BRIEF FOR THE HOUSE OF COMMONS COMMITTEE ON INDUSTRY, SCIENCE AND TECHNOLOGY

THE ROLE OF GREEN ENERGY IN CANADA'S ECONOMIC RECOVERY FROM THE PANDEMIC

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Introduction

Transitions are an integral part of life, whether they involve the stages of a person's experience or the evolution of economies. The challenge is to ensure that they occur smoothly, with as little disruption as possible, and that the changes involve a movement towards a status that is as good as possible, and ideally an improvement over the situation that prevailed before the transition occurred. In public policy terms, the issue now before the committee concerns the role that governments can and should play in setting the policy framework within which buyers and sellers make their decisions about energy products and services that may have adverse or beneficial environmental effects.

The issue involves several complex matters that fall within the boundaries of economics, environmental concerns, science and technology. The specific questions addressed in this paper concern the role that the federal government of Canada should play in determining the contribution of "green" energy in Canada's economic recovery. The risk is that, for political or other reasons, the issues will be misunderstood or over-simplified. I hope this brief will add clarity and factual precision to the questions that the Committee must address.

Is the World Facing an Imminent Climate Catastrophe?

Claims that the world may be dangerously warming are based on the view that human-caused carbon dioxide emissions have a larger effect than all the other sources of natural climate variability, including solar cycles, the relationship between the oceans and the atmosphere, clouds, aerosols in the atmosphere, land and water disturbances, and the presence in the atmosphere of certain gases. This is an unproven theory, not a fact. There are no empirical data showing that carbon dioxide has been or ever will be one of the main drivers of climate change. Global temperatures have risen and fallen for millions of years in ways totally unrelated to human emissions, which only began to increase significantly in the middle of the 19th century. Since then, average global temperatures (to the extent that we can actually measure them) have risen just over one degree Celsius.[1]

Widespread climate alarm has been driven by three important factors: the wording of the United Nations Framework Convention on Climate Change, the design of the mathematic models that the Intergovernmental Panel on Climate Change (IPCC) uses to project climate and

[1] *Climate Change Reconsidered*, the 2009 report of the Nongovernmental International Panel on Climate Change

related economic changes, and the inclusion in the IPCC's modelling scenarios of a "worst case" that many governments and media sources have treated as the most likely case.

The Framework Convention defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". It thus explicitly excludes consideration of natural variability. Mathematical climate models, for all their sophistication, are simply a collection of best guesses; they do not "prove" anything. Whenever one reads a story about impending climate "catastrophe", it is almost always based on one of the scenarios developed by the IPCC called Representative Concentration Pathway 8.5, or RCP8.5. What is rarely explained is that this is a worst-case scenario that was never intended to represent a likely outcome. It is based on highly unrealistic assumptions about population and economic growth and on the future use of coal. It is highly implausible; in fact, it borders on the impossible. The media, however, have treated RCP 8.5 as a prediction and indeed as the base case rather than a wildly unlikely possibility. [2]

Facts:

No credible scientific body has ever said that climate change threatens the collapse of civilization, much less the extinction of the human species.

The claims of increased numbers and severity of extreme weather events are almost all wrong. There has been a 99.7% decline in the death toll from natural disasters since 1931.[3]

Even the IPCC projects that the global economy will be 300 to 500% larger than it is today by 2100. Under most scenarios, the global economy would experience a loss of GDP equal to 2-3% in 2100, although the loss could be less. [4] Consequently, if there are adverse effects from climate change, the world will have the time and the income to adapt.

Are the Countries of the World Rapidly Reducing Greenhouse Gas Emissions?

The countries of the world have been setting targets for greenhouse gas GHG) emissions reductions since 1992. In 2015, at the 21st Conference of the Parties to the Framework Convention on Climate Change (COP21) in Paris, countries agreed to submit voluntary plans every five years as to how they would reduce emissions in future. Several countries, including Canada, submitted plans indicating their voluntary objectives for emissions reductions by 2030.

Facts:

[2] Roger Pielke and Justin Ritchie, Systemic Misuse of Scenarios in Climate Research and Assessment
[3] Our World in Data
[4] Peter Lang and Kenneth Gregory, *Economic Impact of Climate Change Caused by Global Warming*. Crawford School of Public Policy, September 19, 2019

Global GHG emissions rose by 59% from 1990 to 2019.[5]

With the exception of a few countries in Europe, no country has ever met its emission reduction target.

