CANDU Owners Group
1984 - 2019

In 1984, the CANDU Owners Group was formed to help CANDU operators share resources and knowledge to further develop and continuously improve the nuclear plants they operate. Today, 35 years later, COG continues its vital role in helping its members, worldwide, and the broader industry leverage collaboration to create nuclear excellence. What follows is a journey through COG’s last 35 years.

INDUSTRY MILESTONES

1984

Coming into 1984, CANDU holds seven of the Top 10 places for lifetime performance among world reactors

Ontario Hydro

Ontario Hydro is managing the SHUTDOWN of its PICKERING UNITS due to a 1983 pressure tube event when a pressure tube developed a two-metre long split

The reactor is safely shut down

Root cause is determined as a mis-location of annulus gas spacer springs

The event leads to significant learnings and innovation in CANDU research, much of which is done through the newly-formed CANDU Owners Group (COG)

NA-SA, Argentina

EMBALSE goes into service

NPCIL, India

MAPS UNIT 1 goes into service

Ontario Hydro

PICKERING UNIT 6 goes into service

AECL

DOUGLAS POINT reactor is retired

CANDU OWNERS GROUP IS FORMED

by an agreement among the Canadian CANDU-owning utilities Ontario Hydro (now Ontario Power Generation, OPG), Hydro-Québec and New Brunswick Power, plus Atomic Energy of Canada Limited

BARRY COLLINGWOOD
COG Operations Manager
1985

- **Ontario Hydro**
  - **BRUCE UNIT 6** goes into service

**COG’S R&D PROGRAM IS FORMED**

AECL/Ontario Hydro’s jointly-sponsored CANDEV research and development program is expanded to include Hydro-Québec and NB Power. CANDEV is transferred to COG to become the COG R&D Program.

- **Ontario Hydro**
  - **DARLINGTON UNITS** planned for 1985-1988 commissioning are delayed due to changes in political landscape and electricity demand.
  - The project would be pushed over budget and schedule due to accumulating interest rates and changing regulatory requirements during the delay period.

- **Ontario Hydro**
  - **PICKERING UNIT 7** goes into service

- **Ontario Hydro**
  - **BRUCE UNIT 5** goes into service

- **Ontario Hydro**
  - **BRUCE UNIT 6** goes into service

1986

**COG’S FIRST JOINT PROJECT**

Development of Spacer Location and Repositioning (SLAR) tooling becomes the first COG joint project followed by development of Single Fuel Channel Replacement (SFCR) tooling.

- **Ontario Hydro**
  - **PICKERING UNITS** return to service following the 1983 event.
  - COG Joint Projects on SLAR and SFCR contribute to success restart.

- **Ontario Hydro**
  - **DARLINGTON UNITS** planned for 1985-1988 commissioning are delayed due to changes in political landscape and electricity demand.
  - The project would be pushed over budget and schedule due to accumulating interest rates and changing regulatory requirements during the delay period.

**CANDU Owners Group**

- **CNEA (NA-SA) & KHNP JOIN COG**
  - COG membership expanded to include Comisión Nacional de Energía Atómica (now Nucleoeléctrica Argentina Sociedad Anónima, NA-SA) and Korea Hydro & Nuclear Power (KHNP).

**BRIAN MULRONEY**

is elected Prime Minister of Canada

**CHERNOBYL**

The world’s worst nuclear accident occurs at Unit 4 Chernobyl, a graphite-moderated reactor.

