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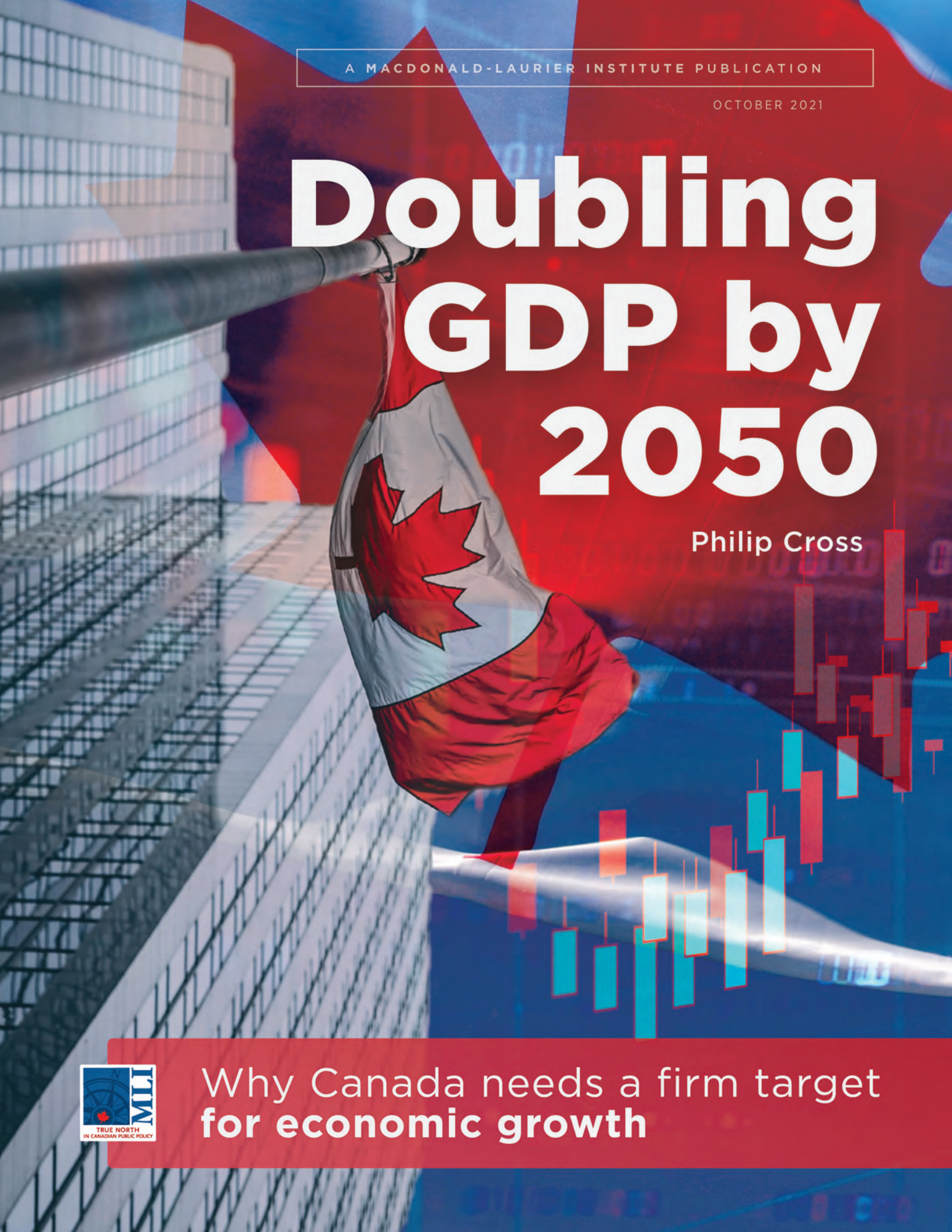
Doubling GDP by 2050

Philip Cross



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Why Canada needs a firm target **for economic growth**

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Executive Summary

Targets to guide government actions are nothing new. For decades, the federal government has set annual targets for the number of immigrants it wants. Inflation targeting is the foundation of the Bank of Canada's monetary policy. Hard budget deficit targets helped governments deal with the fiscal crises of the 1990s and may yet prove indispensable in dealing with today's record deficits.

Given the demonstrated usefulness of hard targets, government needs to set a long-term goal for Canada's GDP. GDP is the key to creating the incomes that drive employment growth. While governments love to set goals for national achievements for the health and well-being of citizens, and for Canada's leadership and influence in the world, they ignore the fact that these things all flow from the greater prosperity that economic growth will bring.

Let's start with the most important target of all – an ambitious goal to double Canada's 2020 level of real GDP by the year 2050, which would grow the economy and create the wealth that will allow Canada to meet climate goals, reduce poverty, be more innovative and become a leader on the world stage. Doubling GDP over the next three decades would entail sustaining annual real GDP growth of 2.5 percent on average. It would mean setting a goal of reaching $4.0 trillion in 2050.

People regularly underestimate how small changes in growth rates that compound over long periods can produce significantly different outcomes. Increasing annual growth by a factor of five (from 1 to 5 percent) results in over seven times more GDP growth after just two decades. Conversely, the reduction in average annual growth from 3.0 percent in the decade from 1991 to 2000 to 2.2 percent in the 2010s helps explain the difference between an era of burgeoning budget surpluses, booming investment, and soaring optimism versus today's chronic budget deficits, faltering investment, and rampant pessimism about the future.

Establishing an ambitious yet readily attainable goal for growth serves several purposes. It is a constant reminder to governments that the past decade's

pace of economic growth is simply not acceptable to Canadians and must be improved. It would force governments to be cognizant of the consequences for growth of its major policy initiatives, notably those that target the distribution over the creation of income or that try to curb greenhouse gas emissions at the expense of incomes. It would put an end to the analysis of government programs in isolation from the impacts on the macro economy; claiming that a national child care program "pays for itself" takes no account of the impact higher government deficits and taxes have on long-term growth. Finally, a hard target would make government accountable for not reaching it.

A central tenet of the proposal to double GDP by 2050 is that accepting slow growth as our economy's "New Normal" understates the importance poor policies have had on dampening growth in recent years (including high deficits, rising taxes, and onerous regulations that hamper investment, notably in natural resources).

> *Constant macroeconomic stimulus is a prime example of a policy that has depressed the economy's long-term potential growth.*

Constant macroeconomic stimulus is a prime example of a policy that has depressed the economy's long-term potential growth. One of the worst unintended consequences of easy monetary policy on long-term growth is that the resulting increase in inequality helps undermine support for capitalism itself. Without economic growth that benefits the average person, support for capitalism wanes, creating a vicious circle in which more taxes and regulation are introduced that only further dampen economic growth.

Many other policies aimed at redistributing income through taxes and transfers involve trade-offs that also suppress growth. For instance, trade-offs exist between many environmental initiatives and the economy. The long-term increase in our living standards originated from increasing the amount of lower-cost energy available to the average person. Hence, expensive plans to lower emissions necessarily involve a trade-off that lowers economic growth. Such plans are doomed to failure. Setting targets for both the economy and the environment will force government to avoid trading off one against the other.

A major benefit of a binding target for GDP is to prevent sacrificing long-term income growth for the expediency of short-term climate targets. We cannot

allow the trade-off of one against the other. A solution must be found where both can be achieved at the same time. The scattershot approach involving myriad policy objectives clearly has failed, partly because of the lack of an over-riding objective. It is time to prioritize effective policies that boost long-term investment and productivity growth in Canada with the goal of doubling GDP.

