A guide to

BRUCE POWER

Bruce Power acknowledges and honours the fact its site lies within the traditional and treaty territory of the Saugeen Ojibway Nation and the traditional harvesting territory of the Métis Nation of Ontario (Region 7) and the Historic Saugeen Métis.

We continue to build relationships with our hosts as we work towards true reconciliation.

Contents

Bruce Power generates

30% OF ONTARIO'S ELECTRICITY

while generating

0 CARBON EMISSIONS,

helping Ontario and Canada toward their Net Zero goals.

Did you know?

Bruce Power NetZero

Established in 2001, Bruce Power has transformed its business by returning four Bruce A units to service between 2003 and 2013, and investing in the long-term future of the site through its Life-Extension Program. It has also transformed its workforce through new hiring and training, extended the life of operating units through innovative planned maintenance programs, and positioned the site for long-term stability.

In 2015, Bruce Power signed a long-term agreement with the Province of Ontario that will see Units 3-8 refurbished between 2020 and 2033, extending the life of the site to 2064. This means ratepayers will receive 30 per cent of their electricity from Bruce Power for decades, while enjoying cleaner air because nuclear creates zero carbon emissions. This private investment program will guarantee one in three homes, hospitals, schools and businesses receive clean nuclear electricity for generations.

By building on the experience we have gained since 2001, while continuously innovating to become more efficient at these important infrastructure programs, we are in a strong position to fulfill our commitment to Ontario's Long-Term Energy Plan by providing low-cost, reliable and carbon-free energy to the province through 2064.

Situated on
LAKE HURON

Quick facts

250 KM
Northwest of Toronto

2,300 ACRES
and 56 kilometres of roads on site

4,200 Employees

OVER 500 SPECIES
of plants & wildlife

ABOUT BRUCE POWER

Bruce Power is a Canadian-owned partnership of TC Energy, Ontario Municipal Employees Retirement Systems (OMERS), the Power Workers' Union and The Society of United Professionals. A majority of our employees are also owners of the business.

Established in 2001, Bruce Power is Canada's only private sector nuclear generator. Ontario's Long-Term Energy Plan is counting on Bruce Power to provide a reliable and carbon-free source of affordable energy through 2064. To do so, Bruce Power has signed a long-term agreement with the province to refurbish six of its eight units. Bruce Power's Life-Extension Program will create and sustain 22,000 jobs annually, while injecting $4 billion into Ontario's economy each year.

Bruce Power employs more than 4,000 people and, over the past 15 years, has been one of the largest investors in Ontario's electricity infrastructure. The site is leased from the Province of Ontario under a long-term arrangement where all of the assets remain publicly owned while Bruce Power funds all infrastructure upgrades, makes annual rent payments, and pays for the cost of waste management and the eventual decommissioning of the facilities.

HISTORICAL TIMELINE

1960s

Construction begins on Douglas Point, Canada's first commercial nuclear reactor.

1960
Douglas Point construction begins.

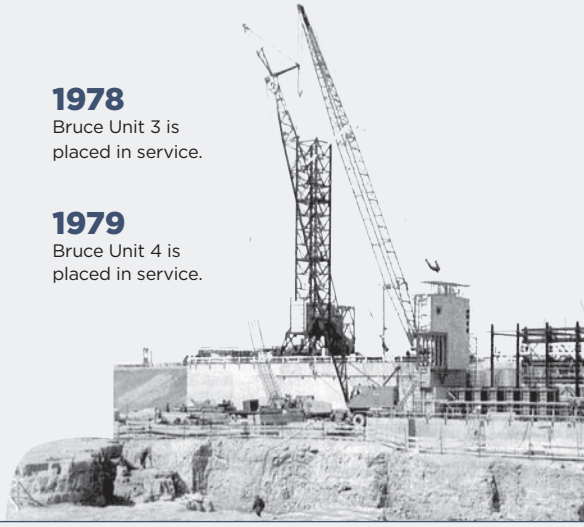
1967
Douglas Point is powered up for the first time.

1968
Plans are announced for four reactors at Bruce A and the (BHWP).

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

1970s

Plans announced for four nuclear reactors at Bruce B.



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.

1980s

1980
BHWP B is commissioned for service.

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

1983
Construction begins on the Bruce Learning Centre (formerly Western Nuclear Training Centre).

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

1985
Bruce Unit 5 is placed in service.

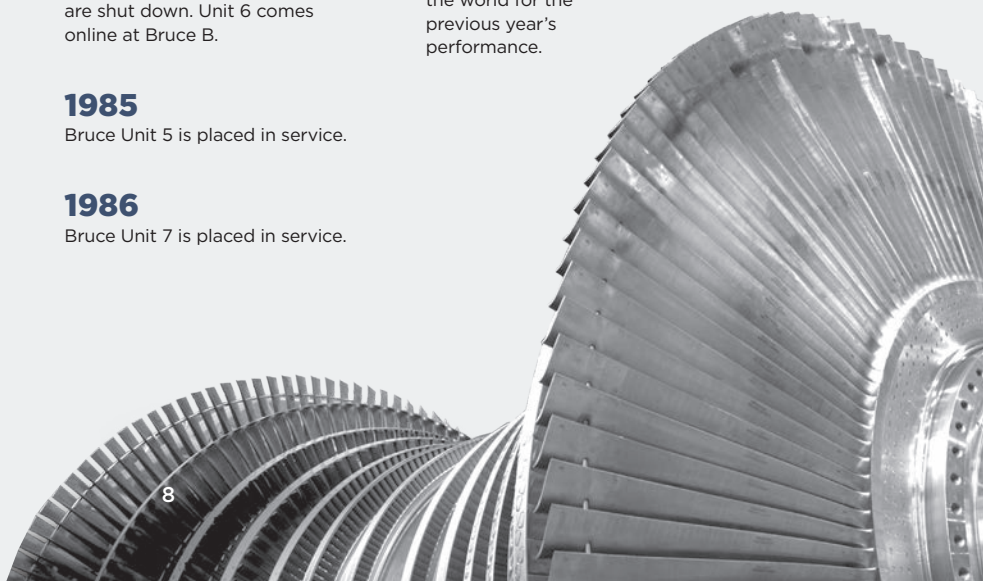
1986
Bruce Unit 7 is placed in service.

