Darlington Nuclear Refurbishment Project

Canada-Romania Partnership in Nuclear Technologies

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ONTARIO POWER GENERATION

Where a brighter tomorrow begins.

Who is OPG?

Publically owned electricity generator dating back more than 100 years

Produce about half of Ontario's electricity; 90%+ carbon emission free

Largest low-cost power generator in Ontario: 40% less

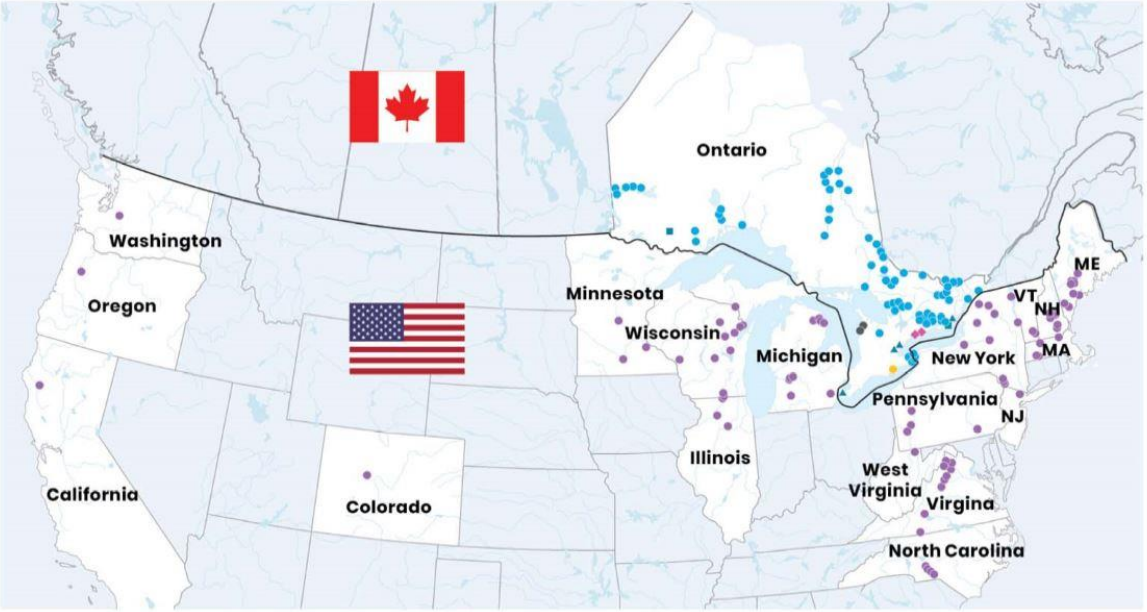
Ontario assets:

- 18,875 MW generating capacity
- 75 stations including 2 Nuclear Stations (Pickering and Darlington)
- 2 leased Nuclear Stations (Bruce)

US assets:

- 85 US hydroelectric stations (619 MW)
  - Eagle Creek Renewable Energy & Cube Hydro (independently operated)

Ontario Power Generation Facilities



2	2	2	1	66	85	4
Nuclear Stations	Leased **Nuclear** Stations	**Thermal** Stations	**Solar** Facility	**Canada Hydroelectric** Stations	**US Hydroelectric** Stations	**Atura Power Gas-Fired** Stations

Pickering Nuclear Station

One of the world's largest nuclear generating station - Six operating units – 3,100 MW

- 14% of Ontario electricity
- Enough power for over 2.2 million homes

Current Performance at Pickering is best in station history - 2019 WANO Peer Review – Exemplary Results!

End of commercial operations 2024-2025 followed by safe storage and decommissioning

Darlington Nuclear Station

In-service early 1990's, providing over 25 years of clean, competitive, reliable power

- Four units; 3524 MW net output
- Delivers 20 percent of Ontario's electricity; power for 2 million homes

Recognized internationally for excellent safety, equipment reliability and operating performance

Unit 1 now holds the world record for continuous operation of a nuclear reactor

DNRU2 completion sets a new standard for CANDU refurbishment

Darlington Nuclear Refurbishment Project

20-year project

- 10 years Planning and 10 years Execution:
  - Each Unit will undergo Refurbishment outage of 35-44 months
  - Overlapping Refurbishment of Units 3, 1 & 4

$12.8B investment

- 14,000+ jobs; $89.9B boost to Ontario's GDP
- Replace major reactor components and upgrade key plant systems
- Substantial safety and equipment investments

Refurbishment Scope and Vendors

Defuel, Fuel Handling, Special

BWXT
BWX Technologies, Inc.

