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THE RELATIVISM OF ENVIRONMENTAL INDICATORS

HIGHLIGHTS

- Relativeness matters in all human endeavours. In the case of environmental indicators and performance measures, factors such as geography, population, and economic structure matter a lot. These are mostly ignored and assumed to be the same across all advanced economy jurisdictions in published analyses concerning environmental progress of Canada and its provinces/territories. Thus, making comparisons of true performance difficult.
- Canada's size is hard to comprehend for those who don't live here. The vast distances travelled to get goods and services to their intended market or to visit family, friends or business customers have few comparisons. For example, no two points in the European Union — home to 500 million plus people — come close to the ~8,100 km distance from St John's, Newfoundland to Winter Harbour, BC. Our total population and population density are 14 and 35 times smaller, respectively, than in the European Union, in a land mass that's ~2.3 times bigger.
- Canada's climate is challenging and hugely variable given that our land area begins at the 42nd latitude and extends to the magnetic north. Between long distances and extreme temperature, Canadians use lots of energy for basic heating, cooling, and mobility.
- Natural resources, dominated by energy and mineral resources, supply more than half of Canada's merchandise exports, and industrial activity represents ~32% of GDP, more than in the European Union — competitiveness matters.
- Our overall environmental performance is increasingly focused on greenhouse gas emissions, both in overall quantity and the intensity per unit of GDP ... with the latter, arguably, serving as the current proxy measure for a country's environmental virtue. But CO₂e/unit of GDP does a poor job of capturing the nuance of energy exports and broader natural resource dependence where Canada has a huge international presence.
- With the science and practice of environmental accounting still nascent, comparative international assessments must be viewed with caution. Canada scores better than many critics suggest, particularly if the analysis dives below the surface of absolute quantities and considers all the attributes that make Canada unique or unusual relative to other advanced economy jurisdictions.

INTRODUCTION

It has been 3 years since the last review of environmental indicators for Canada and BC – and of an assessment of how we compare to other jurisdictions around the world. If you arrived from another planet, reading a smattering of social media and headline news, you might conclude that our environment

is deteriorating. This common messaging by environmental groups is partly attributable to the “availability cascade”,¹ the human propensity to react emotionally to issues, and avoid objective analysis. Moral absolutism is easy, as is criticizing Canada and BC for perceived failures of environmental leadership. Most commentators either don't understand or refuse

to acknowledge the role played by the structure of our economy and Canada's pronounced dependence on its resource endowments and natural geographic advantages. We also happen to live in a vast nation with a harsh climate in many parts of the country. Geography and distance matter, population growth and density matter, as does place-specific climate and related weather factors.

¹Thinking, Fast and Slow. Daniel Kahneman, 2011, p142.

Humans have always been in the process of transforming their environment, whether to meet basic needs — shelter, water, food, clothing — or create art, build monuments, and develop the internet. It all involves the conversion of physical assets, using energy in some form, with both positive and negative by-products. Measuring the negative is now a pre-occupation for many activists, academics and international bodies. Rarely is a good story told from this starting point.

Yet there can be no doubt that the quality of life for most humans has improved markedly over the last ~150 years. The current global average life expectancy of ~70+ years² is almost three times that in the year 1800. Average global GDP per capita in 2015 stood 22 times higher than in 1960.³ Prosperity is a comparatively recent phenomenon, distinguishing the present from any time in history, and linked directly to the industrial revolution beginning in the mid-1800's.⁴ But when the world had only ~1 billion people in 1800, the human footprint was smaller, and pollution was local. Today, with a global population of over 7 billion and growing, what we do and how we do tend to have wider environmental consequences.

It is true that industrialization comes with a hefty footprint. It is also true

that environmental quality is worst at the beginning of a period of industrial growth, peaks at a certain stage of economic development, and then improves with increased development and rising per capita incomes. Most advanced economies have made good progress with relative decoupling⁵ of economic growth from resource use and environmental impacts, including Canada.⁶ However, this is not yet the case for emerging economies. So, we measure against our peers — OECD countries and key trading partners⁷ — where competitiveness is important, relative, and increasingly based on indicators such as greenhouse gas emissions, both total and in terms of intensity per unit of GDP ... with the latter, arguably, serving today as the current proxy measure for a country's environmental virtue.

