

A photograph showing several volunteers working together to fill sandbags. In the foreground, a young man in a dark jacket is using a shovel to fill a sandbag. To his right, an older woman with white hair is also working. In the background, another person wearing a high-visibility orange vest and a hard hat is visible. The scene is outdoors, with trees and a building in the background.

EXECUTIVE SUMMARY

Climate change is a serious and growing drag on Canada's economy and a major financial burden on households in Canada. Damage Control quantifies these impacts, showing how climate change is already damaging infrastructure, destroying assets, and causing avoidable illness and death.

We find that climate change results in cascading negative effects through Canada's economy, as climate damages slow the level of economic activity across sectors and regions, strain government budgets, lower household income, and erode competitiveness. Further, individual households end up paying the highest price for climate change, as slower growth, higher taxes, higher prices, and the costs of direct damages shrink income and wealth.

These impacts are already beginning to take hold and will compound quickly unless something changes. This future is not inevitable: There is a great deal that governments can do to reduce the economic risks and protect people in Canada from

these impacts. Investment in proactive adaptation can substantially reduce overall economic damages, as will global success in reducing greenhouse gas emissions.

Damage Control is the culmination of the Canadian Climate Institute's **Costs of Climate Change** series, a multi-year modelling and research project that aims to better understand and quantify the potential costs of a changing climate in Canada. This report documents a first-of-its-kind study on the combined direct and indirect costs of climate change in Canada, integrating economy-wide macroeconomic analysis with bottom-up studies, including those from previous **Costs of Climate Change** reports.

Our approach to the macroeconomic analysis in *Damage Control* consisted of three steps:

- ▶ First, we identified 16 impact groups where climate change is likely to trigger major material economic consequences in Canada.
- ▶ Second, we estimated the direct economic cost and benefits for each impact group in a series of bottom-up analyses that examined impacts across 14 future climate scenarios, including a low- and high- emissions scenario and seven different climate models. We analyzed impacts at fine geographic scales and short time intervals.
- ▶ Third, we integrated these findings into a macroeconomic model of the Canadian economy, simulating economy-wide

economic impacts across the 16 impact groups through to the end of the century, as well as the costs and benefits of proactive adaptation.

In total, accounting for each impact group, we assessed 84 scenarios: two global climate emissions scenarios, seven downscaled climate scenarios, three asset growth scenarios, and two adaptation scenarios. Yet despite the much more detailed picture that our analysis provides over previous studies, our results nonetheless remain the “tip of the iceberg” when it comes to the full range of effects to Canada’s economy and society from a changing climate. There remain many below-the-waterline risks, where climate change will likely generate substantial impacts, but that have too much uncertainty and complexity to quantify at this stage.



August 29, 2021: Pedestrians in Penticton, British Columbia watch as a forest fire flares up in the hills above the city.

Climate change is a **macroeconomic risk** that threatens to **significantly undermine future prosperity**

Absent aggressive policy to reduce and adapt to the impacts of a warming planet, climate change will drag down the rate of Canada's economic growth and result in a much smaller future economy. This macroeconomic damage will kill jobs, erode Canada's competitiveness, and drive greater government spending.

Climate damages are already resulting in large national income losses over the very short term. In 2025, Canada will experience \$25 billion in losses relative to a stable-climate scenario, which is equal to 50 per cent of projected 2025 GDP growth. The mounting costs compound quickly over the years and decades ahead, rising to \$78 and \$101 billion annually by mid-century for a low and high emissions scenario respectively, and \$391 and \$865 billion respectively by end of century.

In addition to slowing GDP growth, climate impacts will cause large job losses, as heat-induced productivity losses and premature deaths shrink the workforce. Job losses could double to 500,000 by mid-century, and increase to 2.9 million by end of century. These impacts to labour will then ripple through the economy, reducing productivity and raising prices, and ultimately undermining the ability of the economy to support an affordable and secure future for people in Canada.