Retube and Feeder Replacement

SNC·LAVALIN Nuclear
AECON Joint Venture

Turbine / Generator

GE
SNC·LAVALIN Nuclear
AECON Joint Venture

Steam Generators

BWXT
BWX Technologies, Inc.

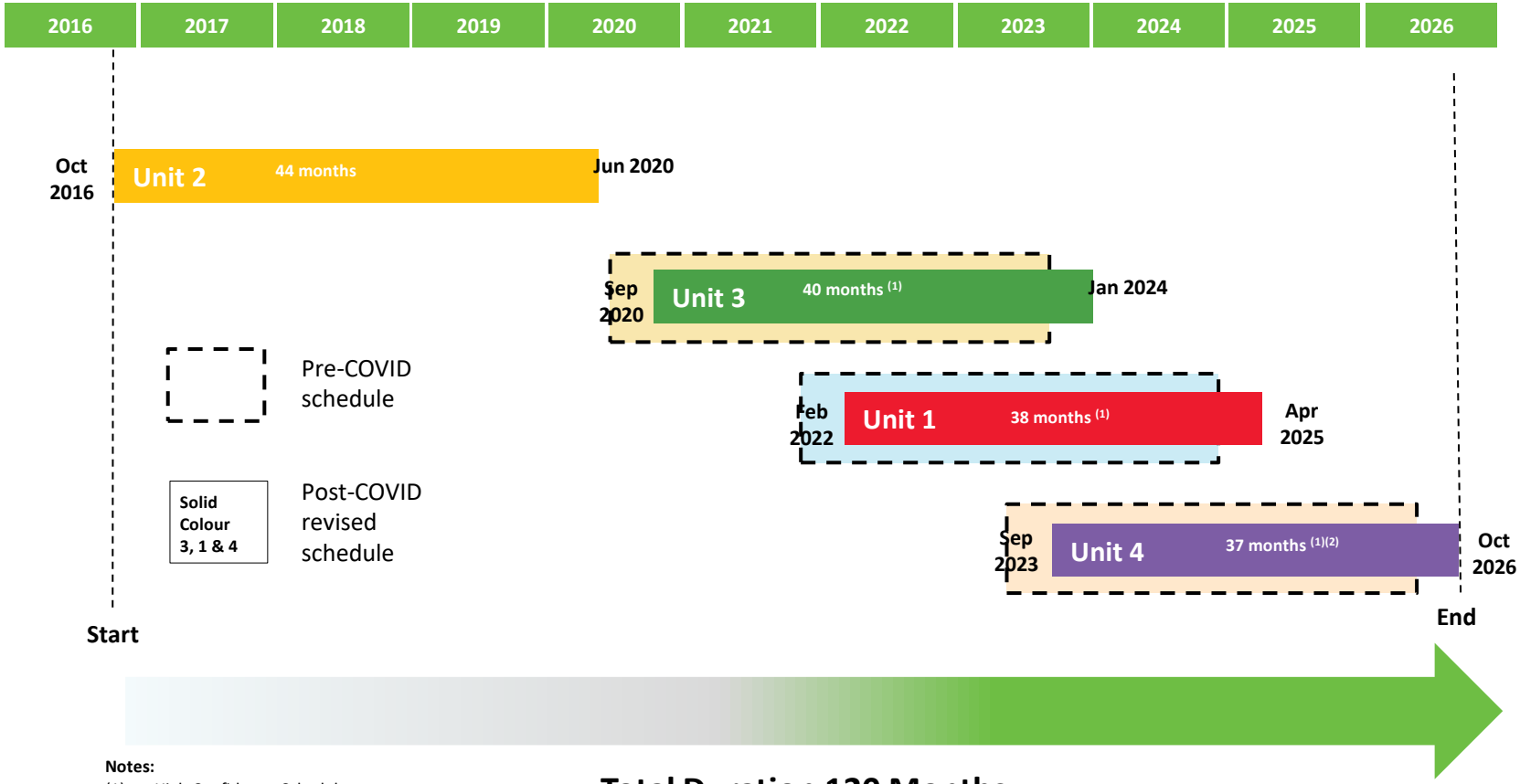
Balance of Plant

FOX CONSTRUCTORS

Cyclic Outage

Black & McDonald

Darlington Refurbishment Schedule



Total Duration 120 Months

Notes:

(1) High Confidence Schedule

(2) Unit 4 will commence upon completion of Unit 3 between Sep/23 and Jan/24

DARLINGTON NUCLEAR REFURBISHMENT PROJECT

30 MORE YEARS OF CLEAN ELECTRICITY

NUCLEAR ENERGY PLAYS A FUNDAMENTAL ROLE IN ONTARIO'S CLEAN-ENERGY EQUATION

THE REFURBISHED DARLINGTON STATION WILL REDUCE GREENHOUSE GAS EMISSIONS BY AN ESTIMATED

297 MILLION TONNES

THAT'S THE EQUIVALENT OF REMOVING

2 MILLION Cars per YEAR

FROM ONTARIO'S ROADS

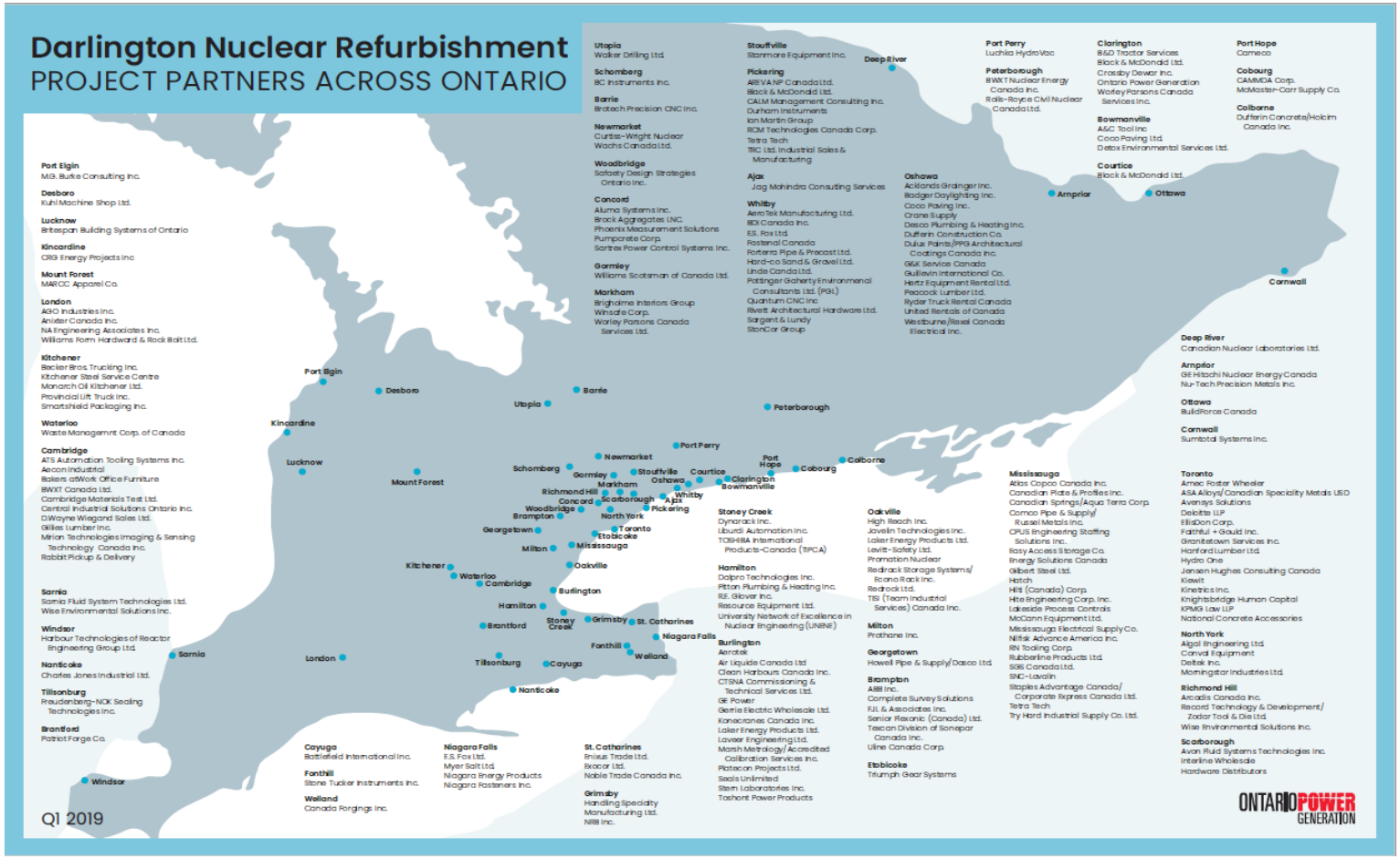
1 IN 5 HOMES AND BUSINESSES ARE POWERED BY DARLINGTON – WITH VIRTUALLY **NO GREENHOUSE GASES**