Sommaire

Pour les gouvernements, se reporter à des cibles dans le but d'orienter ses actions n'a rien de nouveau. Ainsi, depuis des décennies, le gouvernement fédéral fixe des objectifs annuels quant au nombre d'immigrants qu'il souhaite accueillir. Les cibles d'inflation sont le fondement de la politique monétaire de la Banque du Canada. Des objectifs rigoureux en matière de déficit budgétaire ont aidé les gouvernements à affronter les crises budgétaires des années 1990 et pourraient être indispensables pour faire face aux déficits records actuels.

Comme il s'avère pertinent de fixer des objectifs rigoureux, le gouvernement doit fixer un objectif à long terme pour le PIB du Canada. Le PIB est à l'origine de la création des revenus qui alimentent la croissance de l'emploi. Bien que les gouvernements aiment fixer des objectifs de résultats nationaux pour la santé et le bien-être des citoyens, ainsi que pour le leadership et l'influence du Canada dans le monde, ils font abstraction du fait que toutes ces qualités découlent de la grande prospérité qu'apporte la croissance économique.

Commençons par l'objectif le plus important de tous l'objectif ambitieux de doubler le niveau du PIB réel du Canada d'ici 2050, par rapport à 2020. L'atteinte de cet objectif ferait prospérer l'économie et permettrait de créer la richesse nécessaire pour répondre aux enjeux climatiques, réduire la pauvreté, améliorer l'innovation et occuper une place de chef de file sur la scène mondiale. Pour doubler le niveau du PIB réel au cours des trois prochaines décennies, il faudrait maintenir une croissance annuelle moyenne du PIB de 2,5 %. Cela signifie qu'il faudrait fixer comme objectif pour le PIB d'atteindre 4 000 milliards de dollars en 2050.

Les gens sous-estiment régulièrement à quel point de petits changements dans les taux de croissance peuvent s'additionner sur de longues périodes pour produire des résultats très supérieurs. Une augmentation quintuplée de la croissance annuelle (passant de 1 à 5 %) entraîne une croissance du PIB plus de sept fois supérieure au bout de seulement deux décennies. À l'inverse, la réduction de la croissance annuelle moyenne, qui est passée de 3,0 % au cours de la décennie 1991-2000 à 2,2 % au cours des années 2010, a contribué à expliquer pourquoi les excédents budgétaires florissants, l'essor

des investissements et l'optimisme débordant se sont transformés en déficits budgétaires chroniques, en chute de l'investissement et en pessimisme généralisé envers l'avenir.

L'établissement d'un objectif de croissance ambitieux, mais facilement réalisable, servirait plusieurs objectifs. Il rappellerait constamment aux gouvernements que le rythme de la croissance économique décennale n'est tout simplement pas acceptable pour les Canadiens et qu'il doit être amélioré. Il obligerait les gouvernements à prendre conscience des conséquences sur la croissance de leurs principales initiatives politiques, notamment celles qui ciblent davantage la répartition que la création de la richesse ou qui tentent de réduire les émissions de gaz à effet de serre aux dépens de la création de revenus. Il mettrait fin à l'analyse des programmes gouvernementaux effectuée sans examiner leur impact sur la macroéconomie ; prétendre qu'un programme national de garderies « s'autofinancerait » ne tient pas compte de l'impact des déficits publics et des impôts plus élevés sur la croissance à long terme. Au bout du compte, un objectif précis obligerait les gouvernements à rendre des comptes en cas d'échec.

> *« Les mesures continuelles de relance macroéconomique fournissent un excellent exemple de politique qui a affaibli le potentiel de croissance à long terme.*

La proposition visant à doubler le niveau du PIB d'ici 2050 part du principe que l'acceptation de la croissance lente comme la « nouvelle normalité » de notre économie sous-estime l'impact des mauvaises politiques qui ont miné la croissance ces dernières années (notamment les déficits élevés, les hausses d'impôts et les réglementations onéreuses qui entravent les investissements, y compris dans les ressources naturelles).

Les mesures continuelles de relance macroéconomique fournissent un excellent exemple de politique qui a affaibli le potentiel de croissance à long terme. L'une des pires conséquences inattendues des politiques monétaires accommodantes sur la croissance à long terme, c'est que l'augmentation des inégalités qui en a résulté a influé négativement sur l'appui au capitalisme lui-même. En l'absence d'une croissance économique qui profite au citoyen ordinaire, l'appui au capitalisme s'érode, créant un cercle vicieux de nouvelles taxes et réglementations, ce qui ne fait que freiner davantage la croissance économique.

De nombreuses autres politiques visant à redistribuer les revenus par le biais des impôts et des transferts exigent des arbitrages qui freinent également la croissance. Par exemple, de nombreuses initiatives environnementales exigent des concessions de la part de l'économie. Or, l'augmentation à long terme de notre niveau de vie est due à l'augmentation de la quantité d'énergie à faible coût offerte au citoyen ordinaire. Par conséquent, les plans coûteux visant à réduire les émissions compromettent nécessairement la croissance économique. De tels plans sont voués à l'échec. En fixant des objectifs à la fois pour l'économie et pour l'environnement, le gouvernement sera contraint d'éviter d'échanger l'un contre l'autre.

L'un des principaux avantages d'un objectif rigoureux pour le PIB est d'éviter de sacrifier la croissance des revenus à long terme au profit d'une cible climatique à court terme seulement. Nous ne pouvons pas permettre que l'une soit sacrifiée au profit de l'autre. Il faut trouver une solution qui permet de réaliser les deux buts en parallèle. La superposition d'objectifs politiques de toutes sortes a nettement échoué, en partie à cause de l'absence d'un objectif prioritaire. Il est temps de prioriser les politiques efficientes qui stimulent l'investissement à long terme et la croissance de la productivité au Canada en vue de doubler le niveau du PIB.

Introduction

The federal government's spring budget reaffirmed its target of a 36 percent reduction in greenhouse gas emissions by 2030, on the way to its aspirational goal of zero net emissions by 2050. To help realize these goals, made even more ambitious by essentially no progress in lowering emissions since 2005, the government proposed "to develop and apply a climate lens that ensures climate considerations are integrated throughout federal government decision-making" (Canada, Department of Finance 2021, 175).

Targets to guide government actions are nothing new. For decades, the federal government has set annual targets for the number of immigrants, now the only source of Canada's population growth. Inflation targeting is the foundation of the Bank of Canada's monetary policy. Hard budget deficit targets helped governments deal with the fiscal crises of the 1990s and may yet prove indispensable in dealing with today's record deficits.

Given the demonstrated usefulness of hard targets, government needs to set a long-term goal for Canada's GDP. After all, GDP is the key to creating the incomes that drive employment growth and generate the tax revenue to finance most government operations. This underscores the importance of the slowdown in GDP growth over the past decade as innovation and productivity have stalled. Rather than simply accepting slow growth as the "New Normal," this paper proposes establishing the goal of doubling Canada's 2020 level of real GDP by the year 2050.

Doubling GDP over the next three decades would entail sustaining annual real GDP growth of 2.5 percent on average. To achieve this goal, the government should "develop and apply an economic lens that ensures growth considerations are integrated throughout federal government decision-making," just as it instructs for climate considerations. Higher growth is attainable because we believe much of the recent deceleration of the economy was due to the impact of poor policy choices that are within the government's control and not exogenous forces beyond its influence. This paper sets out the growth target of doubling the 2020 level of real GDP by 2050. A separate paper will outline the policies that would enable Canada to reach that goal.

