

Facing the climate crisis head-on to better address it

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On this exceptional occasion that the students of Queen's have given me to deliver the keynote address of the 10th Queen's Sustainability Conference, I will present, in all its seriousness, the magnitude of the climate change crisis and the need to face it.

I am going to show you the immense difficulties and complexities, certainly not to discourage you, but to inspire you, as students, with an increased desire to develop your skills in order to contribute to solutions.

Hence the title of my speech: *"Facing the climate crisis head-on to better address it"*.

First, I will describe the formidable challenge that climate change poses to humanity. Next, I will explain the four reasons why it is so difficult to implement effective actions against climate change, namely: our deep dependence on fossil fuels; the problems

related to alternative solutions; collective action hindered by the free-riding effect; and the considerations of justice and fairness that are so difficult to delineate. Finally, I will conclude by advocating perseverance in action.

1. The magnitude of the climate crisis

The first consideration to keep in mind is that humanity would have an ecological crisis to resolve even if there were no climate changes induced by human activity. After all, it is not climate change that causes overfishing, over-harvesting forests, pollution by chemicals, the proliferation of invasive species, discharging 80% of wastewater without treatment, emptying groundwater or sending vast quantities of plastics into the oceans.

Too often, climate change becomes an easy excuse for inaction. I remember an Environment Minister from a developing country who told me that the rapid desertification in his country was essentially due to climate change. I asked him what programs his government had put in place to help the population avoid cutting down trees around them for heating and cooking. Let's just say his answer seemed quite vague to me.

But climate change will make everything worse: No population will be immune – least of all the poorest and most vulnerable – to the worst impacts of climate change, including the growing intensity of extreme weather events, higher storm surges, hurricanes and sandstorms, a dramatic increase in wildfires, droughts and prolonged heat waves with temperatures around 50°C, catastrophic flooding, melting sea ice and glaciers, rising sea levels and salinization of soil and water, ocean acidification and alterations in seawater chemistry and in fisheries ecology, further extinction of plant and animal species, land degradation, damage to infrastructure and human settlements, increased desertification, pathogen spread, water and food scarcity, all leading to waves of climatic migration and widespread political instability.

Long enumeration, I know. But once again, I am not listing all these calamities to spread discouragement, but to confront you with the risks that climate change poses to humanity.

You have no doubt noticed that most of these risks are water related. Some 40% of the world's landmass can be classified as dryland, or water security hotspots, at risk of desertification, where 2 billion people currently live. Many of these people are on the fringe of being severely affected by soil degradation, food insecurity, poverty and shortage of arable land. The 2023 UN World Water Development warns that the global urban population facing water scarcity is projected to potentially double, from 930 million

in 2016 to between 1.7 and 2.4 billion people, in 2050. Water management is likely to be the main issue for the rest of this century.

Where do all these dangers come from? From greenhouse gas emissions, such as CO₂ and methane, that we emit through our activities and which, once in excess in the atmosphere, trap the sun's rays longer than normal, which warms the climate. A warming of only a few degrees has spectacular consequences on ecosystems.

The Paris Agreement, signed in 2015, set humanity the goal of limiting warming to 1.5 degrees Celsius above the pre-industrial era (around 1850), or in any case not to exceed 2 degrees.

However, since 2015, the rate of global warming has accelerated significantly. Since the early 1970s, the planet was warming on average by 0.2 degrees per decade, but since 2015, the rate of warming has accelerated to 0.35 degrees per decade. At this rate, the 1.5-degree threshold will officially be crossed by 2029 at the latest. Overshoot of the 1.5 target is now inevitable according to the International Energy Agency (IEA). The year 2024 was the hottest on record and the first in which global temperatures exceeded 1.5 degrees.

Current projections are that we could reach or even exceed 3 degrees Celsius above pre-industrial levels by the end of the century, with warming continuing thereafter. A world with 3 degrees Celsius or more of warming is not what we want to leave to future generations.

