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Written submission from North American Young Generation in Nuclear – Durham Chapter

In the Matter of

Request from Ontario Power Generation Inc. to modify the Pickering Nuclear Generating Station integrated implementation plan (Revision 1)

Public Hearing - Hearing in writing based on written submissions

January 2021

Mémoire de North American Young Generation in Nuclear – Durham Chapter

À l'égard de

Demande de Ontario Power Generation Inc. pour modifier le plan intégré de mise en œuvre, révision 1, pour la centrale nucléaire de Pickering

Audience publique - Audience fondée sur des mémoires

Janvier 2021

Canada

NAYGN-Durham Written Submission

Proposed Changes to Ontario Power Generation's Integrated Implementation Plan for the Pickering Nuclear Generating Station

January 2021

NORTH AMERICAN YOUNG GENERATION IN NUCLEAR (NAYGN) – DURHAM CHAPTER
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Introduction

On behalf of NAYGN-Durham, we offer here a few comments related to the upcoming Canadian Nuclear Safety Commission (CNSC) hearing that will consider the proposed changes to Ontario Power Generation's (OPG) integrated implementation plan for the Pickering Nuclear Generating Station.

Our organization (NAYGN) seeks to provide opportunities for young nuclear enthusiasts to hone their leadership skills, develop their professional abilities, create life-long connections, constructively engage with the public, and inspire today's nuclear technology professionals to meet the greatest challenges of our time.

This intervention is submitted in support of the removal of resolution action G25-RS1-04-20 from the Pickering Nuclear Generating Station (PNGS) Integrated Implementation Plan (IIP) and the extension of the deadlines for actions G04-RS2-06-08 and G01-RS1-06-01.

In the following, we address the reliability of OPG's nuclear operations (which is relevant for action G04-RS2-06-08), the safety of nuclear energy in general (relevant to action G01-RS1-06-01), as well as broader themes relevant to nuclear energy both in Ontario and on a global scale.

Reliability

The following discussion relates to resolution action G04-RS2-06-08, as it demonstrates OPG's dedication to reliability and performance excellence. By strictly adhering to procedures and governing documents, regularly reviewing industry operating experience, and committing to continuous improvement, OPG has ensured that all risks are actively mitigated while generating clean, reliable electricity.

In Ontario, we take electricity for granted. Only during rare events, such as extended power outages due to ice-storms, do we stop to reflect on the essential role that electricity plays in enabling us to enjoy our elevated standards of living.

Our way of life demands reliable electricity 24 x 7. The majority of this electricity consists of 'baseload', which Gwyneth Cravens, who worked as editor at the New Yorker and Harper's Magazine (and went from protesting nuclear plants to avidly supporting them) explains as "*the minimum amount of proven, consistent, around-the-clock, rain-or-shine power that utilities must supply to meet the demands of their millions of customers*[1]*.*"

The burden of generating baseload electricity in Ontario falls primarily on the nuclear plants operated by OPG and Bruce Power. The reason these nuclear plants are ideally suited for this crucial role in the energy landscape lies in their impressive capacity factors (the ratio of the actual electricity output compared to the maximum possible output).

Take Pickering Nuclear Generating Station (PNGS) for example. In 2019, PNGS achieved a remarkable 87.55 % capacity factor[2]. The fact that OPG has achieved such high levels of reliable performance speaks to its continuous focus on improving operating procedures, modernizing plant monitoring and control equipment, and sharing learning experiences with other reactor operators in Canada and around the world.

Cravens' is a common experience of those who start off being apprehensive about nuclear energy and then undergo a change of heart upon learning more about the technology. Denise Balkissoon, the Globe and Mail columnist, described her own personal journey in an article titled *How I Learned to Stop Worrying and Love Nuclear Power*[3]. Public perceptions of nuclear power plants in general are often out of step with reality. Nowhere is this truer than in the domain of public safety.

[1] Brand, Stewart. *Whole earth discipline*. Atlantic Books Ltd, 2010.
[2] Q4 2019 Performance Report for Pickering Nuclear – OPG
https://www.opg.com/document/pickering-performance-report-q4-2019
[3] How I learned to stop worrying and love (well, accept that it might help save the planet) nuclear power
https://www.theglobeandmail.com/opinion/article-how-i-learned-to-stop-worrying-and-love-well-accept-that-it-might/

Safety

This section examines OPG's fundamental focus on safety and how this related to resolution action G01-RS1-06-01. Year after year, OPG continues to demonstrate that safety remains the overriding priority by taking all required precautions and considering all potential risks in order to ensure the safety of its employees, the public, and the environment. OPG's consistent commitment to safety provides ample reassurance about concerns that may relate to resolution action G01-RS1-06-01.