The Paris Agreement contains no legal obligations to reduce emissions, and no penalties for non-compliance.

Over the period 2010 to 2019, the country members of the Organization for Economic Cooperation and Development (OECD) reduced their emissions from 13 billion tonnes per year to 12 billion tonnes per year, or 8%. During the same period, the non-OCED countries increased their emissions from 18.1 billion tonnes per year to 22.2 billion tonnes per year, or 23%. Non-OECD emissions thus rose four times as fast as OECD emissions fell during this period.[6]

The non-OECD countries constitute two-thirds of global GHG emissions, a share that is constantly rising.

In 2019, after almost 30 years of international commitments to reduce emissions and the expenditure of $3.7 trillion dollars on climate measures,[7] fossil fuels (coal, oil and natural gas) supplied 84% of the world's primary energy consumption. Renewables supplied 5%; wind and solar energy supplied 2%.[8]

The developing countries have made it clear that their efforts to reduce emissions to meet ambitious targets are contingent on the provision of over $100 billion per year in funding by the wealthier countries. To date, there is no agreement on the apportionment of the payment obligations or the recipients' rights.

<u>What Effect would Canada's Emissions Reductions Have on Either Global Emissions Trends or Climate?</u>

In 2019, Canada's GHG emissions totaled 730 million tonnes, which is 1.6% of the global total.

The trends in future emissions, both in Canada and the world, will be determined by many factors that are very difficult to project accurately. We do not have facts, but rather educated guesses.

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[5] BP Statistical Review of World Energy 2019

[6] Ibid

[7] Collin OhAiseadha et. al., *Energy and Climate Policy – An Evaluation of Global Climate Change Expenditures 2011-2018*, Energies 13(18): 4839

[8] BP Statistical Review of World Energy 2019

According to United Nations data, the global population will grow by more than two billion people between 2018 and 2050, and almost all of this growth will be in Asia and Africa. Europe and North America, which had only 15% of the world's population in 2018, will see that share shrink to 11% by 2050.

A 2017 report by Price Waterhouse Cooper (PWC)[9] offered excellent analysis of the likely patterns of economic growth by region and country to 2050. Among other things, the report found that the world economy could more than double in size by 2050, far outstripping population growth, due to continued technology-driven productivity improvements. Further, emerging markets (E7) could grow around twice as fast as advanced economies on average. (The E7 countries are China, India, Brazil, Russia, Indonesia, Mexico, and Turkey. The G7 countries are the United States, Germany, Japan, the United Kingdom, France, Italy, and Canada.) As a result, six of the seven largest economies in the world are projected to be emerging economies in 2050 led by China, India, and Indonesia. The United States could drop to third place in the GDP rankings, and the European Union share of world GDP could fall below 10% by 2050.

The United States Energy Information Administration, in its 2019 International Energy Outlook report, projected the trends in global energy supply, demand and emissions to 2050. Its economic projections broadly coincided with those of PWC. Overall, the 2019 EIA Outlook projected world energy consumption to rise nearly 50% between 2018 and 2050, due almost entirely to strong economic growth, increased access to marketed energy, and rapid population growth in the non-OECD countries. World energy-related CO2 emissions are projected to grow at an average rate of 0.6% per year between 2018 and 2050, with the rate of growth in the non-OECD countries at about 1% per year. In other words, the EIA projects global CO2 emissions to grow from about 34 billion tonnes in 2018 to 43 billion tonnes in 2050.

This is a long, long way from the "net zero emissions" targets that environmental groups and some western governments are imposing on their citizens. If such emissions reductions were feasible, and if all OECD countries attained them, but emissions growth continued in the non-OECD as now projected, by 2050 global emissions would be about 29 billion tonnes per year, only 16% below the 34.2 billion tonnes of global emissions in 2019.

With its ever-declining shares of global population and income, "the west" will not be able to constrain the aspirations, or the emissions, of the emerging economic and population giants.

