A presentation for

CLIMATE NETWORK LANARK

"Electrify Lanark"

The path to a near zero GHG Ontario

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Carbontakedown.com

30 Minutes

Objective:

Show that a zero carbon 2050 Ontario is possible.

It is well within past and present rates of change.

Your Questions

To achieve zero carbon, the world must electrify almost all current fossil fuel energy use.

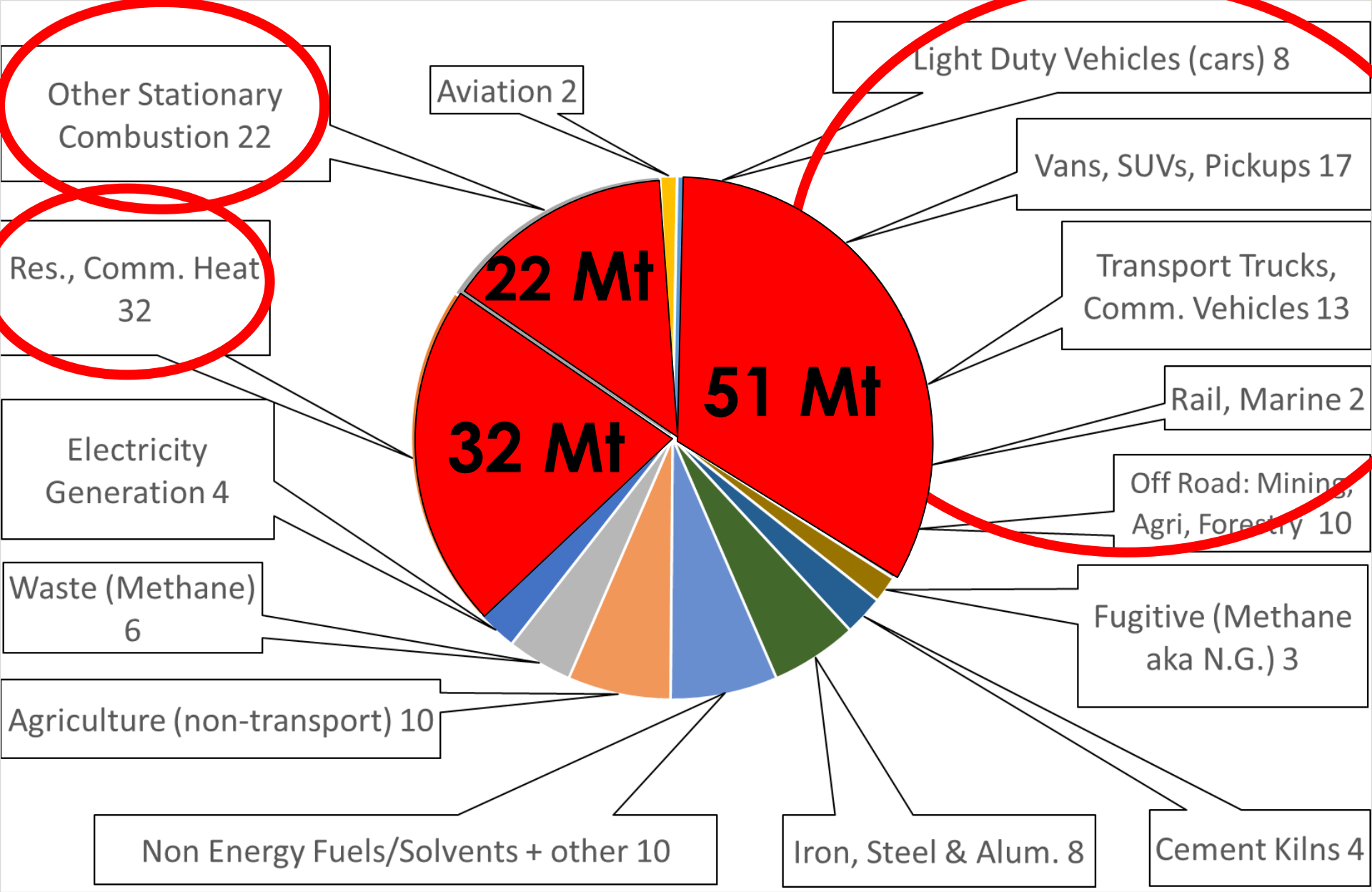
Terminology:

- GHG – Greenhouse Gas – measured in metric tonnes of CO_2e, 1 tonne = 1000 kg
- Mt – millions of tonnes of CO_2e emissions (151 Mt in Ontario in 2021)
- TWh – 1,000,000,000 kWh
  $150,000,000 of electricity at $0.15/kWh

Let's look at the entire province

How much electricity will we require in a 2050 zero carbon Ontario?

First – the GHG emissions!