For the purposes of this paper, the European Union⁸ is used for comparison. It is often held up by critics of Canada's environmental performance as the role model, despite stark contrasts on factors such geography and distance to market, climate, population density and growth, and industrial structure. For the most part, we fail to normalize performance measures with these considerations in mind; they are assumed to be the same across all advanced economies, and only sometimes mentioned as qualifiers.

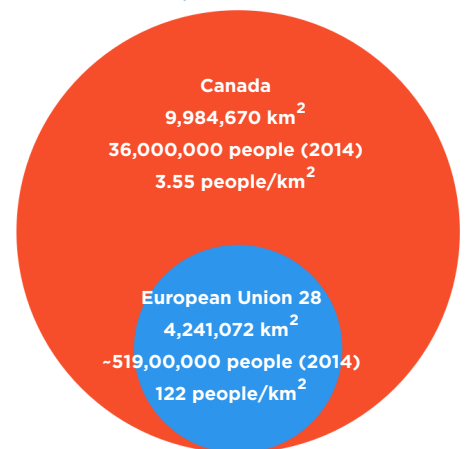
Global Population in 3500 BCE was about the same as Canada's population in 2016.

By 2030 global population is estimated at 8.5 billion.

GEOGRAPHY, POPULATION, ECONOMIC STRUCTURE

Relativeness does matter in all human endeavours. Some obvious differentiating attributes across jurisdictions include **geography and population**. Canada's size is hard to comprehend for those who don't live here. The 28 countries of the European Union have a collective land area that is only 47% of Canada and roughly the same size of the combined geographies of BC, Alberta, Saskatchewan, Manitoba, Yukon plus 60% of the Northwest Territories. On the low-end, BC is 1.5 times bigger than the EU's largest country, France, and 3,000 times bigger than its smallest member, Malta. Fitting the ~520 million people from the EU within Canada means that each of the Canadian regions just mentioned would have

FIGURE 1: CANADA AND EUROPE COMPARED — LAND AREA, POPULATION, AND PEOPLE/KM²



² For OECD countries, this is 80+ years.

³ <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2016&start=1960&view=chart>.

⁴ <https://ourworldindata.org/health-meta/>.

⁵ OECD: Decoupling occurs when the growth rate of an environmental pressure is less than that of its economic driving force (e.g. GDP) over a given period. Decoupling can be measured by decoupling indicators that have an environmental pressure variable for numerator and an economic variable as denominator. Sometimes, the denominator or driving force may be population growth or some other variable

⁶ Absolute decoupling may never be possible without an entire restructuring of the global economy.

⁷ Canada's main trading partners are: United States (75%), the wider European Union (11%), other OECD countries (6%), followed by non-OECD countries (7%), with China and Taiwan accounting for about 5% of the total.

⁸ Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

~38 million people — more than Canada's entire population today.

Population density also matters. Greater density facilitates supply chain integration, hubs for knowledge sharing, opportunities for access to common services, and the availability of labour; it also improves mobility, which leads to higher efficiency and lower costs and less energy use. Canada and British Columbia's lower population density has implications for transportation

costs and energy consumption which differ from the situation facing most EU countries. Finland has the EU's lowest population density at 18 people per square kilometer, with Malta at the other end of the spectrum at 1,352. Overall, the EU has an average density of 122 people per square kilometer. This compares with 5 in BC and 3.5 people per square kilometer for Canada. Only Nova Scotia (17 p/km²) and PEI (26 p/km²) have comparable population densities to any EU country, Finland and Sweden, respectively.

What does this mean for the **distances travelled** to get goods and services to their intended markets, or to visit family, friends or business customers? Figure 2 is illustrative. What is striking is that travelling from the east to west coast in Canada is still about 3,500

kilometers further than travelling between Dublin, Ireland the EU's most western country, to its most eastern member, Cyprus. In fact, even the distance between Skarsvåg, Norway (not an EU country), one of the most northern communities in Europe, and Gibraltar, is still 2,500 km shorter than travelling east to west in Canada. No two points in the European Union come close to the ~8,100 km distance from St John's, Newfoundland to Winter

Harbour, BC. Think of this ... the distance between the great global metropolises of Paris and London is like driving from Vancouver to Vernon. From Lisbon, Portugal to London is almost the same distance as between Vancouver and Yellowknife. And, if a Londoner wanted

to holiday in Nicosia, Cyprus, in Canada they would need to drive the equivalent of Vancouver to Sudbury. The energy, time, and costs of moving goods and people is much higher in Canada, yet the available technologies and means for transporting people and goods is the same — largely based on fossil-fueled planes, trains and trucks/automobiles — for which the internal combustion engine technology has remained essentially the same over time. On top of this, add in the complexities of trade⁹ and Canada's disproportionate reliance on exports of natural resources.