Concerning the global effects of Canadian emissions reductions, it is important to understand that such effects would be felt through changes in carbon dioxide concentrations in the atmosphere, not through annual emissions per se. Professor Ross McKitrick explained the consequences of this for possible changes in future Canadian GHG emissions.[10]

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[9] *The Long View: How will the global economic order change by 2050?* PWC, February, 2017

[10] R. McKitrick, *A Practical Guide to the Economics of Carbon Pricing.* University of Calgary School of Public Policy, Issue 28, September 2016

"Policy discussions in Canada, at least since the days of the Kyoto Protocol, have looked at the costs of reducing our total national emissions by some 10 to 30 per cent depending on the base year. At present this would amount to a reduction of about 0.01 to 0.03 billion tonnes of carbon dioxide, which, if achieved, would eventually reduce the rate of increase in the global CO2 concentration by about 0.01 parts per million (ppm) per year, 17 orders of magnitude smaller than the natural monthly fluctuations in the global record, and hence on a scale that for all practical purposes would have no discernable global effects. Complete cessation of all Canadian CO2 emissions would reduce the global concentration by only about three ppm over the next 100 years."

What are the costs and benefits of the policies and programs to reduce emissions through support for "green energy" and electrification of the economy?

Efforts to increase electricity production from renewables are especially puzzling in Canada, where eighty-two per cent of current electricity generation is already from sources that do not produce greenhouse gases, one of the highest rates in the world.

Solar and Wind Energy

Electrical energy produced by solar and wind energy is highly variable, intermittent and unreliable. These sources produce energy according to the weather and time of day, not when consumers demand it. The consequence is that, in order to assure uninterrupted supplies (to avoid brownouts and blackouts), utilities must either have backup generation that is "dispatchable", such as natural gas-fired plants, or electricity storage. Consumers end up paying twice. It is very expensive to provide bulk electricity storage using batteries. **Currently the use of bulk energy storage by batteries increases the cost of delivered electricity by 10 times the cost of the renewable generation itself.**[11]

The jurisdictions with high percentages of wind and solar generation in Europe (Denmark, Germany and Spain) have the highest electricity prices in the European Union. Danish and German electricity rates are three times those on average in Canada.[12]

In projecting future electricity generation costs, many authorities attempt to calculate the "levelized" cost, which is the expected real total cost (capital plus operating costs) in terms of dollars per megawatt/hour over the life of the plants. As pointed out in a seminal paper by Paul Joskow of the Massachusetts Institute of Technology in 2011, levelized cost comparisons are a misleading metric for comparing intermittent and dispatchable generation technologies because they fail to take account of the large variation in the market value of the electricity they supply. In effect, the levelized cost approach is flawed because it treats all megawatt hours supplied as a homogeneous product, and does not take account of the fact that the value

[11] *U.S. Battery Storage Market Trends*, Energy Information Administration, May 21, 2018
[12] Energy Prices 2020, International Energy Agency, May, 2020

(wholesale market price) of electricity supplied varies widely over time. In effect, the electricity supplied by conventional plants and renewable energy plants is not the same product.

The costs usually quoted for wind and solar energy rarely take into account the costs to taxpayers of government subsidies. I have identified 24 generic ways in which governments in Canada provide subsidies or other market advantages to renewable energy.[13] While no inventory has ever been done that would allow the calculation of the total cost of subsidies in Canada, the Texas Public Policy Foundation has prepared as estimate of the total subsidies provided by the U.S. federal government from 2010 to 2019.[14] The amount provided was U.S. 36.8 billion for wind and ($18.86 per kWh) U.S. $34.4 billion for solar energy ($82.46 per kWh). The comparable subsidy for oil and gas used in electricity generation was 39 cents per kWh.

To be clear, the problem with elevated subsidies is not only the undue burden that they impose on taxpayers. Canadians have been providing significant subsidies to wind, solar and end-use energy efficiency since the early 1970's, with much higher amounts since 2000. The original justification was that these were "infant industries" that needed assistance to establish their foundations, except that the infants never grew up. Taxpayer subsidies have essentially become crutches that protect "green" industries from market competition. Phasing out such subsidies is essential If they are to develop the disciplined approach to cost management and marketing that will truly assure their longer-term survival.