Nuclear energy, on land (power plants) and in the sea (submarines), has accumulated a stellar safety record over the past 60+ years, even when the three incidents at Three Mile Island, Chernobyl, and Fukushima are factored in. Canada's nuclear industry in particular is among the safest and most strictly regulated industries in the world[4]. In fact, in recent years, both of OPG's Pickering and Darlington Nuclear Stations have consistently been awarded the highest possible safety ratings by the CNSC[5].

Public fears of nuclear energy derive mainly from a lack of knowledge, a lack of familiarity, and extensive misinformation. A recent 2019 survey of Canadians' attitudes towards nuclear energy by Abacus Data[6] identified just how poorly informed the public is on even the most basic issues. (Shockingly, about a third of Canadians think that nuclear energy emits as much CO_2 as oil, and another third thinks nuclear emits even more than oil).

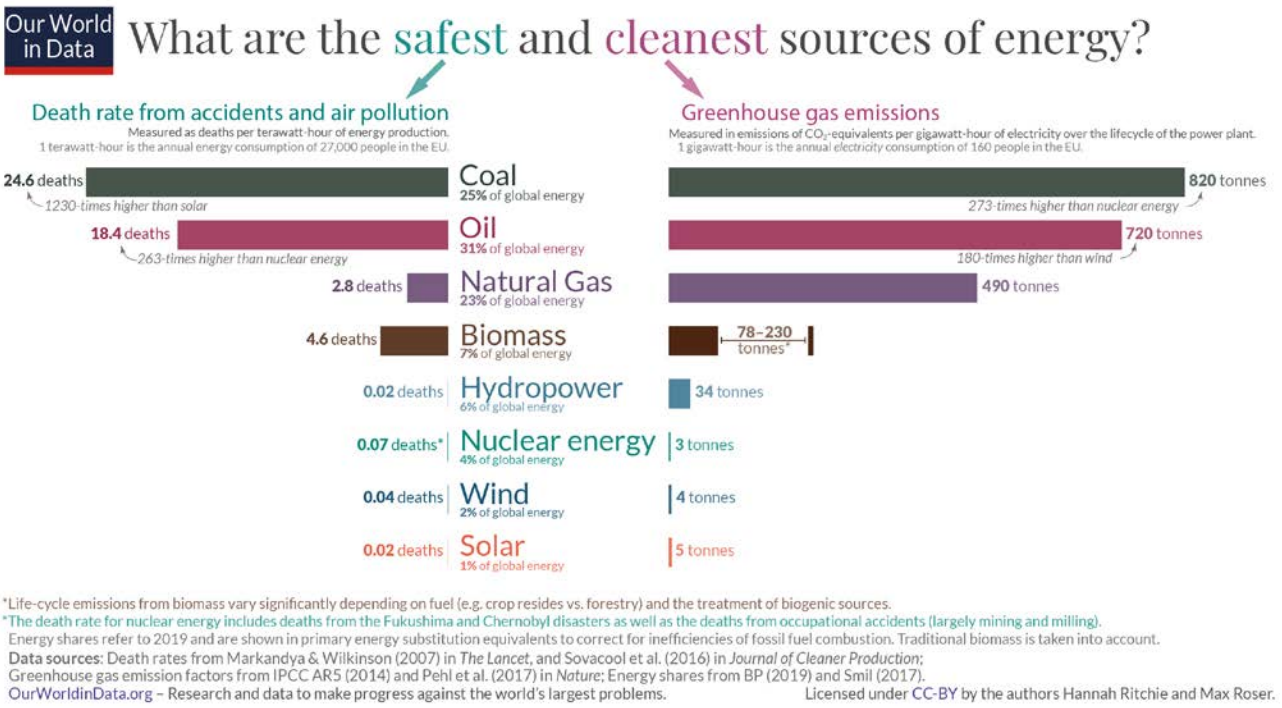
The definitive data on nuclear safety is freely and publicly available at Our World in Data, a website which has also gained prominence in 2020 for being the world's foremost reliable, authoritative, and up-to-date resource on COVID-19 related data. As can be seen in the charts below, nuclear energy is not only among the safest, but also ranks as the cleanest of the energy sources at our disposal[7].