20% OF ONTARIO'S POWER IS SUPPLIED BY DARLINGTON – ENOUGH TO SERVE A CITY OF 2 MILLION PEOPLE

60% OF ONTARIO'S DAILY ELECTRICITY NEEDS ARE SUPPLIED BY THIS PROVINCE'S NUCLEAR FLEET

8¢ kWh 30 YEARS OF POWER BELOW AVERAGE COSTS

ONTARIO POWER GENERATION



One of Canada's largest infrastructure and clean energy projects.

Meeting Canada's Climate Change Goals

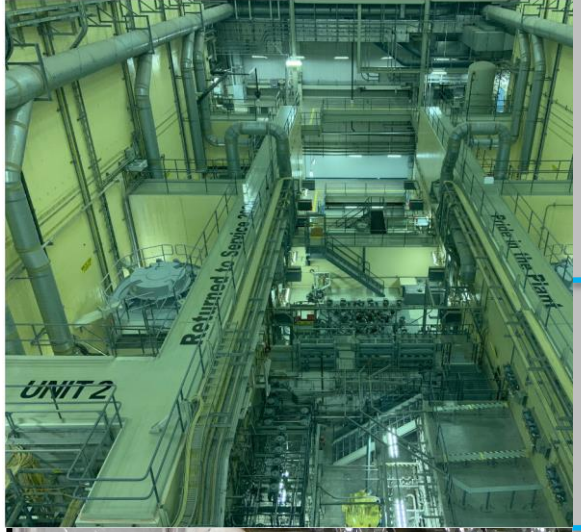
Unit 2

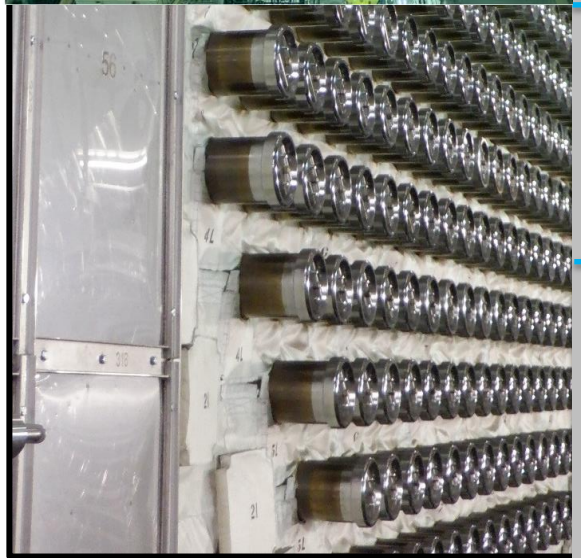
Unit 2 commenced its refurbishment October 15, 2016 and returned to service on June 4, 2020

- 24 Million hours worked with 1 Lost Time Accident (LTA) – final months completed safely with COVID restrictions
- Will provide 30 more years of reliable, clean, low-cost power to Ontario