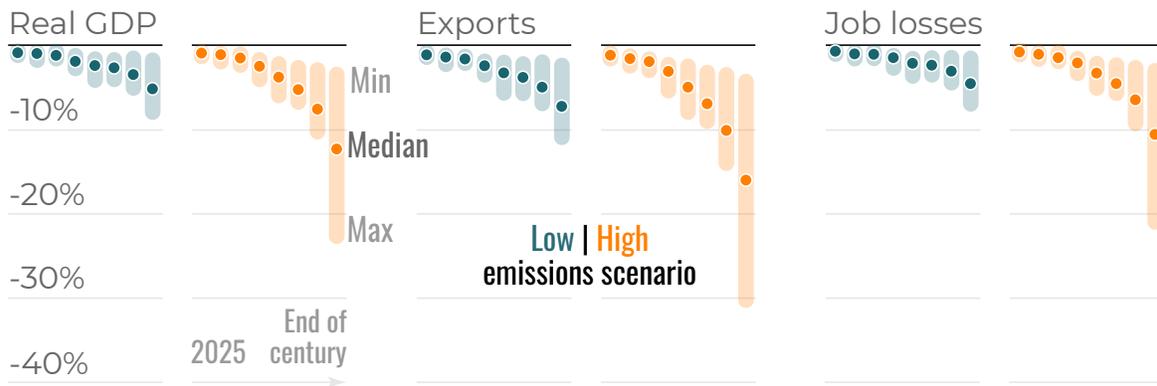


Export losses will grow over time as costs increase and competitiveness is reduced, and imports slow as output falls, reflecting a deepening economic weakness. By the end of the century, export losses in the low-emissions scenario will be \$300 billion or seven per cent below a stable-climate scenario, and \$600 billion or 16 per cent under a high-emissions scenario.

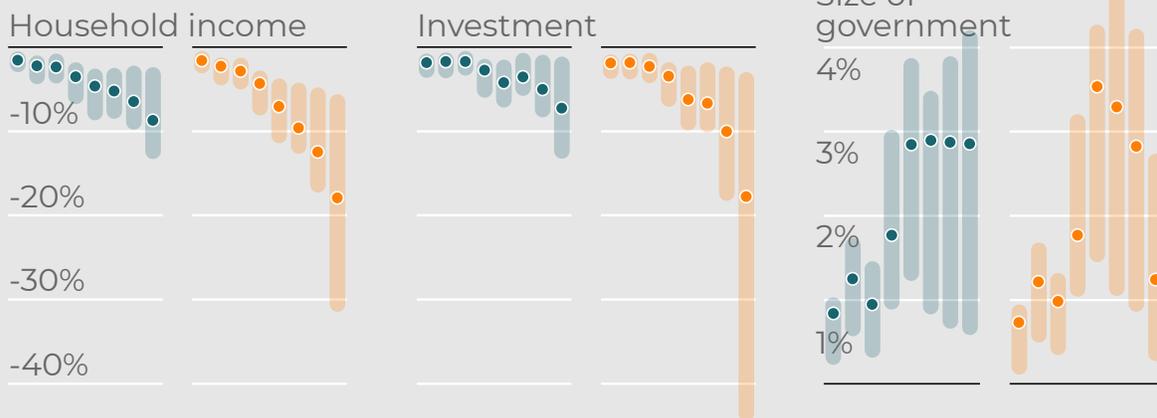
The losses in the global high-emissions scenario will be substantially higher than in the low-emissions scenario across all indicators, particularly after mid-century, driving home the imperative to reduce global greenhouse gas emissions in order to reduce costs.

Climate change will harm Canada's economy and Canadian households across multiple dimensions.

Economic drag indicators



Broken window indicators



The broken window fallacy

While the topline macroeconomic losses from climate impacts are concerning, actual costs for people in Canada are even more severe. These household impacts, obscured in the hit to national gross domestic product (GDP), are a classic case of the broken window fallacy, which describes the distorting effect that spending to repair destroyed assets can have on measures of the economic costs of climate damages. Such forced spending carries with it an opportunity cost, as significant expenditures are being directed merely towards fixing what has been broken, rather than towards new productive activities that create wealth, supporting the long-term well-being of people living in Canada.