[4] CAN 2020 Canadian Nuclear Factbook
https://cna.ca/wp-content/uploads/2019/08/2020-Factbook-EN-digital.pdf
[5] OPG'S Nuclear Stations Achieve Highest Safety Ratings
https://archive.opg.com/pdf_archive/Media Releases/H007_20181109_SafetyReportCards.pdf
[6] Climate Change Worries Open Minds to Modern Nuclear Technology
https://abacusdata.ca/climate-change-worries-open-minds-to-modern-nuclear-technology/
[7] What are the safest and cleanest sources of energy?
https://ourworldindata.org/safest-sources-of-energy

Safety

Contrasted against the millions of deaths related to air-pollution[8], oil train crashes[9], natural gas explosions[10], hydroelectric plant accidents[11] and dam failures[12], and mining fatalities[13], it becomes quite clear that nuclear energy is the safest large-scale form of energy that humanity has ever used[14].

But has this high standard of safety come at an unaffordable cost?

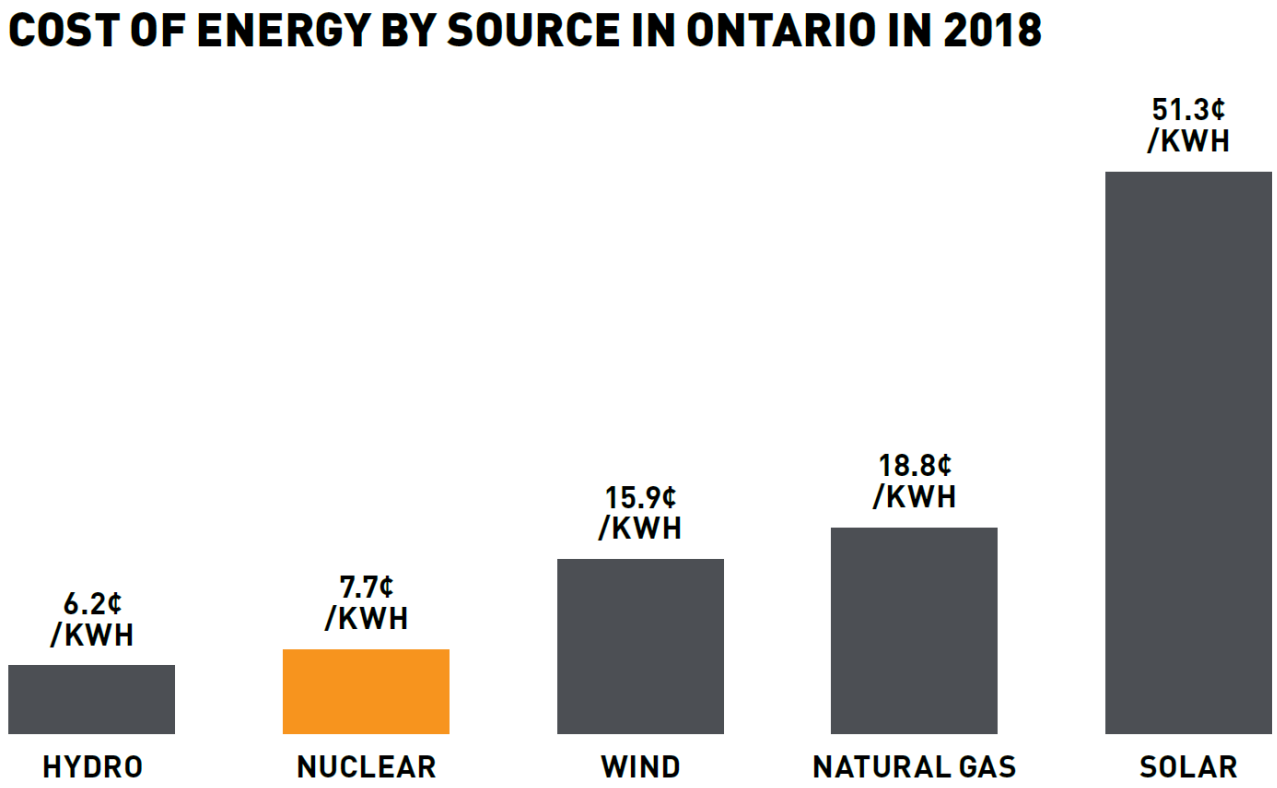


[8] Health impacts of air pollution in Canada
https://www.canada.ca/en/health-canada/services/air-quality/health-effects-indoor-air-pollution.html
[9] Lac-Mégantic rail disaster
https://en.wikipedia.org/wiki/Lac-Mégantic_rail_disaster
[10] List of pipeline accidents in Canada
https://en.wikipedia.org/wiki/List_of_pipeline_accidents
[11] List of hydroelectric power station failures
https://en.wikipedia.org/wiki/List_of_hydroelectric_power_station_failures
[12] Dam failure
https://en.wikipedia.org/wiki/Dam_failure
[13] Coal mining disasters in Canada
https://en.wikipedia.org/wiki/Category:Coal_mining_disasters_in_Canada
[14] Rhodes, Richard. *Energy: A human history*. Simon and Schuster, 2018.

Cost

While nuclear plants can be expensive to build (chiefly as a result of the unparalleled standards of safety and quality control), the long-term costs of operation, fueling, and maintenance are highly competitive with the other alternatives. The case of our own province Ontario illustrates this point.

The chart below, reproduced from the CNA 2020 Nuclear Factbook[15], compares the costs of the various electricity sources in Ontario, among which nuclear energy comes out as one of the cheapest. Because of cheap, affordable, and clean nuclear (and hydro), Ontario continues to be one of the most pleasant places in the world to live in with low electricity prices relative to other regions of similar standards of living around the world.



[15] CAN 2020 Canadian Nuclear Factbook
https://cna.ca/wp-content/uploads/2019/08/2020-Factbook-EN-digital.pdf

Used Fuel

Cheap nuclear electricity has been secured for several generations of Ontarians thanks to the vision of our forward-looking, long-term thinking predecessors. Another issue that is central to the long-term use of nuclear energy is what to do with the waste (or used fuel). Once again, public perceptions on this issue are often at odds with reality.