Setting the goal of doubling GDP by 2050

People regularly underestimate how small changes in growth rates that compound over long periods can produce significantly different outcomes. If the US economy had expanded by 1 percent less between 1870 and 1990, the country would have been no richer than Mexico (Cowen 2016, 40). The magnitude with which seemingly small changes can accumulate into large differences over several decades is why Einstein reputedly marveled that "Compound interest is the eighth wonder of the world." A growth rate of 1 percent increases real GDP by 28 percent over 20 years; boosting growth to 3 percent results in GDP doubling over the same period; raising growth to 5 percent triples GDP in just two decades. In other words, increasing annual growth by a factor of five (from 1 to 5 percent) results in over seven times more GDP growth after just two decades.

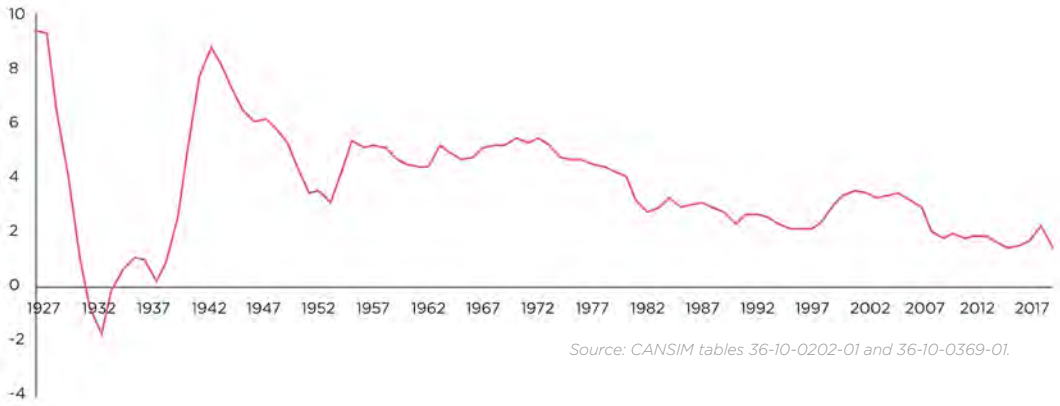
Of course, the power of compound growth applies to small decreases as well as small increases; the reduction in average annual growth from 3.0 percent in the decade from 1991 to 2000 to 2.2 percent in the 2010s helps explain the difference between an era of burgeoning budget surpluses, booming investment, and soaring optimism versus today's chronic budget deficits, faltering investment, and rampant pessimism about the future.

The goal of doubling GDP in three decades may sound audacious but annual average growth of 2.5 percent should be attainable. While certainly more than our recent average of 2.0 percent between 2012 and 2019, it is well within the growth rates Canada sustained for decades before 2008 (Figure 1 shows the 10-year moving average of annual GDP growth). As the macro-economist Robert Lucas observed, real GDP growth in the US has been remarkably stable over the 20th century at about 3 percent for most sub periods. He concludes, "The growth rate of an entire economy is not an easy thing to move around" (Lucas 1988, 13). A central tenet of the proposal to double GDP by 2050 is that accepting slow growth as our economy's "New Normal" understates the importance poor policies have had on dampening growth in recent years (including high deficits, rising taxes, and onerous regulations that hamper investment, notably in natural resources).[1]

Doubling the 2020 level of real GDP means setting a goal of reaching $4.0 trillion in 2050. Realizing this target is slightly complicated by the low level of GDP in 2020 due to the pandemic and its recovery in 2021 and 2022. The federal budget projects real GDP in 2022 will be 3.5 percent lower than if growth had been steady at 2.5 percent, instead of its actual drop of 5.4 percent in 2020 and a recovery of 5.8 percent and 4.0 percent in the next two years. Of more concern is that budget forecasters accept a return to its lethar-

gic pre-pandemic pace of 2.1 percent in 2023 and then 1.8 percent in the following three years (Canada, Department of Finance 2021, 322). If growth averaged 2.5 percent after 2022, GDP would reach the goal of $4.0 trillion in 2050, $674 billion (or 19.9 percent) more than if growth remains at 1.8 percent a year.

FIGURE 1: 10-YEAR AVERAGE REAL GDP GROWTH (IN CONSTANT DOLLARS)



Source: CANSIM tables 36-10-0202-01 and 36-10-0369-01.

Establishing an ambitious yet readily attainable goal for growth serves several purposes. It is a constant reminder to governments that the past decade's pace of economic growth is simply not acceptable to Canadians and must be improved. It would force governments to be cognizant of the consequences for growth of its major policy initiatives, notably those that target the distribution over the creation of income or that try to curb greenhouse gas emissions at the expense of incomes. As it now stands, there is not enough appreciation of the binding trade-offs that exist between economic efficiency and equity or between the environment and the economy. More broadly, it would put an end to the analysis of government programs in isolation from the impacts on the macro economy; claiming that a national child care program "pays for itself" takes no account of the impact higher government deficits and taxes have on long-term growth. Finally, a hard target makes government accountable for not reaching it; simple guidelines and promises to do its best and continue Canada's poor performance are not enough.

Despite what many analysts wish to be true, many policies aimed at redistributing income through taxes and transfers involve trade-offs that suppress growth. The economist Arthur Okun recognized this when he wrote a 1975 paper for the Brookings Institution called *Equality and Efficiency: The Big Tradeoff*, because more of one necessarily means less of the other. Moves to flatten the distribution of income dampen productivity and long-term growth because taxes on higher income earners and transfers to low-income households reduce the incentive to invest and work.

Trade-offs also exist between many environmental initiatives and the economy,

despite politicians repeatedly claiming that society does not have to choose between the two. Denying there is a trade-off between the environment and the economy usually indicates the person speaking is unaware of or indifferent to the negative impact on the economy. While better energy efficiency and less waste are clearly beneficial to the economy and the environment, the fundamental fact is that the long-term increase in our living standards originated from increasing the amount of lower-cost energy available to the average person.

Alex Epstein defines energy as "the capacity to do work" (Epstein 2014, 40). Today that capacity is enormous. The average American's machine energy use is 186,000 calories per day, the equivalent to having 93 human beings at your service for transportation, cooking, or doing chores around the home. Substituting alternative energy sources for cheap fossil fuels has to involve equally low-cost and efficient energy sources or our standard of living will suffer. The corollary is that expensive plans to lower emissions necessarily involve a trade-off that lowers economic growth. Such plans are doomed to failure because, as Brian Lee Crowley noted, in a shrinking economy, burdensome climate policy will deepen social conflicts, while in a growing economy we can afford climate initiatives and still leave people better off (Crowley 2020, 211-212).

> *Expensive plans to lower emissions necessarily involve a trade-off that lowers economic growth.*

Setting a target for GDP in 2050 also helps governments focus on the determinants of long-term growth, which involve quite different policies than does short-term stimulus. Starting with the 2008-2009 Great Financial Crisis, followed by the 2015 oil price shock and now the 2020-2021 pandemic, governments have become over-reliant on policies that stimulate the economy in the short-run but damage the economy's potential to grow in the longer-term. While relentless stimulus has cushioned the downturn of the economy during each of these shocks, it has come at the cost of lower potential growth, one reason the extraordinary stimulus injected over the past decade overall has produced mediocre growth (Cross, 2016, 6). This may be one reason why forecasters do not see a large pay-off in growth from the many initiatives the government has made in the name of raising growth, including more infrastructure investment, funding for women and visible minority entrepreneurs, skills training, support for superclusters of innovation, subsidies to green energy, aid to mass transit, expanded child-care, spending on post-secondary education, and research and development.

