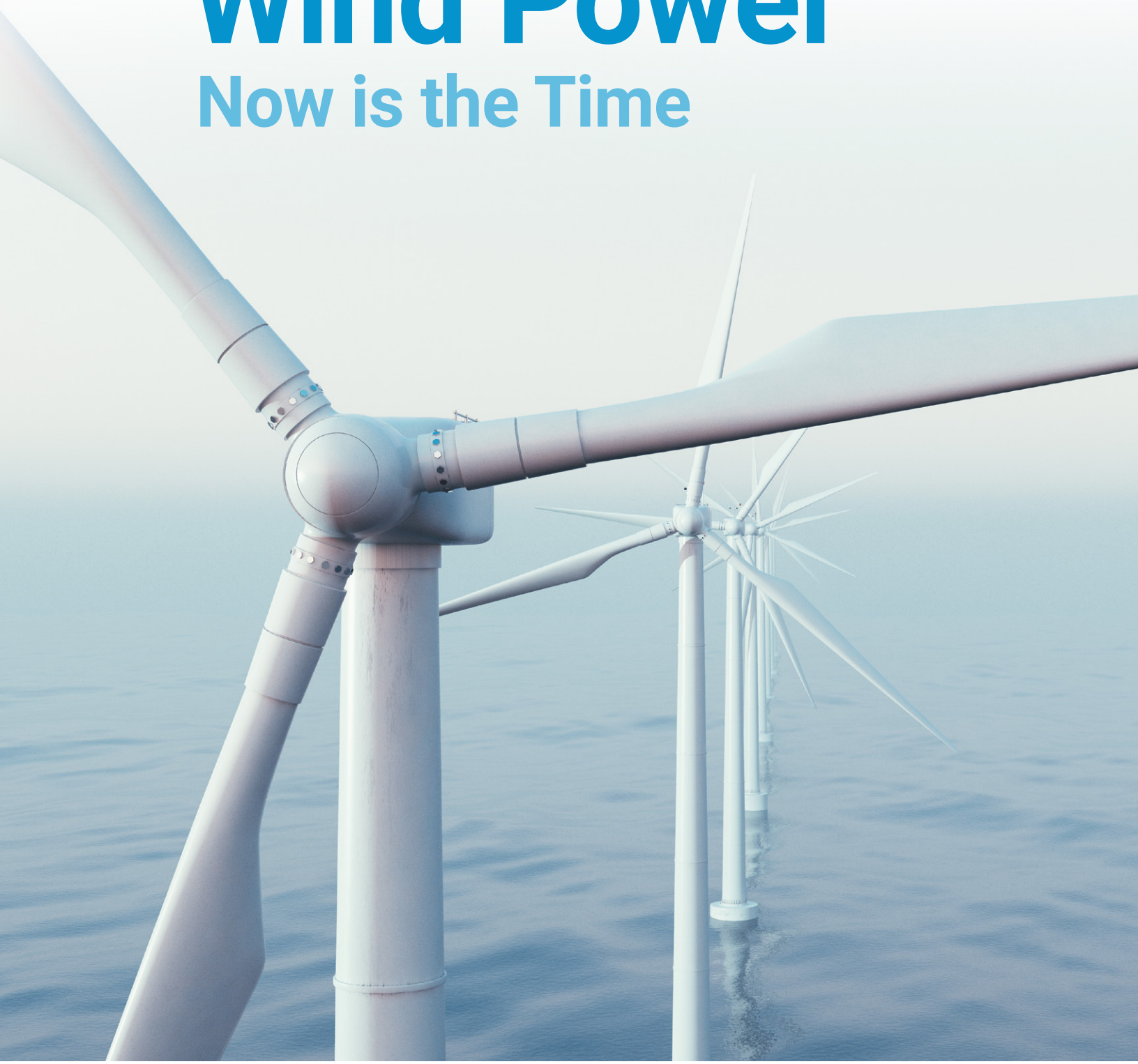
Great Lakes Wind Power

Now is the Time



April 17, 2023

ONTARIO CLEAN AIR ALLIANCE

Acknowledgments

Ontario Clean Air Alliance Research gratefully acknowledges the generous financial support that it has received for this report from:

Echo Foundation

Green Sanderson Family Foundation

Ivey Foundation

Taylor Irwin Family Foundation at the Toronto Foundation

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Introduction

To achieve net zero greenhouse gas (GHG) emissions, we must create a zero-carbon electricity grid and electrify virtually everything.