- A seven on the INES scale, it occurs due to human error and design flaws during an exercise intended to develop a safety procedure for loss of power events.
1984 - 2019

1984 - 2019

MAPS UNIT 2 goes into service

Ontario Hydro

BRUCE UNIT 7 goes into service

1988

Ontario Hydro

BRUCE UNIT 8 goes into service

THE CANDU REACTOR

is ranked as one of Canada’s Top 10 engineering achievements during the previous 100 years (marking Canada’s engineering centennial)

1989

Ontario Hydro

THE SIMPSONS

airs on network TV for the first time, making Homer Simpson the world’s most famously incompetent nuclear power plant employee

1990

Ontario Hydro

DARLINGTON UNIT 2 generates its first electricity

1991

Ontario Hydro

DARLINGTON UNIT 2 goes into service

KHNP purchases two additional CANDU-6 REACTORS from Canada

SNN JOINS COG

With the construction of a CANDU reactor at Cernavoda in Romania, Societatea Nationala Nuclearelectrica (SNN) becomes a COG member

1992

NPCIL, India

NAPS UNIT 1 goes into service

1992

NPCIL, India

NAPS UNIT 2 goes into service

Ontario Hydro

DARLINGTON UNIT 1 goes into service
**PAEC & NPCIL JOIN COG**

Pakistan Atomic Energy Commission and Nuclear Power Corporation of India, owners/operators of a number of PHWR power reactors of CANDU design, join COG

This followed the accident at Chernobyl and recognition that cooperation and sharing of operating experience among nuclear utilities is essential to ensure the safe operation of all nuclear power plants worldwide.

---

**COG's R&D PROGRAM peaks at $180 MILLION per year**

---

**COG'S 1994 STRATEGIC PLANNING HIERARCHY CHART**

for CANDU Owners Group

---

**PAEC, Pakistan**

**ISFoK PROJECT**

with Karachi Nuclear Power Plant Expansion (KANUPP) is launched with IAEA and Canadian Government approval

The ISFoK initiative supports the safe operation of KANUPP (SOK) through the IAEA and COG

---

**Ontario Hydro**

**DARLINGTON UNITS 3 & 4**

go into service

---

**NPCIL, India**

**KAPS UNIT 1** goes into service

---

1994

**Ontario Hydro**

**19 REACTORS ONLINE**

for the first time

---

**NPCIL, India**

**RAPS UNIT 1 & 2** shut down for refurbishment

---

**SNN, Romania**

**FCN NUCLEAR FUEL PLANT**

(later known as Cernavoda) is authorized by AECL and Zircatec Precision Industries Inc. (Canada) as a CANDU 6-type nuclear fuel producer

---

**Ontario Hydro**

**PICKERING UNIT 2** experiences a Loss of Cooling Accident

The Emergency Core Cooling System is successfully used

Public safety is fully maintained

Pickering A remains shut down until all corrective actions are completed in May 1995

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Throughout the mid-1990s, several COG R&D PROJECTS demonstrated generic safety issues were identified and resolved to the satisfaction of the regulator.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>KAPS UNIT 2 goes into service</td>
</tr>
<tr>
<td>1996</td>
<td>BRUCE UNITS 1-4 are shut down and placed in layup by the former Ontario Hydro until 1998</td>
</tr>
<tr>
<td>1997</td>
<td>CERNAVODA UNIT 1 goes into service</td>
</tr>
<tr>
<td>1998</td>
<td>WOLSONG UNIT 2 goes into service</td>
</tr>
</tbody>
</table>

A COG joint project investigates the susceptibility of API 371 TRIP METERS TO RADIO-FREQUENCY INTERFERENCE from portable transceivers and cellular phones helping to prepare CANDU plants for the coming digital transformation.

As a scientist, I would like to note that some of the most interesting work I undertook in my career was under the auspices of COG. It was wonderful to be able to perform novel scientific research, while knowing that there was a customer who needed the results to solve a real problem.

Dr. Joanne Ball, CNL

The Radioiodine Test facility at Whiteshell, which operated from around 1987 to 1998, and which was built for COG R&D.

IAEA releases its report entitled:

** ASSESSMENT AND MANAGEMENT OF AGEING OF MAJOR NUCLEAR POWER PLANT COMPONENTS IMPORTANT TO SAFETY: CANDU PRESSURE TUBES **

The report identifies status and challenges as well as several design and operating improvements developed, in part, through research facilitated by COG over the decade prior.
In 1999, COG moved out from Ontario Hydro to become an independent entity. COG incorporated as a not-for-profit federal corporation, funded voluntarily by CANDU operating utilities, with OPG, AECL, New Brunswick Power and Hydro-Québec signing its new by-laws. COG’s offices moved out of OPG and to a new downtown Toronto location. The COG directing committee was replaced by a board of directors. From 2000 to 2003, grant of membership in the new corporation was provided to all existing COG members.