1987
Bruce Unit 8 is placed in service.

1988
Bruce Units 3, 4, 6 and 7 are Top 10 reactors in the world for the previous year's performance.

Did you Know?

Bruce Units 3, 4, 6 and 7 are Top 10 reactors in the world for the previous year's performance.



1990s

1991
Rehabilitation project approved for Bruce A.

1993
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.

2000s

2000
British Energy leases the site from Ontario Power Generation.

2001
Bruce Power is formed and assumes operational control of the site and confirms plans to restart Units 3 and 4.

2002
Ontario's electricity market opens to competition. TransCanada Corp. and OMERS join Cameco, the Power Workers' Union and The Society of Energy Professionals in the Bruce Power partnership, while British Energy withdraws.

2003
Units 5, 7 and 8 at Bruce B remain online to restore power to the grid after a massive blackout leaves large parts of Ontario and the 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 shut down by Ontario Hydro in 1998.

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

2006
Bruce Power celebrates its fifth anniversary and opens a new Support Centre. Bruce B is the top performing multi-unit nuclear plant in Canada.

2007
History is made in Unit 2 with the first successful replacement of a steam generator in a Canadian nuclear plant.

2008
A protocol agreement is signed with the Saugeen Ojibway Nation.

2010s

2011
Bruce Power responds to the Fukushima nuclear event by increasing emergency response capabilities.

2012
Units 1 and 2 return to service, while life-extension programs are completed in Units 3 and 4.

2014
Cameco exits partnership, leaving TC Energy, OMERS, the Power Workers' Union, The Society of United Professionals and Bruce Power employees as owners.

2014
The return of Bruce A's four units provides 70 per cent of the clean energy needed in Ontario to phase out the province's coal-powered generation.

2015
Bruce Power signs a long-term agreement with province to refurbish Units 3-8, extending life of site to 2064.

2017
Bruce Power and its supplier partners sign millions of dollars in contracts in preparation for the Unit 6 Major Component Replacement Project, which begins in 2020.

2019
Bruce Power partners with Saugeen Ojibway Nation to explore ways to jointly market new medical isotopes while creating economic opportunities locally.

2020s

2020
Unit 6 at Bruce B is removed from service for refurbishment. Bruce Power responds to COVID-19 by donating over two million pieces of personal protective equipment to frontline workers.

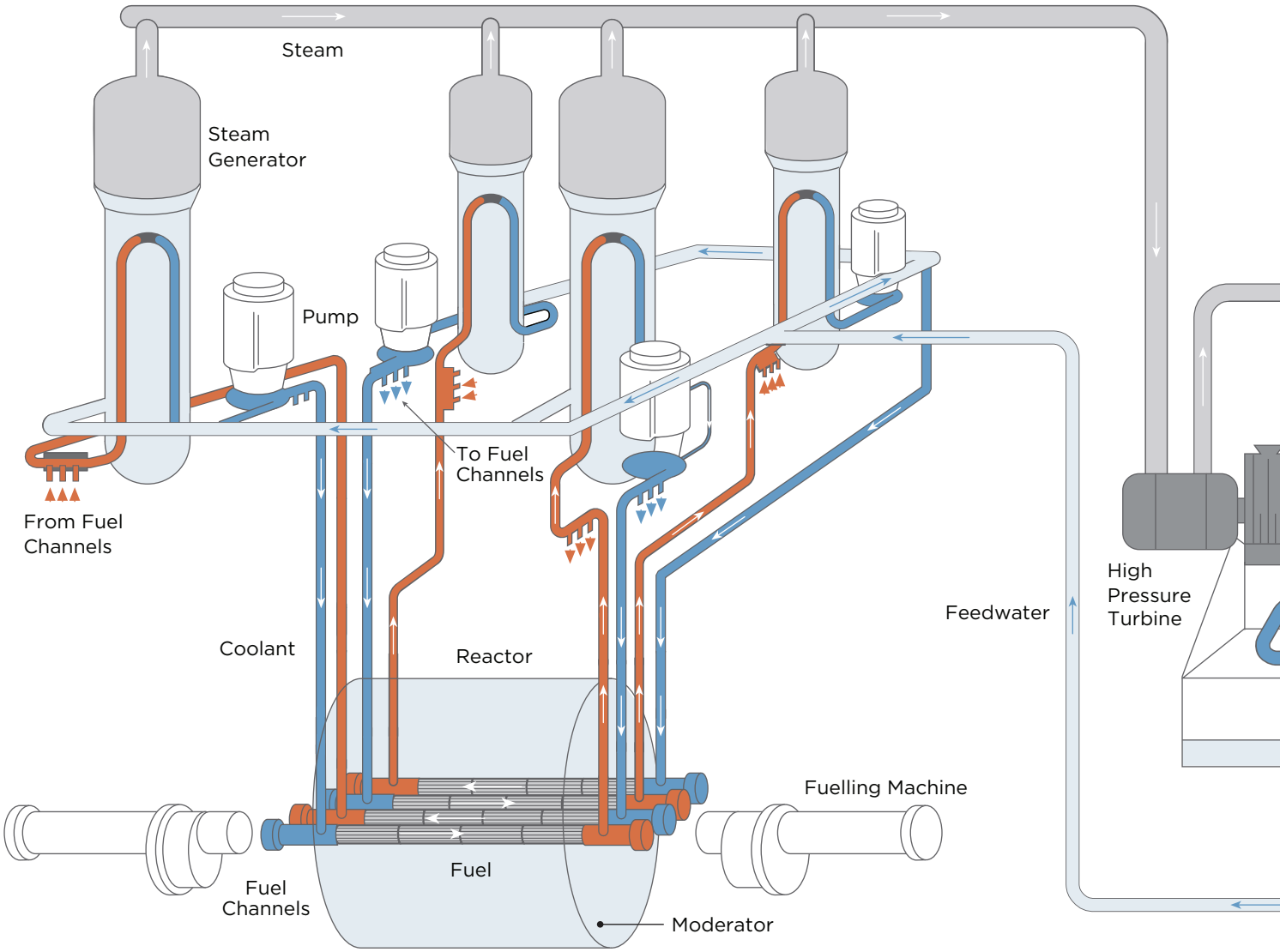
2021
Bruce Power works with the Grey Bruce Health Unit, and others across Ontario, to coordinate regional mass vaccination hubs. One million additional pieces of PPE donated across Ontario.