In December 2022, Ontario's Independent Electricity System Operator (IESO) released its *Pathways to Decarbonization* report, which outlines a strategy to move Ontario to net zero GHG emissions by 2050. According to the IESO, electrifying our economy will increase Ontario's electricity demand by approximately 115% by 2050.[1]

The IESO's report proposes to meet 65% of our incremental electricity needs with **new** renewable energy sources and the remaining 35% with **new** nuclear.[2]

This report will outline the multiple benefits of investing in Great Lakes wind power to help Ontario obtain 100% of its new electricity supply from renewables instead of costly and slow nuclear.

Investing in Great Lakes wind power can help Ontario obtain

100%

of its new electricity supply from renewables

Electricity Potential

According to a 2008 report prepared for the Ontario Power Authority by Helimax Energy Inc., wind farms located at 64 sites in the Great Lakes[i] could produce 111.5 terawatt-hours (TWh) of electricity per year.[3] This is equivalent to 80% of Ontario's total electricity consumption in 2022.[4]

The actual potential is even greater for two reasons. First, as the Helimax report noted, there are additional wind power sites in the Great Lakes that can be feasibly developed.[5]

Second, there have been huge improvements in wind power technology since 2008 that have dramatically increased wind turbine output. The Helimax report assumed the Great Lakes wind farms would have a total capacity of 34,500 megawatts (MW).[6] With today's improved wind power technology, 34,500 MW of wind power capacity would produce 151 TWh of electricity per year.[7] This is more than 100% of Ontario's total electricity consumption in 2022.

Offshore winds in the Great Lakes differ substantially from onshore winds. Offshore winds offer higher wind speeds, better wind consistency and greater air density, meaning fewer offshore turbines can produce more power more consistently than onshore wind farms.[8]

The IESO's *Pathways to Decarbonization* report forecasts that we will need 181 TWh of new zero-carbon electricity generation by 2050. According to the IESO's proposal, 118 TWh of the new supply will be renewables (65%) and 63 TWh will be new nuclear (35%).[9]

Table 1 | IESO's Proposed New Electricity Supply by 2050[10]

Proposed Source	New Zero-Carbon Electricity
Quebec Imports	30 TWh
Hydrogen	12 TWh
Solar	11 TWh
Onshore Wind	51 TWh
Offshore Wind	11 TWh
Nuclear	63 TWh
Total	181 TWh

The IESO's Pathways report arbitrarily assumes that only 2,500 MW of our new supply will be from wind farms located in the Great Lakes.[11] **However, if Ontario were to obtain 17,000 MW of Great Lakes wind power, we could eliminate the need for new nuclear and obtain 100% of our incremental electricity needs from renewables.**[12]

Great Lakes wind power could supply more than

100%

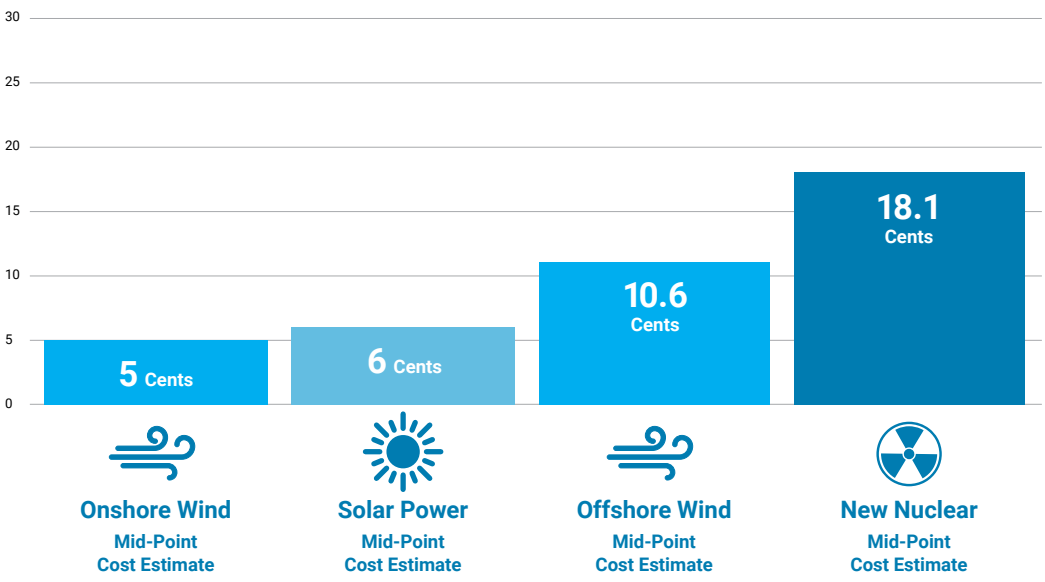
of Ontario's electricity needs

[i] Twenty seven (27) sites are located in Lake Huron and Georgian Bay, 25 in Lake Erie, 9 in Lake Ontario and 3 in Lake Superior.