The new model set the stage for nearly two decades of restructuring, growth and renewal. Today, COG is a trusted nuclear industry leader known for its commitment to excellence through collaboration. In 2018-19, COG invested about $70 million in R&D through its research and joint project programs.

Through collaborative excellence in the creation, retention and transfer of knowledge, COG and its members are making innovative breakthroughs, ensuring continuous improvement in CANDU nuclear plants and helping to set a global nuclear safety and quality culture.
"I have stayed at COG for the people. The bond that my team and I share is amazing. We work very hard but I'm also very lucky because I have such wonderful human beings to work with.

Sonia Qureshi, COG Director JP&S

PAT TIGHE
COG President & CEO

COG STAFF circa 1999
Carmen Trandafir (picture inset), along with Bernice Brooks (second row, third from left) and Mersedeh Safa (first row, third from left) are still with COG today

2000

NPCIL, India

RAJASTHAN UNITS 3 & 4 and KAIGA UNITS 1 & 2 go into service

COG and AECL contribute to industry preparations for Y2K COMPUTER ISSUES as 1999 rolls into 2000

All goes well at midnight, Dec. 31 and plants remain online

SNN joins COG’s R&D PROGRAM

KHNP joins COG’s R&D IST and S&L PROGRAMS

2001

OPG and Bruce Power

LEASE OF OPG’S BRUCE A & B REACTORS to consortium Bruce Power

OPG is directed by the government to reduce its share of Ontario’s electricity to 35% (from 85%) by 2010

Canadian Prime Minister JEAN CHRÉTIEN tours QINSHAN

LAUNCH OF COGonline
offering digital destination for news, OPEX, events and to serve member groups

BRUCE POWER JOINS COG as an independent Canadian member after signing a lease agreement with Ontario Power Generation to operate the Bruce A and B nuclear generating stations
Following the events of **SEPT. 11, 2001**, the CNSC takes steps to enhance security at major nuclear facilities in Canada. Nuclear operators take significant actions to build, train, and strengthen their security forces.

**2002**

**Formation of CANPAC**
The procurement audit service provides COG members a cost-effective and efficient quality assurance program for qualifying Tier 1 suppliers.

**Initiation of CANTEACH PROGRAM**
Supporting knowledge transfer and providing high quality information relating to CANDU nuclear technology for use in various aspects of education, training, design and operation.

**Launch of COGNIZANT**
as an electronic newsletter

**2003**

**TQNPC (CNNO) JOINS COG**
With the construction of a CANDU reactor at Qinshan, Third Qinshan Nuclear Power Company (now CNNP Nuclear Power Operations Management, CNNO) in China becomes a COG member.
1984 - 2019

THE BLACKOUT
Grid failure across Ontario and eight U.S. states on August 14

Ontario Power Generation
QINSHAN UNIT 5 goes into service

COG develops ‘JUST-IN-TIME’ BRIEFINGS

PAEC, Pakistan
KANUPP returns to service following refurbishment

COG launches INSPECTION QUALIFICATION PROGRAM

COGonline features more than 17,000 reports and documents

Bruce Power
BRUCE UNIT 4 returns to service following refurbishment

COG launches EMERGENCY SPARE PARTS ASSISTANCE PROGRAM

The newly elected Liberal government reverses some divestiture of assets from OPG

COG launches NEW SUPPLIER PARTICIPANT PROGRAM

COG begins developing SEVERE ACCIDENT MANAGEMENT GUIDELINES

Bruce Power
BRUCE UNIT 3 returns to service following refurbishment

COG launches MONTHLY CANDU/PHWR UNIT RANKING based on 12-month rolling performance indicators

2004

Ontario Power Generation
PICKERING UNIT 1 returns to service following an extensive re-start project including bringing the units up to current safety codes