In addition, the Canadian **climate** is challenging and hugely variable given that our land area begins at the 42nd latitude and extends to the magnetic north. Although most Canadians live clustered along the 49th parallel, they are scattered across thousands of kilometers of land. In addition, we experience weather and climate in the extremes, everything from -50C in Nunavut to +35C or higher elsewhere. This is not the case in other parts of the world, except perhaps for Russia. Between distance and extreme temperature, Canadians use lots of energy for basic heating, cooling, and mobility.

Population growth is also a relevant consideration. Between 1995 and 2014, BC's population grew by 26%, compared to Canada's 23%. The European Union collectively grew only 5%.¹⁰ BC's overall population expansion was 5 times and Canada's ~4.6 times larger than that of the EU. At the same time, our economies grew by 63%, 66% and 46%, respectively. Population and its structure and spatial distribution influence energy and materials production and consumption patterns and are important determinants of environmental outcomes.¹¹

Industrial activity¹² in Canada represents ~32% of GDP, compared to ~22% for the EU. Of this, advanced manufacturing accounts for about 53% of Canadian industrial output while for Europe it is 83%. The defining factor for Canada is the dominance of mining and oil and gas extraction and processing — all of

National energy intensities and their secular trends require careful consideration because their differences are caused by factors ranging from climate to consumer preferences, with the composition of primary energy consumption and the structure of efficiency of final conversion as a key factor.

Source: Energy Transitions: History, Requirements, Prospects, Vaclav Smil, 2017

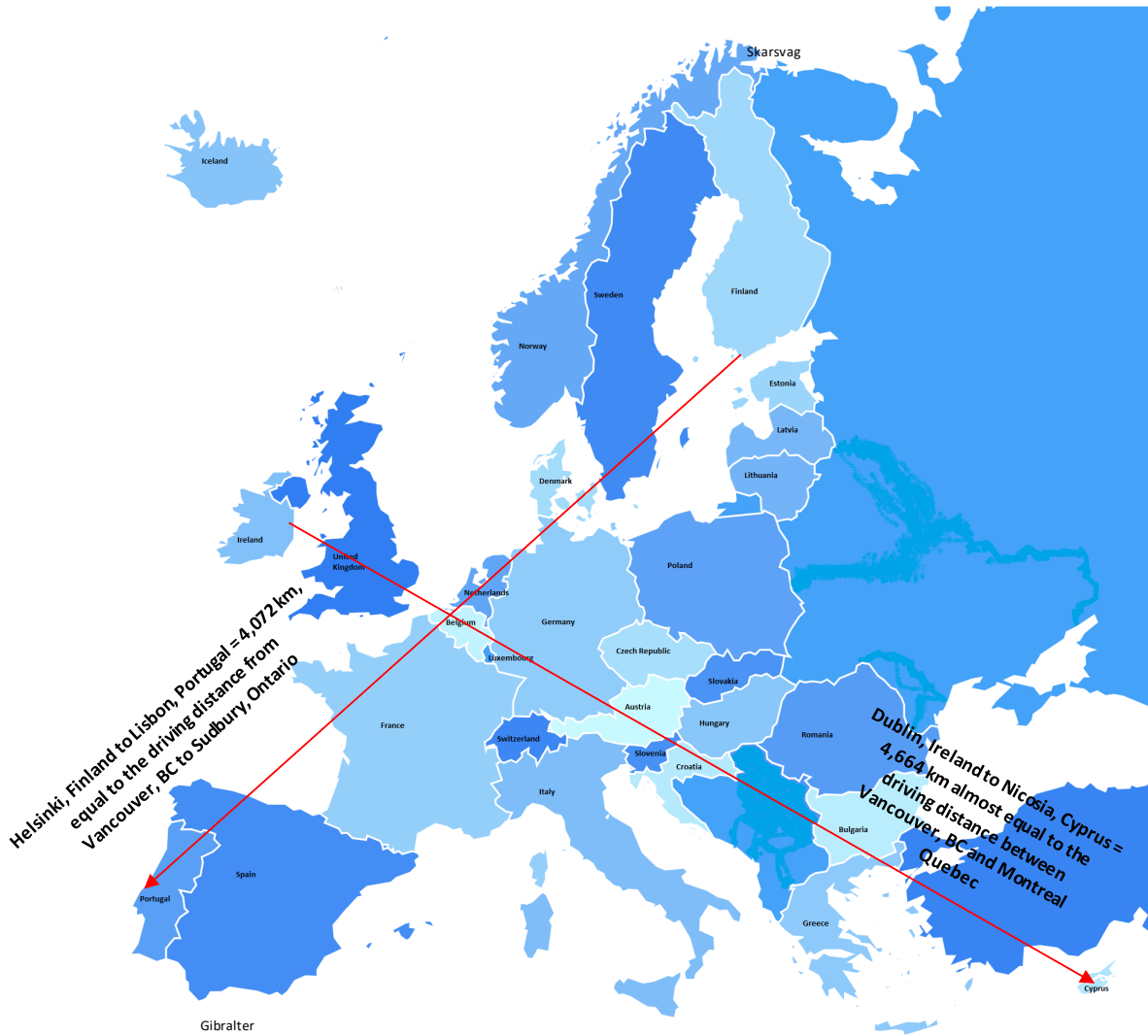
⁹ Canada's main trading partners are: United States (75%), the wider European Union (11%), other OECD countries (6%), followed by non-OECD countries (7%), and China and Taiwan accounting for about 5% of the total.

