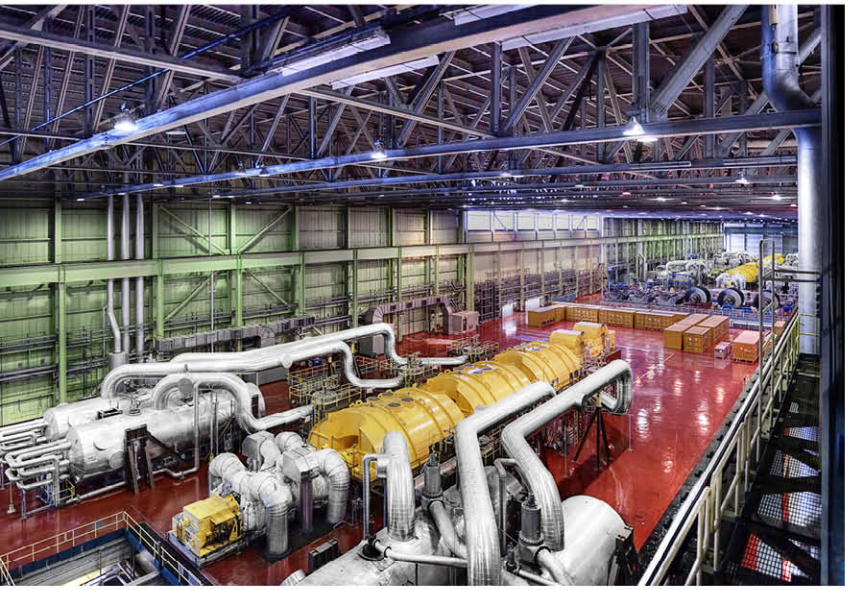
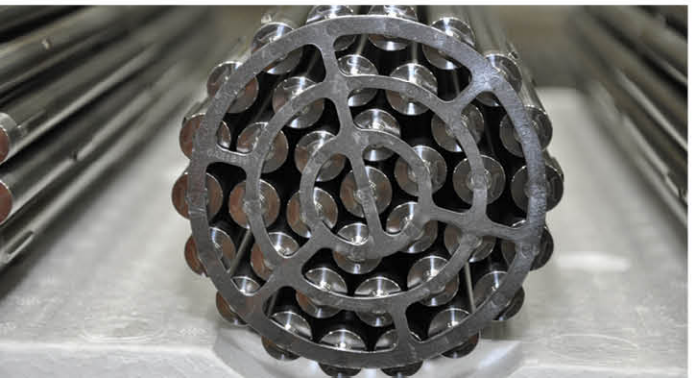
Bruce Power's Long-Term Framework

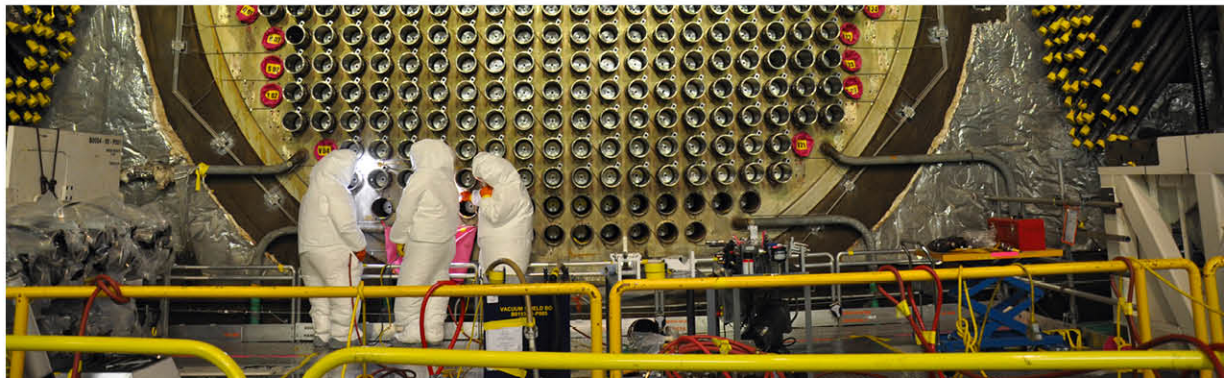
January 2016

Bruce Power™

Innovation at work





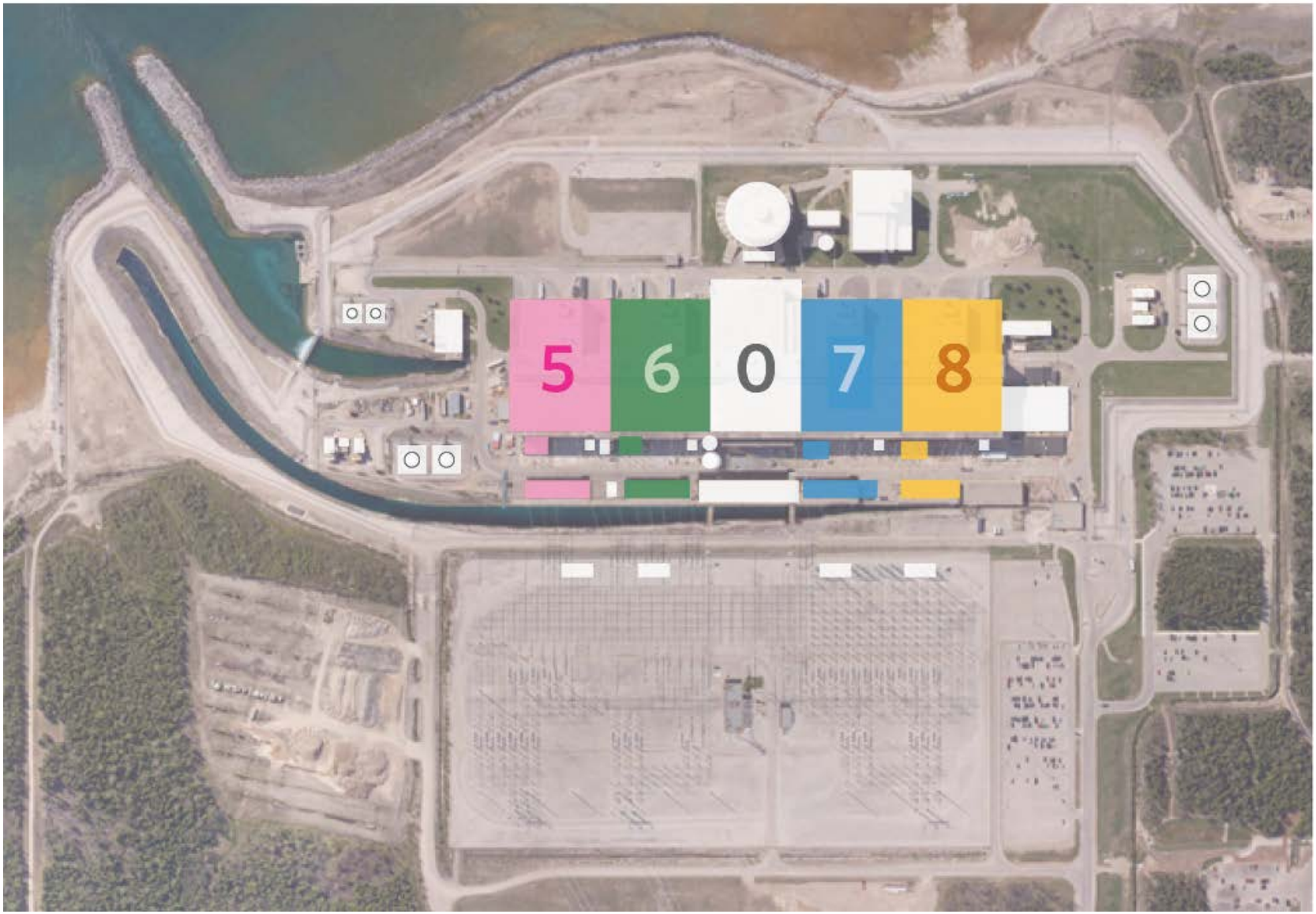


Bruce Nuclear Site

The Bruce nuclear site is the largest operating nuclear facility in the world, which provides roughly one third of Ontario's electricity. It consists of two generating stations (A and B) with a total eight nuclear units:

Bruce A Units 1-4
Units 1&2 – 1,500 MW *Refurbished*
Units 3&4 - 1,500 MW

Bruce B Units 5-8
3,300 MW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Bruce Nuclear Site

Historical Timeline

1960
Douglas Point construction begins.

1967
Douglas Point is powered up for the first time.

1968
Plans are announced for Bruce A and the Bruce Heavy Water Plant.

1969
Bruce A construction begins.
BHWP A construction begins.
Bulk Steam proposal accepted.

1972
A site Bulk Steam System is placed in service. Construction begins on the Western Waste Management Facility.

1973
BHWP A is placed in service.

1974
Construction begins on additional heavy water plants.

1975
A proposal to build Bruce B is approved by the Ontario government.

1976
Construction begins on Bruce B.

1977
Bruce Units 1 and 2 are placed in service.

1978
Bruce Unit 3 is placed in service.

1979
Bruce Unit 4 is placed in service.

1980
BHWP B is commissioned for service.

1981
Unit 1 is ranked the #1 reactor in the world with a 97% capacity factor.

1983
Construction of Bruce Learning Centre (formerly Western Nuclear Training Centre).

1984
Douglas Point and BHWP A are shut down. Unit 6 comes on line at Bruce B.

1985
Bruce Unit 5 in service.

1986
Bruce Unit 7 in service.

1987
Bruce Unit 8 in service.

1988
Bruce Units 3, 4, 6 and 7 place top ten reactors in the world for the previous year's performance.

1991
Rehabilitation project approved for Bruce A.

1993
Faced with largest surplus capacity of electricity in its history, Ontario Hydro defers decision made in previous year to retube Unit 2.

1994
Work begins to dismantle BHWP A.

1995
Unit 2 at Bruce A is shut down and placed in layup.

1997
Unit 1 at Bruce A is shut down and placed in layup.

1998
Units 3 and 4 are shut down and placed in layup.

1999
Ontario Hydro is divided into five successor companies to prepare for a competitive electricity market.

2001
Bruce Power assumes operational control of the site and confirms plans to restart Units 3 and 4. Terrorist attacks in the U.S. prompt the formation of a full-time, rapid-response, armed security force at Bruce Power.

2002
Ontario's electricity market opens to competition. TransCanada Corp. and BPC Generation Infrastructure Trust (OMERS) join Cameco, the PWU and the Society in the Bruce Power partnership while British Energy withdraws.

2003
Units 5, 7 and 8 at Bruce B remain online to help restore power to the grid after a massive blackout leaves large parts of Ontario and the northeastern U.S. without power. Unit 4 is returned to service after being shut down by Ontario Hydro in 1998.

2004
Unit 3 returns to service after being taken off-line by Ontario Hydro in 1998.

2005
A multi-billion dollar agreement is reached between Bruce Power and the Ontario Power Authority to pave the way for the refurbishment of Units 1 and 2, shut down since 1997 and 1995 respectively.

2006
Bruce Power celebrates its 5th anniversary on May 11 when Lieutenant Governor James Bartleman officially opens a new Support Centre. Bruce B finishes the year as the top performing multi-unit nuclear plant in Canada.

2007
History is made in Unit 2 with the installation of the first steam generator ever to be replaced in a Canadian nuclear plant. Bruce Power establishes a multi-year agreement to power the Rogers Centre in a marketing partnership with the Toronto Blue Jays.

2008
Bruce Power progresses 'New Build' initiatives in Ontario, Alberta and Saskatchewan. A protocol agreement is signed with the Saugeen Ojibway Nation.

2009
A walk-in medical clinic for employees is established in the Bruce Power Support Building. A marketing partnership is arranged with Maple Leaf Sports & Entertainment.

2010
Employees on the Bruce site achieve 22 million injury-free hours. The last of the Bruce B units, Unit 8, is up-rated to 93%.

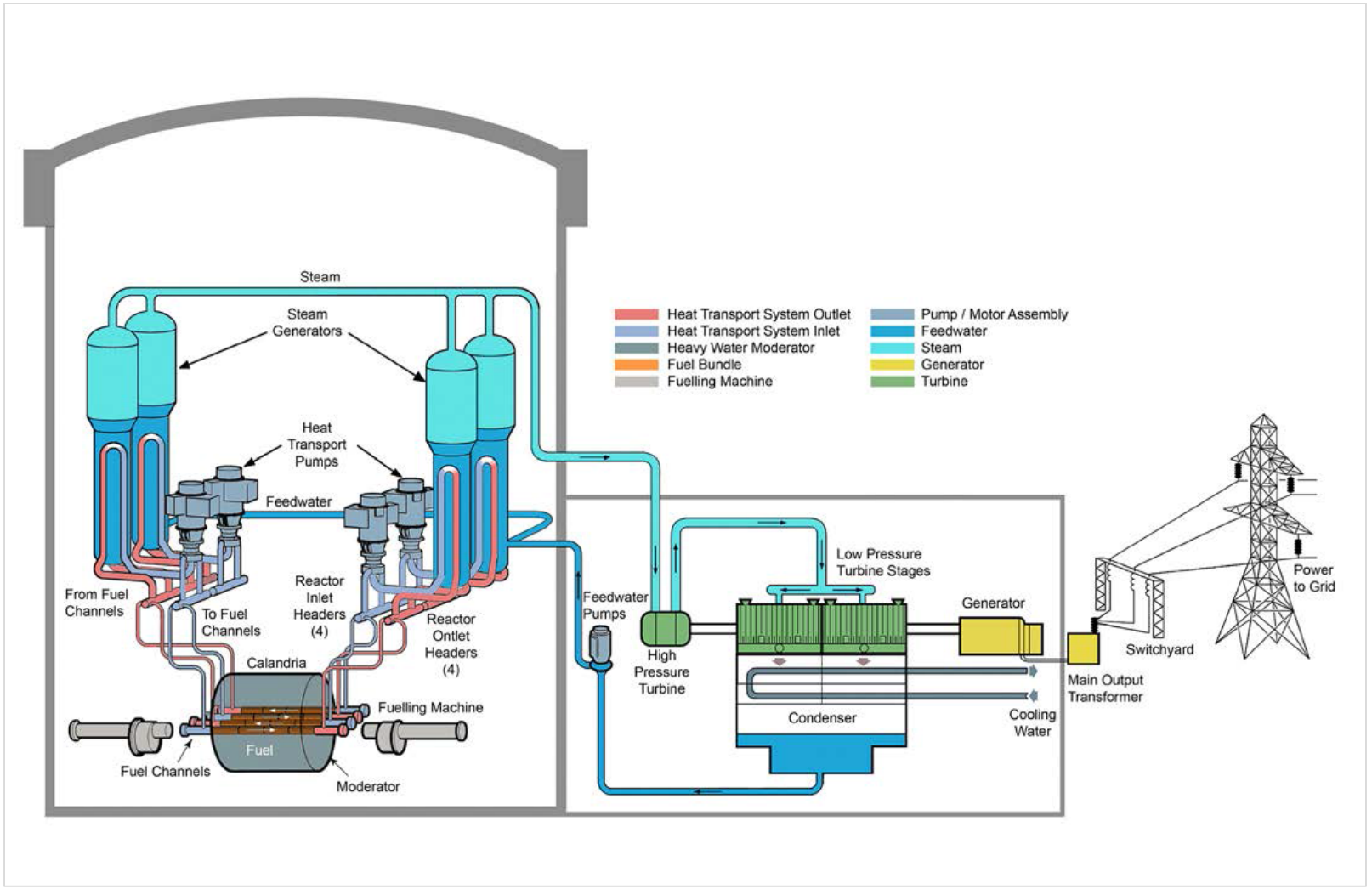
2011
A Fukushima Response Program is launched on site after earthquakes and a tsunami in Japan cripple the Fukushima Daiichi nuclear facility. Bruce Power celebrates its 10th anniversary on May 11 with a site-wide barbecue and scholarship program for area students.

