



NAYGN 2020 Essay Contest: The Nuclear Advantage

# Enviro-Industrial Feasibility of Nuclear Power

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Throughout the many millennia of human existence, the struggle to find a sustainable form of power has never ended. Even the mythical flames brought down from Mount Olympus to humanity led the mighty titan Prometheus to an eternity of torment. Like the torment of Prometheus, humanity now faces the challenge of producing power for our homes and communities, without destroying our environment.

Nuclear power is the only form of sustainable energy production that can meet the ever-growing needs of our world, without causing the catastrophic destruction of our planet. Nuclear power is derived from harnessing the energy that is released during the splitting of uranium atoms, also known as “Nuclear Fission” (Figure 1). Once uranium atoms have been split, the energy that has been released is used to heat light water and produce steam, which is later used to spin turbines and produce energy.

Nuclear has the upper hand in the power generation industry because it has almost zero carbon production, it has a large range of power output and it can run 24/7 365 days a year. (base load – our reliable energy source rather than intermittent)

In modern day society, electricity has become a necessity to heat our homes. Large cities usually use natural gas and coal to provide enough electricity (such as Halifax) since more environmentally friendly power sources are intermittent. Nuclear power plants produce little no carbon emissions and provide the electricity needed to run the city. Arctic communities in Canada’s northern provinces, require alternatives to diesel powered generators which SMR’s or small module reactors can provide. SMR’s are factory built and Can be easily deployed on site, SMR’s can achieve a cleaner and more reliable source of electricity to these small communities in the northern parts of Canada. If it comes to densely populated cities, housing millions of residents such as Toronto would need a large power plant such as the Pickering Nuclear Generating Station (PNGS). The Pickering Nuclear Generating Station has proven to be a reliable energy source for several decades. Nuclear provide one of the largest Capacity factors, zero greenhouse gas emissions and capability to drive base load. Nuclear is a better choice than solar and wind because of the vast difference in amounts of power being generated across its lifecycle also known as known as “Capacity Factor” (Figure 2). This shows that nuclear can produce large amounts of power in the same period as compared to more commonly used sources like natural gas and coal. Also, nuclear plants have the advantage of maintaining the grid for long periods of times, for example “Bruce NGS generated 48.4 billion kWh in 2018”. [1] CANDU has online refueling meaning it can still run even if it is generating electricity (doesn’t need to shut down in order to refuel). Nuclear plants have the advantage of sustaining base load energy while solar plants are dependent on energy from the sun (Figure 3) and wind turbines are dependent on fluctuating weather patterns that drive wind currents. With these advantages, nuclear is a great choice for our energy hungry societies which are dependent on energy 24/7, regardless of sunshine or weather patterns.

Although renewable energy sources are relatively low carbon options, a drawback is significant land use for setting up. With solar, the amount of land it takes up as compared to the amount of power generated is inferior as compared to nuclear which can provide a lot more energy since it runs at an almost 95% capacity factor (Figure 1) 24/7. Other drawback from wind energy is high amounts of noise pollution and large amounts of land usage. What makes nuclear better than solar is that the lifespan of a solar panel is 25 to 30 years while nuclear reactors have an average lifespan of 40 years. An average nuclear reactor unit in the United states produce's 1 000 megawatts which in turn would need a little bit more than 1 square mile of land as compared to wind would need 360 times more land, and solar would require 75 times more land to produce the same amount of energy.[1]

The number one advantage of nuclear is the feasibility of the energy source, when it comes to being environmentally friendly and meeting industry standards. The energy source can be reliable in any scenario, whether it is a small community in the northern provinces of Canada or large cities with millions of residents. Nuclear preserves land by taking up minimal amounts of space with producing zero greenhouse gases making it one of the cleanest energy sources. Like the torch of Olympus, nuclear power will give the ability to heat homes and bring stability to all sorts communities. I believe nuclear power is the superior source to all our needs, whether it has to do with creating stability in producing electricity for cities, space exploration and fuel journeys or even creating isotopes to heal the cancer that is responsible for almost 30% of Canadas deaths.[3]