HOW OUR REACTORS WORK

Bruce Power's reactors use CANDU (Canada Deuterium Uranium) technology. Considered one of the safest nuclear technologies in the world, CANDUs use 'heavy' water and manufactured uranium pellets to generate massive amounts of heat, creating steam to drive a turbine, which creates electricity.

The heat is created in a reactor by the 'fissioning' or splitting of uranium atoms. When the centre — or nucleus — of uranium atoms fission, they split into fragments, separating rapidly and generating heat. Two or three neutrons are released and they go on to collide with other atoms.

CANDU PRESSURIZED HEAVY WATER REACTOR



Heavy water is used to slow the neutrons down in order to sustain the fission process in a controlled chain reaction. Heavy water is also used as a coolant to remove heat from the fuel and carry it to steam generators. The heat in the steam generators turns light water to steam, which is then piped to a series of turbine rotors, which spin a shaft that's connected to the generator. The action of these spinning mechanisms is converted to electrical energy, which then leaves the station for the switch yard, before making its way to Ontario's electrical grid.

WHAT FUELS A CANDU?

Natural uranium is mined in Saskatchewan, and converted and manufactured into pellets by Cameco, in eastern Ontario..

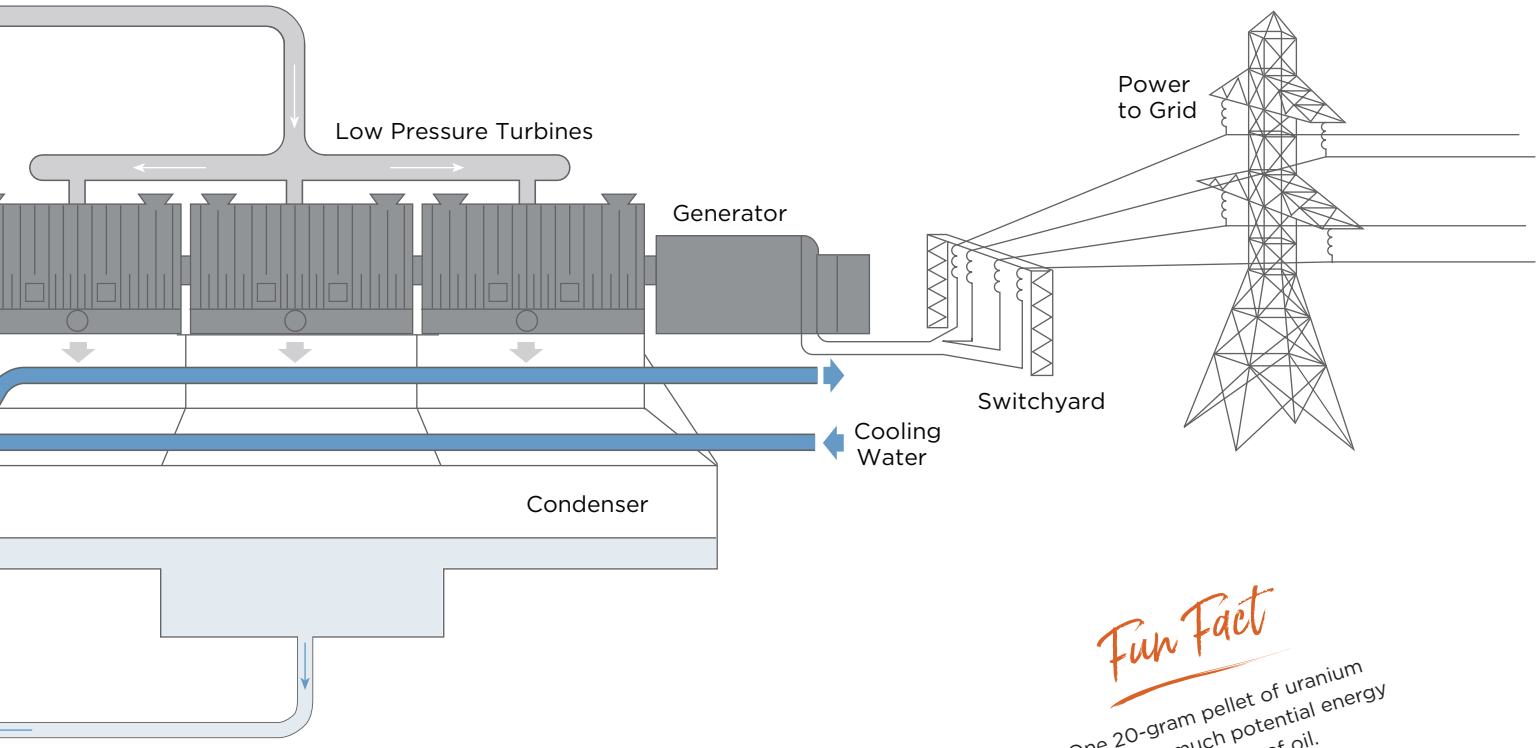
Uranium ore is processed into a powdery substance called 'yellow cake', which is then chemically refined into uranium dioxide and baked into small ceramic pellets. The pellets are sealed inside small metal tubes, which are assembled into fuel bundles. These bundles are about the size of a small fire log and weigh 22 kg.