Once it is removed from the reactor, used nuclear fuel is stored first in water-filled open fuel bays and then in dry heavily-shielded concrete casks, where it remains constantly controlled and monitored. The waste is so compact that it has been estimated that if an average person's entire lifetime use of electricity all came from nuclear energy, all of the waste would fit in a small soda can[16].

On the other hand, the use of fossil fuels (such as coal) for electricity has resulted in the release of toxic fly ash and flue gases which contain radioactivity (coal plants are the largest sources of released radioactivity in the world), heavy metals such as lead and arsenic, and other neurotoxins such as mercury in such large quantities that pregnant women are now advised to avoid wild fish and shellfish. This pollution from fossil fuel waste byproducts is basically permanent. By comparison, the radioactivity of used nuclear fuel decays to one hundred thousandths of its initial level in about 175 years[17].

As for the safe, cheap, and permanent disposal of the waste, the University of California-Berkeley physicist Richard Muller has plainly stated: "*Nuclear waste is not a difficult problem … the technical problems have been solved*[18]." The scientist and environmentalist James Lovelock has even declared that "*an outstanding advantage of nuclear over fossil fuel energy is how easy it is to deal with the waste it produces'*[19]."

As practicing engineers in the nuclear industry with firsthand knowledge of the various kinds of technical challenges involved, it is also clear to us that the issue of waste storage is relatively simple compared to other challenges that have already been surmounted, such as achieving nuclear fission with natural non-enriched uranium and designing passive reliable reactor safety systems.

It is also worth remembering that, given its significant energy content, with a little bit of innovation it may be possible to recycle used fuel in the next generation of advanced nuclear reactor technologies.

[16] Brand, Stewart. *Whole earth discipline*. Atlantic Books Ltd, 2010, p. 81.
[17] Ibid, p. 79.
[18] Muller, Richard. *Energy for future presidents: the science behind the headlines*. WW Norton & Company, 2012, p. 194.
[19] Nuclear Energy: the safe choice for now
http://www.ecolo.org/lovelock/nuclear-safe-choice-05.htm

Innovation

Shortfalls, challenges, and areas for improvement are some of the forces that drive the desire for innovation and change within OPG. By addressing challenges, such as those detailed in resolution actions G04-RS2-06-08 and G01-RS1-06-01, the industry is able to develop and maintain a leading world-class level of technical expertise. Not only is this cycle of continuous improvement advantageous in terms of positioning the Canadian nuclear industry as a leader in future technologies, but it also makes current technologies better with the added bonus of generating skilled jobs and highly reliable and innovative systems.