COG completes development of FEEDER FREEZE TECHNOLOGY

2005

NPCIL, India
TARAPUR UNIT 4 goes into service

COG launches the INTER-STATION ASSISTANCE PROGRAM to connect operators in a shared spare parts inventory and to facilitate better exchange of information for emergent issue identification and resolution
NPCIL, India
TARAPUR UNIT 3 goes into service

Bruce Power
BRUCE UNITS 1 & 4 are shut down for refurbishment

Al Gore’s AN INCONVENIENT TRUTH debuts

Ontario Power Generation
The MINISTRY OF ENERGY directs OPG to begin the federal approvals process for new nuclear generation at Darlington B site

Ontario Power Generation
OPG submits Letter of Intent and Project Description to CNSC for PICKERING-B REFURBISHMENT

NPCIL, India
KAIGA UNIT 3 goes into service

SNN, Romania
CERNAVODA UNIT 2 goes into service

Bruce Power
BRUCE UNIT 2 installs the first steam generator ever to be replaced in a Canadian nuclear plant

2007

Ontario Power Generation
OPG makes business decision NOT TO PROCEED with REFURBISHMENT of PICKERING-B despite clearing environmental assessment and integrated safety review

New Brunswick Power
POINT LEPREAU shuts down for mid-life refurbishment project

A COG joint project made significant gains on the industry’s understanding of FEEDER THINNING AND CRACKING

This included significant review of data, including inlet feeder wall thickness from a Cernavoda reactor

The study results demonstrated little sign of thinning at the inlet walls for CANDU reactors

“I want to thank everybody who built COG, who made it what it is today. We are standing on the shoulders of giants.”

Fred Dermarkar, COG President & CEO
1984 - 2019

2009

COG begins generating a quarterly **EQUIPMENT RELIABILITY INDEX (ERI)** for CANDU stations based on data provided by the stations

COG’s **VIDEO CONFERENCING NETWORK** goes live at COG Board Meeting

**KHNP, Korea**

**WOLSONG UNIT 1** shuts down for refurbishment

**Ontario Power Generation**

OPG begins planning for a **$12.8-BILLION REFURBISHMENT** of four nuclear reactors at Darlington Nuclear

OPG indicates the project, scheduled for completion in 2026, is anticipated to add $15 billion to Ontario’s gross domestic product, create up to 11,800 jobs annually and add up to another 30 years of operation to the plant

**COG**

initiates the **FUEL CHANNEL LIFE MANAGEMENT PROGRAM (FCLM)**

First **INTERNATIONAL COG SIMULATOR TRAINING WORKSHOP**

2010

**Ontario Power Generation**

The government of Ontario announces **DARLINGTON REFURBISHMENT PROJECT**

**NPCIL, India**

**RAJASTHAN UNITS 5 & 6** go into service

2011

**NPCIL, India**

**KAIGA UNIT 4** goes into service

**FUKUSHIMA DAICHI**

nuclear plant event initiated by a tsunami on March 11

The Canadian government **SOLD THE COMMERCIAL CANDU DESIGN** and marketing business of AECL to Candu Energy for $15 million and 15 years worth of royalties

**POST-FUKUSHIMA SEVERE ACCIDENT MANAGEMENT PROJECT**

Following the Fukushima event, COG is requested by senior industry leaders to bring CANDU stations together, coordinate common approaches and responses, share ideas and work together as a team to analyze and create a response

In response, COG launches the Post-Fukushima Severe Accident Management Project, its most rigorous undertaking on the nuclear safety front, delivering technical reports to help meet the requirements of Canadian Nuclear Safety Commission’s Fukushima Action Plan

**The Board of Directors endorses a proposal to fully develop the KNOWLEDGE MANAGEMENT PROGRAM** with the key objective to capture and retain the experience collectively from a wider CANDU base and to transfer knowledge and experience to members in a cost-effective manner

**BARRY COLLINGWOOD**

COG President & CEO (Interim)