The scattershot approach involving myriad policy objectives clearly has failed, partly because of the lack of an over-riding objective. It is time to prioritize effective policies that boost long-term investment and productivity growth in Canada with the goal of doubling GDP.

Quebec has recognized the importance of establishing long-term targets for economic growth, with the goal to "eliminate the gap in the standard of living with Ontario" as measured by real GDP per capita. (Quebec 2019, A.16) To do so, the Legault government proposed raising real GDP growth from its recent average of 1.4 percent to 2.1 percent, primarily through boosting productivity by 1.2 percent a year "through an increase in non-residential business investment" (Quebec 2019, A.15). Quebec's emphasis on growth helped reduce its debt-to-GDP ratio below Ontario's.

The economy, population, and the environment are interrelated

The economic, demographic, and environmental impacts of government policies should be examined together because in reality they are intertwined. Population is an important component of economic growth as it affects both the supply of labour and demand for consumer goods, while the size of the population clearly helps determine Canada's environmental footprint. The pace and configuration of economic growth is a major factor in greenhouse gas emissions. In turn, taxes and regulation designed to lower emissions often dampen overall economic growth. Targeting greenhouse gas emissions without weighing their economic impact invites destructive environmental policies that harm the economy. Setting targets for both the economy and the environment forces government to avoid trading off one against the other.

University of Guelph Professor Ross McKitrick (2016) outlined the difficulty of reducing emissions in a growing society. Overall emissions of greenhouse gases (GHG) are a function of the carbon intensity of our economy (GHG emissions per dollar of GDP), real income (GDP per capita), and population (Pop). This can be expressed as:

$$GHG = GHG/GDP \times GDP/Pop \times Pop$$

Real income and population growth by themselves raise carbon consumption, which makes it more difficult to meet emissions targets. To achieve the promised 36 percent minimum cut in emissions by 2030 from their 2005 baseline will require an average annual decline of 3.8 percent from their actual level in 2019. Achieving such a reduction will be challenging for Canada, which despite years of lip service about the need to reduce emissions has struggled just

to stop them from growing (Canada is hardly unique in that regard). Emissions between 2005 and 2019 fell a total of only 1.2 percent over 14 years, or less than 0.1 percent a year (emissions fell 3.9 percent during the Harper government and rose 1.0 percent after Trudeau arrived because most of the decline occurred during the 2009 recession and the 2015 oil price shock).

However, McKitrick's real insight was that if the population and real GDP per capita increases – they normally do in a healthy society – then carbon intensity needs to fall even faster than total emissions to meet the Paris climate goals (2016).[2] For example, if the population expands by 1.0 percent a year and real GDP per capita grows by 1.5 percent, then emissions intensity has to fall by an annual average of 5.5 percent through 2030, not the 3.8 percent required in the absence of population and economic growth, which is misleadingly advertised as our only goal. A 5.5 percent annual drop in emissions intensity yields a total decline of 46.4 percent between 2019 and 2030.[3]

> *Setting unrealistic climate goals risks making poor policy choices that lead to unwanted outcomes.*

Such a decline in emissions intensity in a short period is unrealistic if we rely only on tools such as carbon pricing and regulation. Unless technology changes rapidly, the economic cost of higher carbon taxes or more stringent regulations will be too much to sustain the growth of the population and the economy. Canada's carbon intensity did decline by 22.9 percent between 2005 and 2019, but almost entirely because of higher GDP and not lower emissions. Hitting the Paris targets requires an outright decline in emissions (not just emissions intensity) from 730 megatonnes in 2019 to 473 megatonnes in 2030, which will be made more difficult by rising GDP and population.

Setting unrealistic climate goals risks making poor policy choices that lead to unwanted outcomes for both the economy and the environment. As 2030 approaches and Canada inevitably is falling well short of its climate goals, the temptation will mount to lower population or GDP growth as a short-cut to reach emission targets. Such a strategy facilitates reaching our climate goals but would compromise Canada's well-being in other important ways. Less population growth necessarily would mean cutting immigration, Canada's only source of population growth, and accelerate the ageing of our population. Already Canada's working age population faces the prospect of higher government debt and more taxes to support the cost of the growing number of elderly (Ragan 2012. In turn, lower population growth also would aggra-

vate the slowdown of economic growth. A major benefit of a binding target for GDP is to prevent sacrificing long-term income growth for the expediency of short-term climate targets. We cannot allow the trade-off of one against the other. A solution must be found where both can be achieved at the same time.

In the long-term, technological innovation is the only viable solution for lowering emissions while maintaining real income growth. However, our society apparently distrusts or discounts technology as the solution to climate change despite having the confidence to trust our lives to other technologies. The recent pandemic justified our society's faith in the ability of technology to solve a seemingly intractable problem. We had no other plan besides vaccines for dealing with COVID-19, as wearing masks and social distancing could not have been sustained much longer without devastating impacts, especially for young people.[4] As former US president Obama's health advisor Dr. Ezekiel Emanuel admitted, "Realistically, COVID-19 will be here for the next 18 months or more. We will not be able to return to normalcy until we find a vaccine or effective medications" (quoted in Axe, Briggs, and Richards, 2020, 156). This confidence in technology was rewarded with the development of multiple vaccines in record time.

Yet when it comes to climate change, trust in promising technologies such as geoengineering or carbon capture and sequestration is quickly dismissed without explanation (Koonin 2021). Geoengineering involves making the earth a bit more reflective so that it absorbs less energy from the sun, while carbon capture and sequestration entails capturing carbon before it is released into the atmosphere or removing carbon already in the atmosphere and storing it, usually underground. Most importantly, both geoengineering and carbon capture would mitigate emissions while allowing for the continued consumption of fossil fuels, yet governments remain reluctant to advocate for either or to maximize their use as part of their policy arsenal. For example, the federal government currently is counting on carbon capture for only 5.8 percent of the total drop in emissions needed by 2030, while it is silent on geoengineering (Canada, Department of Finance 2021, 168).

Others have noted the hesitancy to rely on technology to lower emissions. Obama's science advisor Steven Koonin experienced first-hand how "any mention of geoengineering to governments or NGOs was met with tight-lipped silence, if not actual hostility. The focus was on reducing emissions, and any distraction from that goal, especially one that could allow the world to continue using fossil fuels, was not to be contemplated" (Koonin 2021, 239). Koonin's observation lends support to the suspicion that the real agenda of radical environmentalists is not effectively lowering emissions, but ensuring that they are lowered in specific ways that target fossil fuels, irrespective of the impact on GDP. Note the importance environmentalists attach to a single-minded focus on this goal, a testament to the importance of committing to an easy-to-understand and hard target, something this paper will elaborate upon later.

Keeping the focus on simultaneously reducing emissions and raising incomes is more likely to lead to the open-minded contemplation of solutions that truly help the environment without unnecessarily compromising economic growth. Politicians are more open to such solutions than their advisors, since such solutions would help satisfy the priority the public places on the economy over the environment. A 2021 Environics poll found that 13 percent of Canadians thought the economy was the most important problem facing our nation, versus just 3 percent who cited the environment or climate change (the two were tied at 12 percent in 2020 before the pandemic) (Environics 2021, 4).

