

# Pickering Nuclear Station: its critical role as Toronto's main electricity provider

## Ontario Energy Update

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### Intro: don't panic, but there's trouble ahead

**PNGS slated for exit by 2025** Pickering Nuclear Generating Station (PNGS) is located on Lake Ontario, 25 minutes east of downtown Toronto. Built in the late 1960s through the mid-1970s, PNGS at roughly 3,100 megawatts became the dominant source of electrical supply to the Greater Toronto Area (GTA) and has remained so ever since. Units 4 and 1 respectively were refurbished in the early 2000s. The station has been in more or less continuous service since the early 1980s. It is slated to permanently leave service at the end of 2024.

**Financial and environmental implications of PNGS exit** Plant owner Ontario Power Generation (OPG) will replace PNGS's zero-emitting output with gas-fired output at 400 grams CO<sub>2</sub> per kilowatt hour. This means:

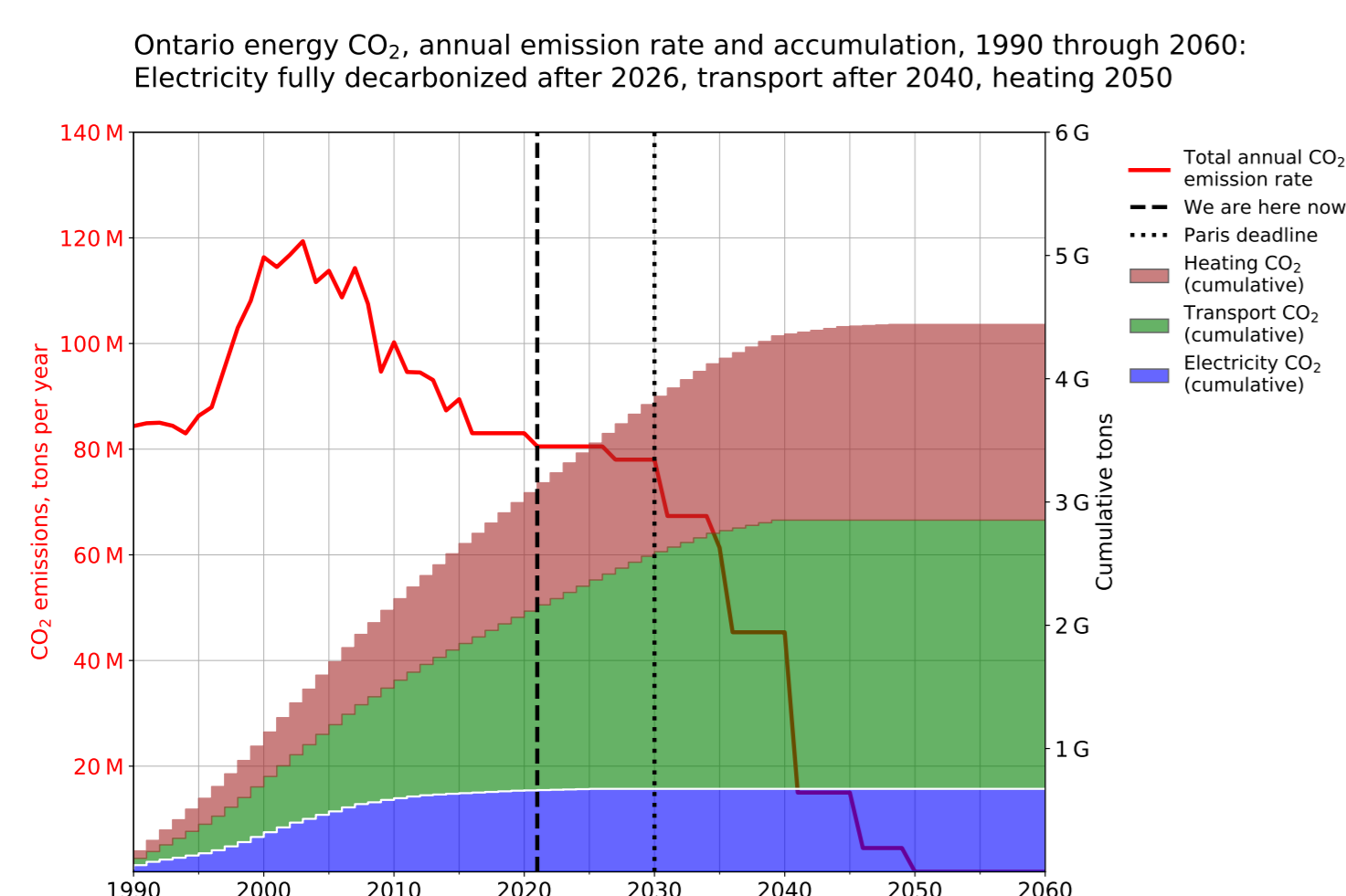
- Over 1 year, 3,100 MW of gas-fired baseload supply will add 10.8 million tons of new CO<sub>2</sub> to the atmosphere.
- At \$50 per ton CO<sub>2</sub> carbon tax, Ontario ratepayers will be forced to pay a further \$543 million per year just for the carbon tax...
- ... on top of likely elevated fuel prices due to the elevated demand for natural gas.