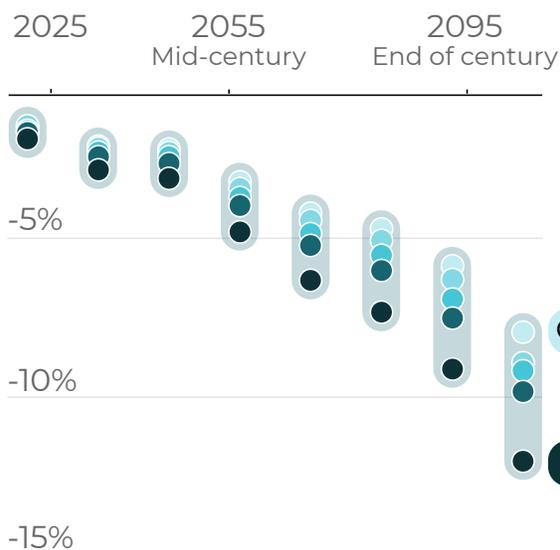
Climate change will make life less affordable by **reducing income** and **increasing expenses**.



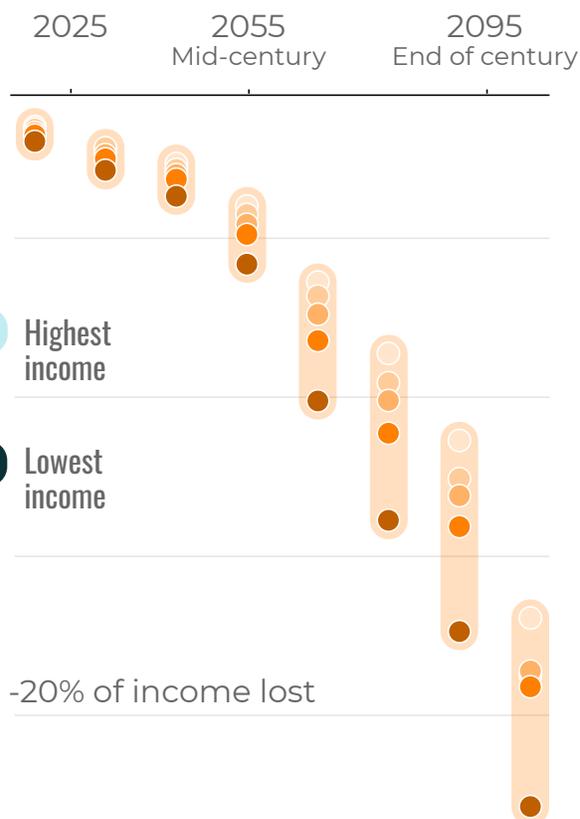
The impacts of climate change will inevitably lower individual wealth as income falls and is redirected to fix what gets prematurely broken. The full extent of the burden placed on individual households is partially obscured by looking only at topline macroeconomic indicators of economic drag. Spending to fix “broken windows” appears on the surface to stimulate some sectors of the economy, as the size of government grows and the construction sector receives a boost. However, there are opportunity costs to this forced spending to fix what climate change has damaged or destroyed, as resources are redirected away from productive new investments that otherwise would support output and wealth creation. These costs are reflected in falling household income, declining business investment, and increased taxation or a reduction in social services. So, while GDP may fall by 12 per cent in a median high-emissions scenario by end of century, prospects for households are even more dire, with income falling by 18 per cent.

All households will lose income, and low-income households will suffer the most.

Low-emissions scenario



High-emissions scenario



Climate change is an **affordability risk** for households in Canada, and **especially for vulnerable populations**

Climate change will hit households hard, making life even less affordable for people in Canada in the years and decades ahead. Affordability pressures will come from all directions.

Slowing economic growth will reduce economic opportunity and result in lower incomes at the same time as governments must raise taxes in order to maintain services and pay for the clean-up and repair from increased weather-related disasters. Job losses will accumulate, depriving people in Canada of a primary source of economic security, while prices for goods increase as costs multiply through supply chains.

As a result, households will be worse off across all climate scenarios. The loss of household income

is already materializing, with a drop in income per capita of \$720 in both emissions scenarios by 2025 compared to a stable-climate scenario, rising to \$1,890 per capita by mid-century in a low-emissions scenario and almost \$2,300 per capita in a high-emissions scenario. Real income losses will cut deep into household affordability after mid-century, and low-income households will be most affected, facing income cuts of 23 per cent in a high-emissions scenario by end of century, while the median income group faces cuts of 19 per cent.



