April 11, 2019

The Role of Nuclear Power and Innovation in Nuclear Energy to Secure Ontario and Canada's Low-Carbon Future

Mike Rencheck, President & CEO
Bruce Power




BrucePower
Innovation at work

About Bruce Power

- Largest operating nuclear facility in the world with a capacity of 6,400 MWs and a key source of life-saving isotopes
- Produces approximately four times as much electricity as Niagara Falls
- Equivalent to the annual energy use of more than 5 million homes
- Enough electricity to power the province of Nova Scotia for nearly five years

View from the North

View from the South

Video

Ontario Families, Businesses Count on Bruce Power

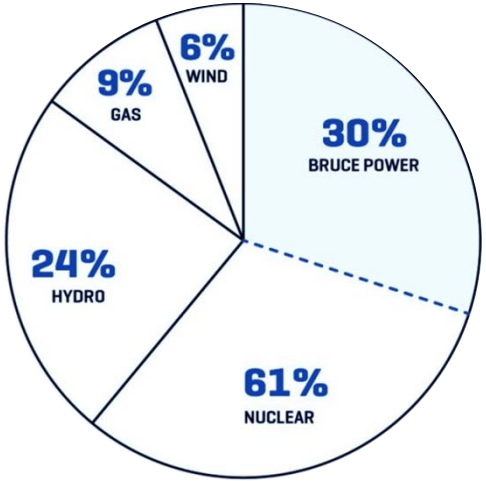
Bruce Power's Role in Ontario

- Reliable source of low-cost power – generate 30% of Ontario's electricity at 30% below the average residential cost
- Clean – Toronto has had zero smog days since 2014, down from a high of 53 in 2006
- Life-saving – medical isotopes used to sterilize 40% of single-use medical devices worldwide and for cancer treatments

Over 95% emissions-free, Ontario has one of the cleanest electricity systems in the world.

Ontario's Electricity is Supplied by a Diverse Group of Non-Emitting Resources

- Nuclear power is Ontario's largest source of emissions-free electricity
- Non-emitting resources are a central component of Ontario's Long-Term Energy Plan (LTEP)

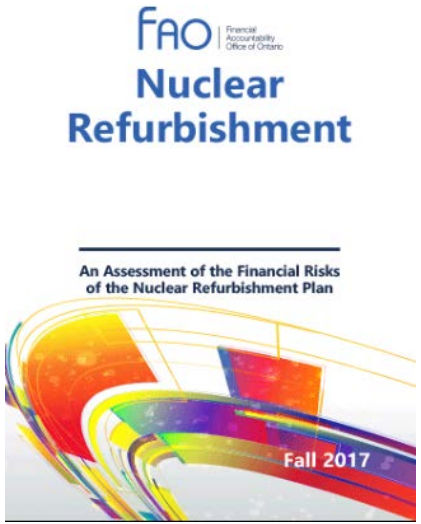


ONTARIO'S ENERGY SUPPLY MIX

Ontario's electricity system is over 95% emissions-free largely due to nuclear and hydro.

Nuclear Power's Role in Canada

- Key attributes of nuclear energy:
  - Affordability
  - Reduced carbon emissions
  - Jobs and economic growth
  - Innovation
  - Healthcare – isotopes



"Currently no portfolio of alternative low emissions generation which would replace nuclear generation at a comparable cost." – *FAO*