Cost

According to Lazard's *Levelized Cost of Energy Analysis*, the cost of electricity from an offshore wind farm is 40% lower than the cost of a new nuclear reactor.[13]

Figure 1 | **Ontario's Electricity Options: A Cost Comparison**[14]



The cost of offshore wind power is **40%** lower than the cost of new nuclear

Construction Time

- According to Lazard, offshore wind farms have a construction time of 12 months.[15]
- According to the IESO, new nuclear reactors can take 10 to 15 years to build.[16]

Speed is of the essence. According to the Intergovernmental Panel on Climate Change, the world needs to reduce its GHG pollution by almost half by 2030 to limit temperature rise to 1.5 degrees Celsius.[17] According to the Secretary-General of the UN, wealthy countries such as Canada should be moving the fastest on decarbonization and should have zero carbon electricity systems by 2035 at the latest.[18]

Fairness to Future Generations

According to the Nuclear Waste Management Organization (NWMO), which is owned by Canada's nuclear power companies, radioactive nuclear wastes must be fully isolated from people and the environment for one million years or more.[19]

After more than 60 years of nuclear operations, Ontario still has no approved plans for the long-term storage of its radioactive nuclear wastes.

It is neither fair nor reasonable to ask future generations to take on the burden of safeguarding more deadly radioactive waste when we have safer and lower cost options for keeping our lights on today.

It is also unreasonable to ask future generations to bear the brunt of a decision to delay action on reducing electricity sector GHG emissions by opting for slow-to-deploy nuclear power instead of fast-to-build renewable technologies.

When the wind doesn't blow

Since the wind doesn't always blow, wind energy must be combined with storage options that can transform intermittent wind energy into a firm 24/7 source of baseload electricity.

The Government of Ontario has announced its intention to procure up to 4,000 MW of storage from stationary storage options (e.g., large batteries) located in Ontario.[20] However, there are also lower cost storage options that Ontario should pursue.

According to a Massachusetts Institute of Technology report, the lowest cost storage option for Ontario's electricity system are Quebec's hydro-electric reservoirs.[21] Specifically, when our wind power production is above average, our surplus wind energy can be exported to Quebec to keep the lights on in Montreal, and Hydro Quebec can store more water in its reservoirs. Conversely, when our wind power production is below average, Hydro Quebec can use the extra water in its reservoirs to produce electricity for export back to Ontario. In short, by integrating our wind generation with Hydro Quebec's reservoirs, we can convert intermittent wind energy into a firm 24/7 source of baseload electricity supply for Ontario.

The IESO has identified how we can increase our access to Hydro Quebec's reservoirs by 7,500 MW by upgrading our transmission links with Quebec at Chats Falls (2,000 MW), Ottawa (2,000 MW), Beauharnois (2,000 MW) and Cornwall (1,500 MW).[22] All of these upgrades can use existing Hydro One transmission corridors.

Our electric vehicles' (EVs) batteries are also a low-cost storage option for wind energy.[23] When combined with bi-directional chargers, our EVs can store surplus wind energy when wind generation is high, and return power back to the grid when wind generation is below average. **In 2030, the total capacity of our EVs' batteries will be more than double the capacity of our gas plants.**[24]

The lowest cost storage option for Ontario's electricity system is Quebec's hydro-electric reservoirs

