean Technology Opportunity – Quantitative Method

Economy-wide economic and energy modelling is used to stimulate a future where Canada scales-up climate and energy policy (current and developing) to achieve the 2030 target of a 30% reduction in GHG emissions compared to 2005 levels. In our scenario, the stringency of climate and energy policy is ratcheted-up to achieve total Canadian GHGs of 543 Mt in 2030. The remaining mitigation commitment (i.e. to reach 512 Mt) is met through 31 Mt of carbon credits from Quebec's cap-and-trade market linked with California, as well as other internationally transferred mitigation outcomes*.

In the analysis, we track private sector investment in fixed-non-residential capital and household capital expenditures to estimate investment, closely following the national accounting approach to estimating investment. Therefore, the estimates can be broadly compared against published statistical agency investment data. The Navius Research g-Tech model underpins the analysis.

Environmental and Clean Technology is defined as any process, product, or service that reduces environmental impacts. For the purpose of this analysis, we similarly define low-carbon technologies to ensure GHG reductions, with mapping to the Government of Canada's Environmental and Clean Technology Products Economic Account.

Low-carbon technologies include energy efficiency technologies in homes and businesses; lower emitting transportation options such as electric vehicles and charging stations; renewable energy generation; electric powered heaters, boilers and industrial equipment; and lower emitting industrial processes.

* Quebec's continued participation in the Western Climate Initiative would likely result in some imports in 2030. Other possible channels could include bilateral government purchases or international units recognized as compliance units for the large industrial emitter programs.

CLEAN TECHNOLOGY INVESTMENT: BY THE NUMBERS

The modelling analysis indicates that Canadian demand for low-carbon technologies will double through 2030, compared to today's levels. As such, investment in low-carbon technologies will climb from an historical annual average of $11 billion in the pre-2020 era, to an average of $22 billion annually through 2030 (Figure 2).

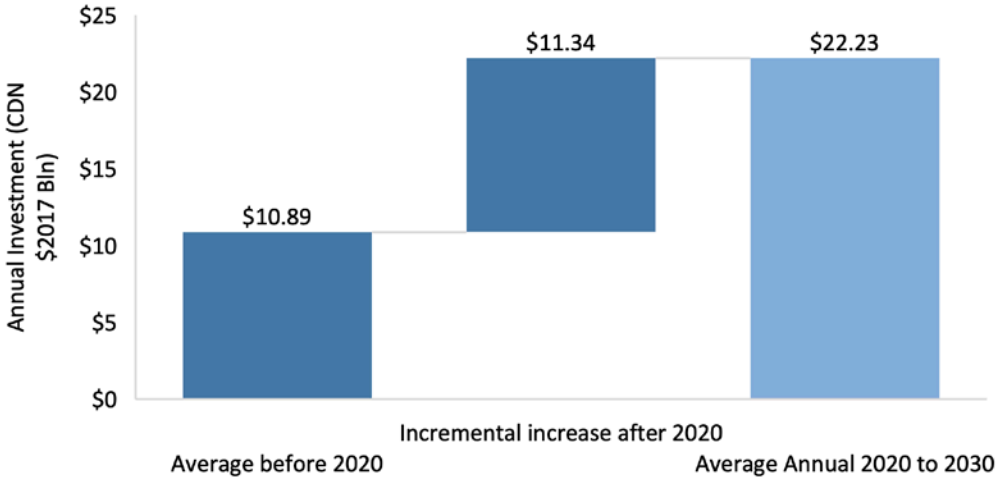
In many cases, these investments in low-carbon technologies pay off in the longer term through reduced energy costs, thereby driven by market forces. At the same time, it will be regulations, carbon pricing and other policies that accelerate the deployment of these clean investments.

For households, the scaling up of low-carbon investment to 2030 represents about 19% of all household spending on transport and building equipment as well as appliances - up from 5% before 2020. For businesses, low-carbon investment as a share of all investment climbs from 2.2% before 2020 and to 4% after 2020.[1]

Cumulatively, $184 billion (net present value) in investments towards low-carbon technologies will be deployed between 2020 and 2030.[1] Although this represents a large opportunity for the clean technology sector, it is important to keep this figure in context, particularly with respect to the required investment flows needed to hit the 2030 climate change target. The incremental investments needed to make climate-compatible choices are small compared to the size of overall investment in the Canadian economy (Figure 3).