2012
Staff and contractors return Units 1 and 2 to service, while life-extension programs are completed in Units 3 and 4. A new Emergency Management Centre is installed in the Visitors' Centre. Bruce Power is recognized as one of Canada's top employers for young people.

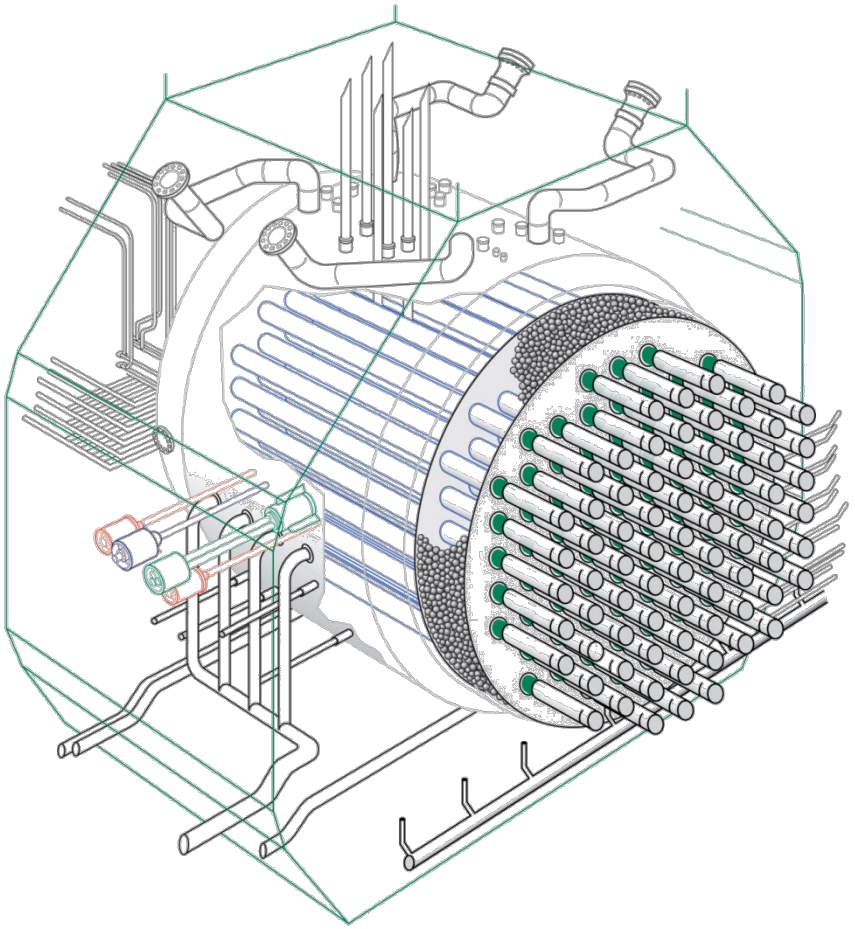
2013
On April 22, for the first time in about two decades, all eight units on the Bruce site were providing electricity to Ontario's grid.

2014
Entered 2014 having broken a site record for production from 1991, producing 30% of Ontario's power and over half its nuclear in 2013.

CANDU Reactors

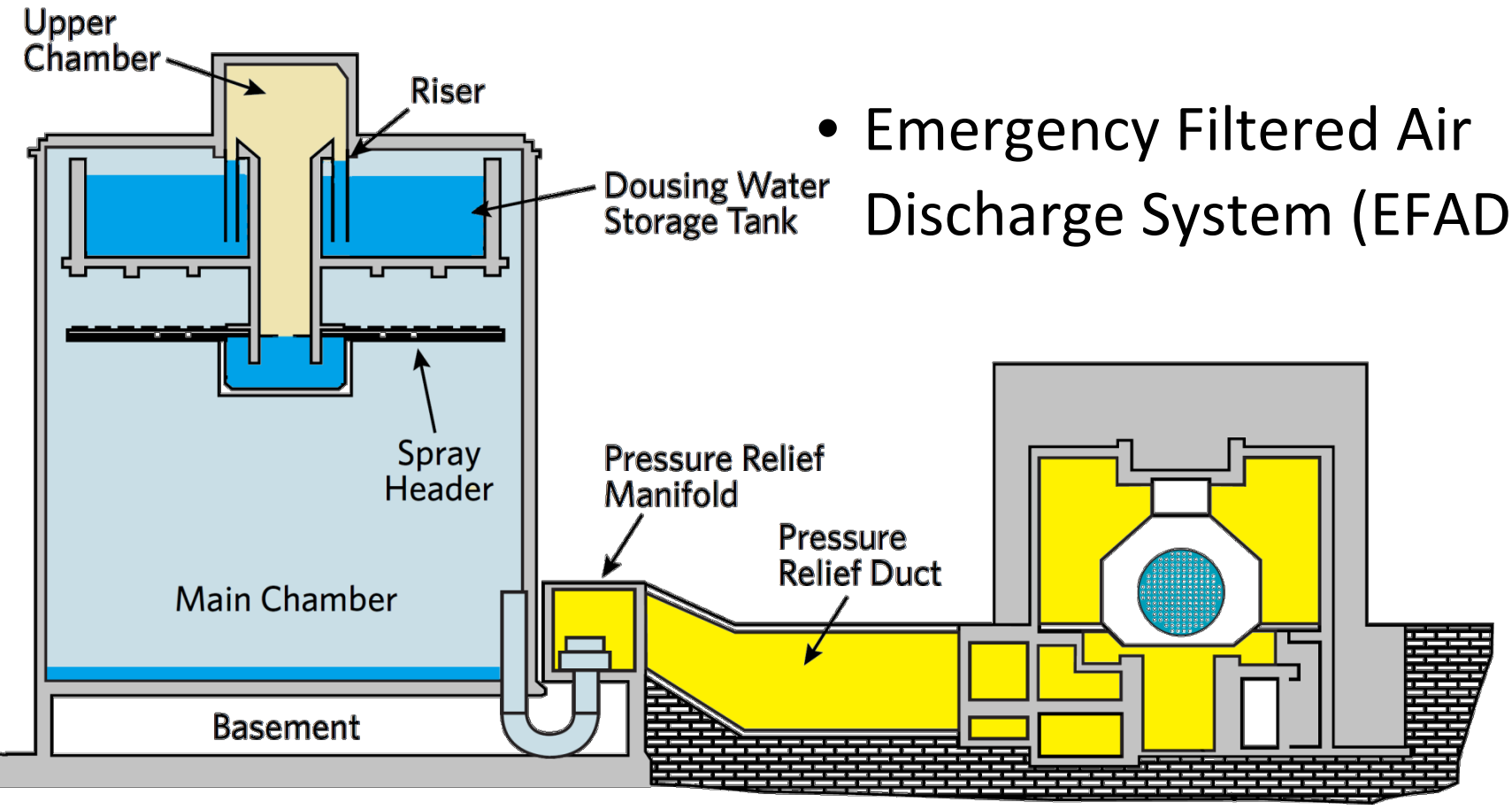


- Calandria
- Pressure tubes
- Shield Tank



Negative Pressure Containment

- Steam condensed by dousing spray



- Emergency Filtered Air Discharge System (EFADS)