Ontario 2021 - 151 Mt GHG

2021 National GHG Inventory Report https://publications.gc.ca/collections/collection_2023/eccc/En81-4-2021-3-eng.pdf

Obvious Questions

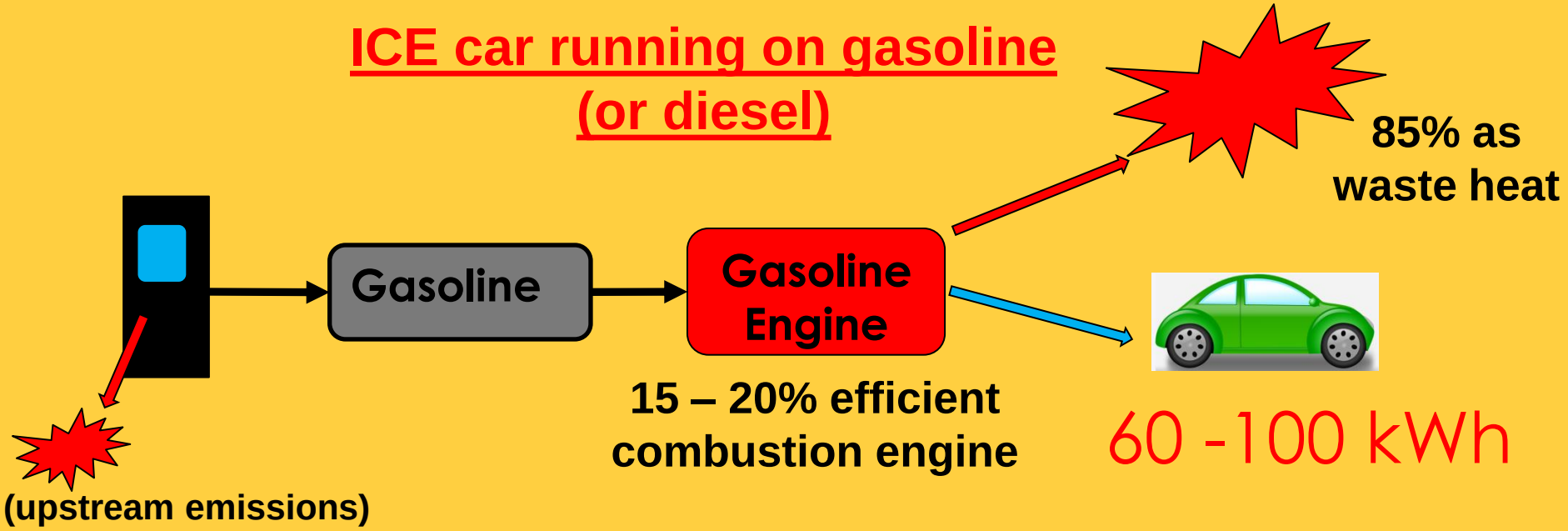
What do we electrify?
How many additional TWh?
Electricity generation type?
What does it cost?
What are the impacts?

Since 2021significant progress in the IESO taking this forward.

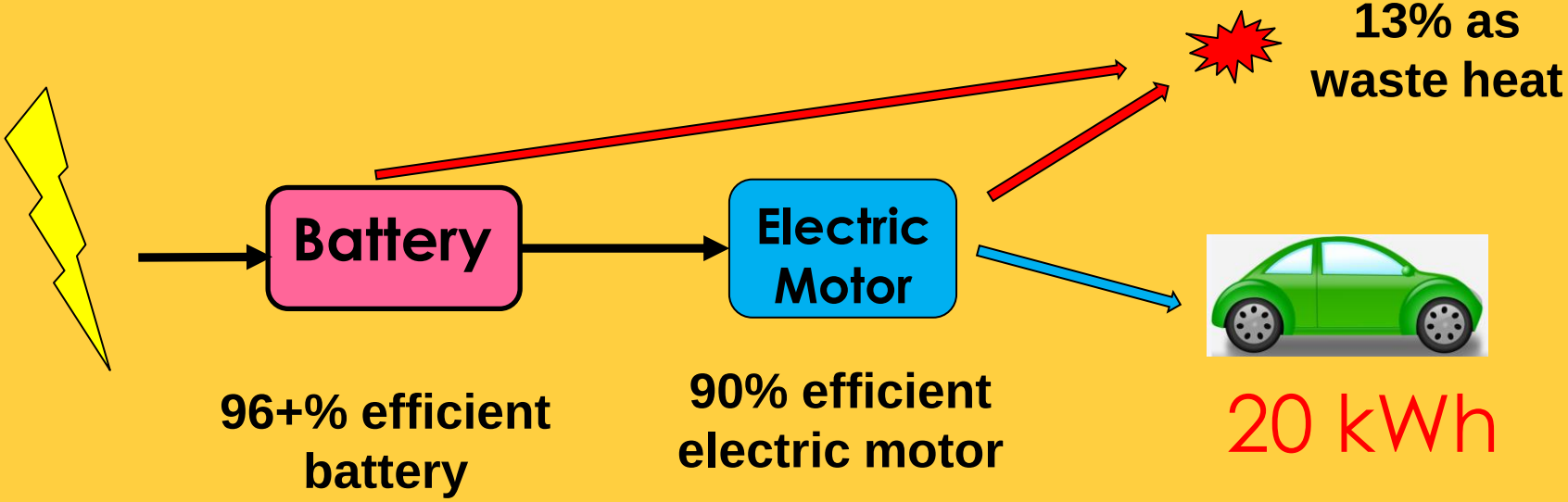
Efficiency Matters!

- When converting from one energy type (gasoline) to another (electricity), we need to know the efficiency of the energy path.
- Much of the energy (80%+) in gasoline powered cars is wasted as heat!
- Ontarions spent about $33 Billion on gasoline, diesel in 2021 and 80% of those $ went as waste heat!

ICE car running on gasoline (or diesel)