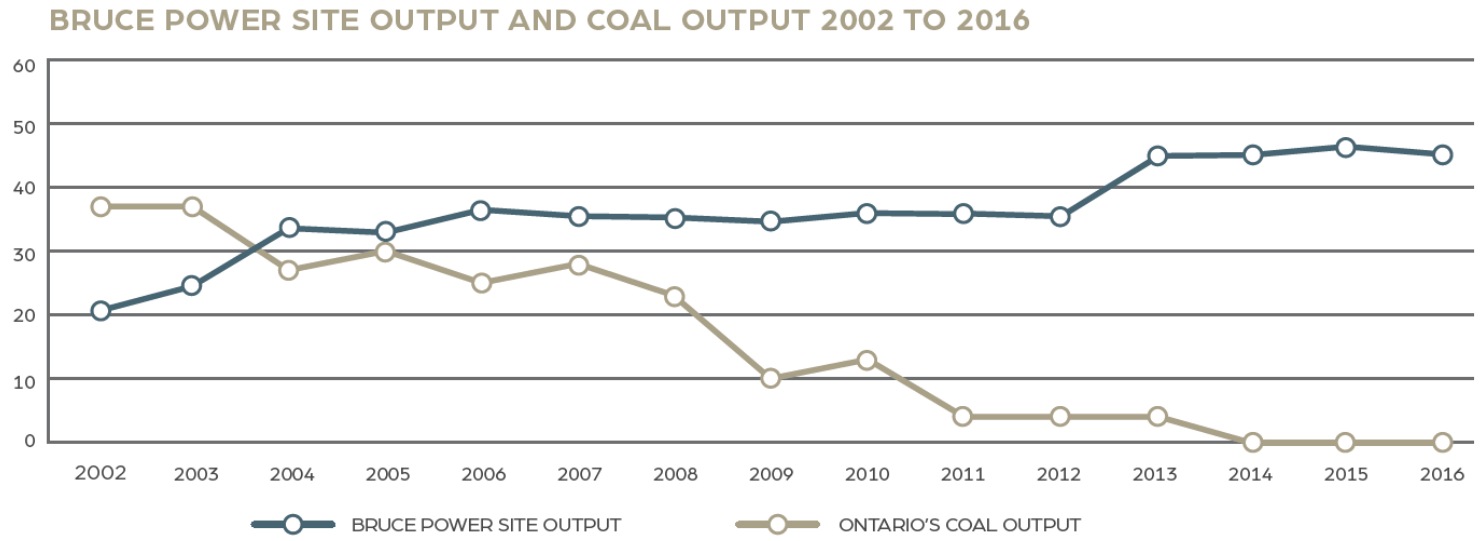
Coal Phase-Out: A Key Part of the Story

- In 2015, Ontario passed legislation to permanently ban coal-fired electricity generation in the province – a first in North America and a significant step in the fight against climate change

Nuclear Up, Coal Down

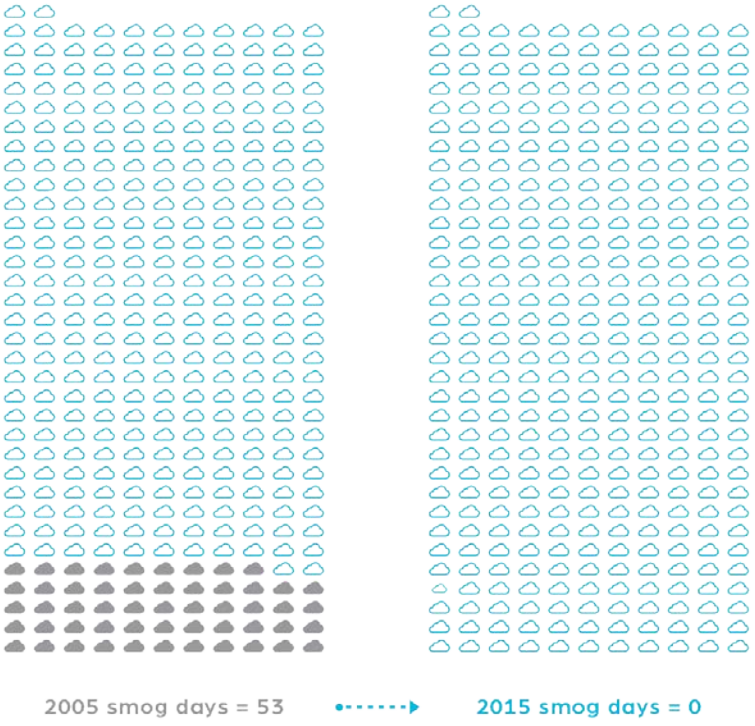
A revitalized eight-unit Bruce Power site:

70% of the energy needed to phase-out coal in Ontario

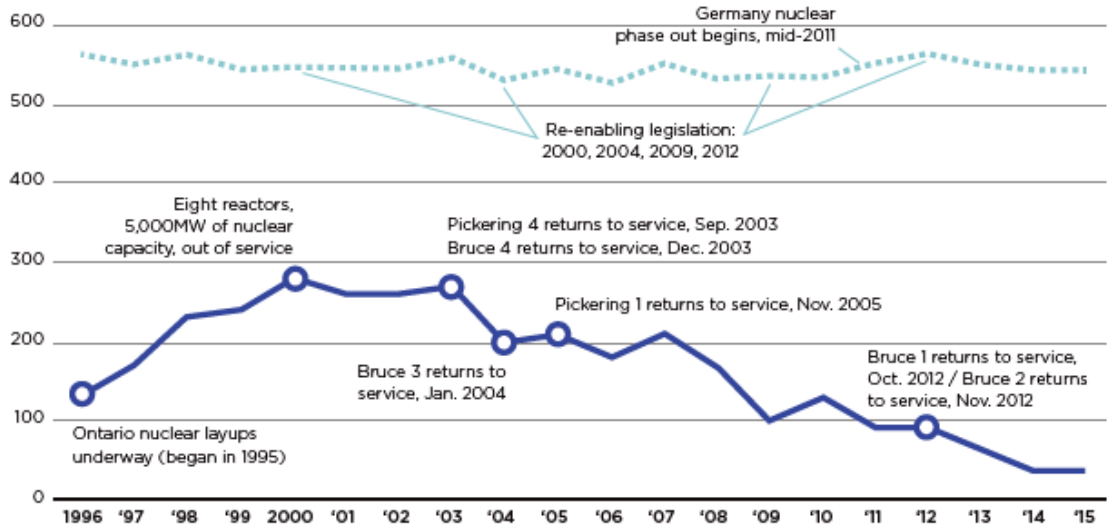


Reduced Smog

- In 2005, the GTA experienced 53 smog days
- Through coal phase-out and clean air initiatives, the province had zero smog days in 2015
- According to a Ministry of Energy report, phasing out coal could avoid 25,000 emergency room visits, 20,000 hospital admissions and more minor illness cases, resulting in a financial benefit of $2.6 billion annually



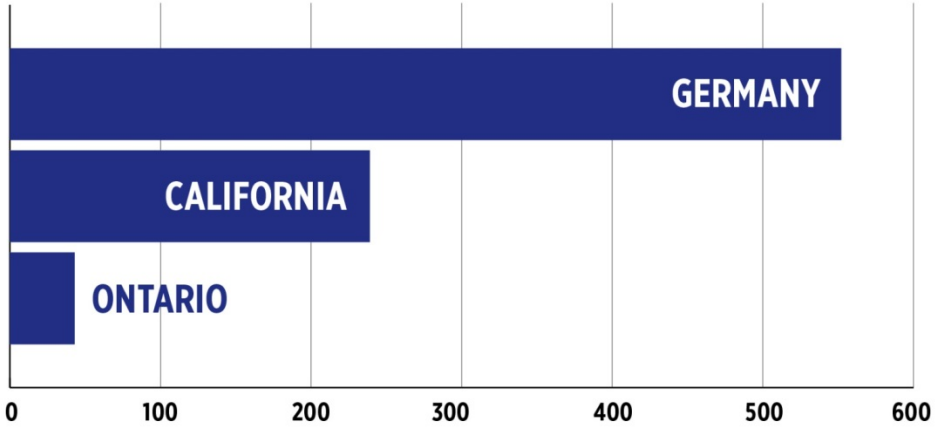
No One Technology Alone: Lessons from Germany



Despite investing billions of dollars in renewable technologies, Germany has been unable to reduce emissions from its electricity sector.

Leading the Way

Emissions Intensity from the Electricity Sector by Jurisdiction (gCO_2eq/kWh)



ONTARIO SOURCE: IESO and Environment Canada.
GERMANY SOURCE: OECD Electricity Information 2017.
CALIFORNIA SOURCE: CA Air Resources Board 2017 GHG Inventory.