There is another problem with having an almost impossible intermediate target for climate. Bill Gates points out that having two climate goals — one for 2030 and another 2050 — may actually hinder attaining the longer-term goal of zero net emissions. In their haste to achieve the 2030 target, for example, countries could be tempted to adopt strategies such as replacing coal-fired generating plants with ones that burn natural gas. This would reduce greenhouse gas emissions in the short-run, but leave in place the infrastructure of new plants that will still be producing emissions in 2050 and therefore make more difficult the goal of achieving net zero emissions (Gates 2021).

Population growth will generate some economic growth

The easiest part of economic growth comes from an expanding population and ultimately the labour force. Even without the innovations or productivity increases that lift GDP per capita, a growing Canadian population boosts GDP as people are fed, clothed, housed, and supplied with all the other basics of life.

Statistics Canada makes projections of Canada's population to 2050 and beyond.[5] Most of its scenarios have Canada's population rising from 37.87 million in 2020 to about 48.8 million in 2050, an increase of 28.8 percent or about 0.9 percent a year. It is noteworthy that all of the increase comes from more immigration, as fertility remains below the replacement rate and the native population shrinks steadily as it grows older.[6]

The continuing growth of Canada's population in itself is one reason to be optimistic that economic growth can be sustained and improved upon. Canada's rising number of people contrasts with the outright declines currently occurring in nations such as Japan and Russia, and soon to occur in much of continental Europe and China. The impact of population on GDP is two-fold. As noted earlier, a growing population props up demand even in the absence of productivity growth. However, rising numbers also increase the possibility

of innovations that enhance productivity. In the words of Erik Brynjolfsson and Andrew McAfee, people are the "ultimate resource" and the most important contribution of population to growth "is the contribution of additional people to our stock of useful knowledge" (2014, 94).

Moreover, an ageing population is not as detrimental to sustained economic growth as many assume. Ageing is often presented as an inevitable drag on economic growth. However, Acemoglu and Restrepo found that "ageing economies, with shrinking workforces, do not seem to grow more slowly than younger economies, as many economists assume they should. Instead, automation picks up" (The Economist, 2017).

Without any change in the productivity of the average person, population growth would boost real GDP 28.8 percent by 2050. This means real GDP per capita would have to increase by over 70 percent by 2050 to achieve the goal of doubling total GDP. Such an increase may seem unreachable to many, after being repeatedly told that slow growth of 1 percent or less is the 'New Normal' for our society.

Is slow growth the New Normal?

Many Canadians believe their economy is not capable of sustaining higher growth after a decade of pedestrian increases averaging 2.2 percent. This echoes the pessimism of a growing number of economists who subscribe to the New Normal doctrine that we have entered an age of chronic slow growth (Cross 2015). Pessimism about long-term growth prospects is becoming embedded in the government's plans. The 2021 budget foresees growth slumping below 2 percent after 2023 after a deceleration to 2.2 percent in the 2010s.

The New Normal hypothesis emerged in the aftermath of the 2008-2009 financial and economic crisis. Former US Treasury Secretary Larry Summers first coined the term, and the idea was amplified by Robert Gordon in his book *The Rise and Fall of American Growth*, which forecast that per capita real GDP growth over the next few decades will average less than 1 percent a year. They argue slow growth will persist because the transformative technological advances of the 20th century will not be repeated, reinforced by the rapid ageing of our society and the lingering effect of the financial crisis (Summers 2017, 564).

A variant was Piketty's gloomy prediction that the weaker growth of income than capital accumulation would drive income and wealth inequality to extreme levels, which would further depress economic growth. McGill Professor Christopher Ragan articulated a Canadian version of the New Normal, with growth limited by an ageing population and a diminishing capacity for stabi-

lization policies to stimulate the economy[7] (Ragan, 2014). Pessimism has not been limited to growth and inequality, as public debates have been filled with concerns about a disappearing middle class, the emergence of a "gig" labour force without steady jobs, and automation threatening the remaining jobs with obsolescence.

The arguments for a New Normal seem plausible, but other interpretations of the recent slowdown are more convincing. The main one blames much of the recent record of sub-par growth on poor policies, which can be more easily corrected than structural forces such as an ageing population. For example, the Bank for International Settlements attributes the protracted growth slump to the dulling impact of monetary and fiscal policies adopted in response to the 2008 crisis and since amplified as the recovery sputtered, resulting in structurally lower potential growth (Bank for International Settlements 2015, 14). This will be elaborated upon in the next section.

Washington Post columnist and author George Will crystallized the accusation that accepting the inevitability of slow growth was excusing policy failures, claiming "Making slow growth normal serves the progressive program of defining economic failure down" (quoted in Levinson 2016, 9). For example, environmental policies have clearly hampered growth with their bevy of higher taxes, regulations, and refusals to approve projects involving resource extraction or pipelines. In recent years, Canada has suffered from the cancellation of megaprojects including the Keystone XL, Energy East and Northern Gateway pipelines, the Saguenay LNG project, and Teck's Frontier oil sands mine, to name only a few.

The growth of the green economy has been nowhere near enough to offset the jobs lost in the pursuit of lower emissions, producing a net loss in GDP and employment. Statistics Canada estimates that the whole "green economy" accounted for only 1.8 percent of all jobs and 3.0 percent of Canada's GDP in 2019, nearly half of which reflected hydro electricity that has existed for decades (Statistics Canada 2020). Other examples of bad policy hampering growth include stimulating housing demand with low interest rates but not expanding its supply. The resulting boom in housing prices has boosted housing's share of GDP to more than all business investment, a recipe for poor productivity growth.

Accepting slow growth as the economy's New Normal carries several risks. It becomes a self-fulfilling expectation by encouraging the fixation of governments and economists on redistribution in the belief that the economy has become a zero-sum game where the only way for one group to improve is at the expense of another. Former Bank of England Governor Mervyn King observed that "With stagnation comes a breakdown of trust. One person's gain is another's loss. The cooperative arrangements that typically characterize a period of economic expansion begin to fall by the wayside, threatening to lock in stagnation for the long-run" (King 2016, 7).

More broadly, pessimism has a negative impact on the psychology of a society, as seen in Argentina and Japan during their long periods of economic stagnation. As King argued, "our societies are not geared for a world of very low growth. Our attachment to the Enlightenment idea of ongoing progress – a reflection of persistent post-war economic success – has left us with little knowledge or understanding of worlds in which rising prosperity is no longer guaranteed" (2016, 6).

What we have seen from nations struggling to grow is sobering and even alarming. The recent experience of the United States shows how groups within a society that have seen their economic position erode over long periods turned to nativist and autocratic politicians in an increasingly desperate search for solutions. Europe is split between the prosperous North and the lagging South, leading to increasing policy paralysis. More fundamentally, macroeconomist Edmund Phelps has noted the different mindsets of societies experiencing secular exhilaration and secular stagnation: "Where there is great dynamism, there is also an abundance of its characteristic fruit: achieving, succeeding, prospering, and flourishing. And where it is lacking, there is a joyless society" (Phelps 2020, 11). A joyless society does not possess the "animal spirits" that help power investment and entrepreneurship.

> *"The idea of a New Normal of stagnation looks to be another over-reaction to a period of poor growth.*

From the optimistic perspective, the idea of a New Normal of stagnation looks to be another over-reaction to a period of poor growth that only temporarily interrupted a long upward trend. Past periods of stagnation also were accompanied by despondency among economists about the future as pronounced as today's pessimism about a New Normal of slow growth. The term "secular stagnation" was originally coined by Alvin Hansen in 1938 to describe how slow economic and population growth reinforced each other, just as the economy was surging and a decade before the baby boom.