All 18 safety and infrastructure projects in service

Unit 2 operating reliably post-refurbishment





Unit 2
100% Complete

24
Million Hours Worked

58
Systems in Service

18
Major Safety & Infrastructure Projects

Unit 2 Reactor Vault

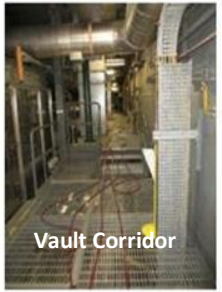
Reactor Face and Feeder Cabinet

Reactor Face and Fueling Machine Columns

Upper Feeders and Header

Reactor Face and Feeder Cabinet

Instrumentation


Vault Corridor

Instrumentation Tubing

Fueling Machine Bridge

Steam Generator Base

Vault Corridor

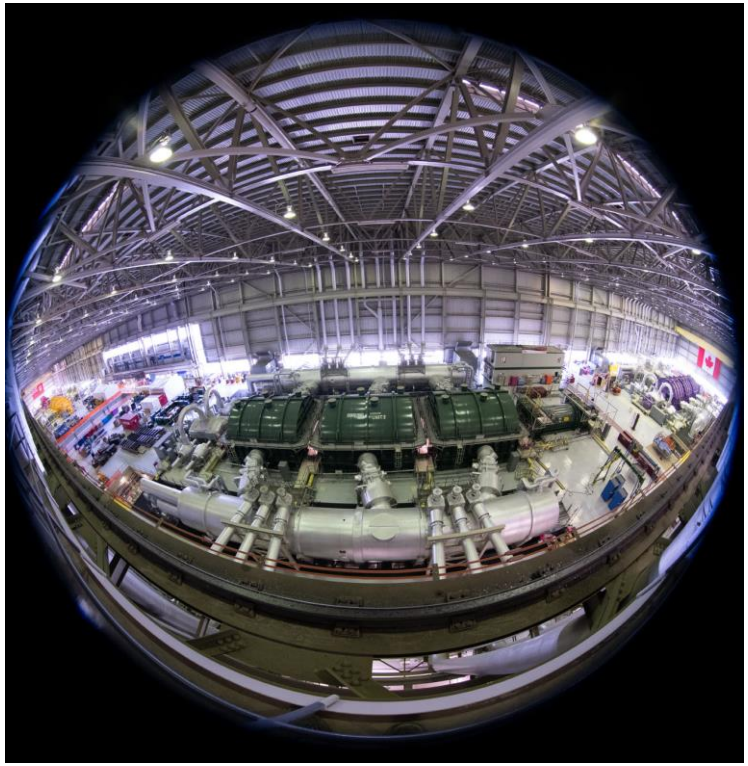
Vault Corridor

Unit 3

Deferred start of Unit 3 Refurbishment due to COVID-19

Unit 3 Refurbishment started September 3, 2020

- Safety continues to be our top priority
  - COVID-19 measures are in place to protect staff and workers
- 40-month schedule
- 4,000+ lessons learned from Unit 2
- Defueling of Unit 3 completed November 25 and containment isolated January 20 – currently in the vault removal phase and approximately 27 days ahead of plan (as of February 16)



Keys to Success

Focus on Planning – scope, schedule, costs, risks.

Proactive Safety Stand-Ups to minimize conventional and radiological safety events

Enhance Training leveraging the Mockup

Establish a readiness process

Use Cost and Schedule metrics transparently to help you improve performance

Establish Regulatory Hold Points and release criteria

Focus on risk mitigation, table-top solutions in preparation

Welcome oversite and feedback – active use of lessons learned and continuous improvement unit over unit – go after opportunities with the same energy that you mitigate risks.

Our Partners are our Key to Success

Establish strong partnerships with your vendors – OneTEAM

As many as 2,000 trades are required to support the remaining Refurbishment activities for Units 3, 1, and 4.

Ontario Power Generation

Creating a Stronger, Cleaner, and More Prosperous Future for all of Ontario

Province's largest clean power generator and clean tech innovator

A diverse mix of generating sources, which includes nuclear, hydropower, thermal and solar

Powering the future of the transportation sector through electrification

Advancing new technologies, like small modular reactors, micro-grids and large-scale energy storage projects

Helping to build the next generation of Ontario's skilled trades and technology workforce

DNGS will produce isotopes (Mo-99 & Co-60) for the medical industry to help save lives

By partnering with impactful organizations, OPG is investing in the future – **today!**

Reinvesting in Ontario

$15M In programs
To educate pool of skilled and qualified workers

2,000 Suppliers
Helping us build and modernize generating assets

$2B Yearly
In property, plants and equipment

$90B GDP boost
By investing in the Darlington Refurbishment