Background

- Bruce Power currently generates 6,300 MW of output from 8-Units of operation. This level of output has been achieved over the last 14-years and enabled through a range of life extension activities including the Restart of Units 1-4 at Bruce A. Ontario's Long Term Energy Plan (LTEP) and off-take arrangements for the site with the market operator (IESO) are will now continue to enable this level of output to meet Provincial electricity needs.

- Despite the strong policy position in the Long Term Energy Plan (LTEP) the commercial end of life of the Bruce Power Units prior to the amended agreement was as follows:
  - –Units 1&2 – 2043
  - –Units 3&4 – 2023/24
  - –Units 5-8 – 2019/2020

- The technical end of life of the Units far exceeds what was the commercial end of life before the deal was announced.

- Bruce A and B have a combined operating license from the Canadian Nuclear Safety Commission (CNSC) that runs until 2020. This license was approved by the CNSC in Q2-2015 and does not contemplate the refurbishment of any Units during this period. As part of the process, the company also is required to complete an Environmental Risk Assessment (ERA).

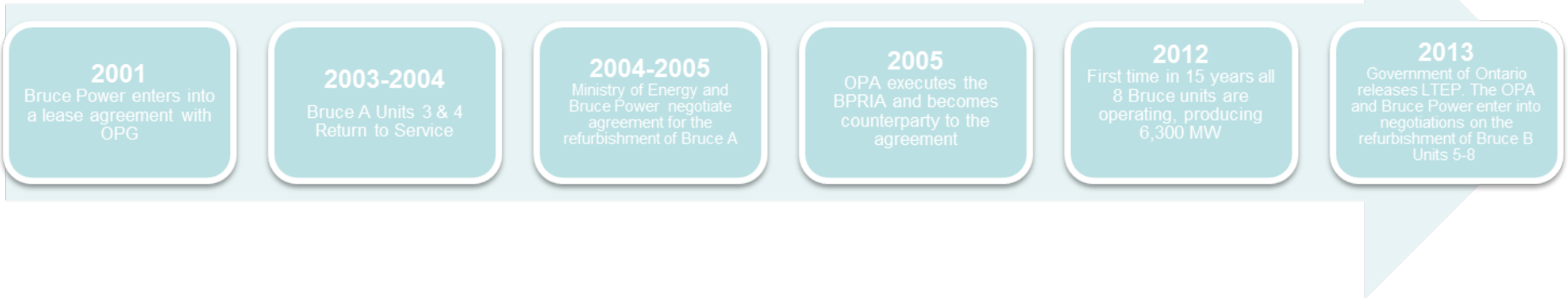
Overview of Amended Agreement

- Secures the site and all eight units for the long term providing 6,300 MW of base load generation until the 2060s while deferring refurbishments to 2020 and beyond
- Builds on the successful elements of the Bruce Power Refurbishment Implementation Agreement (BPRIA), which limited ratepayer exposure to cost overruns and resulted in refurbishment of Units 1&2
- Adheres to the 2013 Long-Term Energy Plan (LTEP) refurbishment principles and ensures that operating and refurbishment execution risks will reside with Bruce Power, and agreement includes contractual off-ramps
- Price consistent with the 2013 LTEP assumptions
- Negotiation process adhered to rigorous financial, technical and fairness due diligence
- Bruce Power will continue to provide a unique capability of flexible generation to address system operational and reliability needs
- Bruce Power will continue to lease the assets and pay long-term waste and decommissioning liabilities.

History of Bruce Refurbishments

BPRIA stands for the Bruce Power Refurbishment Implementation Agreement

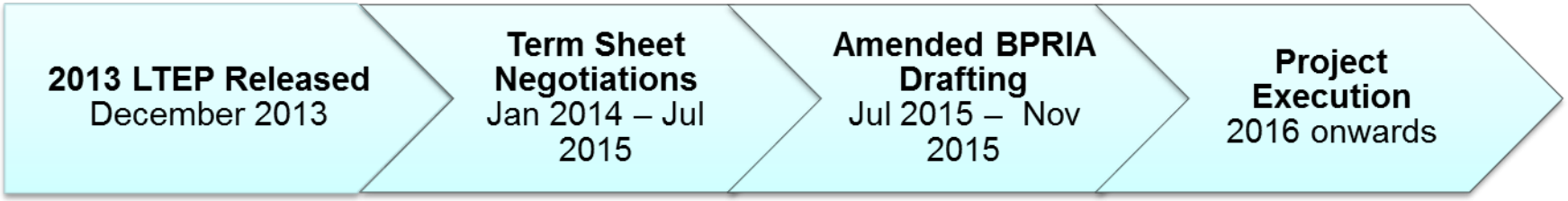
- **The BPRIA was executed in October 2005 with four subsequent amending agreements**
- **Provided a contracted power price for Bruce A, in return for refurbishment of two units and operations of Units 1 to 4**
- **Provided a lower floor price to Bruce B, in return for operations of Units 5 to 8 without refurbishment**
- **The amended and restated BPRIA focuses on the refurbishment of the remaining 6 nuclear units (Bruce A units 3 and 4 and Bruce B) and the ongoing operation of the facility by Bruce Power**



LTEP 7 Guiding Principles for Nuclear Refurbishments

1. Minimize commercial risk on the part of ratepayers and government
2. Mitigate reliability risks by developing contingency plans that include alternative supply options if contract and other objectives are at risk of non-fulfillment
3. Entrench appropriate and realistic off-ramps and scoping
4. Hold private sector operator accountable to the nuclear refurbishment schedule and price
5. Require OPG to hold its contractors accountable to the nuclear refurbishment schedule and price
6. Make site, project management, regulatory requirements and supply chain considerations, and cost and risk containment, the primary factors in developing the implementation plan
7. Take smaller initial steps to ensure there is opportunity to incorporate lessons learned from refurbishment including collaboration by operators

Amended BPRIA Milestones



- **The 2013 Long-Term Energy Plan outlines principles to guide refurbishments**

- **Term sheet outlining the principles for an amended BPRIA finalized in July 2015**

- IESO engages third-party technical and financial experts to provide advice during negotiations, to conduct due diligence and to provide a fairness review

- **IESO and Bruce Power begin translating the term sheet into the amended BPRIA**

- **The amended BPRIA will come into effect January 1, 2016**

- **The first unit will begin refurbishment in 2020**

- **IESO will monitor Bruce Power's performance as they refurbish successive nuclear units**