¹⁰ Using a start year of 1990, BC's population grew by 41%, Canada's 29% and the EU28 by 7%.

¹¹ Green Growth Indicators 2014, OECD.

¹² Includes energy/mining, manufacturing, construction, and forestry/agriculture.

FIGURE 2: POINT TO POINT DISTANCES IN EUROPE RELATIVE TO CANADIAN LOCATIONS



which are energy intensive and take place in areas far from major urban centres. In fact, natural resources supply more than half of Canada’s merchandise exports, several times more than in the EU. This remains the case even though Canada’s economy and labour market have become increasingly services-oriented in recent decades.

ENVIRONMENTAL INDICATORS

What do this large land area, variable climate and weather patterns, population density and growth, and economic structure in which energy and mining figure prominently mean for the indicators commonly used to measure environmental

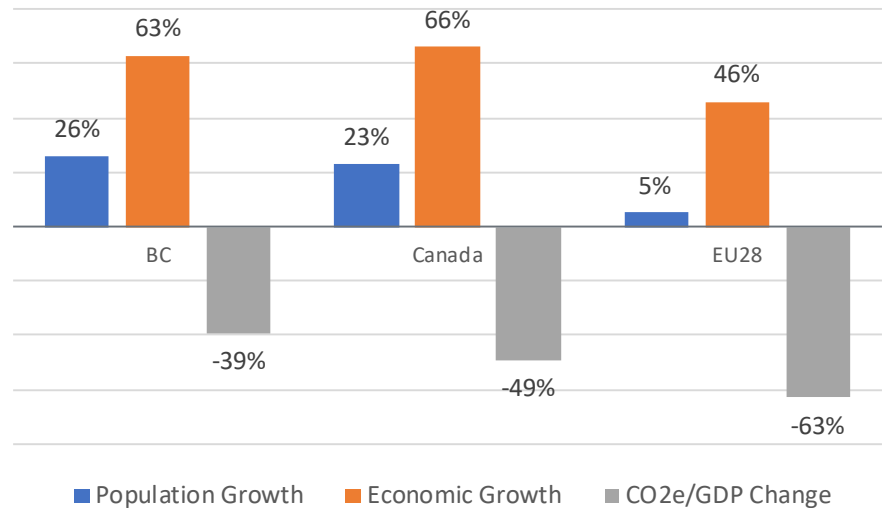
performance? Obviously, in absolute quantities Canada will generally have a larger “environmental footprint” than the far more compact countries of Europe.¹³ These are unfair comparisons, including those made with countries like Norway that have a large primary energy sector like Canada but occupy a land area smaller than Newfoundland and

¹³ The EU’s economy is 10 times the size of Canada (80x bigger than BC), with a population 11 times bigger in a land area 53% smaller.