The Canadian economy is highly climate-sensitive, posing a **major risk to businesses and investors**

The impacts of climate change are not confined to particular regions or sectors of the economy. Businesses and investors across the country and in virtually every sector are at risk.

Climate damages will make all regions worse off by the end of the century, with Northern Canada and Alberta bearing the most significant losses. Northern Canada will bear a disproportionate impact primarily due to infrastructure damage from the effects of permafrost thaw. Northern Canada could see GDP losses of \$5,490 or \$7,080 per capita by mid-century in low- or high-emissions scenarios, respectively, rising to \$11,820 and \$26,060 by end of century. Alberta, the province most exposed to weather-related disasters, could experience median GDP losses at mid-century of \$2,890 per capita in a low-emissions scenario or \$3,920 per capita in a high-emissions scenario.

Most economic sectors will also be negatively impacted across all future climate scenarios.

Manufacturing, the services sector, and transportation will be particularly hard hit by climate impacts. While the construction and agriculture sectors could see benefits, these sectors comprise just 8.5 per cent of Canada's economy and their gains are swamped by the losses experienced by all other sectors. Moreover, the boost to the construction sector is an example of the broken window fallacy, as sector growth is driven by spending to repair damaged infrastructure, which redirects resources away from more productive uses in the economy.

Finally, climate damages impair investments in future productivity. Investment will drop across all climate change scenarios relative to a stable-climate scenario, with the decline accelerating rapidly in the longer term, as costs accumulate and output shrinks.



Climate change is a **fiscal risk** that threatens to **upend government spending**

Climate change puts significant pressure on public finances. Slower economic growth throughout the economy will put downward pressure on government revenue.

This fiscal pressure will manifest at the same time as demands will increase on governments to respond to growing climate costs, such as backstopping weather-related disasters, upgrading and replacing infrastructure, and maintaining healthcare services amidst increased pressures on the health system.

The result will be a forced choice between raising taxes in order to maintain services, accruing additional public debt, or cutting services as climate damages consume a greater share

of government budgets. By 2025, a 0.35 per cent increase in corporate and personal income taxes will be required to cover increased government spending of about \$5 billion annually on climate damages, without eroding services. By mid-century this will rise to more than \$17 billion annually, corresponding to a tax rate increase of approximately one per cent, and by end of century will increase to \$24 billion or \$55 billion annually with tax rate increases of 1.4 per cent and 2.7 per cent for low-emissions and high-emissions scenarios, respectively.



Emissions reductions and proactive adaptation measures, taken together, are the most effective means of reducing cost

Both global emissions reductions and proactive adaptation measures will substantially reduce the costs of climate change to Canada's economy.

Reducing emissions will result in major benefits after mid-century, with the reductions in the low-emissions scenario reducing damages by more than half compared to the high-emissions scenario. Proactive adaptation, meanwhile, will yield major benefits regardless of the emissions