To keep global warming to a maximum of 1.5°C – as required by the Paris Agreement – global emissions must reach net zero by 2050, or by 2070 if not to exceed 2°C. About 110 countries committed to a net zero emissions target by 2050 (only 24 years from now!), and China, the largest emitter, by 2060. But the greenhouse gas emission reduction plans – called Nationally Determined Contributions (NDCs) – announced by these governments are far from being in line with these targets.

Let's take the case of our country. Canada has committed to reducing its greenhouse gas emissions by 40% compared to the 2005 level by 2030 and by 45% in 2035. But according to the latest statistics, it had only reduced its emissions by 8.5%.

The new round of NDCs announced by governments in 2025 do little to move the global trend. There are signs that some countries, notably China, are committing to NDCs that can comfortably be exceeded in practice. The United States under Donald Trump has

withdrawn from the Paris agreement and its parent the United Nations Framework Convention on Climate Change.

We are reaching a tipping point where warming will accelerate warming. The thawing of permafrost in the Arctic releases a huge amount of methane, which contributes to further accelerating climate change. The excess CO₂ absorbed by the oceans makes them more acidic and in doing so makes them less able to absorb CO₂.

This surplus of greenhouse gases that we emit comes, roughly, from two sources: for three quarters, from the combustion of hydrocarbons: oil, natural gas, and coal. For the other quarter, from the depletion of carbon sinks due to deforestation, land degradation, and the impoverishment of organic life in the oceans.

So, since the problem comes from the use of hydrocarbons, we just need to stop using them, right? Much easier said than done.

2. Our deep dependence on fossil fuels

If we were to stop using hydrocarbons as an energy source overnight, the global economy would be paralyzed. We must realize that we are talking about the material foundation of our industrial civilization, which started with the steam engine, thus coal, the most used energy source until 1960. Managing to do without coal, oil, and natural gas while maintaining economic growth will be a truly technological, industrial, and energy revolution, a colossal task, as people are using fossil fuels constantly, in their daily lives, for transport, goods, heating, everything.

It must be clearly seen that we owe a lot to oil, gas, and coal: unprecedented prosperity, the incredible rise that humanity has experienced since the Industrial Revolution, in terms of survival, wealth, and longevity.

From 1820 to 1950, economic growth was spectacular and entirely unprecedented in the Western world, including Japan. Since 1970, it has become so on a global scale. According to the World Bank, in 1970, half of humans lived in extreme poverty, a percentage which went down below 10% starting from 2017.

During these years, hunger receded like never before in history. In fact, the curve of obesity in the world surpassed that of undernutrition at the end of the 2000s, with 1 billion people obese in 2022, compared to 150 million people suffering from undernutrition according to the FAO.

In 1960, the planet had three billion human beings. Today we are 8.3 billion, and we produce and consume more and more per person. According to the FAO, since 1960, global agricultural production has increased 3.7 times, representing a gain of 45% per capita. Our food is responsible for a third of global greenhouse gas emissions, taking into account the energy required and deforestation.

Half of agricultural emissions come from livestock. In China, 3 kg of meat per capita was consumed in 1960, 65 in 2021, which is still significantly less than in Europe and North America, where between 80 and 120 kilograms of meat are consumed per capita per year.

All of this was carried out with energy coming essentially from the combustion of hydrocarbons. When governments began to take action against climate change in the early 1990s, oil, gas, and coal made up more than 80% of the energy used in the world. Despite all our efforts, these fossil fuels still provide around 80% of global energy consumption.

Yes, renewables set new records for deployment in 2024 for the 23rd consecutive year, but oil, natural gas and coal consumption all reached record highs as well, according to the IEA World Energy Outlook 2025. Rather than a transition to low-carbon energy, we have witnessed an accumulation of energy sources to supply a humanity always in search of more energy. The world is in a way in the wake of Texas, the cradle of the American oil industry, which has also become the leading U.S. state for wind and solar power supply.