Labrador — and whose North Sea oil and gas fields are almost “plug and play” compared to oil sands production methods deployed in Canada. Among OECD peers, Canada is more like Australia, which has a similar population density, industrial structure, and temperature extremes, particularly with respect to hot weather, sometimes above 50C — an exact opposite to our cold.

This brings us to **greenhouse gases**. GHG emissions are today’s most frequently cited measure of environmental performance. But total and per capita measures do not capture the nuance of energy exports well.¹⁴ CO₂e per unit of GDP is better, but should be viewed side-by-side with population growth and economic expansion factored in. Taken together, this tells a different story from the usual bad-actor mantle that Canada often wears. A shallow analysis would focus on the EU’s 63% improvement in CO₂e intensity per unit of GDP since the mid-1990s (Figure 3). But this ignores the characteristics of baseline energy systems. In Canada, we have ~80% renewable electricity — in BC, the share is even higher. Few other jurisdictions in the world match this, with only Brazil comparable to Canada. A starting point in which the vast bulk of electricity production is carbon-free means that Canada has fewer low-cost options to reduce GHG emissions. Unlike the EU nations, Canada is also a large net exporter of energy, while the European Union collectively is a substantial net importer.

FIGURE 3: **COMPARISON OF FACTORS AFFECTING EMISSIONS, 1995 TO 2014**



Source: World Bank, DataBC, Statistics Canada, EuroStat.

Understandably, Europe and the United States are lauded for the progress they have made in trimming CO₂e per unit of GDP. Yet, this is mainly a result of transitions away from coal-fired electricity generation since the 1990s. Of note, the EU’s current installed coal-generating capacity is ~48% below what it was in 1990. In the United States, the replacement of the aging coal-generating fleet, much of which was built pre-1990, with natural gas-fired facilities and renewables has played a dominant role in driving down electricity sector GHG emissions.¹⁵ This transition, and the attendant GHG reductions, would have happened anyway; timing is the issue. Moving away from coal was and is not an option available to BC (or most other provinces). In addition, given Canada’s largely existing clean electricity sector,

finding incremental cost-effective emissions reduction opportunities while still accommodating population and economic growth is difficult and can be quite expensive. Moving from 80% to 90% or 100% renewable electricity generation is a lot more challenging than transitioning from one fossil fuel to another (i.e., coal to gas), as has largely been in the case in the United States.

All advanced economies face very similar transportation-related GHG and air pollution challenges given widespread dependence on fossil fuels in this sector. Transportation accounts for some 2/3 of global oil consumption.¹⁶ This sector experiences the same slow pace of technology change and market penetration of alternatives to the existing fleet of planes, trains, and

¹⁴ Who assumes the liability, the producer or the consumer? For example, Norway’s export of oil and gas is not counted as part of the Norwegian GHG emissions inventory. Nordic Energy Research <http://www.nordicenergy.org/figure/greenhouse-gas-emissions-per-capita/>.

¹⁵ This transition may be threatened by the recent repeal of the Obama-era Clean Power Plan.

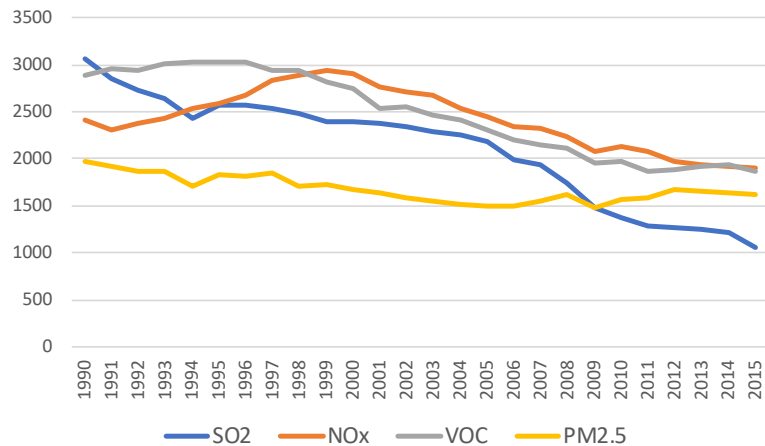
¹⁶ World Energy Outlook 2016, International Energy Agency.