EV powered by zero carbon electricity



Replacing fossil fuel energy by electricity – differing efficiencies

Piston engines are only about 15% - 20% efficient

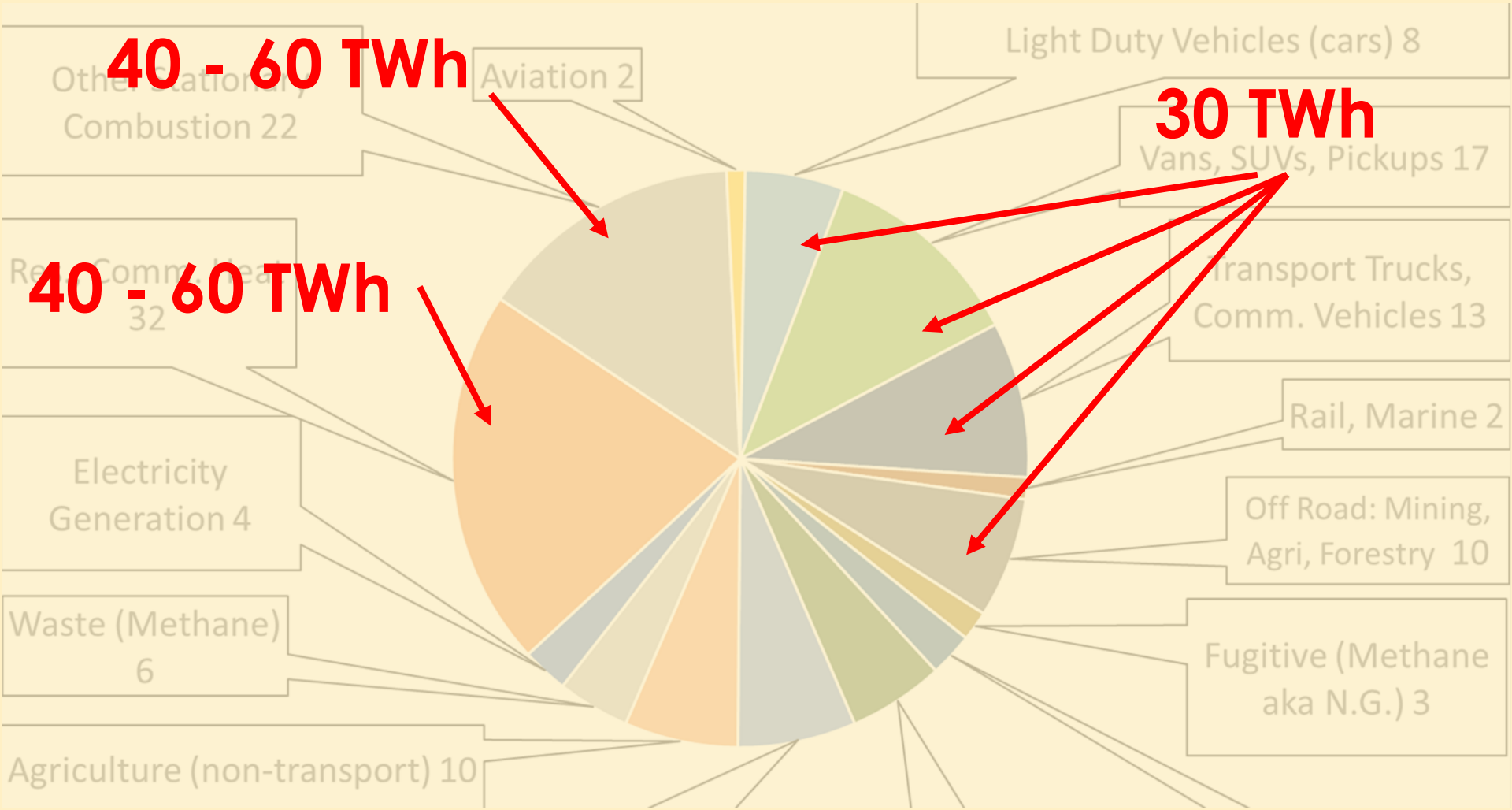
EVs @ 80+%

Natural gas heating systems are 60% - 98% efficient

Heat Pumps @ 200% - 300%

Industrial processes are trickier to replace by