Keynesianism is also based on the idea that an economy can fall into a trap of depressed demand for long periods, although Keynes himself always remained optimistic about the economy's long-term potential for growth. His optimism was vindicated in the decades after World War II, even as others maintained their faith in secular stagnation into the 1960s. A similar wave of pessimism followed the sudden slowdown in economic growth in the mid-1970s. The alarmist forecasts of the Club of Rome that the post-war boom was over coincided with angst in the western world over rising commodity prices

and lower growth. These predictions proved unfounded after the Reagan and Thatcher revolutions re-ignited growth in the 1980s.

Despite periodic bouts of pessimism during downturns in the economy, optimism about long-term growth has always been justified in the past. This reflects the secular increase in our know-how and ability to innovate. As economist and Nobel Prize winner Paul Romer has observed, "The historical pattern has been one of accelerating growth — not just sustained growth but accelerating growth" (quoted in Gilder 2013, 91). There are few reasons to think technological innovations have been exhausted. Meredith outlines many examples of technological innovation at work in today's world, including "robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, the Internet of Things, advanced wireless technologies, 3D printing, and driverless vehicles," (Meredith 2020, 124). In a little over year since those words were written, already we can add new technologies such as air conditioning based on nitinol (The Economist 2021a) and mRNA vaccines (which a cover story in *Business Week* said stood for Many Radical New Applications, including for heart disease, cancer and viruses (Langreth 2021)) to new industries based on improving technology such as artificial meat, space tourism, and drones.

The optimistic view is that the current lull in growth reflects a normal adaptation period as society shifts to more powerful technologies. Brookings Institution's senior fellow Isabel Sawhill argues, "we are at an inflection point at which the seeds of faster growth are in place but need time to mature and spread" (2018, 49). She cites the continued exponential growth of computing power, digitization, and the creative potential of an inter-connected society, the potential of which we saw on full display during the pandemic. Former US Federal Reserve Chair Alan Greenspan echoed this confidence that technology is in a transition period, observing, "The IT revolution provides a chance of extending to the service sector the sort of productivity gains that we are used to in the manufacturing sector" (Greenspan and Wooldridge 2018, 402). Dale Jorgensen summarized the optimism that information technology would become "the foundation of the American growth resurgence. A mantra of the 'new economy' – faster, better, cheaper – captures the speed of technological change and product improvement in semiconductors and the precipitous and continuing fall in semiconductor prices" (Jorgensen 2005, 746).

Many important technological innovations are still possible because innovation "is not coming up with something big and new, but instead recombining

things that already exist" (Brynjolfsson and McAfee 2014, 78). Romer describes the track record of economic growth and innovation easily surpassing expectations is because "every generation has underestimated the potential for finding new recipes and ideas. We consistently fail to grasp how many ideas remain to be discovered.... Possibilities do not merely add up; they multiply" (quoted in Naam 2013, 79).

Relentless short-term stimulus has harmed long-term growth

Critics of the New Normal attribute slower growth more to poor policies than structural forces. Constant macroeconomic stimulus is a prime example of policies that have depressed the economy's long-term potential growth. In a little over a decade, the Canadian economy has been subject to three macroeconomic shocks. Each time, governments responded with a combination of lower interest rates and higher deficits. However, repeated recourse to monetary and fiscal stimulus has blunted their effectiveness while lowering potential growth. Policy-makers often accept that trade-off because the harmful social and economic effects of a recession are worth minimizing, even at the cost of somewhat lower growth in the longer-term.

Chronically slow growth reflects structural forces, notably low productivity gains, which can only be addressed by structural reforms, not short-term stimulus from either monetary or fiscal policy. Policies that boost long-term growth potential often dampen growth in the short-term, such as moves to increase labour market efficiency or liberalize trade, both of which involve transitory job losses. In the words of economist Robert Shiller, "We must therefore consider the short run and the long run separately, and the policy responses to the two are very different" (Shiller 2008, 85).

The trade-off between the stimulus that monetary and fiscal policy lend to the economy in the short-term and their harm to growth in the long-term reflects how most stimulus involves shifting the timing of spending from the future to the present or encourages risky investments that may sour in the long-run. This is most obvious for monetary policy today, where lower interest rates have fuelled a housing bubble in Canada that accounts for nearly one quarter of growth since the recovery from the pandemic began but risks major financial dislocations when it bursts. By the first quarter of 2021, Canada was spending more on housing than on business investment, a testimony to the substitution of short-term stimulus for long-term potential in our priorities.

Fiscal policy operates in a similar manner, although with a longer time horizon, as governments choose to spend today instead of at some future date,

since there is a limit on the size of the government in our economy or there is an upper bound to the amount that government can borrow. There is a consensus that deficit-financed government spending today is done at the cost of less spending or higher taxes in the future. As economics professor William Scarth notes, "Running a deficit budget during a downturn may well decrease the size of that initial recession. But over time the government debt must be worked back down, so the overall speed of adjustment of the economy is reduced. The initial recession is smaller, but the recovery takes longer" (Scarth 2014, 180). The trade-off between more short-term stimulus and less long-term growth exacerbates the reduction of potential output growth during recessionary periods, on top of lower business investment and the erosion of human capital caused by recessions.

Because of their harm to long-term potential growth, countercyclical policies should only be implemented for short periods of time, primarily during the depths of the recession. They were not meant to address persistently slow growth, which increasingly is what they have been asked to do over the past decade (Cross, 2016). They have failed to return growth to normal rates and have reduced the long-term potential growth rate. Statistics Canada estimates the total factor productivity in Canada in 2019 was 0.7 percent below its level in 2000, its worst performance in over 20 years on record.[8] The absence of productivity growth limits Canada's potential GDP growth to its inputs of labour and capital, a risky strategy at a time when population growth is slowing and firms are reluctant to invest.

One of the worst unintended consequences of easy monetary policy on long-term growth is that the resulting increase in inequality helps undermine support for capitalism itself; not in the sense of being replaced by full-blown Venezuelan-type socialism, but because the growing web of government taxes and especially regulations prevents business from operating smoothly and efficiently. Without economic growth that benefits the average person, support for capitalism wanes, creating a vicious circle in which more taxes and regulation are introduced that only further dampen economic growth.

Economic growth cannot be sacrificed for environmental goals

The pursuit of lower greenhouse gas emissions targets risks damaging the economy because of the importance that low-cost energy, primarily from fossil fuels, plays in the long-term growth of incomes. A survey done for Natural Resources Canada found that 37 percent of Canadians felt the government had done a poor job of reconciling the economy and the environment, versus only 24 percent saying it had done a good job (Natural Resources Canada 2021, v).

The dependence of growth on cheaper energy goes back centuries. The famed economic historian Carlo Cipolla attributed both the Agricultural Revolution thousands of years ago and the Industrial Revolution in the late 18th century to people harnessing new energy sources. In the Agricultural Revolution, humans evolved from hunters and gatherers to cultivate and tame the energy in plants and animals, supplemented by fire, wind, and water. Over time, people became more efficient at using all these energy sources through rudimentary farm tools, irrigation, fireplaces, water mills, and sailboats.