automobiles, regardless of location. Logically, when considering the fundamental factors — geography, population, and economic growth — and Canada’s orientation toward carbon-free electricity, Canada’s percentage of emissions from transport-related fossil fuel combustion is higher than the EU’s (but only about 15%), although the situation differs across EU member states.¹⁷ Higher transportation emissions in some EU countries are attributable to a greater use of diesel fuel, which produces ~13% more CO₂ gas per litre of fuel burned, compared to gasoline engines.¹⁸

Canada and BC have made progress on GHGs, and more than a little, contrary to what critics often assert. Along with improvements in CO₂e per unit of GDP, BC and Canada have recorded significant reductions in other **air pollutants**. Figure 4¹⁹ illustrates the downward trend in all commonly measured air emissions. Like CO₂e, when measured on a pollutant per unit of GDP basis we are in fact on par with the EU. See Figure 5 for more details.²⁰

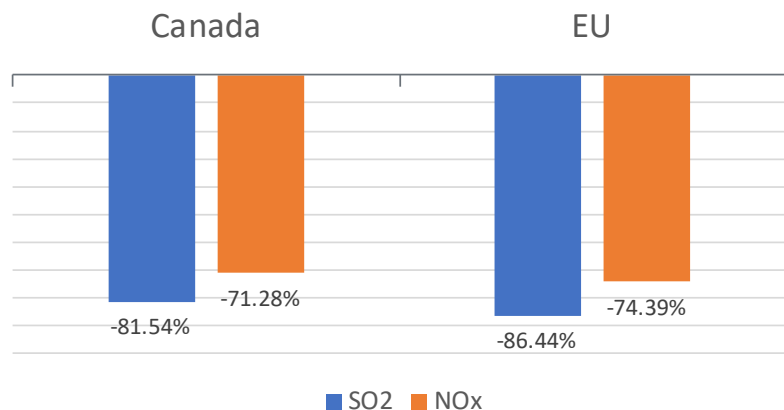
BC’s improvements in SO₂ are comparable to Canada’s. But on NO_x we have done less well, because the bulk of emissions come from the transportation sector, which in the Metro Vancouver area produces more than half of emissions. It is important to pay attention to this region as it is where >50% of British Columbians live (on 0.4% of BC’s land area), and whose residents seem largely unaware of economic activity elsewhere in the

FIGURE 4: OTHER AIR EMISSIONS IN CANADA, KILOTONNES



Source: Environment and Climate Change Canada.

FIGURE 5: CHANGE IN EMISSIONS OF SO₂ AND NO_x PER UNIT OF GDP, 1995 TO 2014



province and its importance to our overall well-being. The good news is that, according to recent data, on all measures of air quality, the Vancouver region is well below the maximum air shed targets.²¹

In terms of other environmental performance measures, **water** is an

emerging area of concern globally. The data to make comparisons among countries is limited and not necessarily standardized. But it is well known that Canada is one of 6 countries that together hold half of the world’s renewable water supplies. Almost 9% of our land area

¹⁷ <https://data.worldbank.org/indicator/EN.CO2.TRAN.ZS>.

¹⁸ http://ec.europa.eu/eurostat/statistics-explained/index.php/Oil_and_petroleum_products_-_a_statistical_overview.

¹⁹ <https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=E79F4C12-1>.

²⁰ National Pollutant Release Inventory, Environment Canada and Climate Change Air Indicators, BC Air Quality, BC Data Catalogue.

²¹ http://www.metrovancouver.org/services/air-quality/AirQualityPublications/Caring_for_the_Air-MV2016.pdf, page 16.

is covered by fresh water. OECD statistics suggest that Canada's water abundance may make us somewhat complacent, since per capita use here is among the highest in the world, next to Iceland and Estonia. But a counterbalance is that we withdraw only about 1% compared to water availability.²² Canada's own published official assessment of water quantity and quality is normal and good/excellent, respectively.²³

BC water assessment focuses on groundwater, with the most recent conclusions being that water levels are stable or increasing, even though about 25% of British Columbians use groundwater and hundreds of groundwater aquifers provide water for industries, municipalities, farms, and rural homeowners.²⁴ No doubt, Canadians and British Columbians can and should be more water conscious and step up efforts to improve water efficiency.