Humanity is too dependent on hydrocarbons to resolve to give them up. Climate policy was relatively popular when it came to setting ambitious reduction targets for deadlines that were thought to be distant. But as environmental policies move from abstract objectives to concrete regulatory measures, agricultural, industrial, “not-in-my-backyard” and other resistance lobbies are getting organized. They are mobilizing against the feared impacts of climate policies on their business, their job, the cost of energy, electricity bills, the price of gasoline, food bills, tax burdens, in short, their lifestyle.

Especially, right-wing populist parties identify with the traditional way of life, strongly linked to the use of hydrocarbons and single car use. Often, they denounce environmental and climate policies as the whims of an out-of-touch and urban elite, disconnected from the real people. That sounds like an echo of Donald Trump's slogan: 'Drill, baby, drill'. Governments are responding by backtracking on their environmental goals.

In many national parliaments, we see budget cuts in environmental programs, climate targets being delayed and projects postponed (like the ban of gas-fired cars) or even abandoned, and climate policies be weakened under the guise of sound deregulation. In the investment world, we witness backpedalling on ESG (environmental, social and governance considerations), exemplified by asset management firms withdrawing from the United Nations' Net Zero Asset Managers initiative.

In Canada, Conservative Leader Pierre Poilievre has made his opposition to carbon pricing his main battleground to become prime minister. The Albertan government reacted very negatively to the intensification of federal climate policies aimed at reducing greenhouse gases emitted from hydrocarbon extraction. The Carney government suspended carbon pricing for individuals, postponed regulations aimed at increasing the sale of electric vehicles, canceled the minimum quota of electric cars for manufacturers, removed the cap on emissions from the oil and gas sector, exempted Alberta from the Clean Electricity Regulations...

In short, everything shows that humans are unable to free themselves from their dependence on hydrocarbons.

Moreover, humanity gives itself other priorities, including, unfortunately, war. Following Putin's aggression against Ukraine, a large-scale rearmament is launched. According to the UN, global military spending amounted to 2.7 trillion US dollars in 2024, while the Climate Policy Initiative estimates global climate finance for 2023 at 1.9 trillion US dollars. So, 2.7 for weapons compared to 1.9 for climate, the conclusion is relentless: Humanity devotes much more funding to the military than to the climate, in other words, much more to protecting itself from itself than to reconciling itself with the planet. If a Martian is watching us, he must be wondering what kind of animal we are.

3. Problematic alternative solutions

We will need all low-carbon energy sources to reduce our dependence on hydrocarbons, but it must be seen that each has its share of difficulties.

For example, we know that hydroelectric power has limited growth potential, as suitable sites in industrialized countries have already been used. The deployment of nuclear energy was strongly slowed down by the accidents at Three Mile Island (1979), Chernobyl (1986), and Fukushima (2011). In 1996, nuclear power supplied 17.5% of the world's electricity supply, but only 9.8% in 2021. This percentage may be only 8% in 2050 following current trends according to the IEA.

And then there are solutions that are slow to deliver on their promises. Green hydrogen produced from renewable energy is still a niche. It remains an unstable energy source, difficult to transport, and much more expensive than hydrogen derived from hydrocarbons.

Carbon Capture and Storage is also a technology that is still very expensive, which is not deployed on a large scale despite the billions in subsidies that governments dedicate to it, notably our federal government. Even if it were to operate at full capacity, this technology would only target about 10 to 15% of the total emissions associated with fossil fuels, because it does not deal with the emissions that are released during combustion.

When I was federal Minister of the Environment in 2004-2006, my ministry had me drive hydrogen-powered buses in front of journalists to whom I was saying that it was the energy of the future. I was right; it is still the energy of the future!

I was made to say that CO₂ capture and storage was the solution of tomorrow. It is still the solution of tomorrow!

Another solution that does not seem capable of delivering the hopes that some see in it is that of local purchasing rather than the globalization of markets. According to UNESCO, long-distance maritime transport of agricultural materials emits far less than that of local products carried in small batches by land.