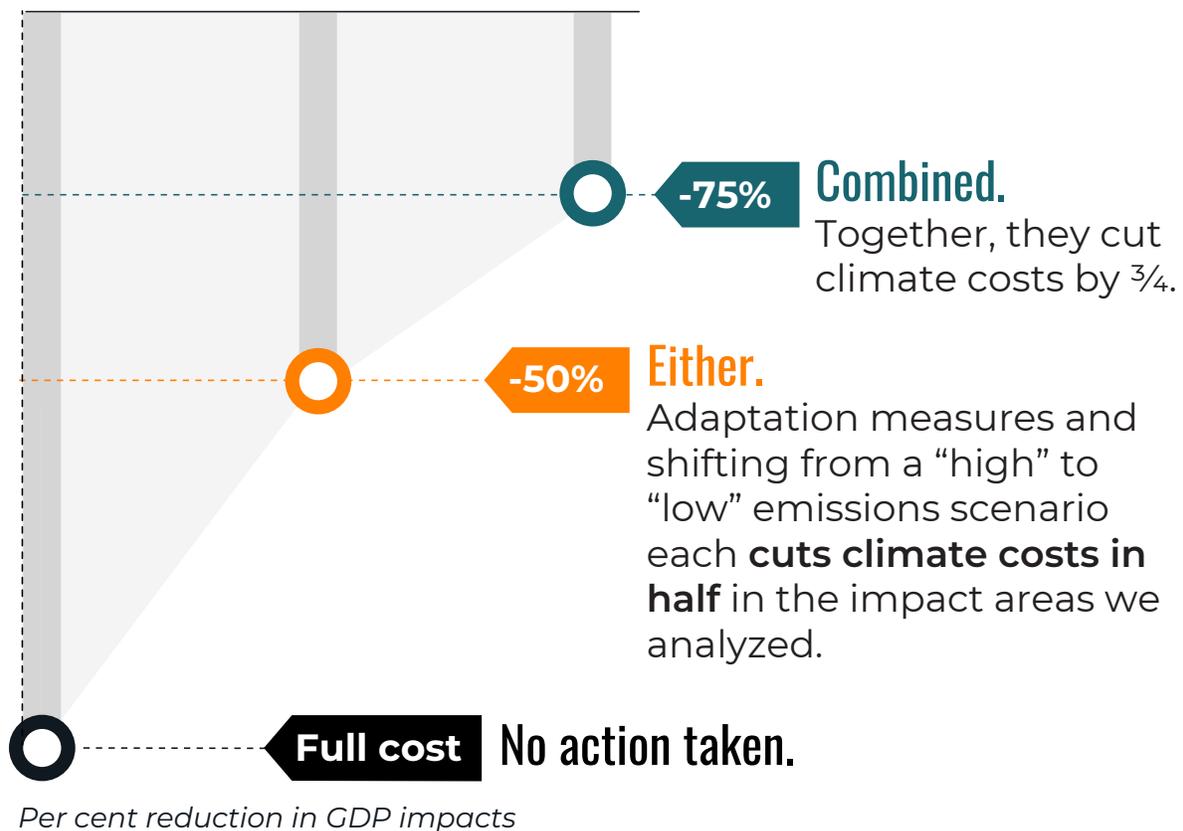
trajectory, and over a shorter time horizon. Taken together, a combination of proactive adaptation measures and global emissions reductions will be the most effective in mitigating damages, reducing Canada's total real GDP losses by 75 per cent.