In terms of **protected areas** and **species at risk**, the Business Council has examined these topics at length, [here](#) and [here](#). British Columbia does well in both absolute and relative terms on parks, protected areas, and conservation areas. Taking in all types of land-use status, British Columbia is at slightly more than double (about the size of Germany) the 17% Aichi target, part of the Convention on Biological Diversity.²⁵ While Canada has done less well using a strict interpretation of the definition "protected", we forget, as do others

who comment on our performance, the country's vast unpopulated spaces. On marine protection, the length of Canada's coastline is immense at 202,080 kilometers — orders of magnitude greater than any country in the world, and mostly inaccessible. BC is ahead of Canada in protecting marine places.

WORLD COMPARISONS

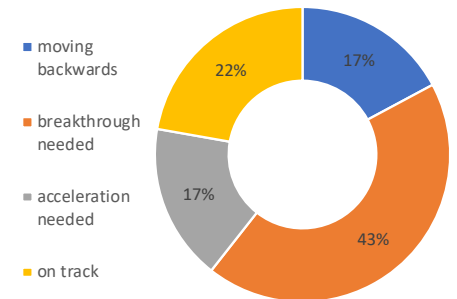
As discussed in our paper entitled [Should We "Green" Gross Domestic Product?](#), humanity is only just beginning to standardize environmental accounting practices,²⁶ thus improving the ability to measure performance across time and jurisdictions. But since there is no formal accepted global practice yet, all assessments must be viewed with caution.

Looking at the [Yale Environmental Performance Index](#), Canada ranks 25th of 180 countries with a score of 85/100, resulting in a 5-percentage point difference vis-à-vis first placed Finland. This is a pretty good result. On this broad metric, Canada sits slightly above the mean and better than the median within this top group.

In a more recent review²⁷ of Canada's progress on the United Nations Sustainable Development Goals, the authors gave Canada a passing overall grade and a mixed performance on the environment. See Figure 6.²⁸

The latter report contains some comments and caveats, notably

FIGURE 6: EVALUATION OF CANADA'S PROGRESS ON ENVIRONMENTAL SDGs



an admission that the focus is on "shortfalls, however small ... rather than celebrating proximity", "extrapolate[ing] trajectories on a linear [rather than or in addition to] mortality and economic growth," with no consideration of "last mile challenges," including the higher costs of making further gains when existing performance is good. The first is an issue, because a small change in direction (e.g., -0.5%) drops the indicator into a "going backwards" category when, in fact, this may be statistically insignificant or a result of data errors. The second caveat is of concern for the reasons already discussed (i.e., simple trend lines focused on changes in absolute quantum measures). The final caveat does not recognize baselines. For example, the change in renewable energy generation does not recognize the current baseline in Canada of 80% carbon-free power, but simply assesses

²² <https://data.oecd.org/water/water-withdrawals.htm>.

²³ <https://ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=D55F8316-1>, <https://ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=68DE8F72-1>.

²⁴ <http://www.env.gov.bc.ca/soe/indicators/water/groundwater-levels.html>.

²⁵ Convention on Biological Diversity, Target 11: <https://www.cbd.int/sp/targets/>.

²⁶ <https://seea.un.org/>.

²⁷ https://www.brookings.edu/wp-content/uploads/2017/10/working-paper_assessing-canadas-domestic-status-on-the-sdgs1.pdf.

²⁸ On track: Already achieved or on track to achieve; Acceleration needed: on course to reach 50% to 100% of stated target; Breakthrough needed: on course to cover <50% of stated target; Moving backward: Negative trend data.

progress on the remaining 20%. Finally, the report attempts to assess the performance of each province and territory by using a combination of data points that is unlikely to contain the refinements of provincial information. The results are broad stroke conclusions that lack finesse and overlook the overall context.

CONCLUSION

Measuring environmental performance remains an emerging field. All published international comparative assessments should be viewed with some caution. Despite a lack of direct comparability, Canada and BC score better than many critics suggest, especially when viewed through a lens that pays attention to the factors of geography, population, and economic/industrial structure. There is work to be done to improve environmental performance over time in both Canada and BC, but it is wise to begin with a realistic and balanced starting point.

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