The solar and wind industries claim that they offer significant local employment benefits, notwithstanding the fact that almost all the major manufacturers of solar energy equipment are based in China and almost all the manufacturers or wind energy equipment are based in Europe and China. The effects of renewables-driven higher electricity rates have been studied in several European countries. According to a study done at the Universidad Rey Juan Carlos, Spain provided subsidies of more than one million euros per job in the wind industry, and the resulting high electricity rates destroyed 2.2 jobs for every green job created.[15] A study by the Bruno Leoni Institute found that the same amount of capital that creates one job in the green sector in Italy would create 6.9 jobs if invested in other industries.[16] Manual Frondel of the Rheinisch-Westfalisches Institute found that Germany provided per-worker subsidies to producers of photovoltaics as high as 175,000 euros (CDN $245,000).[17] CEPOS, a Danish think tank, found that Denmark's renewable energy subsidies raised electricity rates there to the highest in Europe. They also shifted employment from more productive work in other sectors to

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[13] Robert Lyman. *Broken Promises: Why Renewables Offer No Resilient Recovery*, Friends of Science, May 5, 2020

[14] Brent Bennett, *The Siren Song that Never Ends: Federal Energy Subsidies and Support 2010 to 2019*, Texas Public Policy Foundation, April 23, 2020

[15] Gabriel Calzada Alvarez et. al. Study of the Effects of Public Aid to Renewable Energy Sources. Universidad Rey Juan Carlos, March 2009

[16] Luciano Lavecchia and Carl Stagnaro, *Are Green Jobs Real? The Case of Italy.* Milan, Italy: Instituto Bruno Leoni, May 2020

[17] Manual Frondel et, al. *Economic Impacts from the Promotion of Renewable Energies, the German Experience.* Germany: Rheinisch Westfalisches Institut fur Wirtschaft Sforchung, 2009

less productive work in the wind industry.[18] In the United Kingdom, a study by Verso Economics found that for every job created in renewable energy, 3.7 jobs were lost in other sectors.[19] In short, experience in other countries indicates that policies that divert money from the general economy to subsidize renewable energy result in lower value employment in the "Clean Tech" industries, disproportionate loss of employment and income in the broader economy, and higher costs for consumers.

The Fraser Institute performed an econometric analysis of the consequences of Ontario's Green Energy Act that provided major rate-based subsidies to wind and solar energy in that province. **It found that the policies had serious adverse effects on the manufacturing sector, likely producing the loss of 75,000 permanent jobs.[20]**

Electrification of the Economy

Total electrification means converting the entire Canadian economy to use electricity as a fuel. This includes all appliances in residential and commercial buildings, all furnaces, all transportation uses in every mode, and all other uses. For purposes of analysis, it includes assuring that 100% of the existing and new demand for electricity is met with renewables plus electricity storage. As no other energy sources would be used, it would mean abandoning the infrastructure now used to produce, transport and process oil, natural gas and coal; these would become "stranded assets".

To calculate the costs of such a transition, we need access to estimates of the costs of different electricity generation options and of the different electricity-consuming applications, such as equipment and vehicles. One such analysis is based upon the data from the United States Energy Information Administration (EIA). It also included estimates of the costs to satisfy peak loads that may occur in a weather event or other emergency.[21]

Overall, the estimates of the cost of electrifying the United States economy range between $18 trillion and $29 trillion in "first costs".

Translating U.S. cost data into probable costs for Canada requires one to make some assumptions. If the costs of complete electrification in Canada are directly proportional to the current patterns of energy demand by fuel and sector, then the costs of electrification would be at least 15% of those in the United States. **That would place the costs of electrification at somewhere between U.S. $2.7 trillion (Cdn $3.6 trillion) and U.S. $4.35 trillion (Cdn $5.9**

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[18] Hugh Sharmen, Henrik Meyer and Martin Agerup, *Wind Energy: The Case of Denmark*. Copenhagen, Denmark: Center for Politiski Studier, September, 2009

[19] Richard Marsh and Tom Miers, *Worth the Candle? The Economic Impact of Renewable Energy Policy in Scotland and the UK*. Kirkcady, Scotland: Verso Economics, March 2011

[20] R. McKitrick. *Understanding Changes in Ontario's Electricity Markets and Their Effects*, Fraser Institute, April, 2018

[21] Thomas Tanton, *Cost of Electrification: A State by State Analysis and Results*, October, 2020

trillion). That does not include the stranded assets costs or the deadweight losses which, based on the value of the oil sands alone, would appear to be at least $9 trillion.