UNIQUE DESIGN

CANDUs have a number of unique design features and characteristics not seen in other reactor designs.

They include:

- A reactor core comprising of several hundred small diameter fuel channels rather than one huge pressure vessel.
- Heavy water (D_2O) for moderator and coolant.
- Separate low pressure moderator and high pressure fuel cooling systems.
- Reactivity devices that are located in the cool low pressure moderator, and not subjected to high temperatures or pressures.
- Natural uranium fuel, which is not enriched and cannot be used for weapons.
- Reactors can be refueled while still safely operating at full power.
- Two fully capable shutdown systems, independent from each other, which are designed to act automatically in the unlikely situation a reactor requires immediate shutdown.

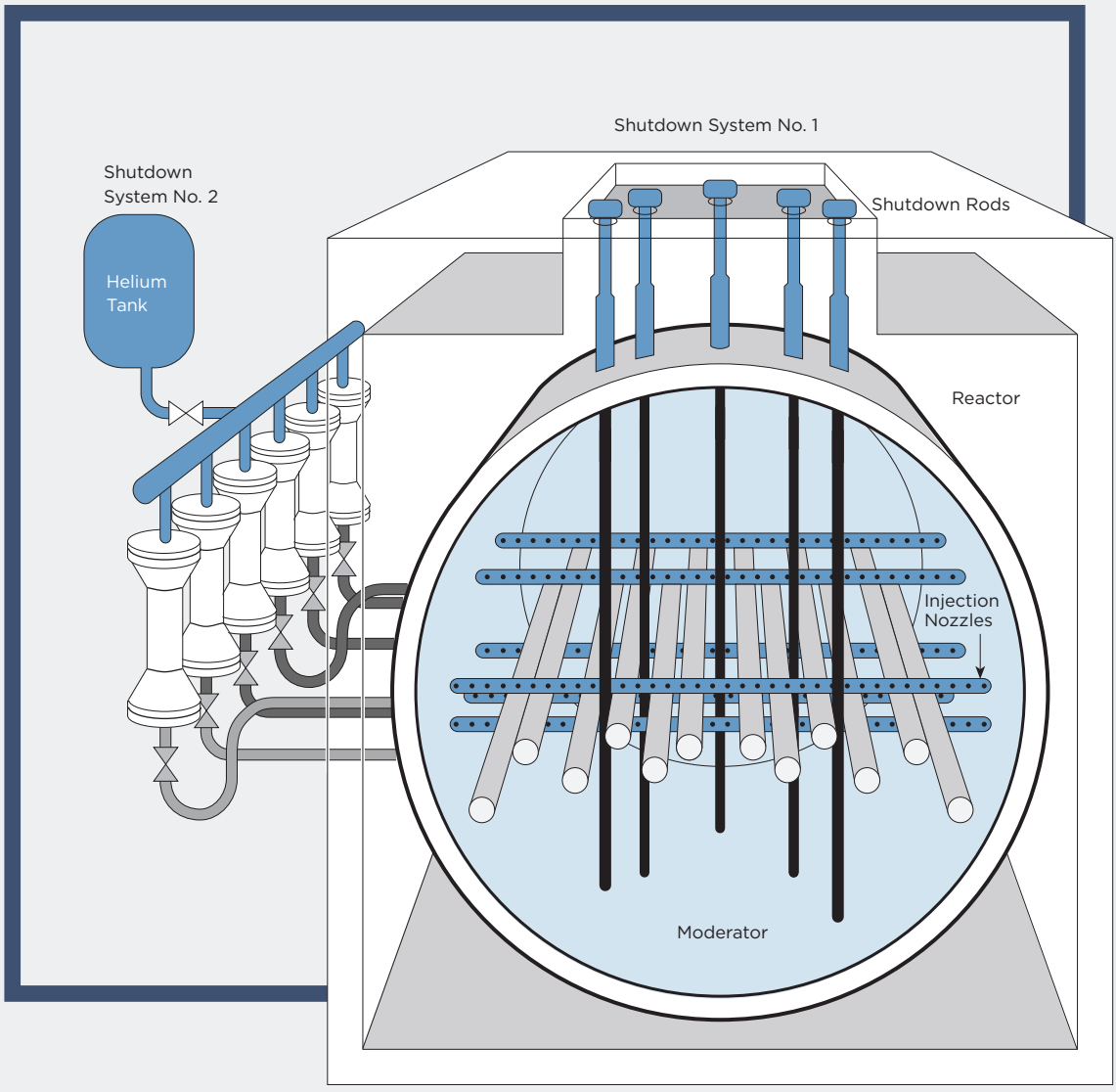


Fun Fact

One 20-gram pellet of uranium contains as much potential energy as 205 litres of oil.