In terms of waste for example, in addition to the advantage of being able to recycle used fuel, new and advanced reactor technologies promise a host of other potential benefits including: walk-away passive safety features, zero waste, no proliferation capability, simplified mass-production capacity, low-maintenance, no refueling, and cheaper electricity.

In Canada, innovative reactor technologies are poised to play a major role in providing clean, safe, reliable, and cheap electricity in remote and difficult locations, which is especially beneficial to Canadian Indigenous populations[20]. Already, the nuclear industry in Canada generates more than $6 billion in revenues per year and supports, both directly and indirectly, a total of 60,000 highly-skilled and well-paying Canadian jobs[21].

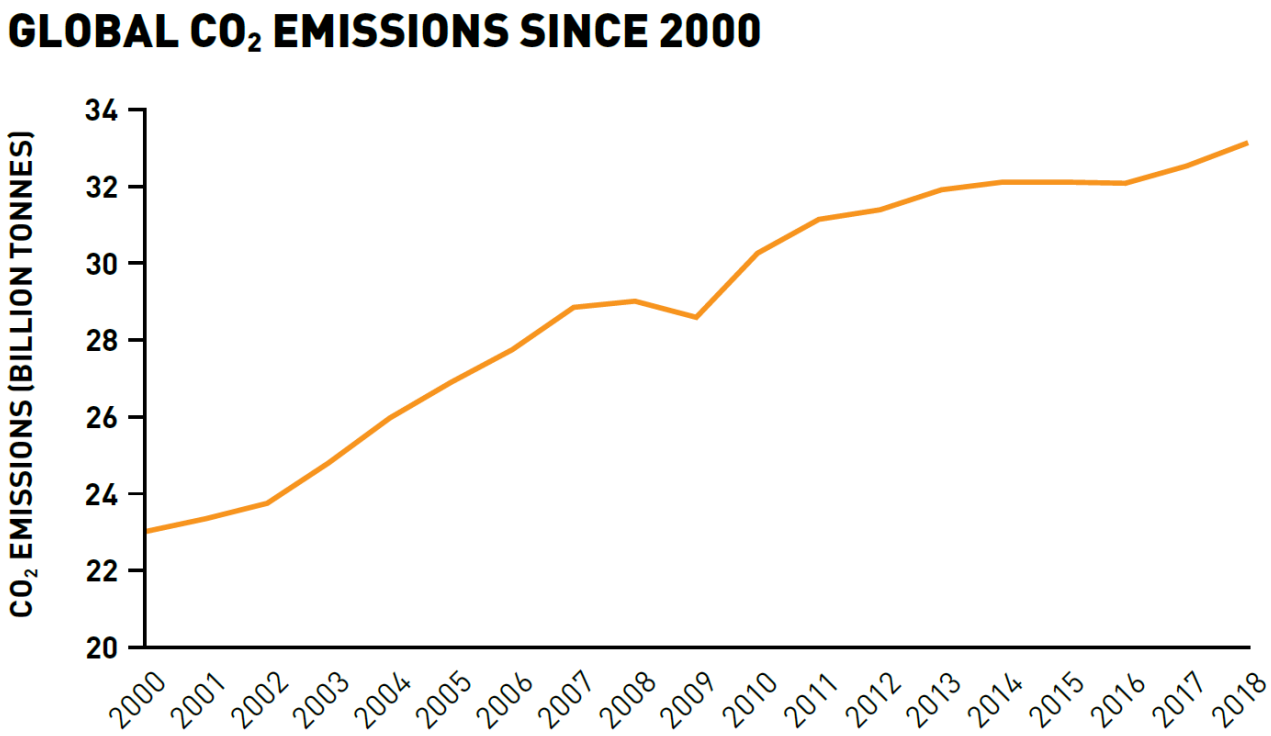
Quite aside from contributing enormously to the advantage of Ontario's energy sector, the benefits of nuclear extend far beyond the electrical grid. In medicine for example, nuclear energy enables the delivery of over 1.5 million diagnostic scans and 15,000 radiation therapy treatments every year[22].

Perhaps most importantly, the support and development of nuclear energy in Canada can set an example for the world to follow in solving one of humanity's most pressing challenges: establishing a future with a stable climate and an abundance of energy.

[20] A Canadian Roadmap for Small Modular Reactors
https://smrroadmap.ca/
[21] CAN 2020 Canadian Nuclear Factbook
https://cna.ca/wp-content/uploads/2019/08/2020-Factbook-EN-digital.pdf
[22] Ibid.