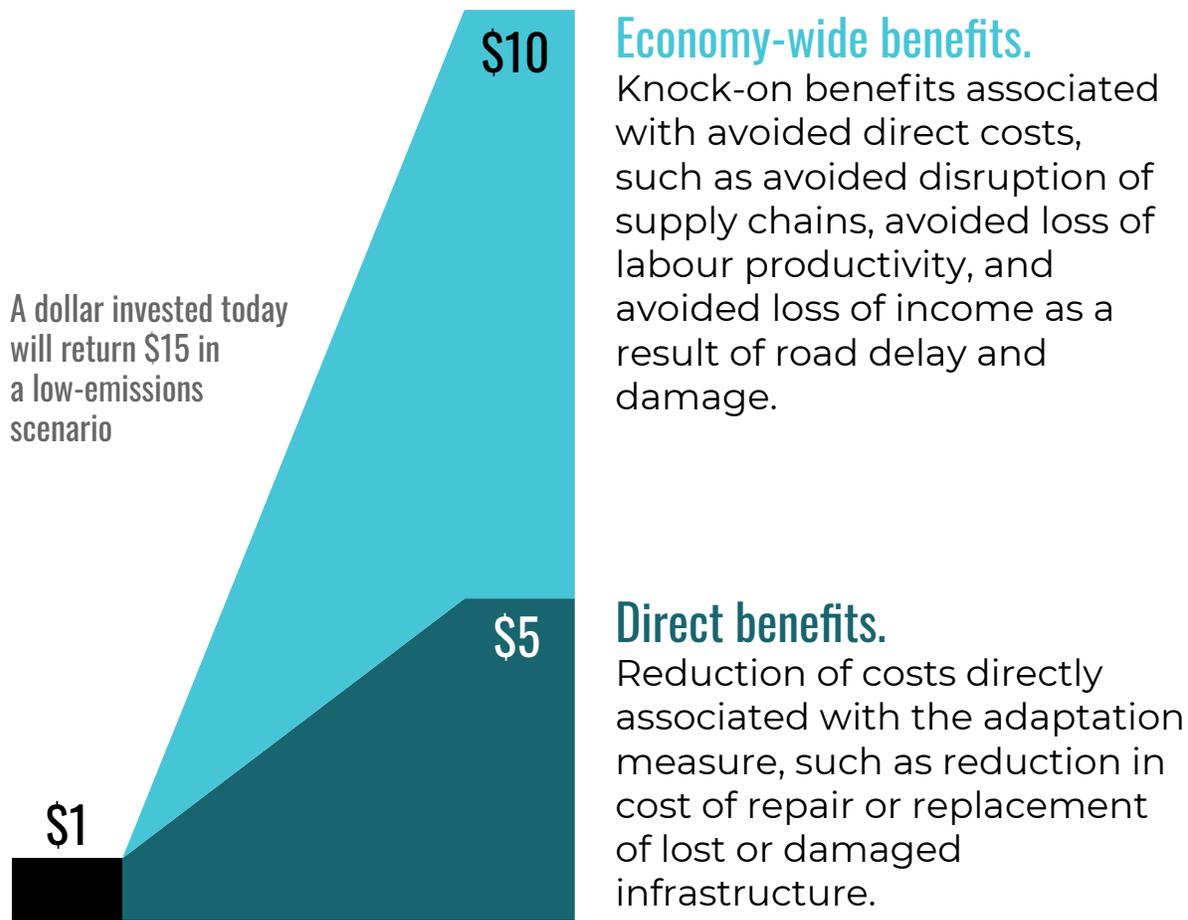
Moreover, our macroeconomic analysis shows that spending on proactive adaptation has major economy-wide benefits. Our results indicate that for every \$1 spent on the adaptation measures we modelled, \$13-\$15 in total benefits accrue. This includes \$5-\$6 of benefits for every adaptation dollar spent by avoiding direct damages such

as premature infrastructure repair and replacement costs and \$6-\$10 of knock-on benefits that work their way through the economy. A macroeconomic frame reinforces the case that proactive adaptation is a smart investment, illustrating that it generates substantial direct and indirect societal returns.

Adaptation and global emissions reductions, taken together, can dramatically reduce costs.



Proactive adaptation is a strong investment that generates major economic returns.



Recommendations

1. Governments should **build climate impacts** and **adaptation policies** into their own **economic decision making**.

Governments in Canada have failed to account for the economic threat posed by a warming and increasing volatile climate, leading to a collective underestimation of both the costs of inaction and the economic benefits of ambitious climate policies. Moving forward, governments should build the costs of climate change impacts, as well as the costs and benefits of adaptation and mitigation policies, into economic analysis and decision-making processes so that policy and spending decisions reflect the very real and significant costs of choosing not to invest in adaptation and emissions reductions.

2. Governments should **encourage**—and where appropriate, **mandate**—accounting for climate change risks **in private-sector decision making**.

As the frequency and severity of weather-related disasters continues to increase, the costs from physical climate damages are already beginning to accumulate both through direct impacts as well as through indirect costs that spread through the economy. The private sector must respond to this growing threat by integrating physical risk and risk-reduction measures into their risk management practices, a practice that governments and regulators should support through accelerating climate risk disclosure initiatives and generating climate information to support accurate and consistent disclosure nationwide.