Fun Fact

The CANDU reactor design has two independent, fast-acting shutdown systems that are physically separate and have their own power supplies and monitoring equipment.



NUCLEAR SAFETY

To achieve optimum safety, Bruce Power, along with other nuclear plants, operate using a 'defence-in-depth' approach. Using high-quality design, equipment and operators ensures accidents don't happen.

SAFETY SYSTEMS

Each CANDU unit has four special safety systems. They include Shutdown System No. 1, Shutdown System No. 2, the Emergency Coolant Injection System, and the Containment System. These systems are tested frequently but not used in day-to-day operations. Completely independent of one another, they activate automatically if reactor systems exceed established parameters.

Each system is completely independent and designed to be fail safe, which means if a component of one of the shutdown systems fails, the rest of the system is capable of performing its function, or is automatically activated to shut down the reactor.

SHUTDOWN SYSTEM NO. 1 (SDS1)

This primary method of quickly shutting down the reactor when certain parameters enter an unacceptable range is the automatic release of spring-assisted gravity-drop absorber rods. The rods absorb neutrons, stopping the fission process in seconds.

SHUTDOWN SYSTEM NO. 2 (SDS2)

An alternate method of quickly shutting down the reactor is the rapid injection of a gadolinium nitrate solution into the moderator system through horizontal tubes. When triggered automatically, high-pressure helium forces the gadolinium through the tubes to absorb neutrons and shut down the reactor in seconds.

EMERGENCY COOLANT INJECTION SYSTEM (ECI)

This system is designed to provide cooling water to the heat transport system if a leak occurs. When called upon, the system injects light water over the fuel to stop it from overheating.

The ECI works in three stages: high-pressure injection, medium-pressure injection and low-pressure recirculation. High-pressure injection uses pressurized tanks to inject water into the heat transport system. The medium-pressure stage supplies water by pumping it from a storage tank. The long-term recirculation stage recovers water that has been collected in the basement of the reactor building and pumps it back into the heat transport system through heat exchangers.

CONTAINMENT SYSTEM

Each reactor is located in its own airtight vault with concrete walls that are more than a metre thick. Maintained at a negative pressure, the reactor vault is connected to the station's central fuelling duct, which connects to two pressure-relief ducts that link to a large cylindrical structure called the vacuum building.

Maintained at one-tenth atmospheric pressure, the vacuum building is poised to suck up radioactive steam and contaminants in the unlikely event of a reactor accident. Once triggered, it douses the steam and contaminants with water from an overhead storage tank.

Unique to multi-unit CANDU stations like Bruce A and B, the vacuum building provides an additional protective barrier to the release of radioactivity to the environment.

Fun Fact

There are 19 operational reactors in Canada.