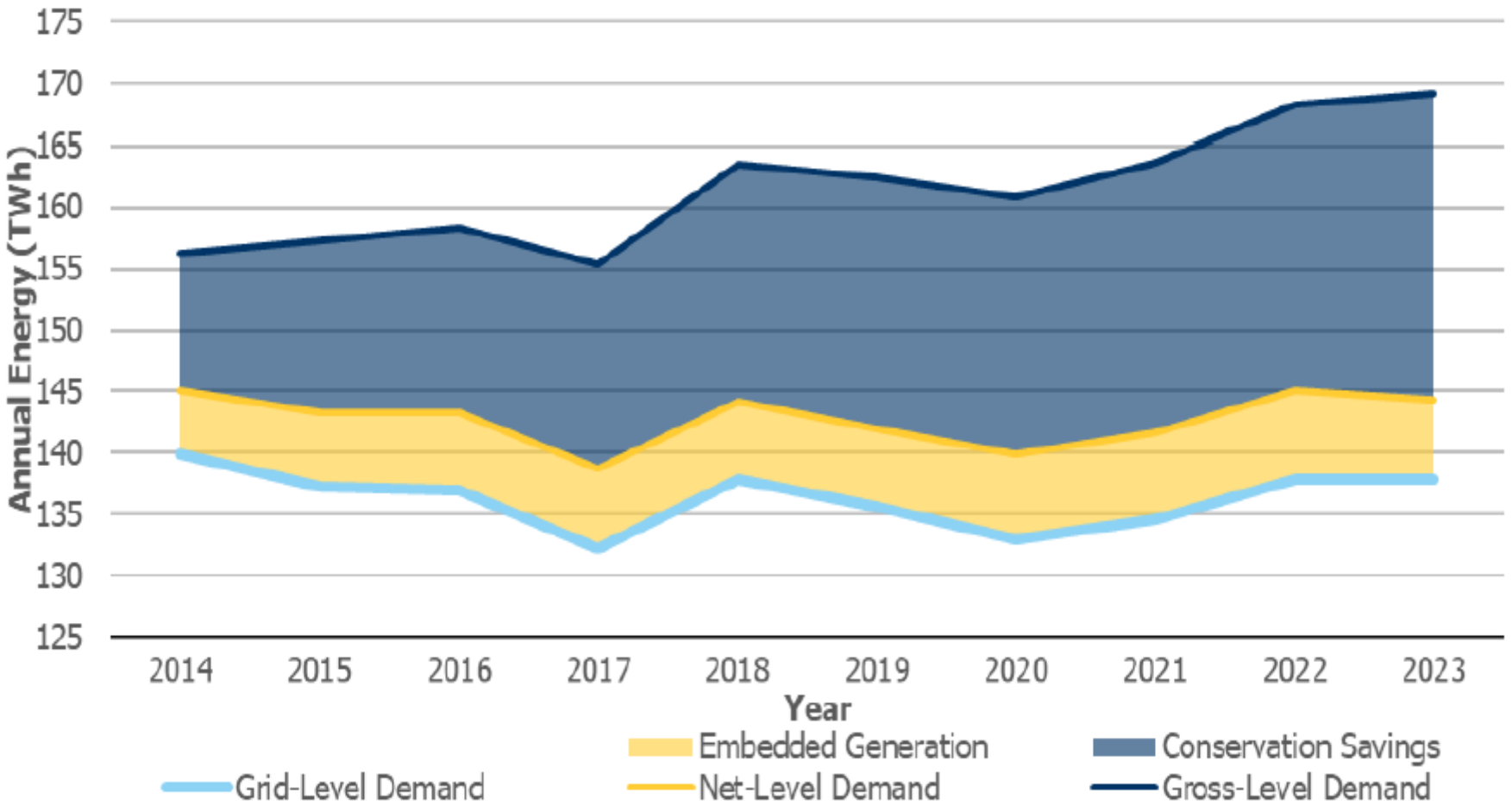
Heat pumps, electric, biofuel, hydrogen



70% Provincial reduction in GHGs

Requires 110 - 150 TWh of electricity to replace these fossil fueled activities

Ontario Grid*

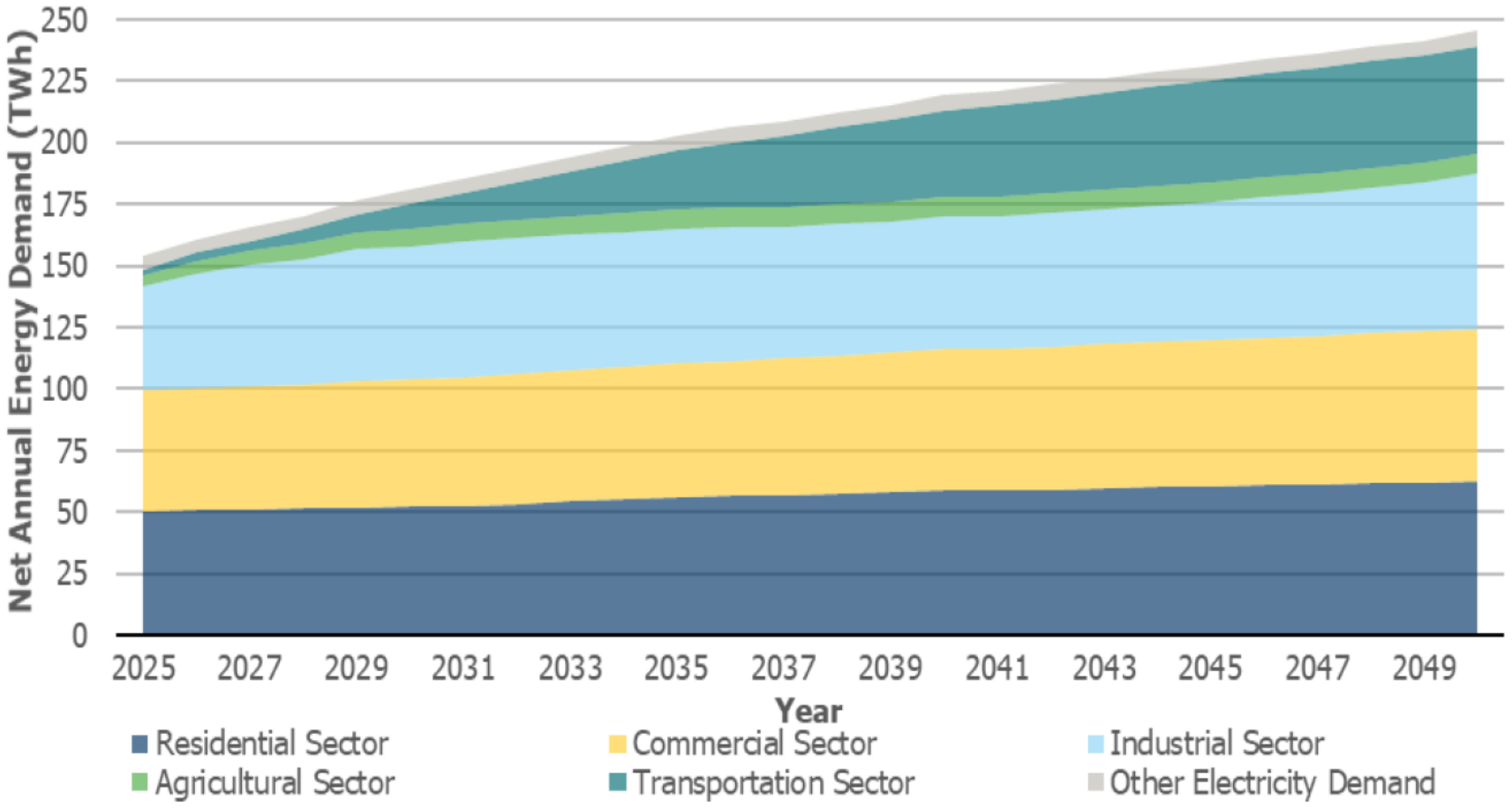


*Page 20, IESO March 2024 Annual Planning Outlook