> *Oil is the dominant energy source today because it is cheap, reliable, and portable.*

The Industrial Revolution "can be regarded as the process whereby the large-scale exploitation of new sources of energy by means of inanimate converters was set on foot" (Cipolla 1978, 54). Fossil fuels played a negligible role in supplying energy until the Industrial Revolution. Fossil fuels proved especially efficient and convenient in meeting the energy demands of industrialization. Coal was the first widespread source of inanimate energy.[9] Its use began a cumulative process, where a rising supply of energy stimulated more economic growth, which boosted education that led to the discovery of new sources of energy, notably other fossil fuels. (Note that human capital played a subsidiary role to energy in the Industrial Revolution, which began in Northwest Europe because it was the first to harness new energy sources, not because it was the first to educate the masses.) In 1850, fossil fuels accounted for only 5 percent of energy. Today they represent 87 percent of global energy supply, the same as a decade ago (Yergin 2011, 3). The International Energy Agency foresees fossil fuels continuing to supply 75 percent of all the world's energy in 2040. The age of fossil fuels is far from over, no matter the lofty goals espoused at the Paris Climate Change Conference.

Oil is the dominant energy source today because it is cheap, reliable, and portable. Its portability means it can be shipped long distances by pipeline or railcar, and then carried around in aircraft or vehicles. Portability is why oil fuels most transportation, supplying 93 percent of the fuel used by road vehicles, planes, boats, and railcars. Stephen Chu, Obama's secretary of energy and a Nobel physicist, conceded in 2010 that oil would remain the world's dominant fuel "because oil is an ideal transportation fuel." A gallon of gasoline has the energy content of 31,000 calories and is very efficient, delivering 85 percent of its energy when ignited to the engine. Chu pointed out that equalling the energy in a car's gasoline tank requires a battery with eight times

more volume and weight (Epstein 2014, 71). Gas engines are the inefficient process in vehicle transport, converting only about 15 percent of their energy to forward propulsion (the rest is lost as heat). We must sharply increase the efficiency in using energy, just as we raised the technical efficiency of steam from 5 percent for the Watt steam engine in the 18th century to 40 percent for steam turbines after the Second World War.

Emissions from fossil fuels will diminish as we learn to use them more efficiently, instead of the great waste that now occurs with the current technology of car engines, power generation, and home heating. The transition to a fully digital economy will accelerate the process, helping raise economic growth and lower greenhouse gas emissions. Aggregate energy efficiency in the US rose from 2.5 percent to around 13 percent over the course of the 20th century, implying that nearly 87 percent of the energy used was wasted during transmission. However, the technology exists to raise efficiency to as high as 60 percent over the next 20 years, which would boost productivity and sharply lower emissions (Rifkin 2019, 22-23).

It is important to carefully manage the transition of energy sources away from fossil fuels that directly release carbon into the atmosphere. It is impossible to predict which energy sources technology will allow us to develop in the future or how they will boost the efficient use of energy, any more than it was possible a few years ago to predict the shale revolution in oil and gas. Climate change goals do not justify limiting fossil fuels at all costs. Danish statistician Bjorn Lomborg estimates that cutting carbon emissions under the Paris Agreement would cost the global economy at least $1 trillion a year, money that could be better spent improving lives in myriad other ways (Lomborg 2020, 116). Jean Pisani-Ferry in a recent report argued that while he was optimistic about the long-run effects of transitioning to a carbon-neutral economy, there "is no reason to overlook transitions costs. These costs, while bearable, are likely to be significant. Rather than pretending that they are trivial, policy-makers should face reality and design transition strategies accordingly" (quoted in Wallace 2021).

The transition from fossil fuels to new energy sources will take time. International authority on the history of energy transitions Vaclav Smil concludes that past energy transitions took two or three generations (2017, 395). The "law of long lead times" holds that weaning our society off fossil fuels will be a much more difficult process than many like to assume, and will reflect the considerable capital embedded in the existing energy infrastructure built upon fossil fuels. Commercial buildings, industrial plants, and homes are constructed with a 60-year planning horizon. Power plants are also planned on the basis of a lifespan of several decades, while a new oil field may require a decade between exploration and first production. The automobile fleet changes very slowly and it will require about two decades to replace Canada's existing stock of 33 million vehicles on the road. Energy expert Daniel Yergin

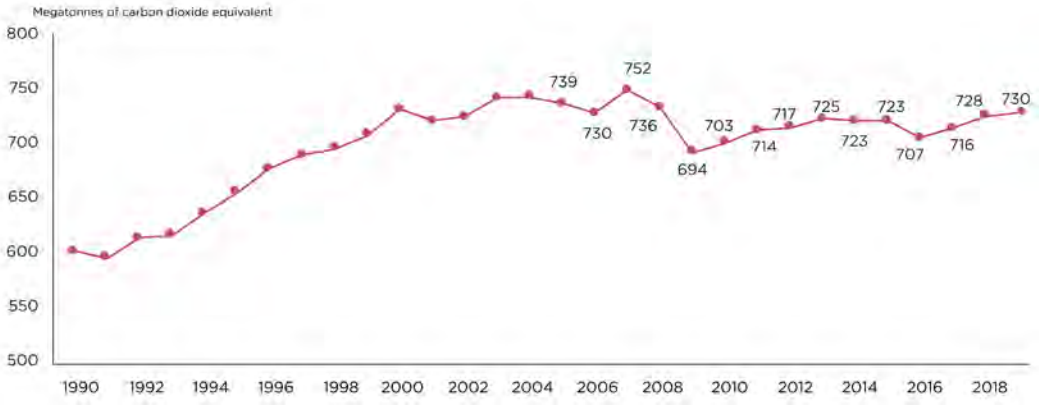
concludes that "history demonstrates that energy transition takes a long time. It took almost a century before oil overtook coal as the number one energy source" (Yergin 2011, 715). The reality is that fossil fuels will be part of our economy for decades to come, and our economic, energy, and environmental policies need to be grounded in this reality.

Canada's emissions target is unclear

One reason Canada has failed to make any progress towards its emissions goals is that the government's target for lower emissions is unclear. Just in the last year, the Liberal government has had at least three goals for emissions reduction. The first was the original Paris Accord target signed in 2016, promising a 30 percent reduction in the 2005 level of emissions by 2030. In December 2020, the government outlined a new goal of cutting emissions 36 percent from their 2005 level by 2030. Then in April 2021 the prime minister announced during the Biden climate summit of global leaders that Canada would achieve a 40 to 45 percent reduction of emissions by 2030. When targets are clearly defined, as for inflation or immigration, governments have an excellent record of achieving them. However, deploying an ever-changing array of benchmarks and targets "are popular ways to cloak meagre green ambitions and continue polluting" (The Economist, 2021b, 73).

Some of the confusion reflects that the government often switches the base of its calculation from the actual level of emissions in 2005 (as specified in the Paris Agreement) to an implausible projection of what emissions could have been if policy had not changed in 2015. However, Figure 2 shows that emissions in Canada clearly had levelled off after 2005, with a slight decline by 2019. The notion that emissions were on a lunar trajectory that would carry them to 815 megatonnes by 2030 was never credible, and is irrelevant to the clear Paris target of 30 percent below the 2005 level. By adding this fabricated increase of 12 percent, which never occurred and is difficult to justify, the total reduction in emissions by 2030 is also artificially inflated. Allowing governments to calculate emission declines from a hypothetical level invites widespread abuse and evasion. It is mysterious why the government would open such a Pandora's Box that helps less scrupulous countries avoid the specific targets in the Paris Accord. *The Economist* notes that climate goals that involve comparisons with "business-as-usual scenarios" or "fiddling with baselines" are usually deployed by emerging economies trying to justify rising emissions (The Economist 2021b, 73).