A climate mitigation strategy that has the potential to become highly problematic is geoengineering, a term that references attempts to modify the climate in order to counter the negative effects of climate change. It includes setting in motion technologies that either remove carbon dioxide from the atmosphere or return some of the sun's rays back into space. Otherwise, the excess GHGs stored in the atmosphere will persist for hundreds of years, so unless we want to stay in this overheated state, the world will have to counteract these gases and the warming they cause in one way or another. The only way would be to widespread deployment of CO₂ removal technologies that are currently unproven at large scale.

One can see the potential for conflict if nations blame each other for weather disasters that they believe to have been caused by geoengineering. If humans are really going to come to this and play gods with the power of the sun across the globe, it will have to at least be done in a very concerted way, ideally with the approval of the United Nations as a precondition.

Carbon-free energy will create a new form of dependency. Indeed, solar and wind as energy sources and hydrogen as an energy carrier require an immense volume of critical materials. Critical minerals and metals like cobalt, graphite, lithium and rare earths, are the building blocks for the clean and digital economy – in addition to being essential for defence technologies. They are used to manufacture the batteries needed to store electricity and are also in permanent magnets, solar panels, wind turbines, telephones, computers and electric cars – the production of which requires seven times more critical minerals than that of conventional cars.

The extraction and processing of these key materials for the energy transition are largely carried out by China. China's share of refining is around 35% for nickel, 40% for copper, 50-70% for lithium and cobalt, and nearly 90% for rare earth elements. It is a very good thing that a country has taken the lead in such crucial production, but it would be more reassuring if this country were not under an autocratic regime.

China's control over the critical materials market is all the more worrying, given that it also dominates other key supply chains, such as semiconductors, batteries, solar panels, and electric vehicles. The concern is that the Xi regime will increasingly weaponize its dominance and use the export of critical minerals as a leverage tool to pressure client countries into adopting policies in line with its interests. Hence the crucial role that a democratic country like Canada must play, provided that it manages to bring to the market the abundant critical resources contained in its soil.

Over the next few decades, the world will face the twin, simultaneous pressures of greed for fossil fuels and an insatiable appetite for critical minerals. The use of fossil fuels is not about to disappear and their replacement by the advent of renewable energies will take some time. Despite positive trends in the uptake of renewable technologies, fossil fuel energy commodities will likely continue to shape geopolitics and trade and investment relationships into the foreseeable future.

4. Coping with the free-riding effect

We have just seen how much the exit from our dependence on hydrocarbons will require a huge effort full of pitfalls and difficulties. But how to motivate humans for such a monumental task?

People see and feel their need for gasoline and coal, but cannot see or feel a tonne of CO₂; it has no color, no odor, no shape.

Politicians cannot commit to their voters that any additional effort to reduce their fuel consumption will be rewarded by immediate protection against global warming damage; no politician can credibly promise this. If the city of Kingston managed to reduce its GHG emissions by half, this accomplishment in and of itself would not have any noticeable effect on Kingston's climate. As GHG emissions have no borders, they spread around the world. They also spread over time, over decades, if not centuries.

The truly diffused global and non-localizable nature of the greenhouse effect adds considerably to the enormity of our task, because it exacerbates a problem well-known to theorists of collective action, namely the free-riding effect.

This dilemma is encountered whenever, although the collective interest in acting is known, the individual incentive to act is weak, because those who do nothing (the free riders) benefit from the efforts of those who act. As a corollary, those who are mainly causing the problem (here the large emitters of GHGs) are not the only ones to incur the costs, and indeed transfer a large part of the negative consequences to those who have almost nothing to do with it.

This weakness of individual incentives results in an enormous collective action problem, because everyone can find a reason to be a free rider, that is, to do the least they can get away with while benefiting from the actions of others.

The way to counter this free-riding effect is to change the rules of the game in order to strengthen individual incentives to act. In the case of combating climate change, the best way to stimulate this incentive to act for individuals, companies or countries would be to agree on a global carbon pricing system, which would make it beneficial for everyone to reduce their GHG emissions. Thus, "the less I emit, the less I pay".