Total capital expenditure related to the adoption of new low-carbon solutions equates to only 14% of total Canadian investment flows for all energy production and consumption over the 2020-3030 time period, compared to 8% in the pre-2020 era. **Ultimately, it is this manageable reallocation of capital spending that will support a clean growth pathway consistent with our climate objectives to 2030 and beyond.**

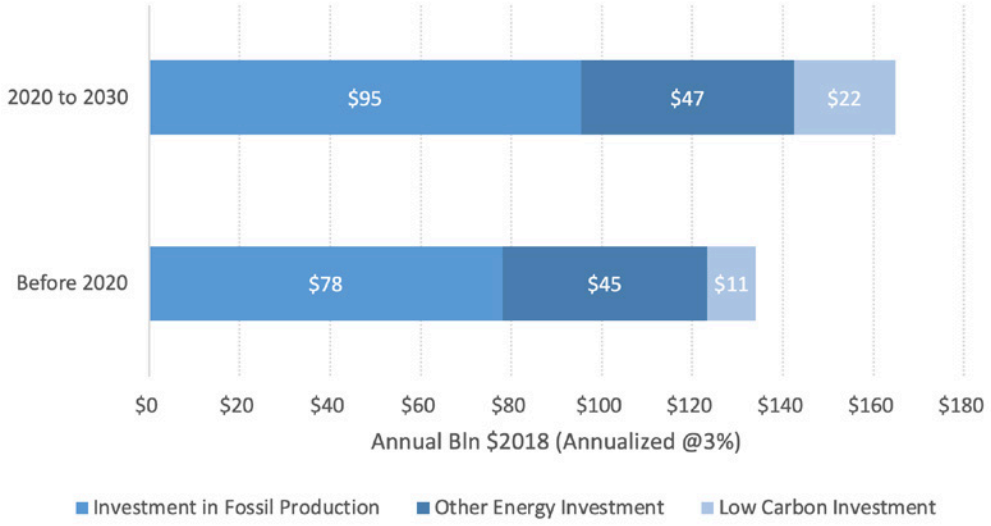
Figure 2: Growing Clean: Annual Investment in Low-Carbon Technology to 2030



[1] Pre-2020 time period reflects current carbon policy and its impact on investment, using the 2015 to 2020 period to estimate an average for the period. After 2020 estimates the future scaling up of investment as policy ambition increases post-2020 to achieve Canada's 2030 target. For each period, the net present value of future investment is estimated assuming a discount rate of 3%. The equivalent annual cost, or average annual investment, for each period is estimated again assuming a 3% discount rate.

Figure 3: Average Annual Investment in Types of Energy

Canadian demand for low-carbon technologies will double through 2030, compared to today's levels.



DECARBONIZATION DRIVERS: WHICH CLEAN TECHNOLOGIES ARE DESTINED FOR RAPID GROWTH?

Thus far, the analysis has focused on the overall magnitude and pace of the low-carbon technology opportunity. The next question that is addressed is: *where will this incremental investment occur?* The modelling breaks the investment down into sector-based analysis:

- Investment into **non-emitting electricity** technologies and infrastructure increases to $12 billion annually post-2020, an increase of 70% over pre-2020 levels. The cumulative total is $98.9 billion between 2020 and 2030 with an annual growth rate of 7%.

- Investment into **industrial decarbonisation** infrastructure increases to $3.6 billion annually, or a six-fold increase above current levels. The cumulative total is $30 billion by 2030 reflecting an annual growth rate of 20%.

- **Building efficiency and electrification** climbs from $2.5 billion annually to $3.5 billion annually through 2030, or a 42% increase over the pre-2020 period.

- **Low-carbon vehicles** investment increases from $0.5 billion historically to $2.8 billion annually through 2030, or a six-fold increase. The cumulative total is $23 billion with an annual growth rate of 23%.

- **Renewable fuels** including renewable natural gas, ethanol and biodiesel grow annual at a rate of 8% with a cumulative total of $2.3 billion over the period to 2030.