### Electrifying the economy: transport and heating

**No electrification without nuclear** Worryingly, there is at the present time (early September 2022) no public debate regarding Ontario's urgent requirement to replace PNGS with non-emitting capacity of similar size and capacity factor. There is however a debate in the beginning stage about how Ontario will electrify currently fossil-powered equipment and processes in transportation and heating.

**Electrification policy is disconnected** Calling for electrification on one hand while ignoring the need for zero-emitting generation on the other represents a serious disconnect in the public sphere. Fig 1 shows the sheer size of the requirement to reduce annual GHG emissions, and the strong time pressure Ontario is under to achieve this reduction. Allowing any current emission rate to actually increase in this circumstance is completely at odds with many decades of public declarations. Yet that is exactly what is developing.

**Everything must be electrified** "Everything" includes heating and transport. We've barely even started thinking about this. Exiting PNGS without a nuclear replacement will turn the red curve in Fig 1 upward. We can't do that.



**Fig 1:** The energy and GHG challenge facing Ontario. The red curve must go to zero by 2050. That means full electrification of heating and transport by 2050. Yet Ontario is poised to go exactly in the opposite direction by 2025, with the exit of Pickering.

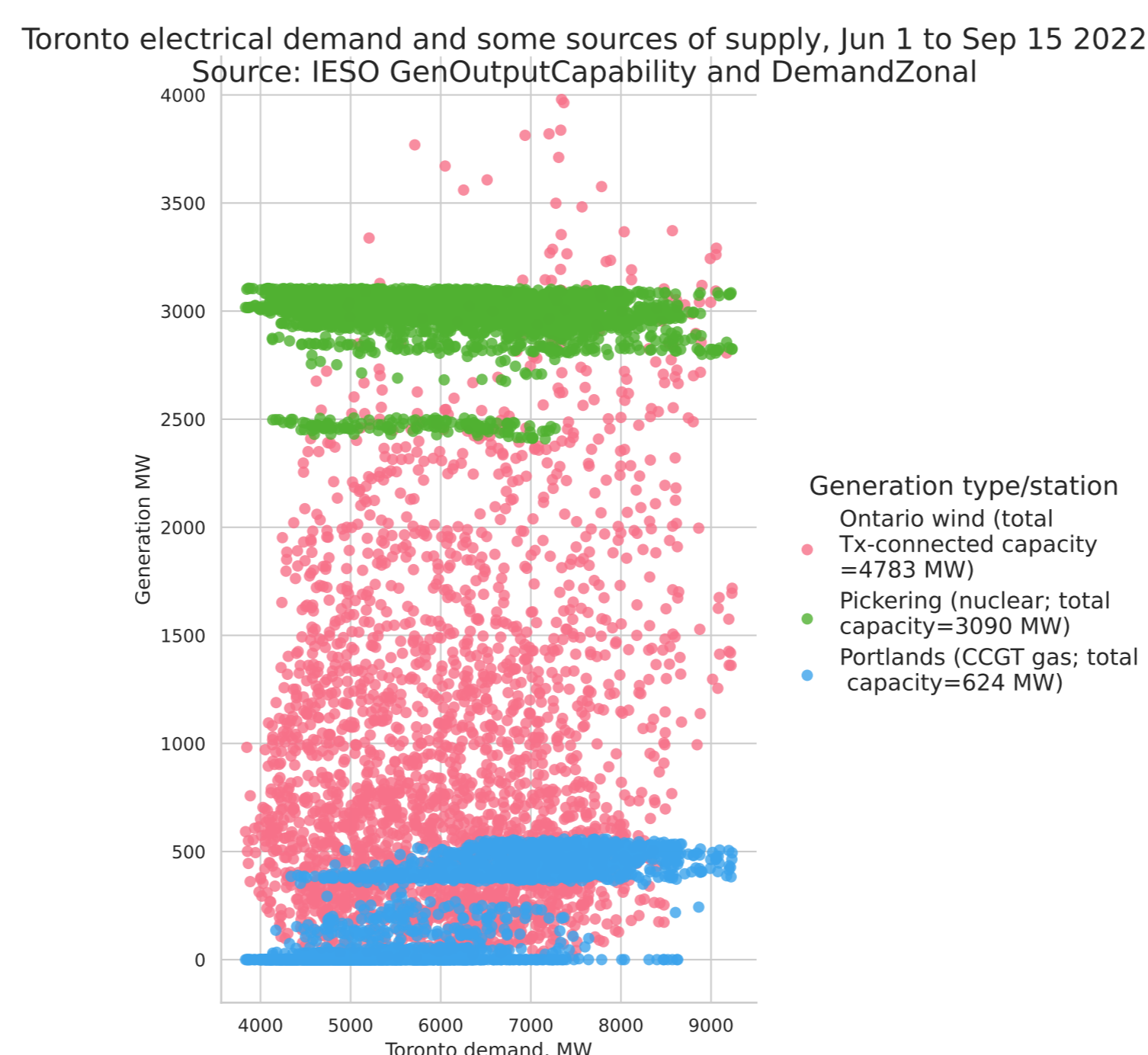
### CANDU: a Canadian provider of Toronto's power

**Toronto runs on 24/7 electricity** PNGS in summer provides over 60 percent of Toronto's minimum (baseload) demand; see Fig 2. It is a CANDU plant, invented in Ontario, specifically to ensure energy security.

- CANDU fuel is made from Canadian uranium which is:
  - Mined in Saskatchewan.
  - Refined, and fashioned into reactor fuel, in Ontario.

→ Used in power reactors in Ontario and New Brunswick.

→ Stored after once-through use at the reactor sites; will be permanently stored in ultra-stable Canadian Shield rock at a to-be-determined site.



**Fig 2:** PNGS output scatter shows the pattern expected of a baseload-provider: all values within a narrow range, and all at or close to the station's maximum capacity, through all demand conditions. Portlands' scatter shows responsiveness to demand conditions. When PNGS exits, Portlands and other gas plant output will assume true baseload duties—which will expand dramatically with electrification and population growth (Fig 4). Wind scatter shows poor correlation with demand; wind cannot perform either role.