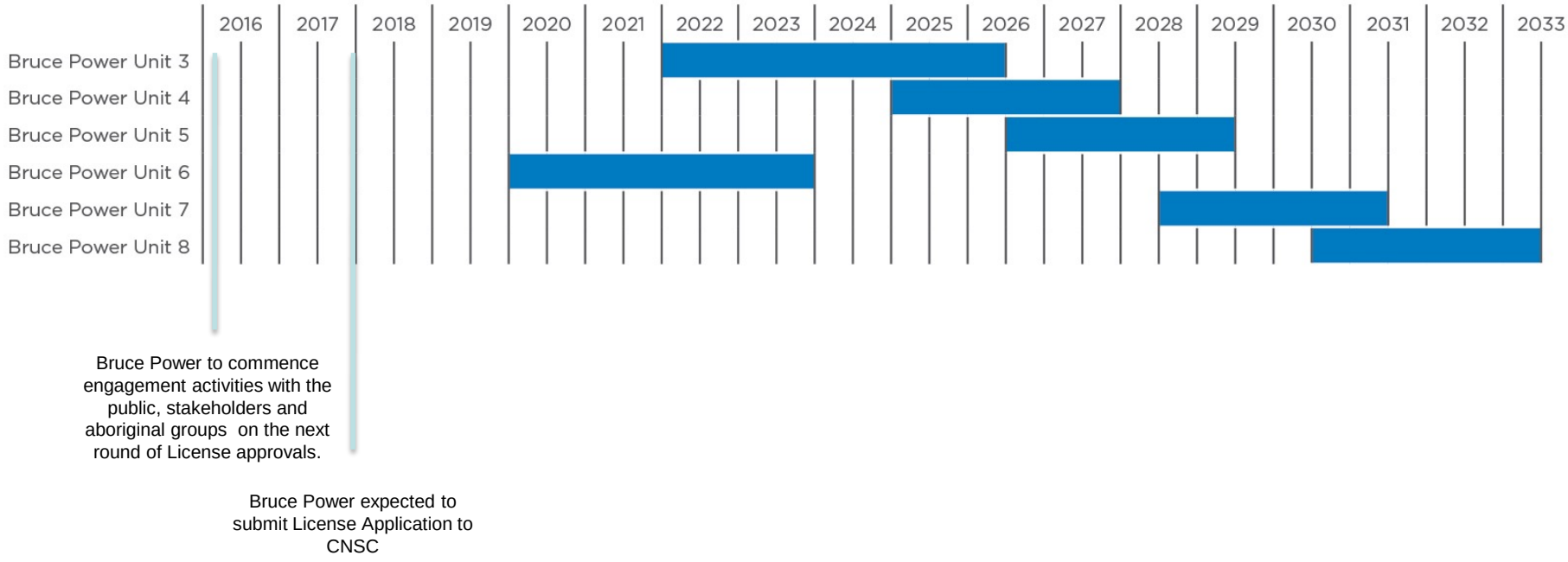
- **IESO has opportunities to exercise contractual off-ramps**

Key elements of the Amended Agreement

Item	Amended BPRIA
Agreement	• One agreement with one site wide price for energy • 6 units to be refurbished
Term	• 2064 (subject to contractual off-ramps listed below)
Refurbishment Cost	• Fixed cost provided prior to the refurbishment outage following which, BP will take 100% of overruns • A sharing mechanism will be used for under-spends
Refurbishment Off-Ramps	• IESO can exercise off-ramp over pre-determined cost threshold • IESO has off-ramps if proceeding with refurbishments is no longer economic

Refurbishment Schedule & CNSC Licensing

- Bruce Power does not plan to advance any refurbishment activities before 2020, however, will commence engagement activities with the public, stakeholders and aboriginal communities in early 2016 related to its longer-term regulatory activities to enable this schedule.



- Darlington refurbishments occur within the same timeframe! Potential for 3 or even 4 units to be in Refurb mode at same time!

Elements of Agreement

–The agreement is consistent with LTEP principles, and improves the LTEP cost curve in the short to medium term

–Includes off-ramps for performance and changes to the economic environment

–Preserves flexibility should more economic alternatives become available

–$13 billion of private sector capital investment over the near to mid-term – this is focused on MCR and Asset Management Activities.

–Amended agreement will be posted on IESO's & Bruce Power website

–Bruce Power will be investing $225 Million in sustaining capital, in addition to outages.

–From 2016-2020, the company is planning to invest $2 Billion of the $13 Billion MCR and Asset Management Programs.

Agreement Price

- On Jan. 1, 2016, Bruce Power will receive a single price for all output from the site of $65.73 per megawatt hour (MWh)

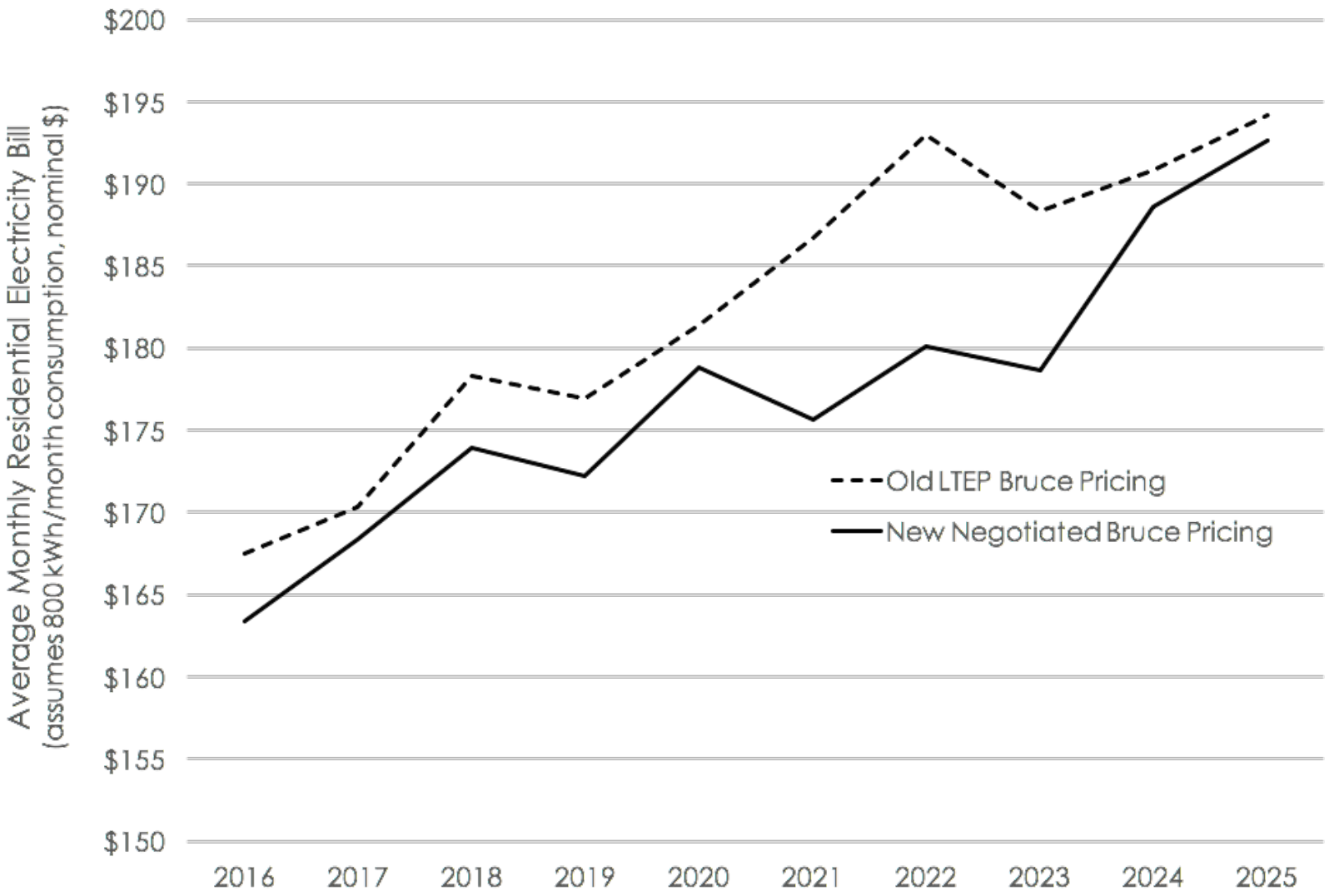
Per the published agreement:

- Contract Price: $56.40/MWh
- Dynamic Capability Payment: $1.33/MWh
- Estimated Fuel Cost: $8/MWh
  (Fuel cost and lifetime disposal costs)

} **$65.73/ MWh**

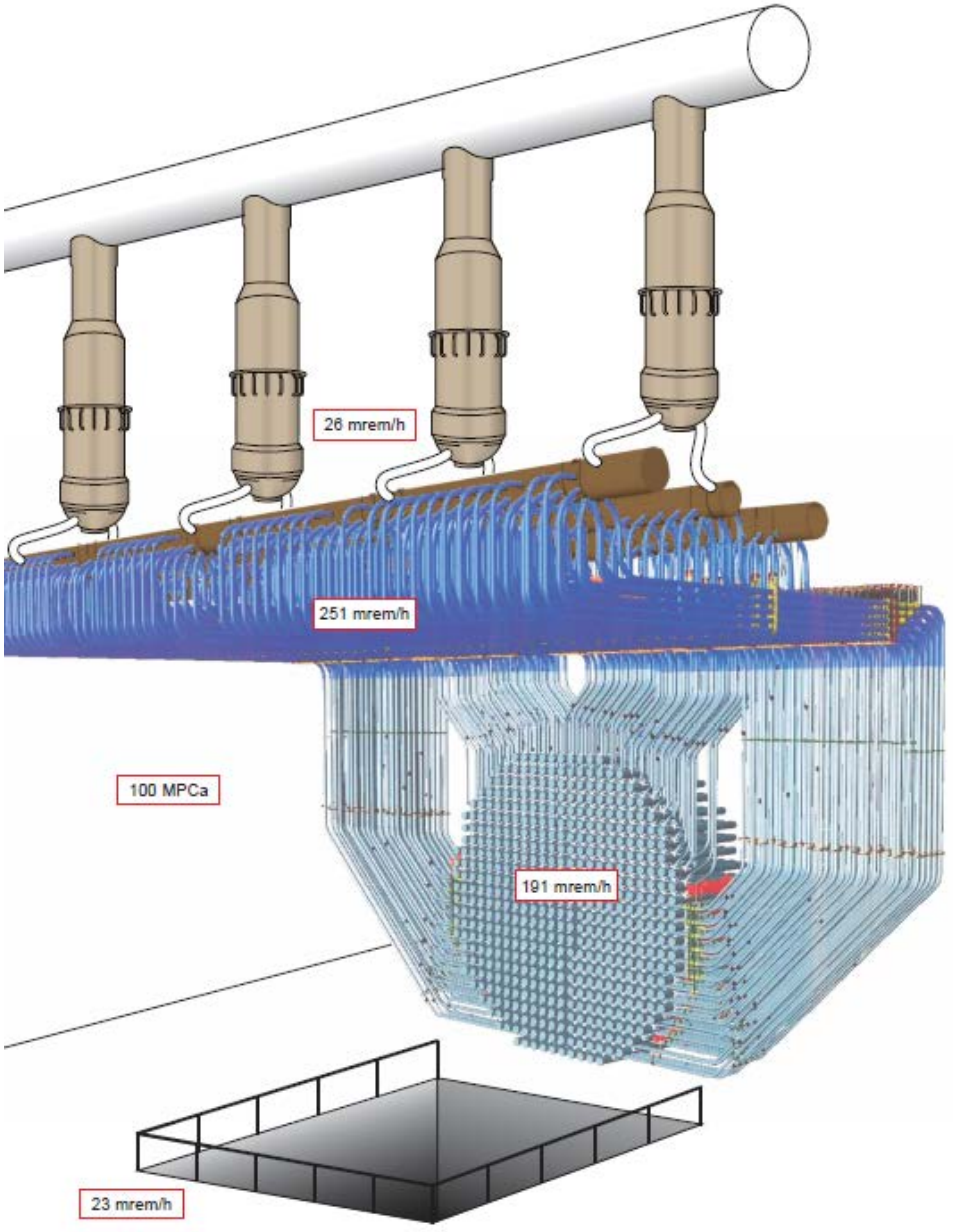
- With additional refurbishment costs, the price over the life of the agreement will be approximately $77/ MWh

Electricity Bill Impact of Negotiated Bruce Pricing



Major Component Replacement

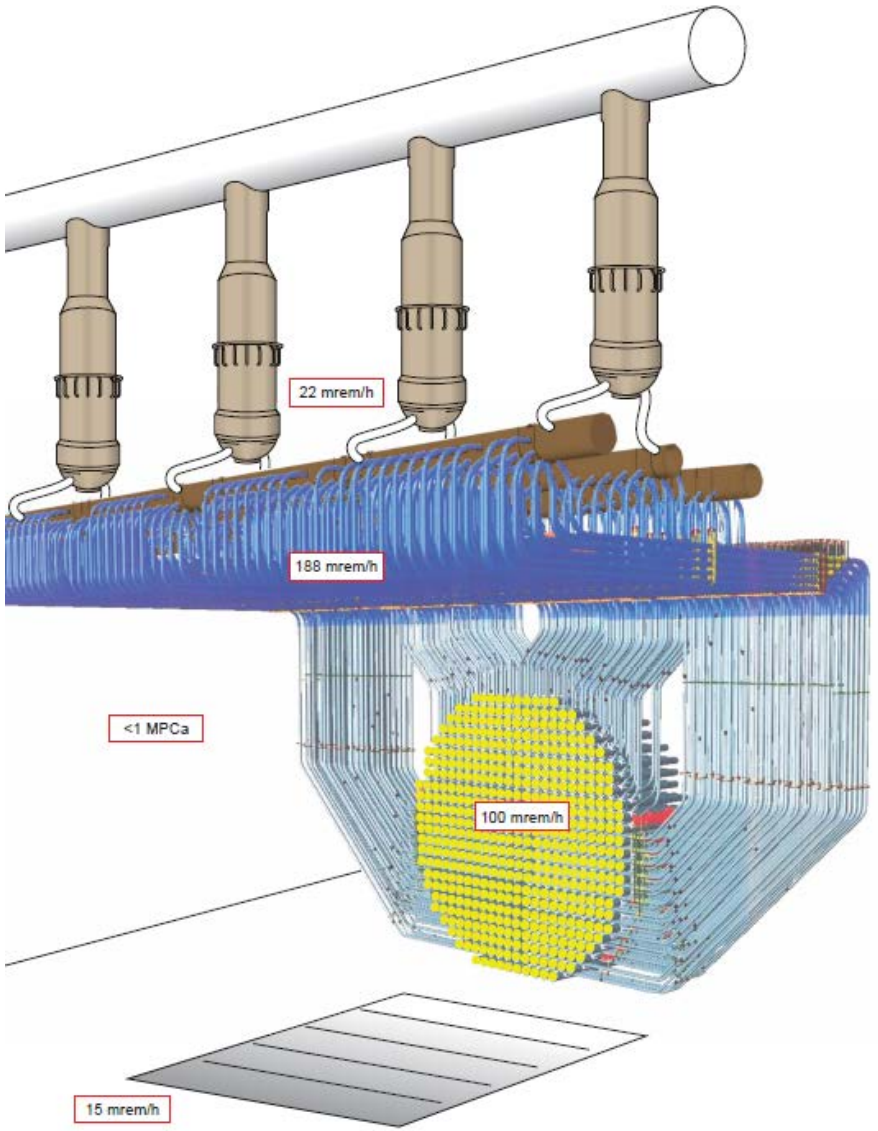
Initial Conditions:
1. Boilers (8)
2. Feeders(960)
3. Endfittings(960)
4. Pressure& Calandria Tubes(960)
5. Fuelling Machine Duct Open



Major Component Replacement

Step 1:
Remove Fuel
Remove Heavy Water
Shield the Reactor face
Install Bulkheads
Chemical Decon?