Bruce Power **8** • Pickering **6**
Darlington **4** • Point Lepreau **1**

BRUCE POWER
TIVERTON, ON

ONTARIO POWER GENERATION
DARLINGTON, ON

4 OPERATING CANDU SITES

ONTARIO POWER GENERATION
PICKERING, ON

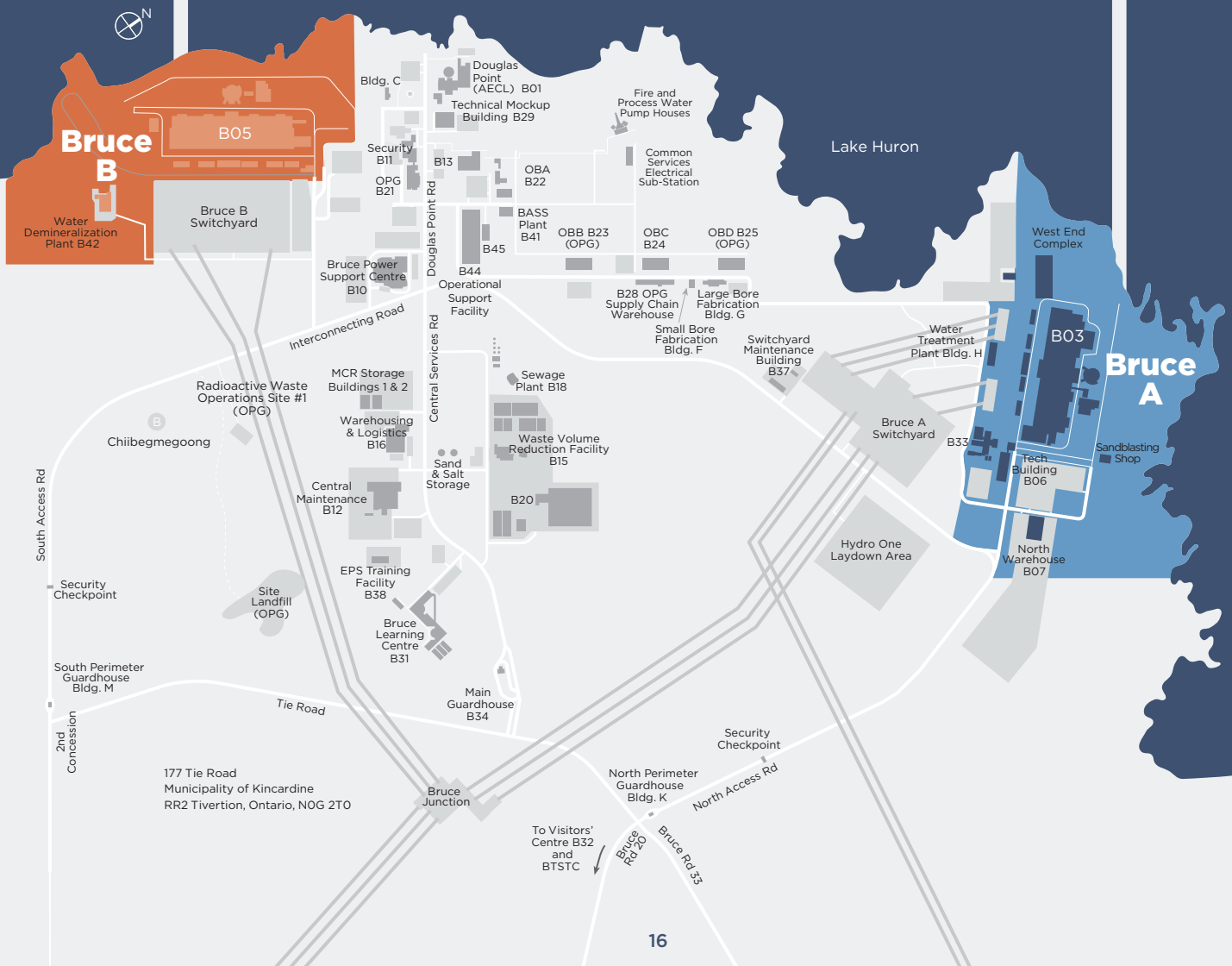
NEW BRUNSWICK POWER
POINT LEPREAU, NB

CANDU IN CANADA

The prototype 20,000 kilowatt (kw) CANDU plant came online in 1962 in Deep River, ON, followed in 1968 by the 200,000 kw Douglas Point Generating Station, located on the Bruce Power site. Douglas Point was decommissioned in 1984. Construction on Bruce A began in 1969 and its four units were fully operational by 1979. Bruce B construction began in 1976 and its four units were fully operational by 1987.

There are currently 19 operational CANDU reactors in Canada — Bruce Power (eight), Pickering (six), Darlington (four) and Point Lepreau, New Brunswick (one). Refurbishment of six units at Bruce Power and four units at Darlington has been approved by the Province of Ontario and will take place over the next two decades, extending the life of the units by an estimated 30+ years.

Bruce Generating Station
A & B LOCATIONS

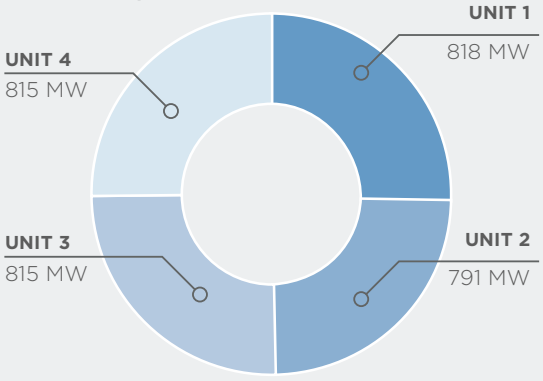


STATION PROFILES

BRUCE A — 4 REACTORS

IN SERVICE	LAY-UP	RESTART
Unit 1 – 1977/09/01	1997/10/16	2012
Unit 2 – 1977/09/01	1995/10/08	2012
Unit 3 – 1978/02/01	1998/04/09	2004
Unit 4 – 1979/01/18	1998/03/16	2003