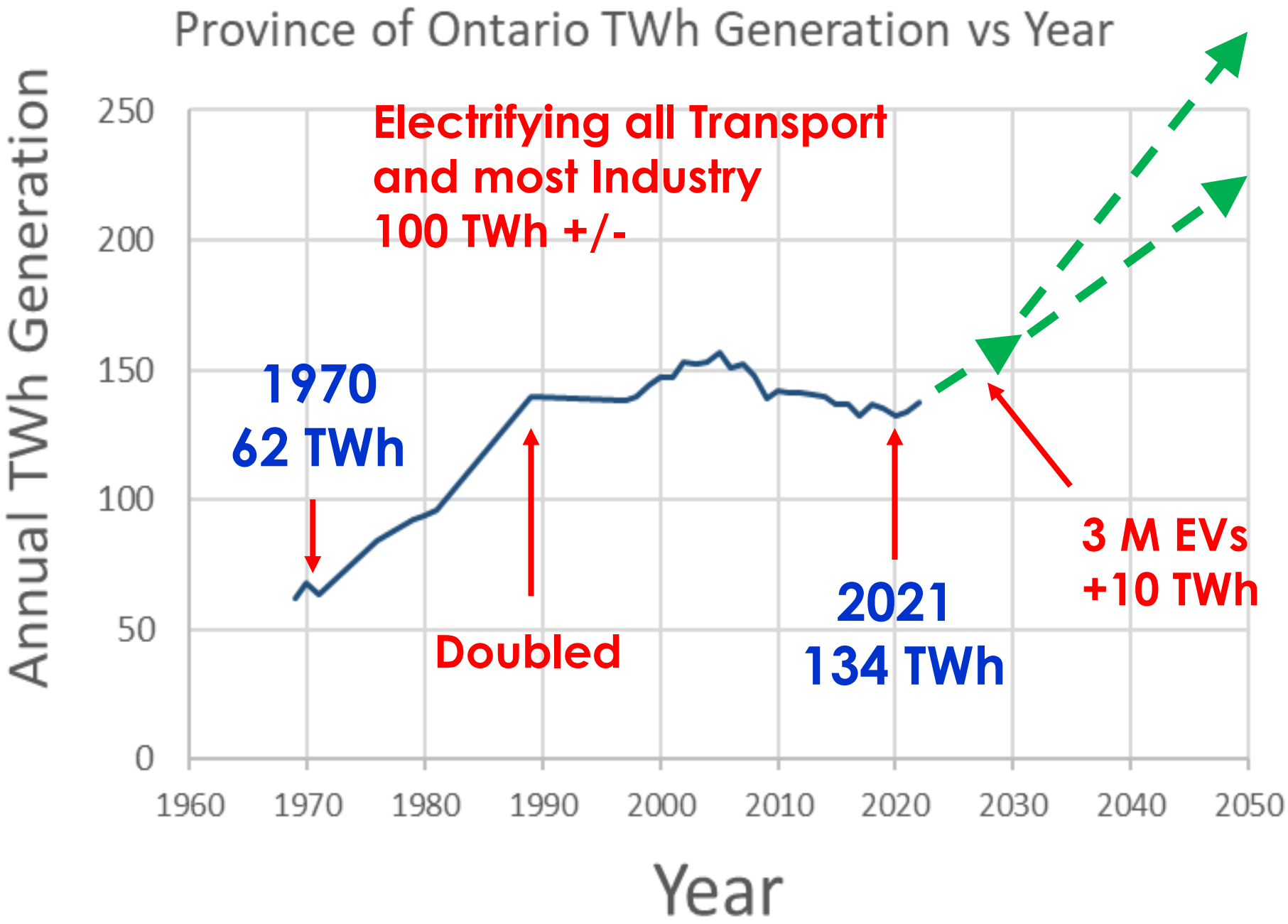
IESO March 2024 APO
(Annual Planning Outlook)

Projects TWh of generation required out to 2050

The IESO Projection to 2050*



*Page 18, IESO March 2024 Annual Planning Outlook



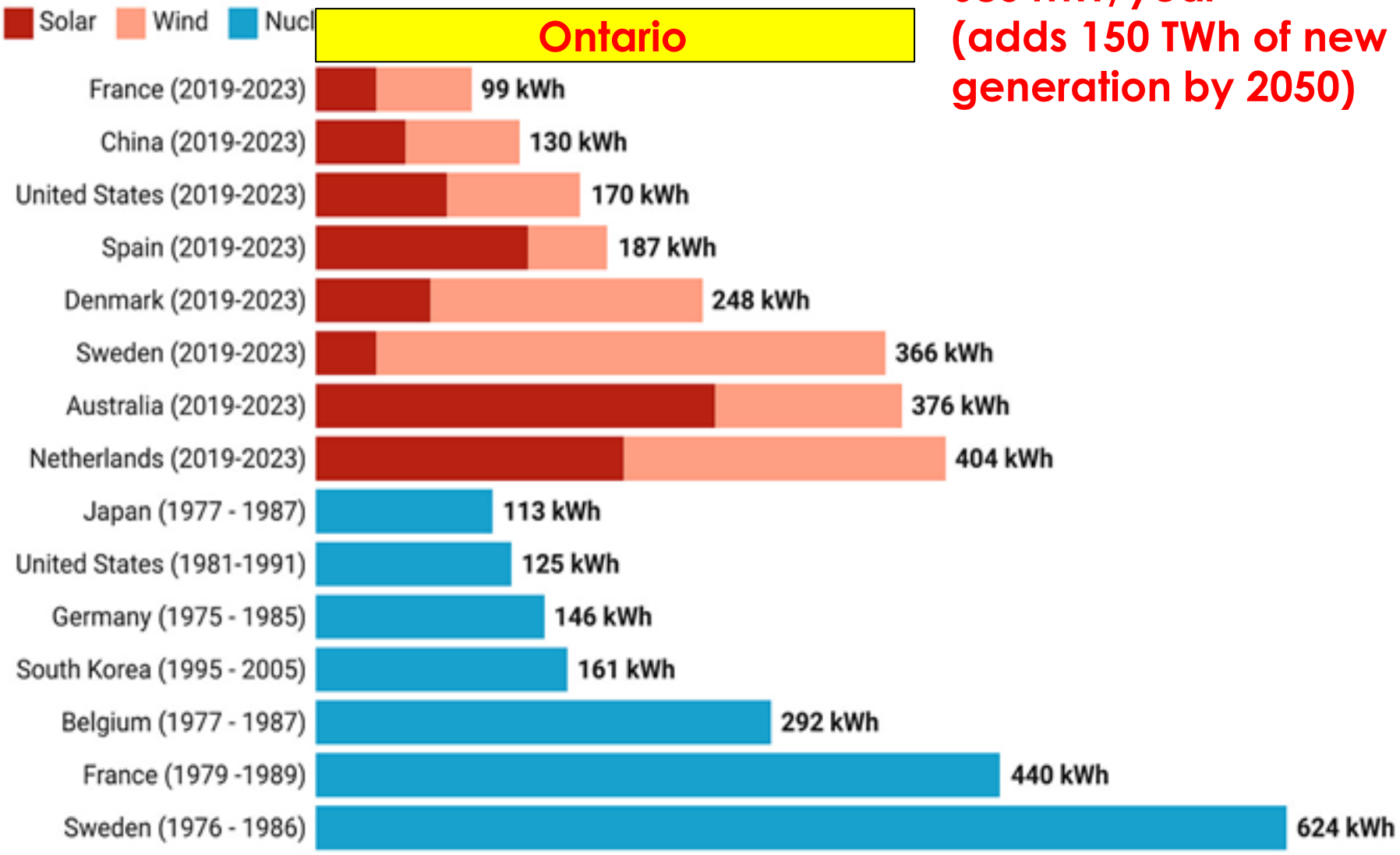
(Stats Can, IESO and Ontario Hydro & Lapp)

What are the details?