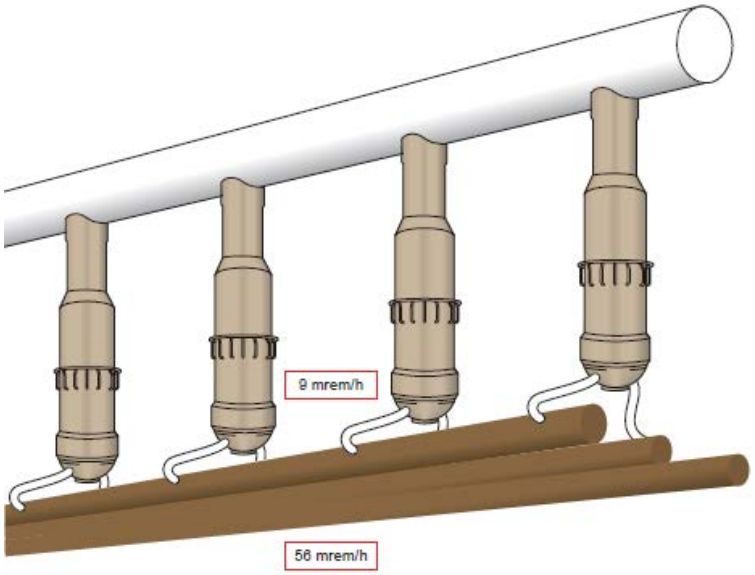
1. Boilers (8)
2. Feeders(960)
3. Endfittings(960)
4. Pressure & Calandria Tubes(960)
5. Fuelling Machine Duct Closed

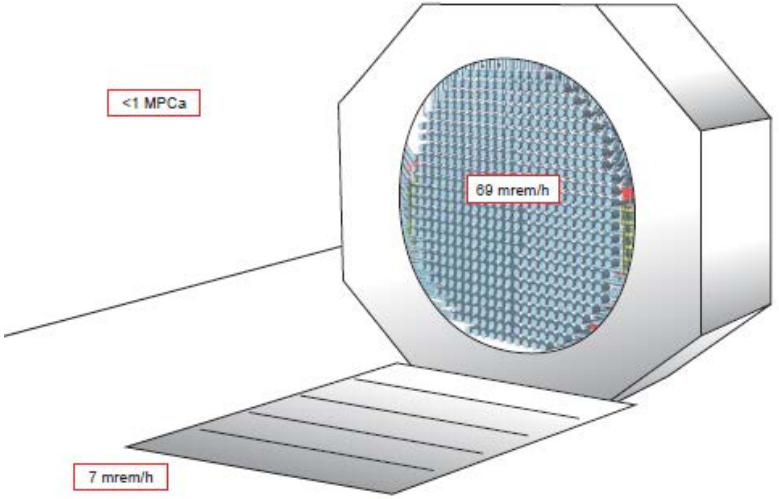


Major Component Replacement

Step 2:
Remove Feeder Tubes
Remove Endfittings

1. Boilers (8)
2. Feeders Removed
3. Endfittings Removed
4. Pressure & Calandria Tubes(960)
5. Fuelling Machine Duct Closed