I proposed carbon pricing to Canadians as Leader of the Opposition in 2008. Mr. Harper destroyed me electorally by campaigning against 'Dion's tax.' Justin Trudeau implemented one as Prime Minister, and Mr. Poilievre made it very unpopular with his 'axe the tax' slogan, to the point that Mr. Carney had to cancel its portion related to individuals, while maintaining the one to industry, which Mr. Poilievre wants to abolish.

Like others, including highly respected economists, I have written in favor of universal carbon pricing. This good idea is not progressing, but we must not give up.

Prime Minister Trudeau took the leadership of a Global Carbon Pricing Challenge, through which Canada is asking all countries to adopt carbon pricing as a central element of their climate strategies. Canada should continue this leadership.

On January 1, 2026, the European Union formally launched the world's first carbon border levy: the border carbon adjustment mechanism (CBAM). The European Union will impose tariffs at its borders on certain goods that have not been tariffed by their country of origin. That means that for a country like Canada to have our own carbon pricing policy is becoming as an asset for exports to Europe. Carbon tariffs must become a reality of world trade.

5. In search of climate justice

In addition to carbon pricing, another way to combat free-rider behavior is moral pressure: making those who do nothing feel guilty or exposed to criticism. For this, rules of fairness must prevail: those who can do more must do more. But these rules of fairness are not easy to establish. We need to make the transition socially just for the people most directly affected.

In Canada, in Germany, in the EU, just transition plans are deployed to provide tailored financial and practical support to workers, unions, regions and sectors most affected in moving away from fossil fuels, notably coal.

At the international level, it is not easy to find common ground between developed countries and developing countries, in a world where global energy demand is expected to continue to increase due to population and economic growth and where around 730 million people still live without electricity.

Developing countries tell rich countries: you did it, you fix it. It is you who carried out the industrial revolution; it is up to you to reduce your emissions. For us, our priority is to achieve development as you did, to lift our populations out of poverty, to give them access to affordable electricity.

The problem is that the share of greenhouse gas emissions coming from emerging and developing economies is booming. In 1920, 95% of fossil carbon emissions were located in North America, Europe, and Japan. In 1945, it was still 90%, then 75% in 1990. But between 1990 and 2024, emissions from China, India, and Indonesia exploded, rising from 14% to 40% of the global total. In 2024, the United States accounted for only 11% of global emissions and the European Union for 6%.

The same phenomenon of geographical displacement occurred for the depletion of carbon sinks. In 1920, a quarter of depletion related to deforestation came from the

United States. They now mainly come from tropical forests, such as the Amazon or the Congo Basin.

As the impacts of climate change are felt, there is pressure for international aid to focus on adapting to these effects rather than on mitigating GHG emissions. My opinion on this is that we must combine both: Aid for adaptation must also allow for mitigation. A main focus of adaptation should be on forests and water, in financing projects that are combining carbon sinks and sequestration, with flood protection, food and water security, livelihoods improvement, and biodiversity conservation. Canada has especially a lot to offer, as it relates to expertise on forests, water and sustainable agriculture.

An issue that comes to mind is that of states whose economies are based primarily on the export of oil and gas. The end of the hydrocarbon era, or the process of getting there, risks destabilizing these countries, especially those already mired in conflict zones.

Twenty-two countries depend on fossil fuels for 20 percent or more of their GDP. To get out of fossil fuels may create dangerous perturbation in these countries. Some oil-dependent states have become rentier states characterized by authoritarianism, repression, poor governance, and high level of corruption and violent conflicts. Besides the obvious case of Russia, the Middle East will face challenges, as it holds half of the world's oil reserves and is one of the most militarized regions in the world.

Conclusion: Combine determination with pragmatism

I told you at the beginning that I would explain the difficulties plainly and without complacency, and that it is not to discourage you, but to give you the desire to act. But to act effectively, that is, with the population, because the best green plan, the most purist, will go nowhere without the support of the people.