### Figures

Figure 1

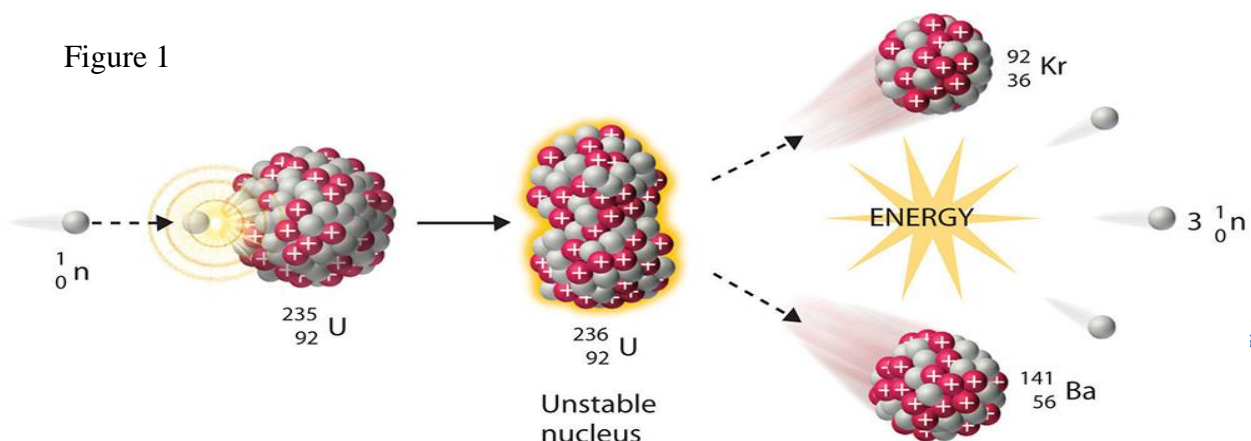


Figure 2

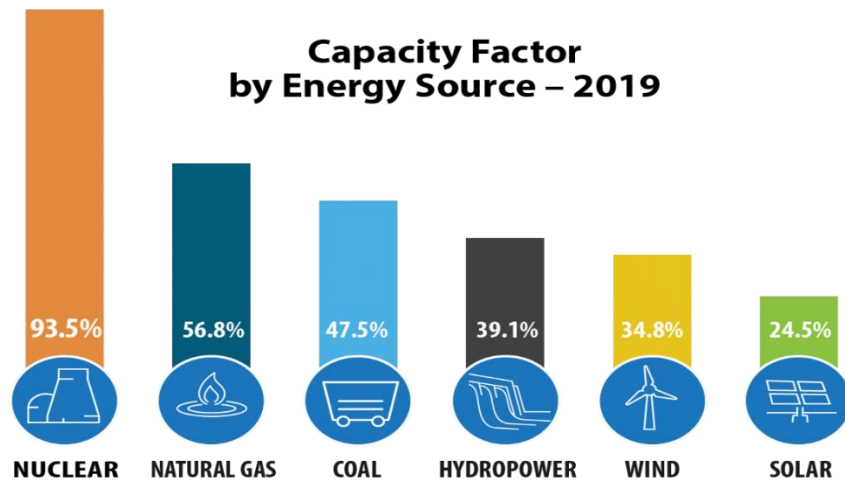
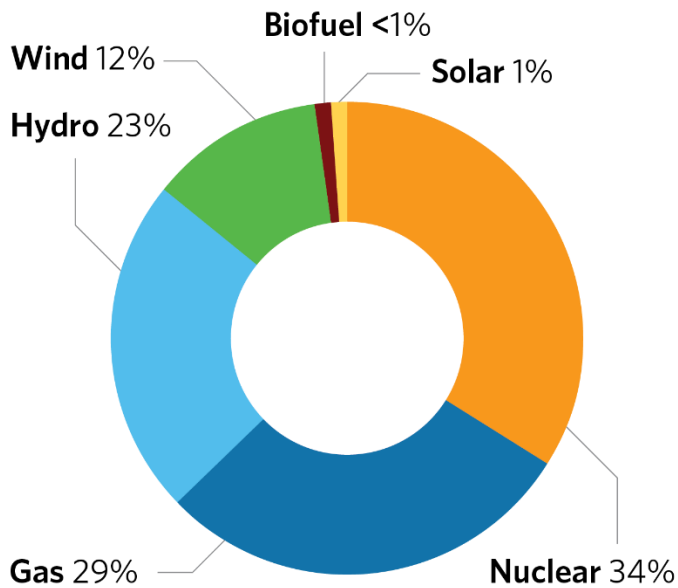