The cost to electrify the U.S. economy would translate into annual cost increases of at least U.S. $5,000 per household, paid directly and indirectly.[22] Annual consumer expenditures for energy would roughly double. Translating this into Canadian dollars and adding 15% would mean that the incremental cost per Canadian household would be $7,760 per year. This, of course, excludes the cost to the economy for the stranded assets and the deadweight losses. It is also a national average; the costs to households in Alberta, Saskatchewan and Newfoundland and Labrador would be much higher.

To this one might add the non-monetized costs such as the loss of consumer preference, the increased risks to energy security and reliability and the increased vulnerability of the energy system to disasters and cyber-attacks.

A central premise of those who foresee complete decarbonization of the global economy is that all of the economic sectors and services whose energy needs are now met by fossil fuels can be electrified. Yet, today the technologies needed to make this feasible do not exist outside the laboratory, if there. That is especially the case in the transportation sector, where the high energy density of oil products makes them the ideal source of motive power. **With currently available technology, there is no way to switch to the use of cellulosic ethanol, to have hydrogen vehicles, to electrify commercial aircraft for passenger or freight movement, or to electrify commercial trucking. While it is technically feasible to electrify passenger rail and even freight rail systems, the costs of replacing existing locomotives, cars and infrastructure are in the billions of dollars, and no privately-owned and operated rail company would accept the risks.** To claim that this could be accomplished within a few decades is simply beyond the pale of belief.

<u>Which considerations should guide government policy in “managing” transitions to a “green” economy?</u>

Recent academic research on the timescales required from invention (i.e. discovery) to widespread commercialisation of energy technologies included empirical reviews of the timescales required by 13 products and technologies.[23] The average of these was between two and four decades, with a median time of 32 years, or 43 years in the case of electricity generation technologies. This does not factor in the time required to achieve a turnover of the capital stock in which society may have invested hundreds of billions, or trillions, of dollars. Typically, for example, the life expectancy of rail tracks is 50 years, bridges 50 years, electricity generating plants 35– 80 years, and apartment buildings 60– 80 years. Similarly, new technologies cannot achieve widespread dissemination in the face of consumer resistance.

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[22] Ibid

[23] Robert Gross. *How Long Does Innovation and Commercialization in the Energy Sectors Take?* Energy Policy, September 2018.

Government policies and regulation may eliminate certain choices, but they cannot force people to buy.

One must acknowledge a number of very significant barriers to rapid decarbonisation. Professor Vaclav Smil of the University of Manitoba is the world's foremost authority on energy transitions. In his book *Energy Transitions: History, Requirements, Prospects*, he provides a number of examples. He concludes that decarbonisation is extremely challenging and describes the idea that it can be achieved in a few decades as a 'grand delusion'.

Professor Smil did not address another major barrier, which is the effect of decarbonisation policies on the distribution of economic benefits and burdens in society. Promoting wind and solar energy, for example, may increase incomes for the companies that produce these technologies (mostly in China), but policies that undercut the viability of oil, natural gas and coal production and fossil-fuel-based power generation impose large losses on the regions and communities where that production occurs.

An argument can be made that, in the face of high market costs and barriers, governments can use policy instruments to force the pace of change. This is true, especially if one assumes that they will retain the support of the electorate in doing so. **Outside of the centrally planned economies, however, no government has attempted to prescribe the timelines for commercialisation of new technologies or the dates by which a large share of society's needs must be met by a new technology.** Governments that try to decide which energy sources Canadians will produce and consume in future will not have perfect knowledge or perfect information. Among other things, they will seek to judge future energy market conditions and prices in a rapidly evolving and highly competitive world. In the past, governments around the world spent billions of dollars based on the perception that the world was running out of low-cost oil, so that new non-oil alternatives would have a large competitive advantage. In fact, those who forecast the 'end of oil' have been proven wrong again and again, and new exploration and development technologies have increased supply even faster than the rapidly growing global oil demand. By 2019, the world's oil consumption surpassed 100 million barrels per day, yet there was so much supply available that prices were depressed.

'Picking winners' may be an increasingly popular aspect of national industrial policy (despite its history of failures), but a prudent government should be hesitant about committing billions of taxpayers' dollars to technologies that are not ready and cannot compete without permanent subsidies.