So we have three challenges: first, time is running out, we need to act now, without delay, otherwise it will be too late to avoid the terrible impacts of climate change. Second, the task is immense, nothing less than changing the material basis of our civilization: energy produced through burning fossil fuels. Third we need to keep voters on board, while their daily life is today so closely linked to the use of fossil fuels.

To maintain the support of the population for this transition, it must not be seen as adventurous, abrupt, costly, and unfair. Those who fear the end of the world must ally with those who worry about not being able to pay their bills at the end of the month.

We must act quickly. But we must act effectively. And we cannot be effective without the support of the population. Hence the need to combine determination and pragmatism. A difficult combination.

We do not want climate-skeptic politicians who refuse to do anything — and boast about it — to win their elections. That is why we are reduced to rejoicing when the 'do little' win over the 'do nothing,' even though we know very well that scientists are asking us to 'do much more'.

We must support and encourage those decision-makers willing to do more, in the development of innovative and socially just solutions, and who, above all, understand that the imperatives of justice and equity are necessary conditions for success.

We are not doing enough, alright, but we are not doing nothing either. We must build on what works. We must accelerate the pace of decarbonization and biodiversity protection through efficient carbon pricing mechanisms and other measures. We must ensure that our economies remain competitive, technology-driven and innovative. We must ensure a just transition where businesses, workers, unions and local communities find the necessary support at all stages of this major economic transition.

The green transition of renewable energy sources is well underway everywhere. Solar panels, wind turbines, and batteries to offset their intermittency are increasingly establishing themselves as the least expensive way to produce electricity. The economies of scale related to mass production will make prices even more competitive. In the same way, we must accelerate and not slow down the replacement of the combustion engine with the electric engine in automobiles. The goal is to decarbonize electricity production and electrify the economy.

Let's continue to improve our energy efficiency. Globally, it takes almost twice less energy to produce a unit of GDP in 2021 than in 1980.

Donald Trump's presidency is a disaster for the fight against climate change. Yet, even he has not managed to slow down American divestment from coal, which began in the mid-2000s.

The rate of deforestation is decreasing in Indonesia and the Amazon. And there are other similar advances.

I know that all of this is not enough. But there is good news, on which we must build.

And one of these builders must be Canada. Yes, our country is the fourth largest producer of oil and the fifth of natural gas, and we are being asked by all sides to increase our hydrocarbon production. But we are also a country that can lead the way on the global transition, with our vast mineral and metal resources, our global mining expertise, our technological leadership and our skilled workforce.

It will be essential that our ability to bring critical resources to the market materializes. For this, there will need to be a great deal of cooperation in the energy and mining sectors, on an unprecedented scale, business partnerships, long-term contracts, massive investments, agreements on mining extraction standards that are socially and environmentally demanding and respectful of Indigenous Peoples.

European democratic states are seeking to get out of their dependence on Russian gas and on critical minerals from China. There is then a real interest in a stable, allied democracy, strong in technology and R&D, and blessed with critical natural resources like Canada.

And then there is nuclear energy where Canada plays a major role. To achieve carbon neutrality by 2050, one of the requirements of the International Energy Agency's scenario calls for an 80% increase in global nuclear power generation by 2040. Canada has a long history in the nuclear field. We have decades of experience in developing, operating and refurbishing our unique heavy water natural uranium reactor technology – the Candu reactor. Further, small modular reactors (SMRs) provide the opportunity to demonstrate continued Canadian leadership in the next generation of nuclear technologies. And Canada is one of the world's largest uranium exporters, producing 10% of the total global output.

Here, then, are the tasks that await Canada and the entire world. We are facing one of the greatest challenges in modern history: nothing less than reconciling humanity with the planet, while ensuring that those who fear the end of the world and those who worry about the end of the month remain united while achieving their goals. Hence the necessity of combining determination and pragmatism.