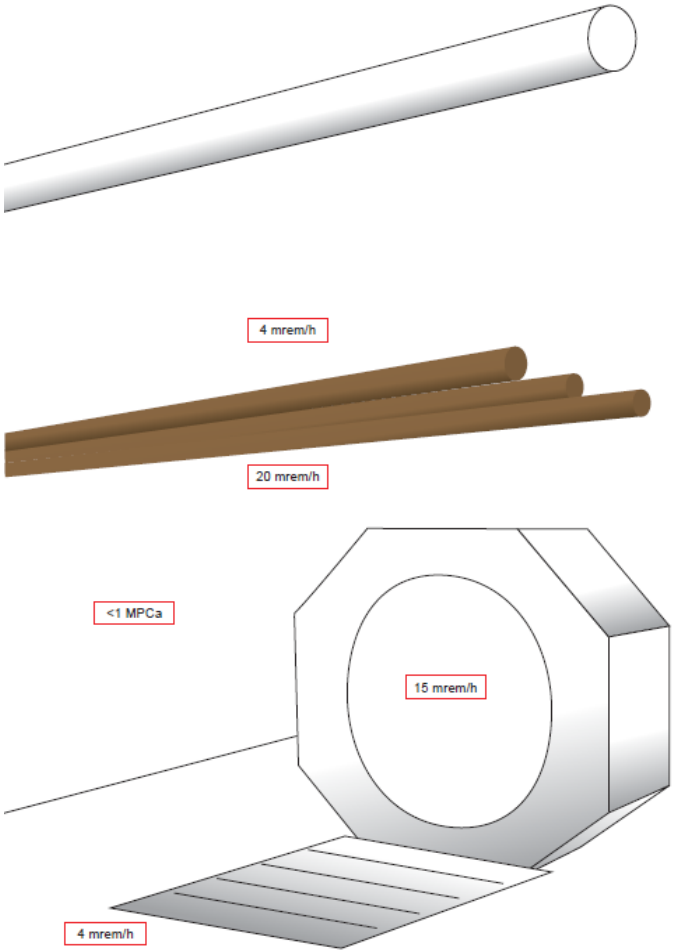


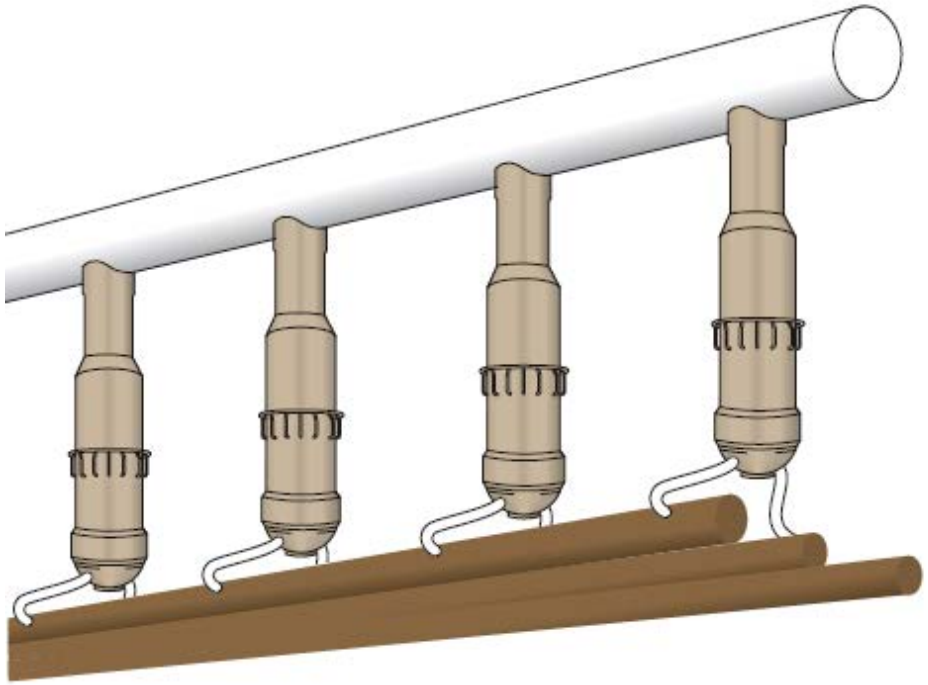


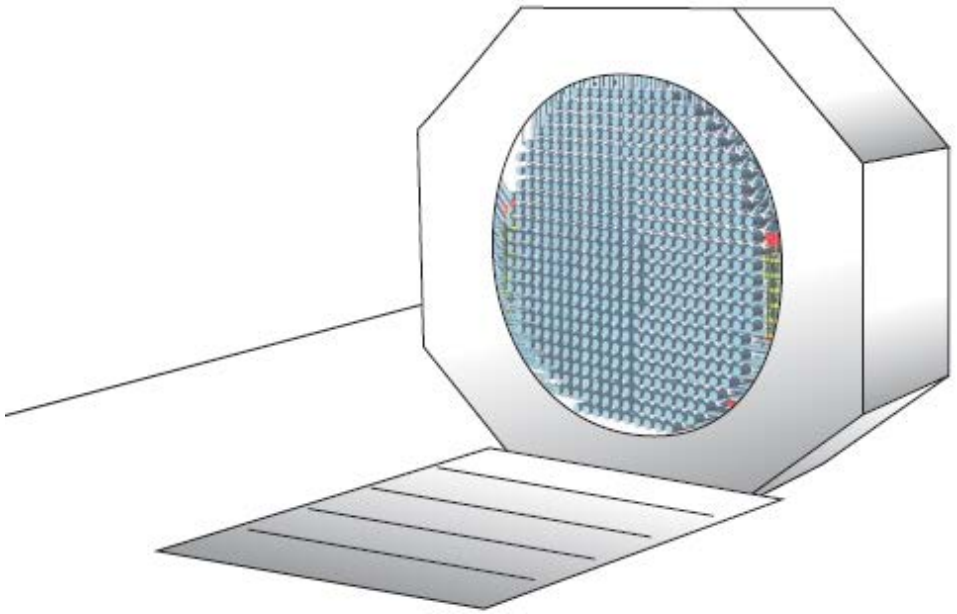
Major Component Replacement

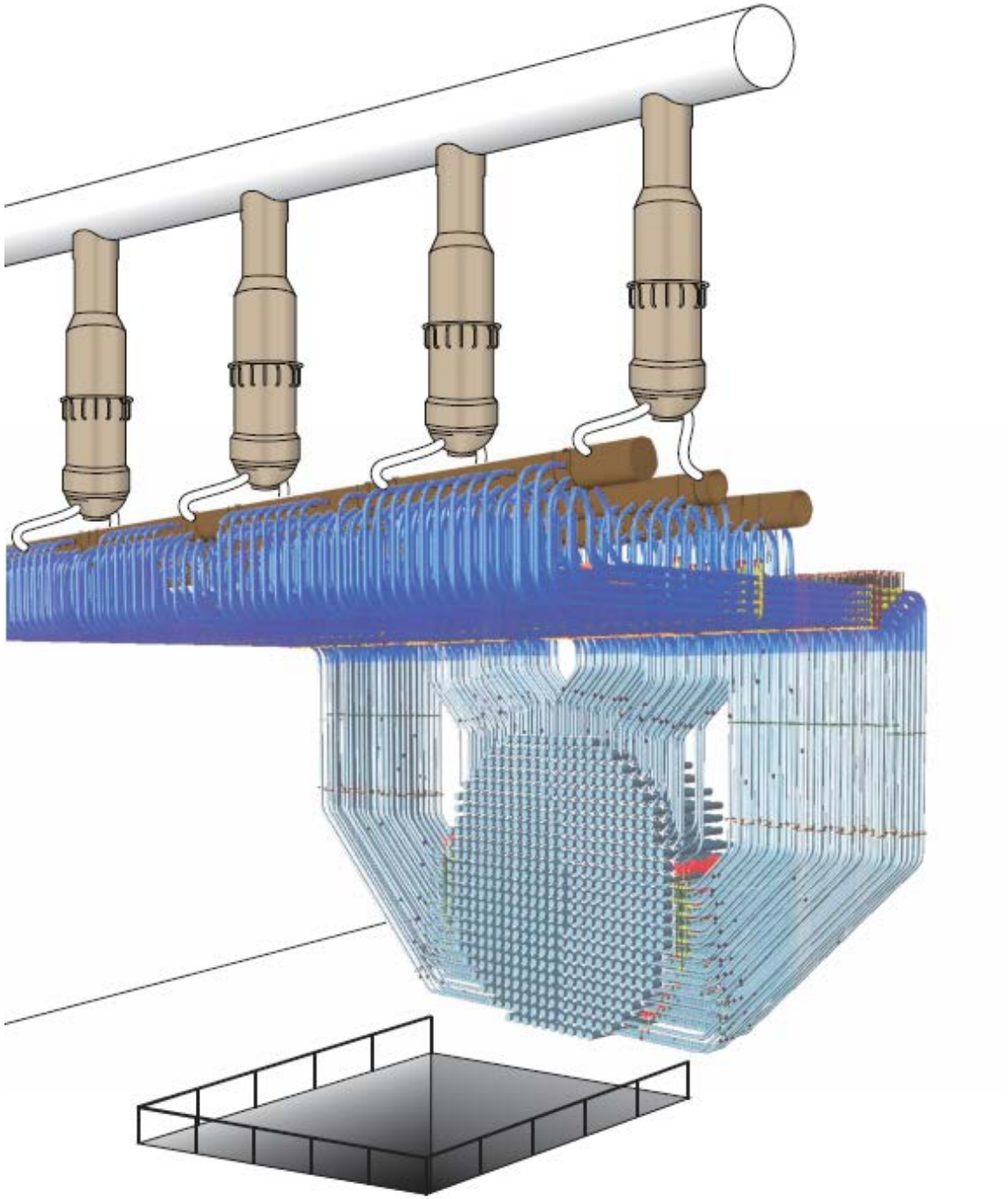
Step 3:
Remove Boilers
Remove Pressure/Calandria Tubes

1. Boilers Removed
2. Feeders Removed
3. Endfittings Removed
4. Pressure & Calandria Tubes Removed
5. Fuelling Machine Duct Closed









Summary

- The amended agreement is good news not only for the Site, surrounding communities and nuclear industry but for Ontario broadly.

- The start of the first MCR/refurbishment in 2020 does not mean there will a delay in short-term investments – an overall conservative estimate from 2016-2020 is $3-4 Billion.

- During refurbishment of one reactor we still have the normal operating and outage planning schedule for the other seven

- Where we will seeking help:
  - Resources in RP/HP, Engineering, Project Mgmt, skilled trades
  - Instrumentation, Protective Equipment, Shielding
  - Decon, Waste Handling/segregation and disposal

Questions?