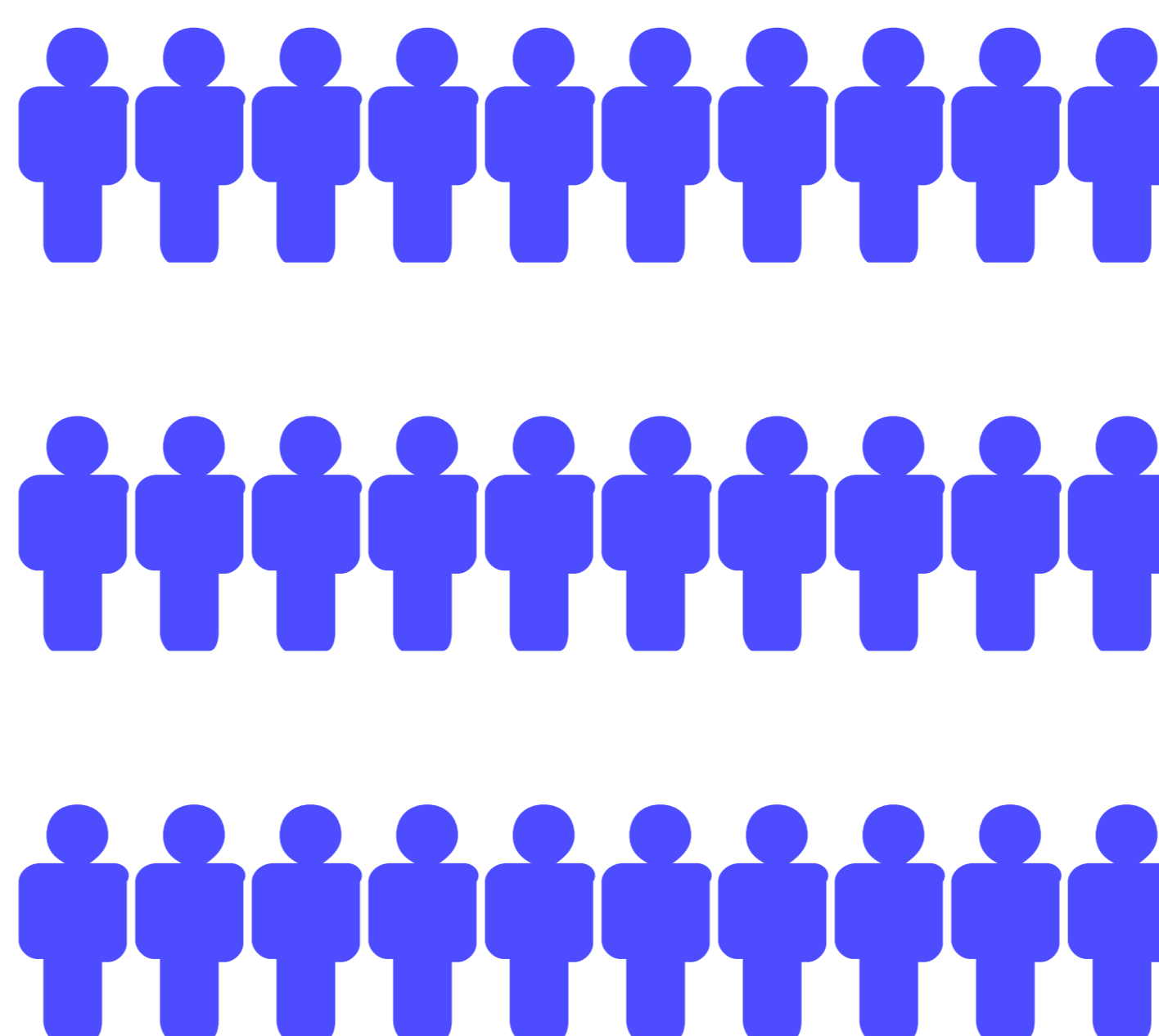
**CANDU workforce: high skilled, essential, and with high growth potential** Canadian reactor technology directly and indirectly contributes hundreds of millions of dollars to municipal coffers.

- Direct: In Bruce County, over \$120 million paid in local taxes.
- Indirect: Hundreds of local business startups.
- Stable, long term, high quality employment—the bedrock of a thriving community.