Land Area
Cost
Build Time
Public Approval
Can it be Done?

Average annual increase in low-carbon electricity output per person

Given for solar and wind over the last five years, compared to peak build-out periods of nuclear during the 1970s and 1980s.



Source: Ember (2024) • Created with Datawrapper

(Hannah Ritchie, 2024, World in Data)

150 TWh

Photovoltaics

- 125,000 MW Cap.
- 14 % Cap. Factor

- 2,100 km^2
- 0.2 % Ont. area

- $160 B*

Nuclear

- 20,400 MW Cap.
- 85% Cap. Factor

- 69 km^2 (waste?)
- 0.007 % Ont. area

- $230 - $380 B
- $204 B* (68 SMRs @ $3B)

Wind

- 49,500 MW Cap.
- 35 % Cap. Factor

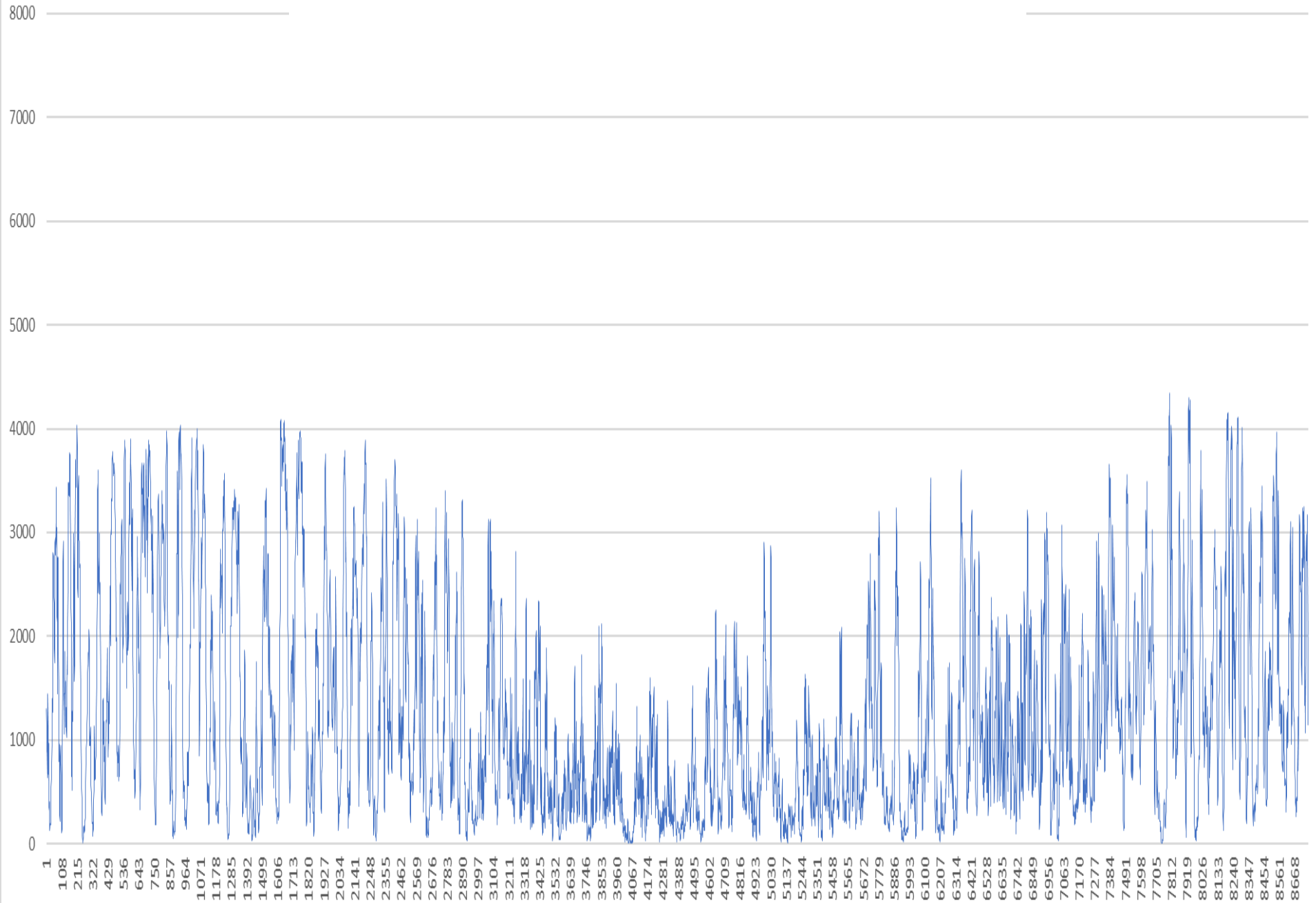
- 600 – 2,800 km^2
- 6 – 28 km^2 actual
- (0.0006 – 0.28 % Ont. area)