Figure 4: Cumulative Investment in Low-Carbon Technology to 2030

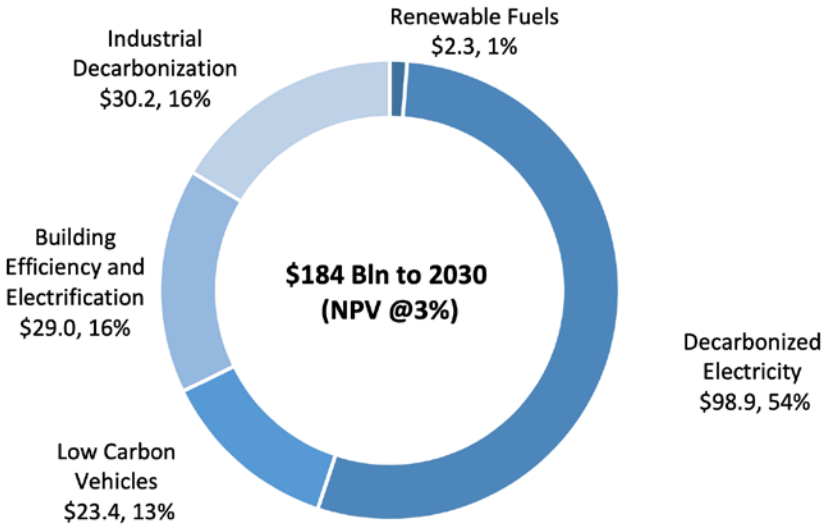


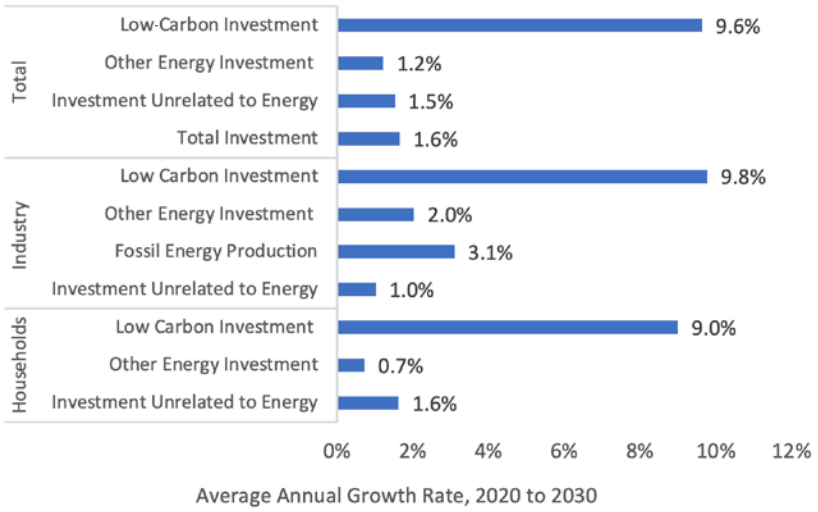
Figure 5: Growing Investment in Low-Carbon Technologies for Buildings

LOW-CARBON INVESTMENT: OUTSTRIPPING THE AVERAGE

Particularly striking is the rate of growth in low-carbon technology investment, which is outstripping all Canadian investment by a factor of almost 6 in the modelling (Figure 5). Total investment nationally grows 1.65% annually while low-carbon investment grows almost 10% annually. For households, the pattern is much the same, with an annual increase in the rate of investment in low-carbon technologies much greater, almost 10 times more than investments into other energy technologies.

The notion that more stringent climate policy will choke out oil and gas investment is not supported by the scenario. Investment in fossil energy production, including fossil electricity generation and fossil fuel production, expands at a rate 3.1% annually even with Canada achieving its 2030 GHG target. However, this expansion masks a drop of 48% in fossil fuel electricity generation offset with an expansion of 3.4% in fossil fuel production. Still, this rate is three times higher than the forecast of investment for the rest of industry.

Figure 5: Average Annual Growth Rate in Investment, 2020 to 2030



CONCLUSION: AN OPTIMISTIC FUTURE FOR CLEAN TECHNOLOGIES

As businesses, homeowners and governments make choices in their acquisition of capital assets such as vehicles, electric power systems, machinery, appliances, and cooling and heating options, there is major opportunity to underpin these investments with low-carbon technologies. Canada's clean technology sector has the potential to significantly ramp-up as demand increases with more climate ambition. This demand can be met through domestic production or clean technology imports.

It is clear that Canadians will need to continue to reorient public and private investment towards low-carbon solutions, to meet climate ambition to 2030 and beyond. Investment decisions taken over the next few years will be critical to putting Canada's economy on a lower-carbon trajectory. If Canada continues on its current low-carbon pathway, our analysis suggests that we can expect to see a doubling in domestic demand, and related investment, in low-carbon technologies through 2030.

Investments can support Canada's transition to a low-carbon economy by allowing for improved environmental outcomes while growing the economy.

The analysis helps to quantify the domestic clean growth opportunity for innovative clean technologies. It also helps provide better foresight to the financial community about how investment patterns will change under current and developing carbon policy.

The investments and consumer demand expected in the next decade for low-carbon infrastructure and technologies is sizeable. These investments can support Canada's transition to a low-carbon economy by allowing for improved environmental outcomes while growing the economy.

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