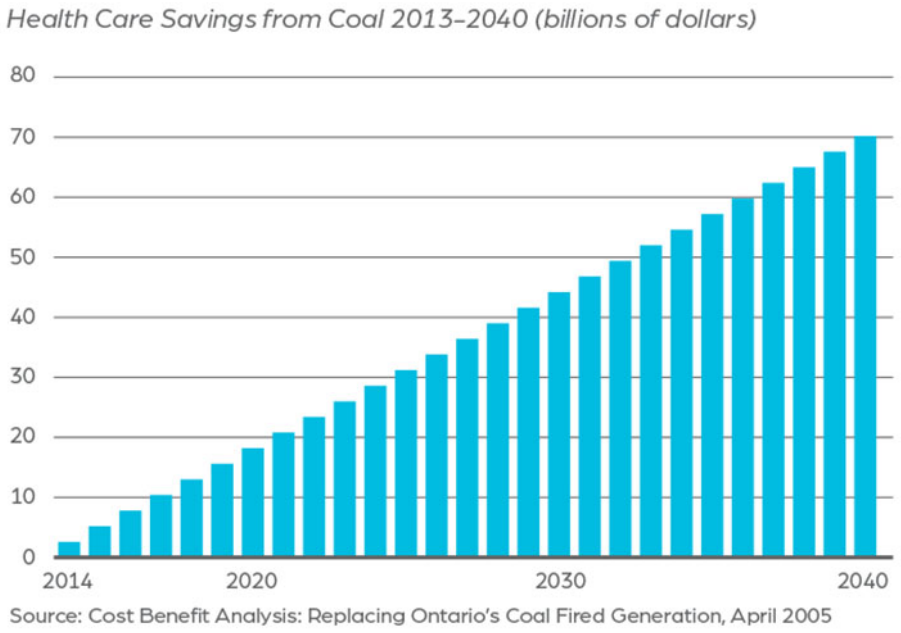
Price of power: Ontario – 12¢/kWh; Germany – 33¢/kWh (USD); California – 24¢/kWh (USD)

Cleaner Air for Decades to Come

- Cleaner air from cleaner energy – made possible through the adoption of new reduced emissions resources and the refurbishment of our nuclear reactor units
- Our Life-Extension Program will help ensure this important source of emissions-free, low-cost electricity will be meeting our electricity needs for decades to come
- Closing coal-fired power plants represents one of the largest greenhouse gas reduction initiatives in North America – the closure has eliminated more than 30 mega tonnes of annual GHG emissions, equivalent to taking 7 million vehicles off our roads

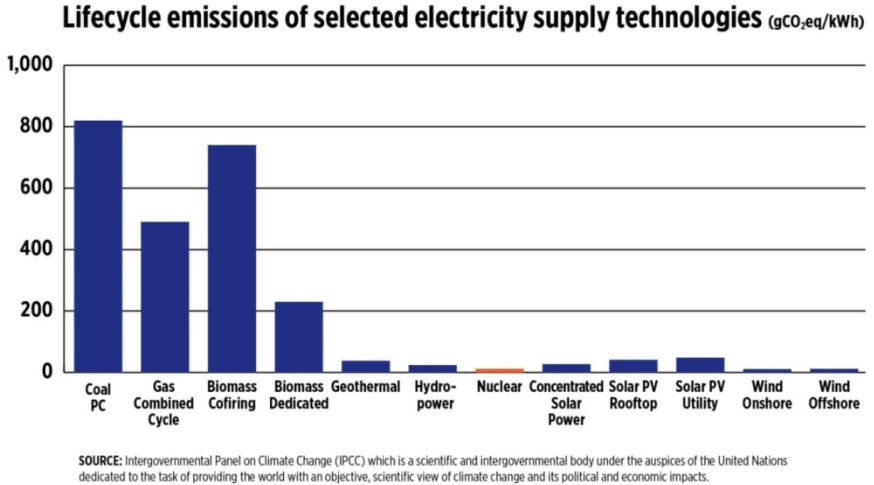
Health Benefits for Decades to Come

- Canada is serious about tackling climate change and improving the quality of the air we breathe
- We need to secure the important role nuclear power plays in meeting our health and electricity needs for today and tomorrow