- $100 B*

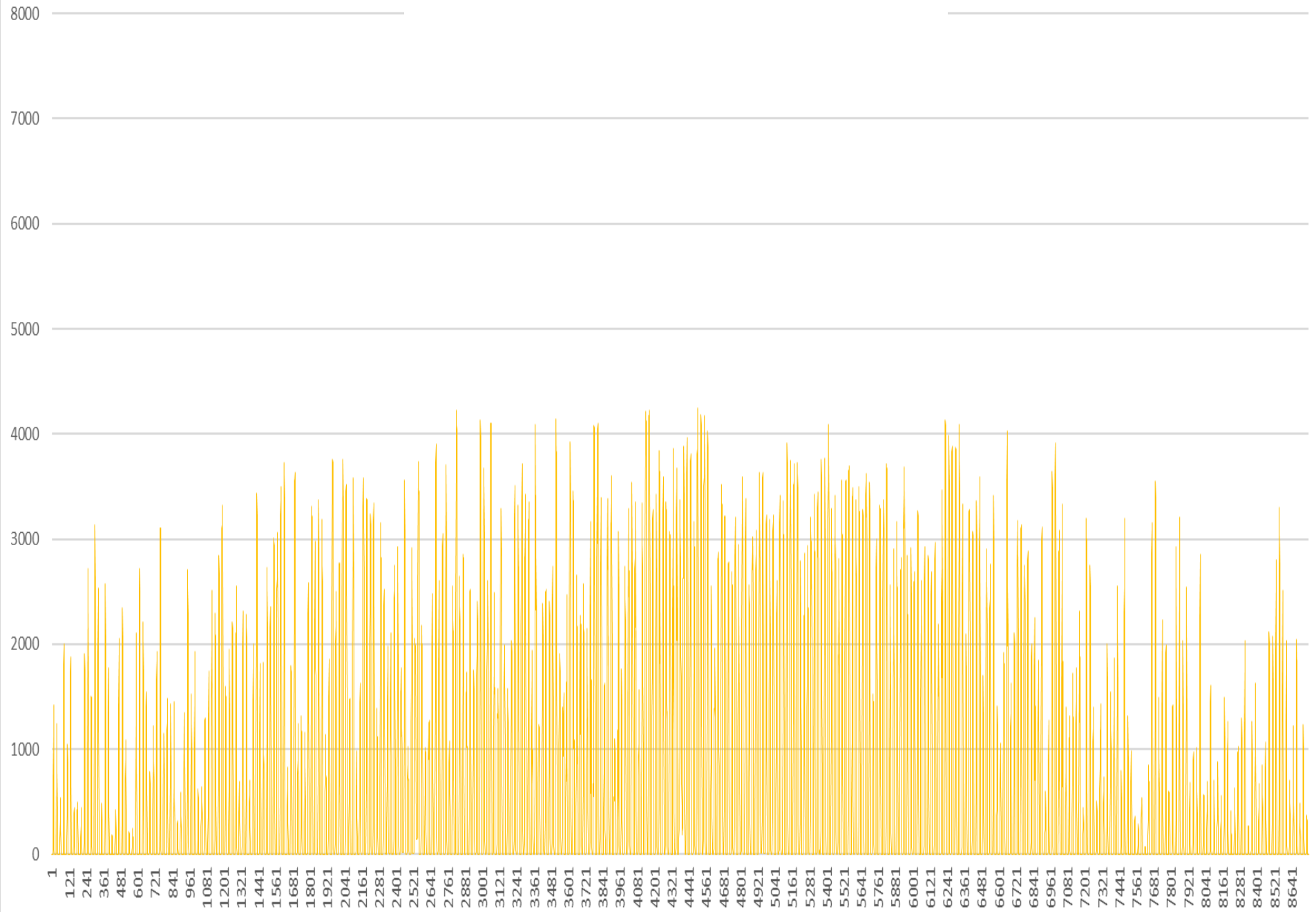
*$1300/kW solar, $1400/kW wind, $10,000/kW SMR


75 TWh from PV = 32 km x 32 km
(1050 km²) of Land
2021 Forest Fires
8000 km²
GTA = 7,100 km²
NITOBA
ONTARIO
QUEBEC
MINNESOTA
Minneapolis
WISCONSIN
MICHIGAN
Detroit
Chicago
IOWA
Montreal
Ottawa
NEW YORK
Google

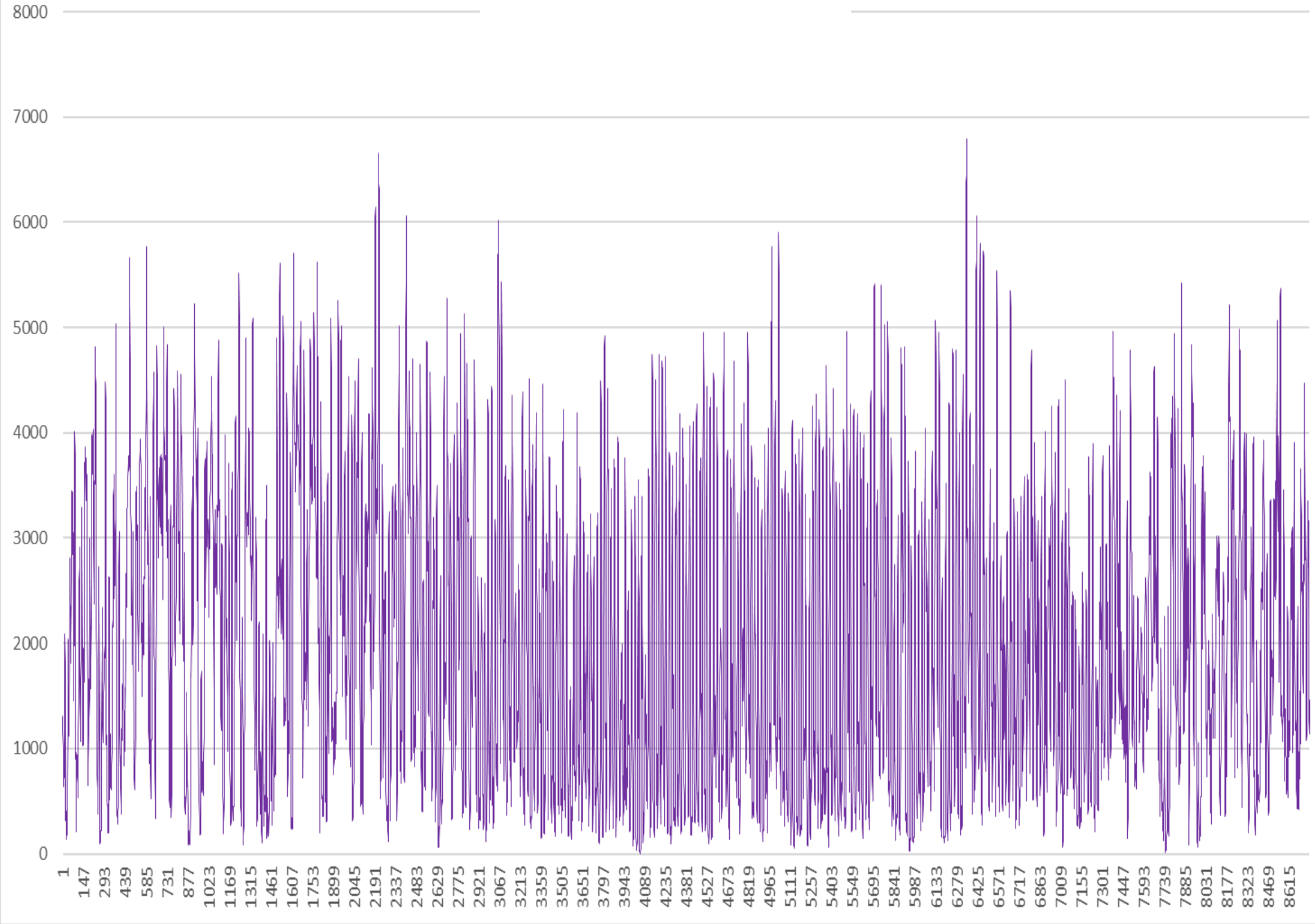
Actual Wind Power in Ontario (IESO 2019 Data)