FIGURE 2: GREENHOUSE GAS EMISSIONS, CANADA, 1990 TO 2019



Source: Environment and Climate Change Canada, 2021b.

Canada's actual target for lowering emissions is unclear. Adding to the confusion is that the government's documents contradict each other. Even as the government announced on April 17 that emissions would be reduced by over 40 percent, the federal budget of April 19 reiterated "Canada is now positioned to reduce emissions by about 36 percent below 2005 levels by 2030" (Canada, Department of Finance 2021, 173). In December 2020, Environment and Climate Change Canada claimed that "the proposed actions outlined in this plan will — once fully implemented — enable Canada to exceed its current 2030 target… putting us in the range of 32% to 40% below 2005 levels in 2030" (Environment and Climate Change Canada 2020, 60). However, the 2021 announcement said that the target had never changed from a 30 percent cut, clearly stating, "Canada's target up until today was to reduce greenhouse gas emissions by 30% below 2005 levels by 2030" (Environment and Climate Change Canada 2021a,1).

Some government documents outlining Canada's climate goals contradict themselves. For example, the 2020 plan *A Healthy Environment and A Healthy Economy* trumpeted it would "reduce greenhouse gas emissions by 30% below 2005 levels by 2030," yet three pages later a graph clearly designated the mythic level of 815 megatonnes as the "starting point," inviting the calculation that emissions would fall 38 percent (Environment and Climate Change Canada 2020, 60-63). Similarly, the April 2021 announcement of new targets said that "Canada's target up until today was to reduce greenhouse gas emissions by 30% below 2005 levels by 2030," but two pages later claimed that its policies "will bring Canada's 2030 emissions to at least 31% below 2005 levels" (Environment and Climate Change Canada 2021a, 1-3).

Some of the muddle seems to originate in the government's confusing policy and publicity announcements with the greenhouse gas reduction targets (called Nationally Determined Contributions) required every five years by the Paris Agreement. For goals to be taken seriously, they must be stated clearly, consistently, and simply, such as the Bank of Canada's target of 2 percent inflation – or our proposal of doubling GDP by 2050.

Shifting budget deficit targets undermine credibility

The government's confusing and unproductive experience with emissions targets shows that non-binding goals are easily put off, fabricated, or simply ignored. The Liberal government has also demonstrated how constantly shifting their goal for budget deficits became a political exercise in ex-post rationalizing ever-larger deficits. Conversely, the success in meeting immigration and inflation targets show the usefulness of firm targets to guide policy.

When it comes to budget deficits, one of the current government's problems is the lack of a consistent and rigid fiscal target. It began with an election promise of temporary deficits not exceeding $20 billion before returning to balance by the end of their first term. The government then adopted progressively easier targets, first keeping the deficit as a percent of GDP at 3 percent, then stabilizing the debt relative to GDP, and finally the abandonment of a target altogether, to be replaced by "fiscal guardrails." The very notion of "fiscal guardrails" is unclear; the 2021 budget says indicators such as the employment rate, unemployment, and hours worked are used "to assess and gauge the impact of fiscal policy support," but do not have any direct impact on the government's fiscal policy (Canada, Department of Finance 2021, 36).

Replacing every target with ever-easier goals undermined the government's credibility for being fiscally responsible. The 2021 budget refers to reducing the federal debt-to-GDP ratio as its "fiscal anchor," but lays out no specific targets or ceilings (Canada, Department of Finance 2021, 53).

Conclusion

The lesson from Canada's experience with malleable targets for emissions levels and the budget deficit is that a commitment to doubling real GDP by 2050 has to be clear and sincere. The government must make doubling GDP a mandatory part of the decision-making process for all major policy initiatives. Climate policies, for example, must be formulated with an explicit accounting of their expected impact on economic growth. This does not mean that every initiative has to contribute to more economic growth. It entails that when policies are implemented that the government knows hamper doubling the GDP by 2050, then other policies must be included that stimulate growth. This is hardly new for policy-makers: they have long known the truth in Thomas Sowell's aphorism that "There are no solutions, there are only trade-offs" (quoted in Axe, Briggs, and Richards 2020, 163).

The Canadian public increasingly seems ready to follow many economists in accepting the inevitability that meager economic growth will continue for the foreseeable future. Establishing the goal of doubling GDP by 2050 would help refocus policy-making and revitalize the economy. It would force the government to acknowledge that many of its policies have helped depress growth in recent years. It would send the signal that slow growth is not inevitable or tolerable and that ways must be found to raise investment, boost productivity, and restore Canada's competitiveness.

Governments must be fully committed (with the same focus that Koonin noted earlier has been successfully adopted by environmentalists) to the targets they set or little progress will be made. Constantly changing targets has the same effect of having none at all, especially if the change involves altering the reference level from which changes are calculated. The government should also follow the example of a clear and easy to understand target for GDP in setting its targets for emissions reductions and budget deficits.

About the author

Philip Cross is a Munk Senior Fellow at the Macdonald-Laurier Institute. Prior to joining MLI, Mr. Cross spent 36 years at Statistics Canada specializing in macroeconomics. He was appointed Chief Economic Analyst in 2008 and was responsible for ensuring quality and coherency of all major economic statistics. During his career, he also wrote the "Current Economic Conditions" section of the Canadian Economic Observer, which provides Statistics Canada's view of the economy. He is a frequent commentator on the economy and interpreter of Statistics Canada reports for the media and general public. He is also a member of the CD Howe Business Cycle Dating Committee.

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Endnotes

1 Ian Keay estimates that natural resources have lifted Canada's per capita income by about 20 percent (Keay, 2007).

2 From this perspective, Canada's 1 percent decline in emissions over the last 14 years is impressive because it was accomplished while GDP grew 28 percent, implying that the emissions intensity of GDP fell by 22.9 percent.

3 Using McKitrick's formula, carbon intensity in 2019 was 0.347 (730 megatonnes of emissions divided by GDP of $2,102 billion). For emissions to recede 36 percent from their 2005 level, they must reach 473 megatonnes in 2030; if GDP rises by 2.5 percent a year for the rest of this decade it will total $2,546 billion in 2030. Dividing 473 by 2,546 gives a carbon intensity of 0.186 in 2030, 46.4 percent below its 2019 level of 0.347.

4 Admissions to pediatric hospitals for eating disorders already have increased sharply as teens struggled with isolation and negative social media (Kohly 2021).

5 The various scenarios are laid out in Statistics Canada Table 17-10-0057-01: Projected population, by projection scenario, age and sex, as of July 1.

6 Not all population forecasts agree. For example, the Office of the Superintendent of Financial Institutions Canada has projected Canada's population at 41.4 million in 2050, using a lower baseline for immigration (Office of the Superintendent of Financial Institutions Canada 2005, 17).

7 Of course, as this paper argues, governments have more in their arsenal than stabilization policies to boost potential growth.

8 Statistics Canada Table 36-10-0208-01: Multifactor productivity, value-added, capital input and labour input in the aggregate business sector and major sub-sectors, by industry. Total factor productivity measures the amount of output that can be produced from a certain amount of input.

9 The mix of fossil fuels that North Americans consume changed over time. First, oil gradually displaced coal in home heating. Once flared off as an unwanted by-product of oil production, natural gas is rapidly replacing coal in electricity generating plants. These trends will continue as regulations in both the US and Canada shut down power plants fuelled by coal. Exporting liquefied natural gas from British Columbia to China would help China reduce its dependence on coal-fired plants.

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>
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