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**BARRY COLLINGWOOD**

COG President & CEO (Interim)
COG's R&D program launches **37M FUEL BUNDLE PROJECT**
investigating improving heat removal from fuel under certain accident conditions in collaboration with Stern Laboratories

**New Brunswick Power**

**POINT LEPREAU** returns to service following four-year refurbishment that extends its operating life to 2039

**HYDRO-QUÉBEC**
is no longer a COG member following the decision to permanently shut down their CANDU reactor

**Bruce Power**

**BRUCE UNITS 1 & 2** return to service following completion of refurbishment projects

**Ontario Power Generation**

**A 10-YEAR SITE LICENCE** is issued to OPG for preparation of site for new build at **DARLINGTON B**
Though the original new build project did not move forward due to government direction, the environmental assessment and licensing work positions OPG for future opportunities on the Darlington site

COG moves their offices to their current home at **655 BAY STREET** in **TORONTO**

**KHPN, Korea**

**WOLSONG UNIT 1** returns to service following a 25-month shut-down
This is the first time a CANDU-6 reactor is successfully retubed

COG completes the **OUTAGE DURATION OPTIMIZATION PROJECT**
The project’s objective is to reduce the time CANDU power plants are shutdown for planned maintenance outages

COG establishes a **FUKUSHIMA RESPONSE JOINT PROJECT** to address specific areas identified by the regulator
The goal is to provide guidance that would ensure a systematic and consistent approach for assessing activities of key importance in closing the CNSC Fukushima action items (FAIs), and to support international participant responses
The planned output includes updated technical basis documents (TBDs) and an updated generic SAMG set, incorporating lessons learned from the Fukushima event
A number of vendors provide deliverables for the project, based on their knowledge and experience in related areas including: Candu Energy Inc., AMEC, Kinectrics/Candesco, ERIN Engineering Inc. and Atomic Energy of Canada Ltd.

**SEVERE ACCIDENT JOINT PROJECT** is created, delivering updates to technical basis documents and Severe Accident Management Guidelines through lessons learned and operational experience (OPEX) post-Fukushima

The COG-initiated-and-managed **FCLM** supports the extension of original nominal fuel channel life by four-to-five years
FRED DERMARKAR
COG President & CEO

COG implements DELL APPASSURE
for a comprehensive disaster recovery solution for its IT system
Its new duplicate and compression technology reduces backup time and minimizes the storage footprint
Recovery time and data loss are dramatically reduced by “virtually shadowing” the key servers and running small-time-interval incremental backups

COG RECOGNIZED BY EPRI
for Application Material Degradation Matrix to CANDU reactors

COG creates the CANDU 6 FLEET
to capitalize on the synergies of C6 utilities

COG launches STRATEGIC RESEARCH & DEVELOPMENT
focusing on a long-term vision creating research that will help the CANDU industry remain sustainable and strong over the next several decades

COG’S PRESIDENTS
Barry Collingwood* 1984 - 1999
John Sommerville 1999
Patrick Tighe 1999 - 2001
John Sommerville 2001 - 2002
Brian MacTavish 2002 - 2006
John Froats 2006 - 2010
Barry Collingwood* 2010 - 2011
Robert C. Morrison 2011 - 2014
Fred Dermarkar 2014 - present

* Barry Collingwood served as COG’s operations manager until incorporation in 1999; then as interim president in 2010-2011.

OPG and Bruce Power
PICKERING-B and BRUCE-B UNITS
reach NOMINAL LIFE
/design-based assumption/
of 210,000 EFPH

PARIS CLIMATE AGREEMENT

THE FISSION KATZ
(comprised of staff members past and present)
perform at the 30th anniversary celebration

The Fission Katz continued to perform at various charity functions and COG celebration and charity events until 2018

2014
COG’s **OBsolescence Peer Group** held a first international workshop featuring procurement and engineering experts with participation from 17 vendor companies.

COG member OPG wins **EPRI Technology Transfer Award** for work on Innovative Applications of the Modular Accident Analysis Program (MAAP) Code.