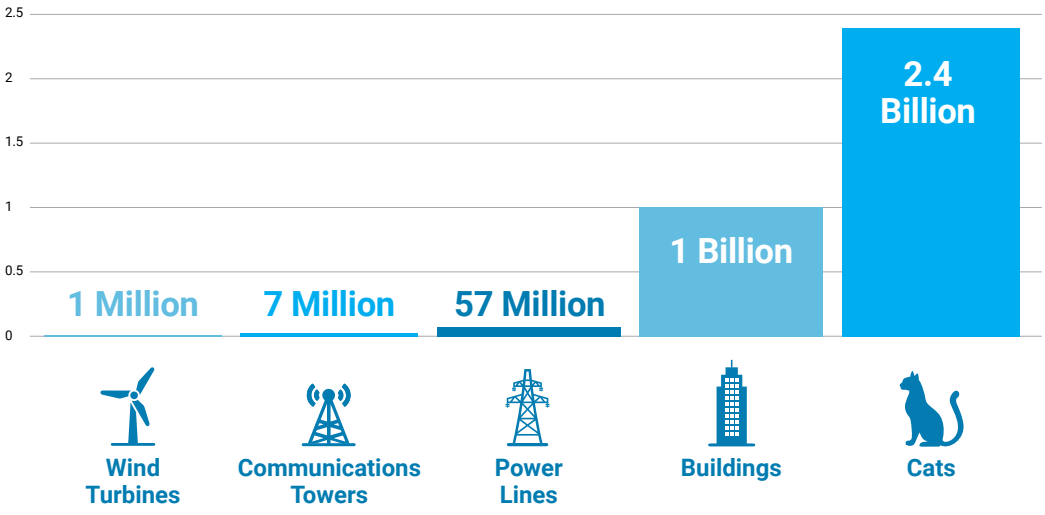
Moratorium on Offshore Wind Projects

In February 2011, in response to waterfront residents who were opposed to a potential offshore wind farm 2 to 4 km from the Scarborough Bluffs[25], the Government of Ontario imposed a moratorium on offshore wind projects.[26]

According to the official government news release, the 2011 moratorium was needed to permit "further scientific research" so that future decisions could be based "on the best available scientific data."[27] The Ontario Ministry of Natural Resources did subsequently undertake a couple of studies on the impacts of offshore wind farms on fish and fish habitat.[28] The reports' authors, Sarah Nienhuis and Erin Dunlop, found that offshore wind projects can be implemented with minimal aquatic impacts:

"Offshore wind power generation within the Great Lakes has the potential to be implemented with minimal impacts on the aquatic system if mitigation options are adopted, benefits are enhanced, learning is built into the management cycle, precaution is taken as to site location, and appropriate baseline and effects monitoring is conducted."[29]

Figure 2 | **Annual Bird Deaths in U.S.**[30]



Offshore wind power generation can be implemented with minimal impacts on the aquatic system

Similarly, mitigation measures must be implemented to minimize the impacts of offshore wind projects on migratory birds. For example:

- Wind turbines must not be located in areas where risks to birds and bats cannot be mitigated.
- Offshore wind projects can be combined with radar systems to "see" when significant numbers of birds are crossing the Great Lakes during the migration seasons. When significant bird movements are detected in the area of wind turbines, the turbines can be shut down.
- A recent study discovered that painting one of a wind turbine's blades black and keeping the remaining two gray or white reduced bird mortalities by up to 72% due to the increased contrast and hence visibility.[31]

According to the National Wildlife Federation and the National Audubon Society, responsible wind power is needed to address the threat of climate change:

"Unless substantial wind power and other renewable energy development occur in a rapid and timely manner, there will be significant and irreversible impacts to wildlife and biodiversity."[32]

In 2022 the Lake Erie Energy Development Corporation received approval for the Great Lakes' first offshore wind farm. The Icebreaker project proposes to build six wind turbines eight to ten miles off the Lake Erie shoreline, near Cleveland.[33] This pilot project will help demonstrate the feasibility of offshore technology in this energy rich environment and is likely to lead to many other offshore wind developments on the U.S. side of the Great Lakes. If Ontario sits on its hands, it also robs the province's workers of opportunities to be part of this new industry.

Mitigation measures
must be implemented to minimize impacts on migratory birds

Conclusions

By investing in wind, water and solar power, instead of higher-cost new nuclear reactors, Ontario can obtain 100% of its new electricity supply from renewables while simultaneously lowering its electricity rates. Responsible development of offshore wind power will reduce GHG emissions, lower our electricity rates, create new economic opportunities, and avoid a legacy of deadly radioactive waste that future generations would be required to store for a million years.

Ontario can obtain
100%
of its new electricity supply from renewables while simultaneously lowering its electricity rates

Recommendations

1. Great Lakes wind power projects should be permitted on a project-by-project basis—subject to environmental assessment reviews that demonstrate that their potential adverse impacts have been minimized, and that ongoing monitoring of impacts on birds and bats is in place.

2. The IESO should establish *annual* competitive procurement processes for new renewable electricity supplies (solar, waterpower, onshore wind and offshore wind power) to help Ontario move to net zero GHG pollution as soon as possible.

Sources

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