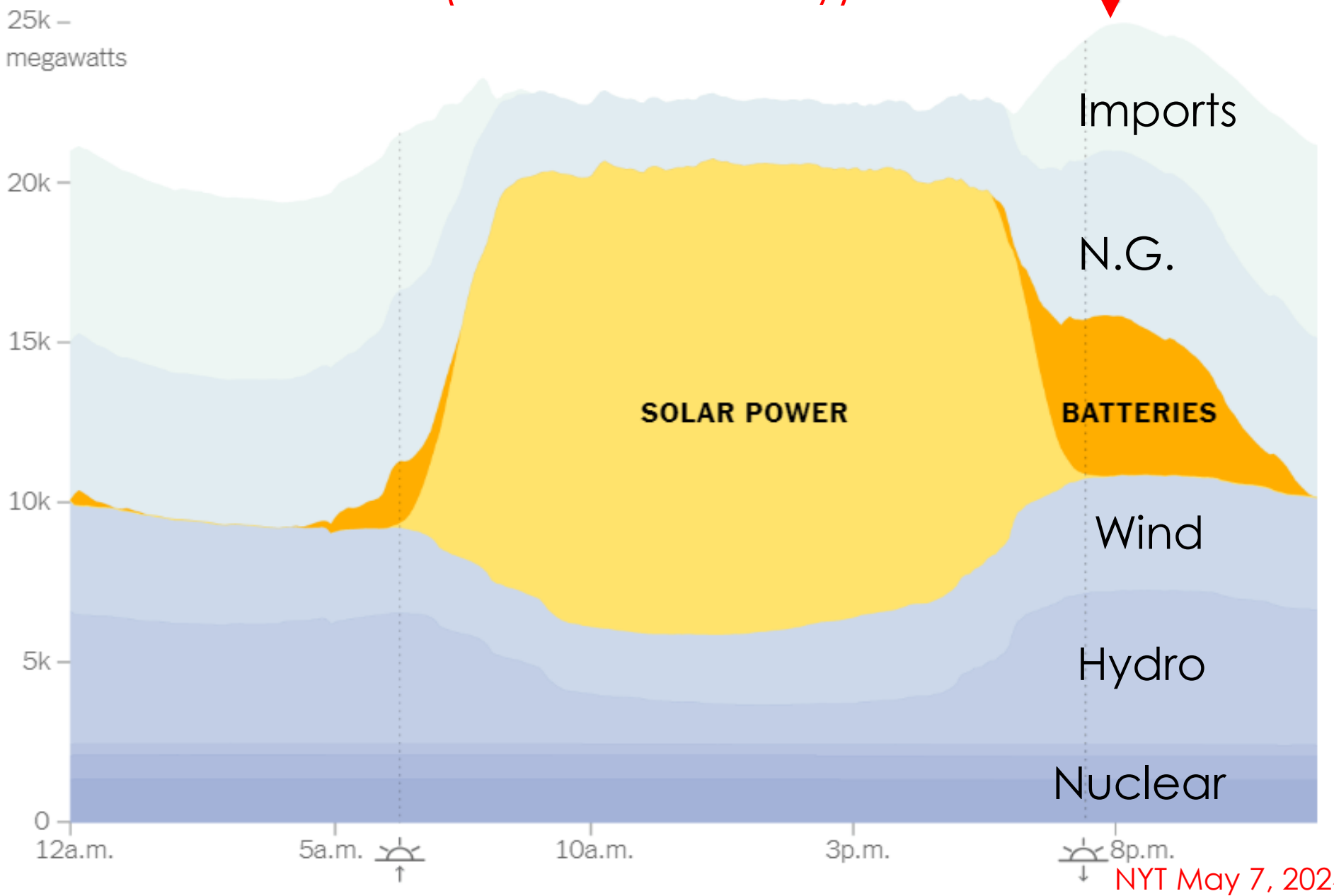
Large solar farms on the Grid X 10



Wind plus 10 X solar



April 2024 – Average Daily Generation California Grid (300 TWh Annually)



NYT May 7, 2024

Annual expenses

Gasoline/Diesel/N.G.:	$ 33 B
Natural gas:	$ 14 B
Fossil Fuel 2021 Total	$ 47 B

Ontario's GDP	$800 B
Ontario cell phone market	$ 10 B
Darlington & Bruce refurb	$ 26 B
IESO - invested since 2003	$ 70 B
150 TWh solar and wind?	$10 -15 B

Conclusions

To take Ontario to a low carbon 2050, we must…

- Have a government that makes it a priority to get there. IESO moving forward…but….
- Eliminate N.G. electricity generation.
- Support EV and Heat Pump adoption.
- Meaningful consultation to determine which of (or combination of) Wind, Nuclear and/or Solar and electricity storage provides the best value for citizens, is deployable in the timeline and is environmentally acceptable.
- Hurray!! - Avoided fossil fuel cost of $40B/year

What can you do?

- Contact your MPP
- Electric car (approx. 2 years GHG payback)
- Cold climate heat pump
- Hybrid electric hot water heater (instead of N.G.)
- Home energy audit to find most cost effective retrofits
- Fly less or not at all
- Wifi based thermostat
- Buy less of everything..except EVs and Heat pumps!


Thank You
for Your Attention
Questions?
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