Importance of a Low-Emissions, Balanced Supply Mix

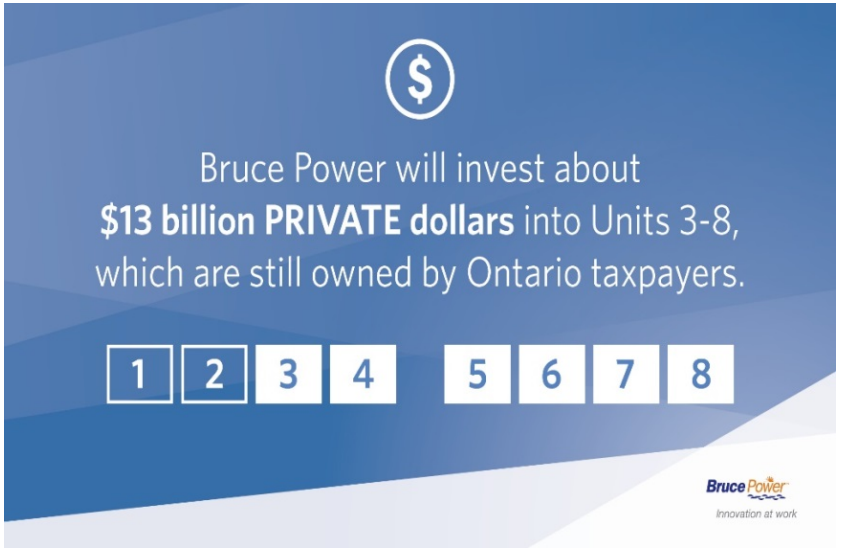
- As the world moves toward further electrification, it will be important to ensure that a balanced supply mix with emissions-free options is pursued



SOURCE: Intergovernmental Panel on Climate Change (IPCC) which is a scientific and intergovernmental body under the auspices of the United Nations dedicated to the task of providing the world with an objective, scientific view of climate change and its political and economic impacts.

Securing Our Clean Energy Future

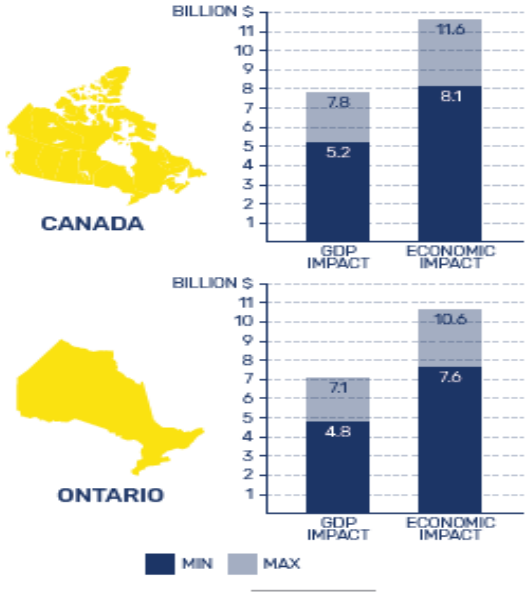
- Bruce Power Refurbishment Implementation Agreement announced in 2015
- Extends life of units to 2064
- Secures 6,400 MW through a multi-year, $13-billion investment
- Maximizes the value of these assets to Ontario's electricity system – Asset Management and Major Component Replacement



The nuclear refurbishment program in Ontario will ensure a stable source of emissions-free electricity for years to come.