The **CANDU 6 Fleet** signs a six objective agreement including rod-based guaranteed shutdown to save time, dose and money, improved reliability of emergency power diesels and strategies to mitigate aging of the primary heat transport system.

**Bruce Power** sets a site production record of **47.63 Terawatt-hours** of carbon-free energy.

**Bruce Power** and the **Independent Electricity System Operators (IESO)** announce an amended, long-term agreement to secure 6,300 megawatts of electricity from the Bruce Power site through a multi-year, $13-billion investment program.

Bruce Power will begin main component replacement on Units 3-8 in 2020, starting in Unit 6.

This will generate between 1,500 and 2,500 jobs on site annually – and 18,000 across Ontario directly and indirectly – while injecting up to $4 billion annually into Ontario’s economy.

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**CNL Joins COG**

AECL transfers its COG membership to Canadian Nuclear Laboratories.

**COG partners with** **Organization of Canadian Nuclear Industries (OCNI)** and its members on a number of initiatives to further strengthen the nuclear supply chain including efforts to strengthen against counterfeit, fraudulent and suspect items (CFSI).

Actions include a workshop of suppliers, utilities and regulators to talk about expectations and strategies.

**Left to right:** OCNI President Ron Oberth and COG President Fred Dermarkar sign a partnership agreement to further strengthen the supplier community engagement.
The CANDU INDUSTRY ASSESSMENT COMMITTEE JOINT AUDIT PROGRAM (CANIAC) is formed to contribute to enhanced safety, reliability and economics in CANDU plants through a collaborative quality assurance audit service.

A COG workshop on LOW AND INTERMEDIATE LEVEL NUCLEAR WASTE focuses on source reduction and research opportunities. Topics included waste minimization, characterization and processing; use of reusable protective equipment and laundering; development of communications to change worker behaviour; and formal benchmarking as a means for sharing best practices.

The COG EQUIPMENT RELIABILITY PEER GROUP creates five initiatives for equipment reliability:
- Equipment Health Initiative
- Preventative Maintenance (PM) Strategy
- Component Classification and Maintenance Strategy Review
- Required Frequency and Criticality Initiative
- Condition-Based Maintenance (CBM) Strategy

COG actively strengthens its SUPPLIER PARTICIPANT PROGRAM to support refurbishment and Major Component Replacement (MCR).

Experiments on HIGH TEMPERATURE FUEL BUNDLE DEFORMATION are completed.

While analysis of the data continues, enough is now available for the development of a deformation model for Anticipated Operational Occurrences (AOO) and some types of Loss of Coolant Accident (LOCA). A new model to predict the behavior of the overload cracking at flaws implemented into CSA Standard N285.8.

KHNP VISITS NB POWER for a community session at Point Lepreau as part of a C6 Fleet collaborative initiative on strengthening social licence.

WOLSONG UNIT 1 at 100% full power after relicensing. In recognition of COG’s contribution, KHNP CEO Seok Cho presented a plaque of thanks to COG President Fred Dermarkar who noted the efforts and collaboration of COG members. All COG members benefited significantly by learning from the Wolsong experience.

KHNP, Korea

CNL begins full operation under the government-owned, contractor-operated model.
2016

Completion of Phase 2 of the **FUEL CHANNEL LIFE MANAGEMENT PROJECT**

The project enabled many stations to benefit from a four-to-five-year extension of operations, improved life cycle management plans, and increased confidence in operation and business plans. The revenue resulting from the extra years of operating multiple units amounts to billions of dollars for the utilities involved.

**Utility nuclear leaders identify “grand challenges” requiring long-term strategies as part of COG’s STRATEGIC RESEARCH & DEVELOPMENT (SRD) PROGRAM**

R&D projects to provide tools for **AS LOW AS REASONABLY ACHIEVABLE (ALARA) and DOSE REDUCTION DURING OUTAGES & REFURBISHMENT** are completed.

