

From: Glen Hodgson  
To: Canadians Concerned about Green Growth  
Date: November 27, 2020  
Re: **HOW MUCH INVESTMENT IS REQUIRED TO REDUCE GHG EMISSIONS WITHOUT SACRIFICING GROWTH?**

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In the extensive debate on the policies and innovation required to reduce Canada's GHG emissions while achieving solid economic growth, discussion on the scale and distribution of investment needed has been absent, and whether and how private capital markets can meet the requirements.

Research on the investment spending that will be required is now beginning to emerge, but there is no consensus yet on the best research method to use to calculate the need.

One approach would be to use economy-wide modelling to produce an aggregate assessment. A 2017 Conference Board [study](#) used its macro-economic modelling capacity to estimate the investment needed to reduce GHG emissions sharply over time, as well as projecting related growth performance.

The study estimated that between \$2 trillion and \$3.4 trillion (in 2011 dollars) in new investment in low-emissions energy sources, uses and technologies would be required to 2050, representing 40 percent or more of total Canadian investment. With this scale of investment, there would be minimal impact on Canadian economic growth. This research has some methodological issues, such as how to incorporate business innovations to reduce emissions, and therefore likely overestimates the investment needed.

A just-released [study](#) from the new Institute for Sustainable Finance uses a very different approach and reaches a much lower estimate of required investment to achieve Canada's current 2030 emission reduction targets. The research is based on a bottom-up estimate of average GHG abatement costs (cost per tonne of GHGs abated) applied to nine broad sectors: oil and gas, transportation, buildings, electricity, heavy industry, agriculture, waste, and land use and forestry. The study multiplies each sector's share of emissions by its estimated average abatement cost, to derive the sectoral investment required to cut emissions – and then adds up the results. Overall, the study estimates Canada will require aggregate investment of (only) \$128 billion over the next 10 years to achieve its 2030 targets, the midpoint of a wide possible investment range of \$90 to \$166 billion.

This latest study has its own methodological issues, by using average (or historical) abatement costs rather than marginal (or current) costs, assuming those costs will be constant over time, and assuming that all sectors will adapt at the same rate. It also uses a very high level of sectoral aggregation, does not include inflation, and does not address the infrastructure and private investment that will be required for climate change mitigation.

That said, it makes sense to use a sectoral and regional approach to estimate required investment to reduce GHG emissions, based on a detailed evaluation of marginal abatement costs and anticipating possible technological change. Further refinements to this approach could offer more precision.

Yet another research approach would apply a common methodology across countries or regions. A recent comprehensive [engineering study](#) developed a detailed evaluation of energy transition pathways by country for 143 countries to eliminate net GHG emissions from energy by 2050. It estimated that \$73 trillion (in 2013 US dollars) in global investment would be required.

Canada was projected to need \$600 billion over 30 years, a number that included investment in zero-GHG power generation – hydro, wind and solar – plus short and long-distance transmission and local distribution. The study does not include nuclear, electricity storage, or gas thermal power with carbon capture and storage while also assuming a 60-percent gain in Canadian energy efficiency.

#### Assessment

These three studies have differing research approaches and produce markedly different results. Each has methodological shortcomings that can be addressed in future research. However, they share a common view: with sufficient overall investment, adjustment toward a growing economy with falling or no net GHG emissions is seen as economically and technically feasible.

What next? Future research on investment to reduce GHG emissions could usefully focus on:

- Deeper analysis of the relationship between investment to reduce emissions and economic growth.
- A more detailed sectoral and regional approach across the entire economy, including sectors and infrastructure.
- The potential pace of technological change by sector, and the impact on marginal or incremental costs (with inflation included).
- The scale of required investment specifically in low- or no-emissions electricity production transmission and distribution, with real-world assumptions on electricity supply reliability and storage; and much greater detail on abatement investment in oil and gas.
- The scale of investment required to improve climate resilience, as well as to reduce GHG emissions.
- The most effective areas of investment, i.e. where the greatest reductions in GHG emissions can be achieved for the lowest investment cost.
- And of course, the specific sources of private and public capital and funding for low-emissions investment, and how that investment might be allocated.

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