While workers at CANDU plants produce huge amounts of bulk energy, they are also makers of medical isotopes, helping to bring affordable modern precision healthcare to millions of Canadians. These isotopes include:

- Cobalt-60, for sterilization and cancer radiotherapy.
- Molybdenum-99, for precision diagnosis.
- Lutetium-177, to fight cancer.

**Ontario's past—and its future** PNGS has contributed most of the above benefits to its host community, and to Ontario and Canada, since the 1960s. It was the world's first multi-unit CANDU station. Extending it and/or replacing it will continue that contribution for many decades ahead.

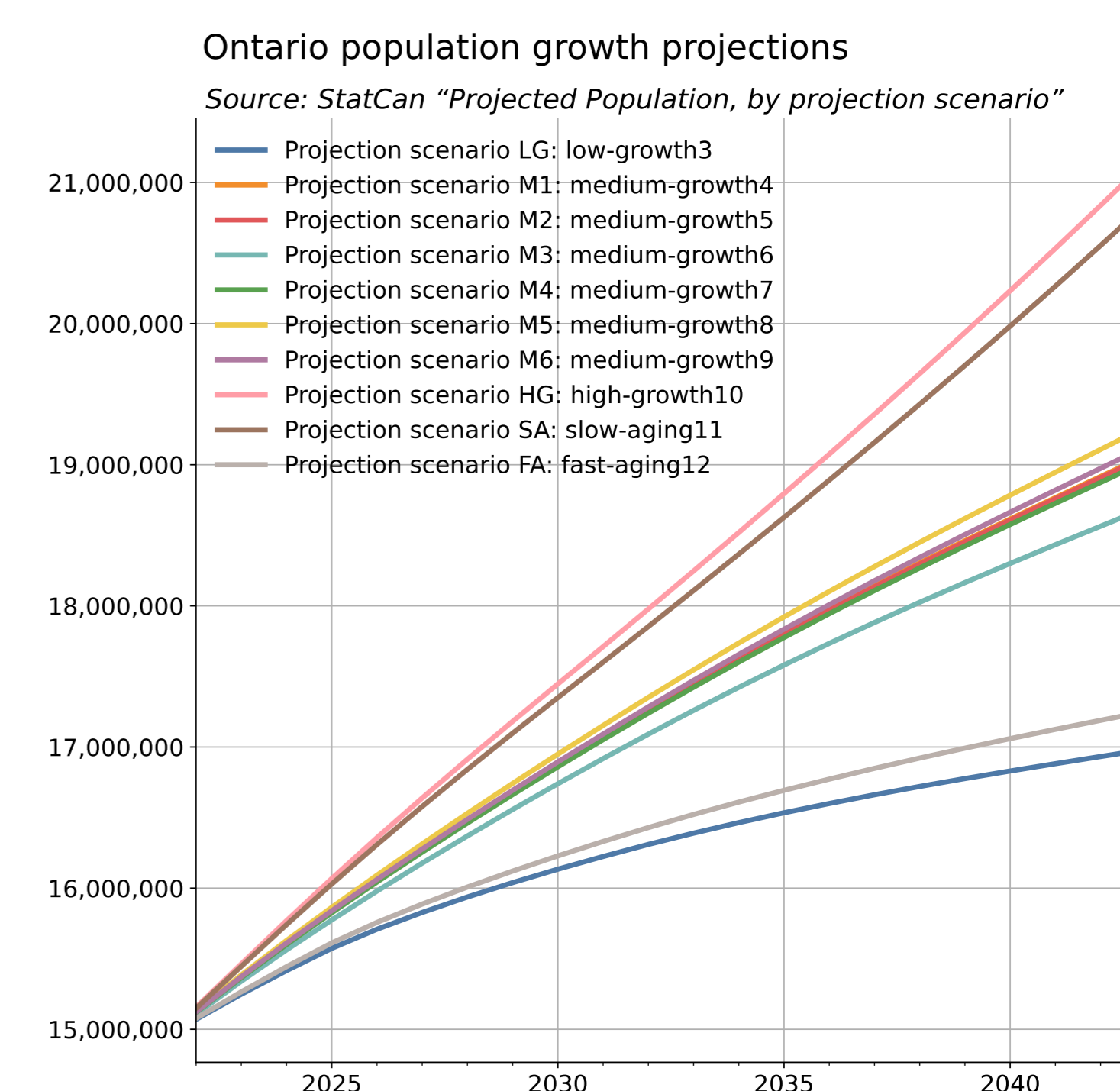


**Fig 3:** The CANDU workforce required to refurbish/replace PNGS. Each figure represents 100 workers. At \$75,000 average annual salary, each figure also represents \$21,000 of federal/provincial income tax, totalling \$63 million injected into general government revenues per year. Each worker, through their labour, will help to generate 8.6 million kilowatt hours, and avoid 3,349 tons of CO<sub>2</sub>, per year, projected over the new life of the plant. PNGS has manufactured over 1 billion Curies of lifesaving Cobalt-60 over the plant's lifetime. CANDU plants can also make Molybdenum-99. The Bruce plant will soon make Lutetium-177. No other power reactor technology in the world has this linkage with modern precision healthcare.

### PNGS: refurbish or replace?

**Existing workforce** Extending PNGS's life is the most straightforward way to keep the site operating and Toronto supplied with zero-emission power. But eventually the reactors must be refurbished or replaced. The economic benefits of refurbishment and new construction are well known; and in the case of refurbishment on full display currently, in the Darlington and Bruce projects. The refurbishment workforce is highly proficient and has proved it can deliver major projects on time and budget.

**Zero emission baseload** Ontario's Government and OPG have said refurbishing PNGS is not a viable option. If a compelling case indeed cannot be made, then the only reasonable answer is to replace PNGS with new zero-emission capacity. Only nuclear can provide this. We ask that OPG acknowledge the unique value of PNGS as a vital supplier of bulk zero-emission power to Toronto, and that the Company refurbish it or replace it with new nuclear of equal size.