**COG’s FCLM PROJECT supports safe operation of Darlington to 210,000 EFPH and Pickering to 240,000 EFPH**

**HYDRO-QUÉBEC REJOINS COG** as a participant in the Information Exchange program.

**COG member New Brunswick Power wins EPRI TECHNOLOGY TRANSFER AWARD for work on Use of Heat Exchanger Guidance to Develop In-house Program**

**Ontario Power Generation**

- OPG awards a 50/50 joint venture $2.75 BILLION contract to **AECON** and **SNC-LAVALIN NUCLEAR** for the execution phase of its refurbishment project.

- **DARLINGTON REFURBISHMENT** gets underway starting with work on Unit 2.

**NA-SA, Argentina**

- **EMBALSE** shuts down for refurbishment.

2017

**COG launches the SMR FORUM creating a platform for exploration of Small Modular Reactors, in keeping with COG’s role in the Canadian SMR Roadmap**
COG testifies at **CNL LICENCE RENEWAL HEARING** highlighting the importance of CNL research to the CANDU industry

First **COG COLLABORATION WEEK** takes place
The conference featured workshops, an R&D expo and an opening plenary including leaders from across the nuclear industry
More than 200 participants attended

**NWMO JOINS COG**
as a participant in the Nuclear Safety and Environmental Affairs program
The Radioactive Waste Leadership Forum is formed through COG the same year

**SNN announces plans for**
**CERNAVODA UNIT 1 REFURBISHMENT** starting in 2026 that will extend plant operations by 30 years
The refurbishment will produce a significant savings compared to new generation and will strengthen the return on the original investment in the plant, making it even more economical for Romania’s electricity users

**COG adapts with the times and stays current. It helps the industry going forward.**
Paul Thompson, NB Power

**COG’s FCLM PROJECT** supports safe life extension of Darlington to 235,000 EFPH and 247,000 EFPH for Pickering and Bruce
By 2021, FCLM is expected to support Pickering up to 295,000 EFPH and Bruce up to 300,000 EFPH

**Sonja Qureshi, COG director of Joint Projects and Services becomes chair of**
**WOMEN IN NUCLEAR CANADA**
Golden Horseshoe West chapter

**UNENE-initiated and COG-administered**
**THE ESSENTIAL CANDU TEXTBOOK**
is published in partnership with funding participants: OPG, Bruce Power, NB Power, AECL-CRL, SNN, CNNO, CNSC, Kinectrics, AMEC-NSS, SNC-Lavalin and CNS

**Ontario Power Generation**

**OPG launches X-LAB INNOVATION ACCELERATOR**, tapping into the latest technology to improve training and make work processes more efficient with innovative items including virtual reality headsets and smart glasses
COG’s SUPPLIER PARTICIPANT PROGRAM membership welcomes its first international supplier, KEPCO E&C

14TH COG/IAEA TECHNICAL COMMITTEE MEETING on the Exchange of Operational Safety Experience of Pressurized Heavy Water Reactors (TCM) in Argentina sees record participation and 56 presentations

2018

Bruce Power
Bruce Power receives 10-YEAR LICENCE RENEWAL from CNSC
COG testifies at the regulatory hearing

Ontario Power Generation
Pickering Nuclear receives 10-YEAR LICENCE RENEWAL from CNSC, including continued operation to 2024
COG testifies at the regulatory hearing

Canadian Nuclear Laboratories
THE NATIONAL RESEARCH UNIVERSAL (NRU) RESEARCH REACTOR operated by the Canadian Nuclear Laboratories (CNL) at Chalk River was shut down on March 31

COG industry team’s work on whole-site PROBABILISTIC SAFETY ASSESSMENT (PSA) helps demonstrate safety at the successful Pickering Nuclear 10-YEAR OPERATING LICENSE RENEWAL

COG forms and progresses the SUPPLY CHAIN, OBsolescence and PROCUREMENT
This high potential area offers opportunity for joint project development, especially in the areas of strategic sourcing, bulk procurement, obsolescence solutions, emergency spare parts and inventory and vendor management

REGULATORY APPROVAL FOR EXTENDED FUEL CHANNEL LIFE
Both OPG Pickering and Bruce Power receive the green light to extend reactor operation, providing Ontario with years of additional noncarbon electricity