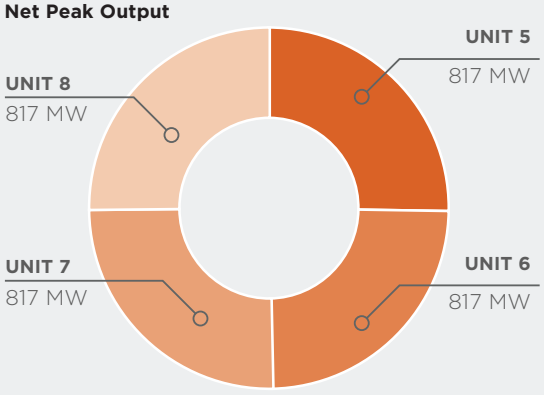
Net Peak Output

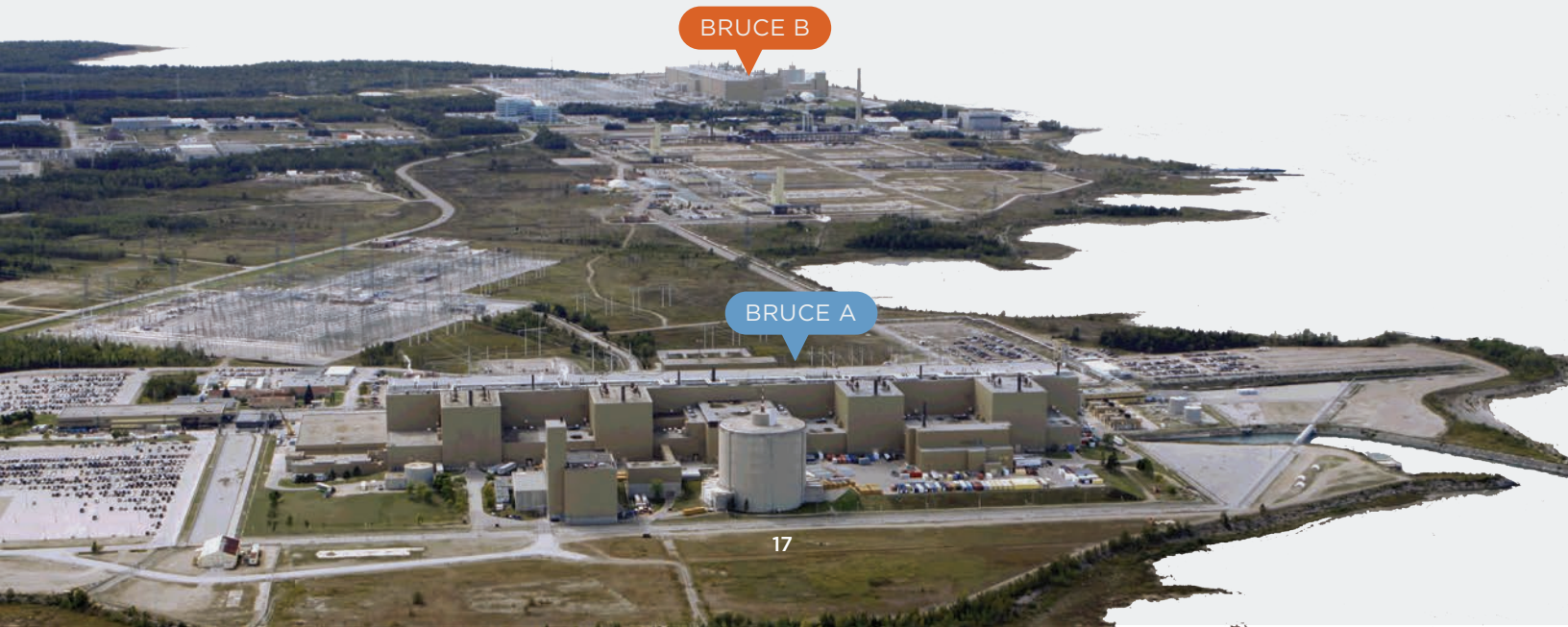


BRUCE B — 4 REACTORS

IN SERVICE
Unit 5 – 1985/03/01
Unit 6 – 1984/09/14
Unit 7 – 1986/04/10
Unit 8 – 1987/05/22

Net Peak Output



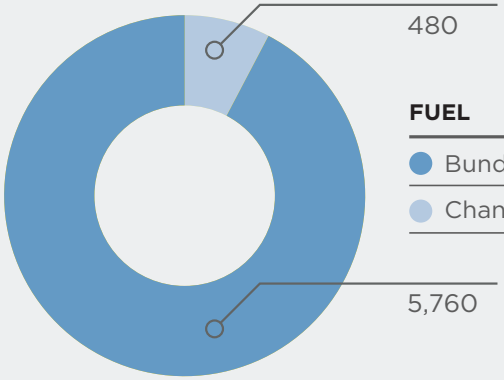


BRUCE A

BUILDING, STRUCTURES AND REACTOR VESSELS

AREA/ITEM	WIDTH	LENGTH	HEIGHT	WALL THICKNESS	MATERIAL	OTHER
Reactor Building	92 ft (28.04 m)	104 ft (31.7 m)	162.5 ft (49.53 m)		Reinforced concrete	
Reactor Vault	92 ft (28.04 m)	104 ft (31.7 m)	46.5 ft (14.18 m)	6 ft (1.83 m)		
Reactor Auxiliary Bay	150 ft (45.7 m)	1,426 ft (434.7 m)	48 ft (14.6 m)			
Turbine Hall	180 ft (54.86 m)	1,460 ft (445 m)	134 ft (40.8 m)			
Vacuum building	160 ft 6 in (49 m) *(Inside diameter)*		149 ft (45.4 m)	3 ft 9 in (1.14 m)		Water storage 2.2 million gallons (10,000 m^3)
Calandria	27 ft 9 in (8.46 m) *(Inside diameter)*	19 ft 6 in (5.95 m)	149 ft (45.4 m)	1.25 in (3.17 cm)	Austenitic stainless steel	
Calandria tubes	5.077 in (12.9 cm) *(Inside diameter)*			0.054 in (0.137 cm)	Zircaloy – 2 seam welded	Quantity 480

REACTOR PHYSICS



FUEL	NUMBER
Bundles	5,760
Channels	480

FUEL FACTS	
Type	37 element bundles
Length	19.5 in (49.5 cm)
Number per channel	12
Total weight of bundle	52.1 lb (23.65 kg)

TURBINE GENERATOR	
TURBINE	
Turbine set per reactor	1
Number of high-pressure cylinders	1
Number of low-pressure cylinders	3
Speed	1,800 rpm
GENERATOR	
One per turbine	18,500 volts