Demonstrating Our Economic Importance

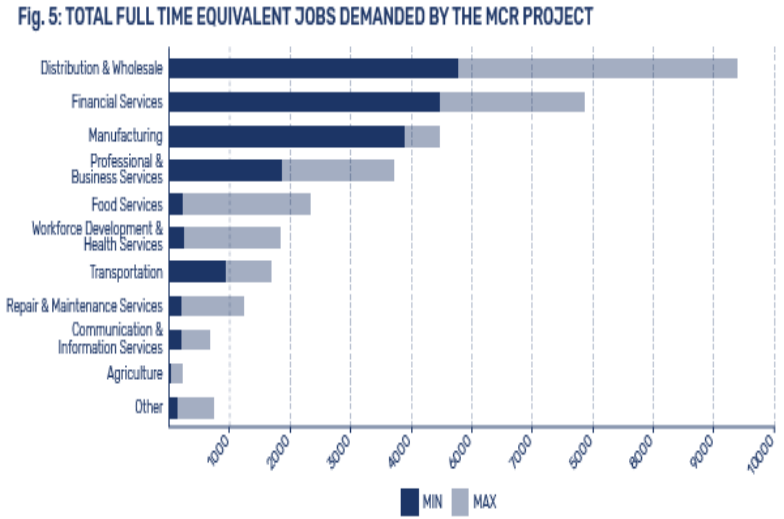
- 22,000 direct and indirect jobs annually
- $4 billion in annual economic benefit to Ontario through direct and indirect spending
- Life extension will support an additional 5,000 direct and indirect jobs annually
- The OCC estimates the impact on GDP to be between $4.8 and $7.1 billion for Ontario and between $5.2 and $7.8 billion for Canada



"As Ontario's energy demand grows, nuclear truly is the best option to meet those demands with reduced GHG emissions. The Bruce Power MCR Project will not only drive economic growth in the region, it will position Ontario as a global leader in nuclear innovation and expertise." *– Rocco Rossi, President & CEO, Ontario Chamber of Commerce*

Observations on Labour Demand

- Ontario labour to receive between $3.8 and $4.6 billion and Canadian workers located in other provinces to receive an additional $300 million
- 22,000 direct and indirect jobs annually



"The refurbishments of Ontario's nuclear fleet will provide thousands of training opportunities and well-paying jobs for residents of the local communities, and for Ontarians in general bearing in mind the diversity reflected in those communities. – *Patrick Dillon, Provincial Building Trades and Construction Trades Council of Ontario*

Rural Economic Development

DEVELOPMENT

250,000 SQFT
of commercial and industrial spaces

10,000
residential developments approved

$100 MILLION
in new infrastructure

LABOUR DEMAND

400
direct jobs from suppliers

3000
overall jobs in the region

300
new small business start-ups[14]

The MCR Project has had a profound impact on communities across Ontario, creating new economic opportunities for investment, job creation, workforce development and export competitiveness.

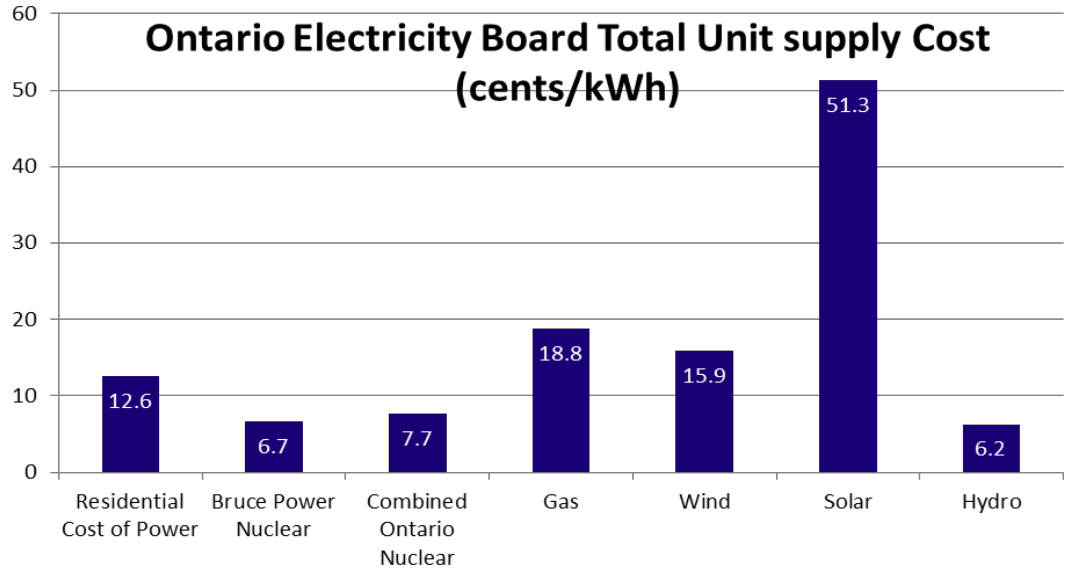
Partnerships with Local Communities

- Bruce Power owes much of its success to the surrounding communities
- Our goal is to ensure the full benefits of life extension are realized by the local economy
- Improved contracting process to encourage local economic growth
- Companies doing work with Bruce Power will now provide a breakdown of the total price of work to be completed within Bruce, Grey and Huron counties, and within Ontario, while also indicating the total value of work to be performed in Canada