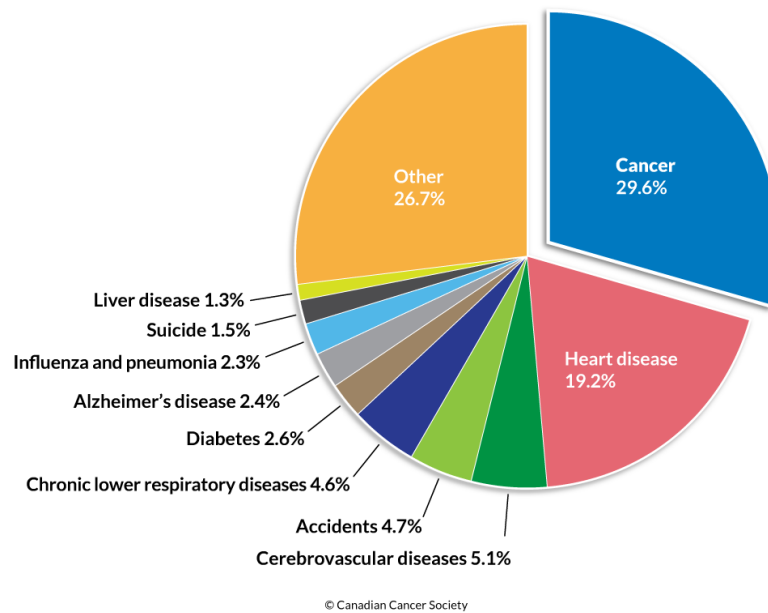
Figure 3



<b>Nuclear</b>	13,009 MW or 34%
<b>Gas/Oil</b>	11,317 MW or 29%
<b>Hydro</b>	9,060 MW or 23%
<b>Wind</b>	4,486 MW or 12%
<b>Biofuel</b>	295 MW or <1%
<b>Solar</b>	478 MW or 1%

Figure 4

Proportion of Deaths Due to Cancer and Other Causes, Canada, 2016



**Reference**

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<https://www.energy.gov/sites/prod/files/2019/01/f58/Ultimate%20Fast%20Facts%20Guide-PRINT.pdf> [1]

[https://www.ieso.ca/-/media/Images/IESO/Charts-and-Graphs/Current\\_Supply\\_Mix-Tx-18MO.ashx?h=1338&w=2460&la=en&hash=C05119033168B1994BADF882F8F07121](https://www.ieso.ca/-/media/Images/IESO/Charts-and-Graphs/Current_Supply_Mix-Tx-18MO.ashx?h=1338&w=2460&la=en&hash=C05119033168B1994BADF882F8F07121)

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“Cancer Statistics at a Glance - Canadian Cancer Society.” <https://www.cancer.ca/en/cancer-information/cancer-101/cancer-statistics-at-a-glance/?region=on#:~:text=Cancer%20is%20the%20leading%20cause,women%20will%20die%20from%20cancer.> [3]

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