Emissions

As the graph below shows[23], despite concerted efforts, global greenhouse gas emissions remain stubbornly high. The world has gradually come to realize that all carbon-free solutions require the deployment of an enormous amount of additional energy, except for nuclear. Beyond its proven reliability at the scale required, nuclear energy can also be the foundation on which to build new technologies to remove and sequester CO_2 from the atmosphere.

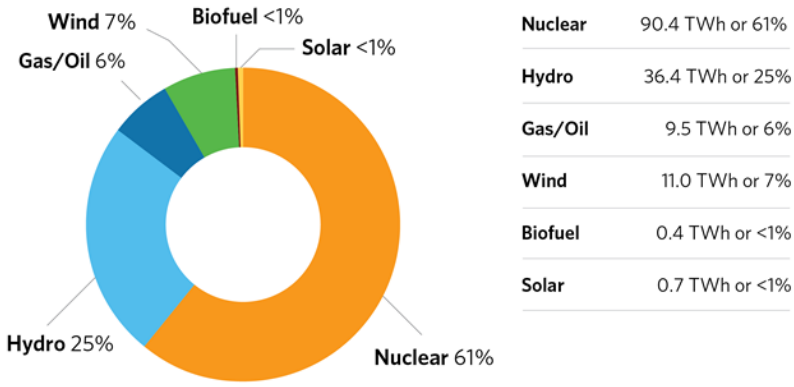


[23] CAN 2020 Canadian Nuclear Factbook
https://cna.ca/wp-content/uploads/2019/08/2020-Factbook-EN-digital.pdf

Emissions

The developing world needs electricity to support economic growth and poverty reduction efforts. Ontario, with its proven model of rapid decarbonization and economic and energy growth, sets the example for others to follow. As Harvard Professor Steven Pinker has remarked: "*[in terms of] carbon emitted per kilowatt-hour of electricity generated … Ontario come[s] in at one-tenth the world average, a level that would solve our [climate change] problem if all other countries matched [its] performance*[24]*.*"

Rapid decarbonization was achieved in Ontario by building 16 nuclear reactors in 17 years from 1976-1993[25]. In 2003, the phasing out of coal, which constituted 25 % of the electricity supply at the time, was initiated. By 2014, coal was completely eliminated. Nuclear energy went from about 42 % to 60 % of the total energy supply[26]. As a result, CO_2 emissions from Ontario's electricity sector dropped by almost 90 % in one decade, with fossil fuels (mostly methane gas) reduced to a small fraction. The mix of electricity production in Ontario for 2019 is shown below[27].



[24] Goldstein, Joshua S., and Staffan A. Qvist. *A bright future: How some countries have solved climate change and the rest can follow*. PublicAffairs, 2019, p. x.
[25] Nuclear Power in Canada
https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/canada-nuclear-power.aspx
[26] The End of Coal
https://www.ontario.ca/page/end-coal
[27] Energy Output by Fuel Type 2019
https://www.ieso.ca/en/Corporate-IESO/Media/Overview

The Future

We can no longer afford to wait. We know that the easiest and fastest way to reduce emissions and rapidly decarbonize the economy is to rely on nuclear energy. We have proven in Ontario that it is possible, and have shown how it can be done. We need to establish clean electric grids to enable the electrification of the transportation, heavy manufacturing, heating, and other high-energy use industries. We can do this by supporting a nuclear clean-energy transformation through streamlined regulation and approval processes, increased investment in research and development, and incentivizing the move away from carbon-intensive energy sources.

The protection of the environment and the alleviation of world poverty are worthy causes. Our nuclear industry in Ontario sets an example that we can all be proud of. Nuclear energy is clean and safe, but it continues to require our vigilant support. As members of the young generation of nuclear energy enthusiasts, we ask that our industry be supported by thoughtful and careful consideration and recognition of the benefits that all citizens of Ontario enjoy from this wonderful technology.

We need to help the Canadian nuclear industry set an example for the rest of the world. Let's heed the words of the Executive Director of the International Energy Agency (IEA), Fatih Birol:

> *Without action to provide more support for nuclear power, global efforts to transition to a cleaner energy system will become drastically harder and more costly*[28].

[28] Nuclear Power in a Clean Energy System
https://www.iea.org/reports/nuclear-power-in-a-clean-energy-system