Video

Bruce Power's Nuclear Supply Chain Network

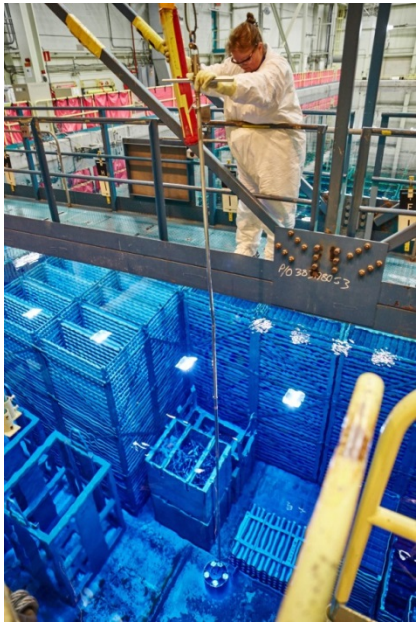
A Low-Cost Electricity Source



Low-cost, emissions-free power will be more important in the years to come than ever before.

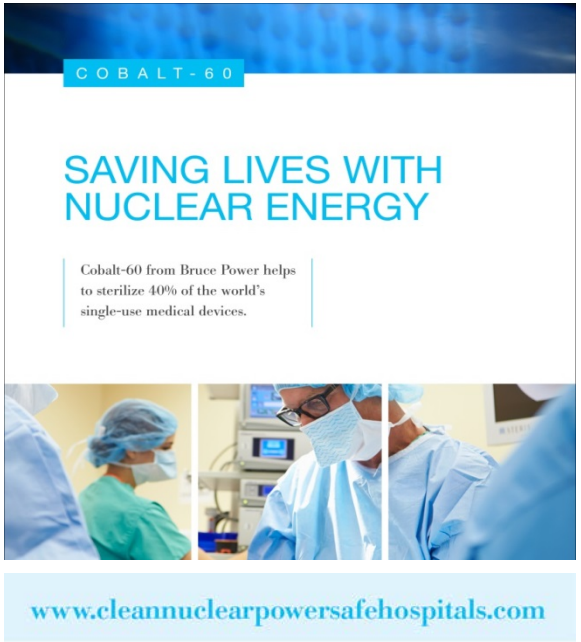
The Future of Nuclear: Innovation and Sustainability

- Leveraging innovation collectively as an industry – sharing information, working with suppliers, MOUs
- Medical isotopes – Bruce Power and others in the industry are laying the groundwork
- Nuclear Innovation Institute – applied research and training, business acceleration and incubation, talent development and training, benefiting rural Ontario's youth



Isotopes

- **LSA Cobalt-60 –** sterilization of medical equipment, consumer products and food; combats spread of Zika virus
- **HSA Cobalt-60 –** radiation-based treatment of cancer and other diseases, non-invasive Gamma Knife treatment; only produced in a small number of nuclear reactors globally
- MOU established to determine the feasibility of producing short-lived medical-use isotopes at Bruce Power



Isotopes and the CNIC

- Bruce Power is exploring opportunities to produce medical radio-isotopes in Bruce A and Bruce B reactors, in particular those that can be used to cure cancer
- This would further Bruce Power's role as an essential partner of the heath care system and an important corporate citizen contributing to the fight to cure cancer

Video

Canadian Nuclear Isotopes Council

Securing Our Future: Strategic View

- The future of our industry and the success of Bruce Power relies on:
  - Safely operating our units
  - Executing our outages and projects, on time and on budget
  - Maintaining strong partnerships, and community and policy support
  - A commitment to innovation and sustainability

Partnering for Success

- Trust
- Advocacy
- Supplier support
- Skilled trades

Questions?