**Fig 4:** Every million in population entails roughly 10 billion kWh of annual Ontario electrical demand. Assuming that is baseload, 1 million Ontarians require 1,000 megawatts of generating capacity. By 2030, Ontario's population will, according to StatCan, have grown from 14.57 million in 2019 to as much as 17.4 million. This suggests requirement for 1,500 MW to 2,800 MW of new generating capacity, on top of what exists today, by 2030. That amount could approach 2,000 MW–4,200 MW only 5 years after that. PNGS's 3,100 MW is scheduled to be gone by 2025.

### Ontario unprepared for 2030

**Pressing need to start planning bulk zero emitting generation** Electrical demand is projected to increase significantly between now and 2045, as the result of both electrification and population growth (Fig 4). Ontario strongly needs new electric power generating capacity.

**PNGS exit exposes system to serious risks** The Independent Electricity System Operator agrees demand could grow dramatically (≈2 percent annually between now and 2043), but appears comfortable with natural gas supplying the bulk of new generation to meet it. This is contrary to federal intent to have cut Canadian GHGs by at least 40 percent from 2005 levels by 2030. At the current trajectory, Ontario and Canada will simply not meet international commitments to reduce manmade CO<sub>2</sub> emissions. The closure of PNGS will:

1. Tie the energy-security fortunes of Toronto to the vagaries of the continental natural gas market.
2. Expose Ontario electricity to price, environmental, security of supply, and safety risks.

**Debate urgently needed, and must start now** To lose 3,100 MW of clean baseload supply in 2025 risks undoing Ontario's continent-leading environmental achievements in electricity over the past decades.

**How will Ontario electrify after 2025?** Electric cars, buses, and trains are in Ontario's future. So is electric heating. This entails massive new generation capacity, capable of bulk zero-emissions power. Only nuclear can provide this. A general nuclear expansion, similar to what Ontario achieved in the 1970s and 1980s, promises literally a century of clean prosperity. Let's begin now.