The utilities gain billions of dollars of additional revenue and service from the capital investment while providing a continuity of service through Ontario’s nuclear refurbishment period
This is possible through the multi-year COG joint project that demonstrated safety margin and the technical basis for continued operation
### 1984 - 2019

#### Bruce Power

Bruce Power and the Bruce County announce plans to establish the **NUCLEAR INNOVATION INSTITUTE (NII)**

A year later, NII announces their first international partner, the University of Strathclyde’s Advanced Nuclear Research Centre

#### HBO’s **CHERNOBYL** series debuts

#### EMBALSE returns to service following three-year refurbishment that extends its operating life for another 30 years

#### NHNP, Korea

**WOLSONG UNIT 1** shuts down, lowering the global number of CANDU reactors to 46

#### 9th CLEAN ENERGY MINISTERIAL

New nuclear innovation partnership is announced between the United States, Canada and Japan to investigate nuclear energy’s role in future clean energy systems

#### NA-SA, Argentina

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#### 2019

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**COG and the IAEA**

**SIGN A PRACTICAL ARRANGEMENT**

Building on existing working partnership

**COG members OPG and Bruce Power win EPRI TECHNOLOGY TRANSFER AWARD**

For work developing Standardized Test Evaluations

**Almost $70 MILLION INVESTED**

In **COG R&D** and **JOINT PROJECTS**

**COG begins developing an EXPANDED COLLABORATION MODEL**

To include more member-country labs through a work-in-kind program

**COG’s OPEX DATABASE** totals about **44,000 ENTRIES**

Providing members searchable information to help solve problems based on past experience from COG members

**CRITICAL HEAT FLUX RESEARCH (CHF)**

Demonstrates safety in aging CANDU pressure tubes

Demonstration of critical heat flux to 6.8% creep confirms safe continued operation of existing channels

A significant factor in continued operation of CANDU plants is demonstrated longevity and safety margin of key reactor components

COG research on behalf of its members on critical heat flux in reactors has been instrumental in validating fitness for continued service

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CANDU Owners Group  

COG’s **SUPPLIER PARTICIPANT PROGRAM** experiences significant growth, reaching almost 30 members and launching the **FRONT-LINE SUPERVISOR LEADERSHIP TRAINING PROGRAM**

COG forms an **SMR VENDOR FORUM** further contributing to the industry’s SMR development initiatives and increasing collaborative efforts by members and industry participants through COG as part of COG’s contribution to the Canadian SMR roadmap.

Bruce Power officially launches the **NUCLEAR INNOVATION INSTITUTE**, a centre of excellence for innovation, talent development and applied research.

Ontario Power Generation

OPG nears completion of **DARLINGTON UNIT 2 REFURBISHMENT** and prepares to begin work on Unit 3.

Several COG members further invest in **MEDICAL ISOPODE** harvesting and development partnerships for life-saving diagnostics, treatments and medicines.

Bruce Power

Bruce Power tremendously values our relationship with COG and all of the work that we’ve done together over the past many years. Certainly, AECL’s research is better for its cooperation with COG.

Shannon Quinn, AECL

**AECL REJOINS COG** as a participant in the Nuclear Safety & Environmental Affairs program.

New Brunswick Power

New Brunswick Power is **RECOGNIZED FOR OPERATING EXCELLENCE** following several years of steadily improving performance following its 2012 return to service following refurbishment.

COG wins the Canadian Nuclear Society’s **JOHN S. HEWITT TEAM ACHIEVEMENT AWARD** for its achievements in advancing technical and leadership knowledge and sharing operating experience across CANDU stations around the world.

**10TH CLEAN ENERGY MINISTERIAL** is held in Vancouver

For the first time, a significant focus is given to the role of nuclear.

The book *Breakthroughs* is released by the Nice Futures partners featuring nuclear innovations.

New Brunswick Power

COG’s Bernice Brooks (centre) and other members of the COG team accept the award. Bernice Brooks has served as assistant to every COG president since the company was incorporated in 1999.