3. Governments should **scale-up adaptation measures** to match the magnitude of the risk Canada faces.

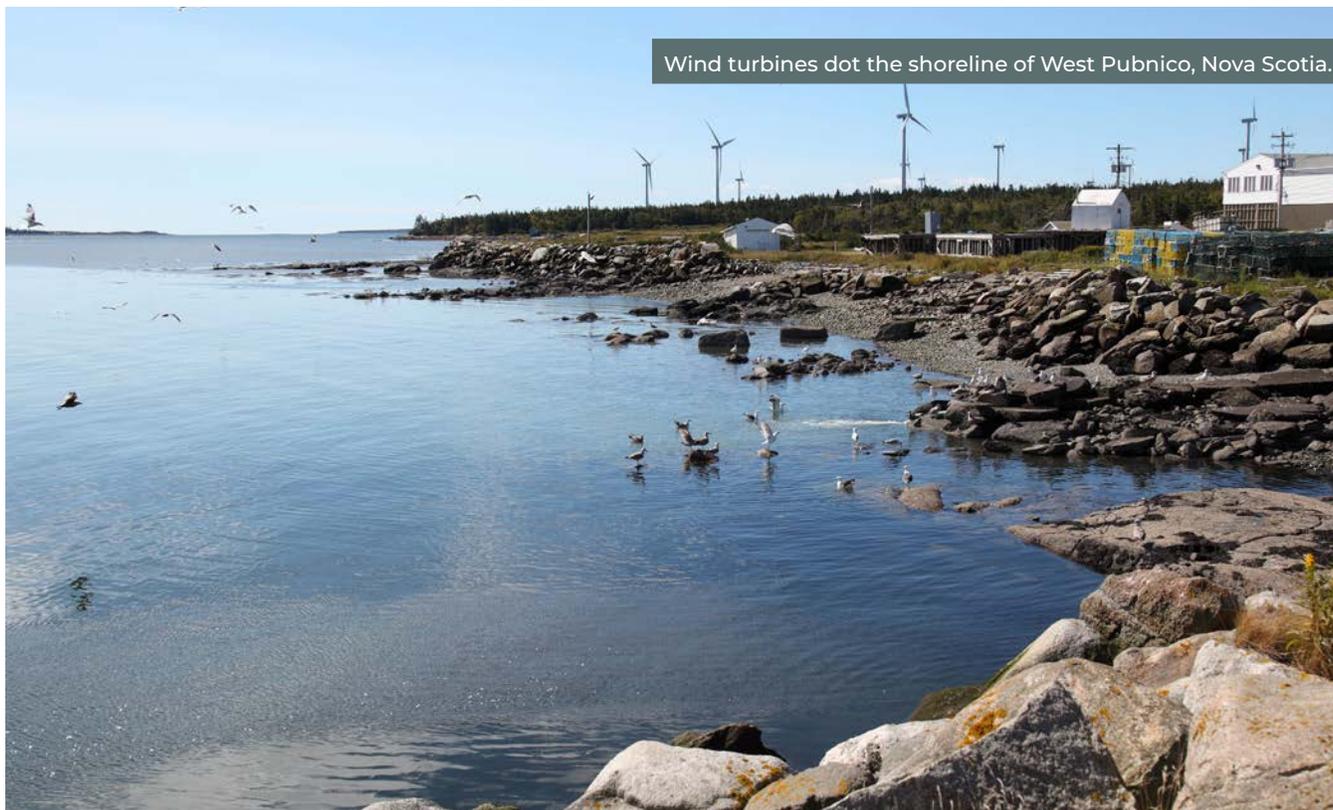
Proactive adaptation can protect the health, security, and well-being of people in Canada and mitigate the impacts of climate change on Canada's economy, providing a return on investment of \$13-\$15 per dollar spent. Despite the clear benefits, Canada is behind on adaptation and governments need to urgently scale-up adaptation policy and investment to match the scale of our climate risk, starting with the forthcoming *National Adaptation Strategy*.

4. Governments should **double down on aggressive reductions in emissions** both at home and abroad.

Moving from a high to a low-emissions scenario results in significant reductions in climate damages. Without major emissions reductions, adaptation alone will be insufficient to address growing climate damages in Canada. All orders of government should continue to develop and implement ambitious policies to reduce Canadian emissions and meet our targets, while also supporting and encouraging global efforts to reduce emissions.

5. Governments should **invest in understanding and preparing** for the **economic risks** of climate change **that have not yet been modelled**.

While this report provides a more detailed picture of the economic risks facing Canada from a changing climate, these risks are just the tip of the iceberg and there are many others that we suspect may have major impacts but that we don't yet have the tools to understand. While governments should not hesitate to act immediately based on what we know today, they should also invest in further research to better understand and prepare for the full scope of climate impacts and economic risks that lie ahead.



Wind turbines dot the shoreline of West Pubnico, Nova Scotia.