BRUCE B

BUILDING, STRUCTURES AND REACTOR VESSELS

AREA/ITEM	WIDTH	LENGTH	HEIGHT	WALL THICKNESS	MATERIAL	OTHER
Reactor Building	92 ft (28.04 m)	104 ft (31.7 m)	162.5 ft (49.53 m)		Reinforced concrete	
Reactor Vault	92 ft (28.04 m)	104 ft (31.7 m)	46.5 ft (14.18 m)	6 ft (1.83 m)		
Reactor Auxiliary Bay	150 ft (45.7 m)	1,426 ft (434.7 m)	48 ft (14.6 m)			
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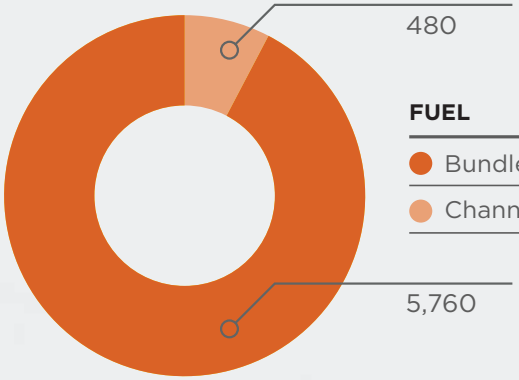
TURBINE GENERATOR	
TURBINE	
Turbine set per reactor	1
Number of high-pressure cylinders	1
Number of low-pressure cylinders	3
Speed	1,800 rpm
GENERATOR	
One per turbine	24,000 volts

REACTOR PHYSICS



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WHAT IS RADIATION?

Radiation is energy that travels through space. Humans have been exposed to radiation from natural sources since the dawn of time. We get radiation from the ground, air, food we eat and our entire solar system.

There are several types of radiation including alpha, beta and gamma.

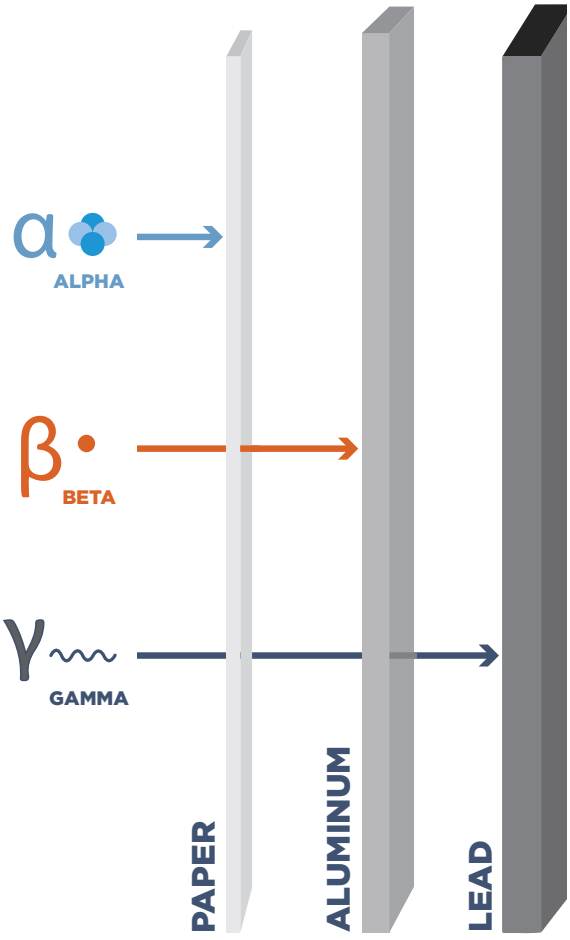
ALPHA: These particles are produced from the radioactive decay of heavy elements such as uranium. They are composed of two neutrons and two protons identical to the nucleus of a helium atom. Alpha particles can only travel a short distance in any material, due to their relative size and electrical charge from two protons. This means a sheet of paper can stop alpha particles.

BETA: These particles are electrons that come from the transformation of a neutron in the nucleus of an atom to a proton. They can travel up to about five metres in air and one centimetre in tissue.

GAMMA: These rays are electromagnetic radiation similar to X-rays. Unlike alpha and beta, which are produced by machines, gamma rays are emitted from the nucleus of a radioactive atom that is in an excited state. Gamma rays travel at the speed of light and can penetrate long distances in air and tissue. Several centimetres of lead or metres of water are needed to stop typical gamma rays such as those from Cobalt-60, which is used to sterilize medical devices and treat cancer after it is harvested from Bruce B's reactors during planned maintenance outages.

Fun Fact

Alpha radiation is readily stopped by a sheet of paper, beta radiation is halted by an aluminum plate and typical gamma rays are stopped by several centimetres of lead.



HOW IS RADIATION MEASURED?

The amount of radiation received by a person is referred to as 'dose' and is measured in units known as microsieverts.

Background radiation comes from natural sources (soil, rocks, water, air and vegetation) and artificial sources (medical X-rays, industrial sources like smoke detectors and even watches). According to Health Canada, the amount of natural radiation each of us receives is between 2,000 and 4,000 microsieverts per year. The Canadian Nuclear Safety Commission has established an upper limit of 1,000 microsieverts of human-made radiation per year for members of the public.

TIME, DISTANCE & SHIELDING

To reduce radiation exposure, nuclear energy workers keep their distance from radioactive sources, limit their exposure time and use shielding. They are also equipped with a wide range of personal protective equipment to limit exposure.

*Fun Facts**

1.8 The most dose Bruce Power's year-round neighbours could have received is the **equivalent of eating 18 bananas.**

A **year of watching TV** at an average rate.

Having a **chest X-ray**.

65 **Flying** from Melbourne to London via Singapore.

1,000 Canadian Nuclear Safety Commission's **allowable limit for residents** for human-made radiation per year.

ESTIMATED DOSE*	ACTIVITY
1.8	**The most Bruce Power's year-round neighbours could have received is the equivalent of eating 18 bananas.**
5	Sleeping next to your spouse for one year.
10	A year of watching TV at an average rate.
10	A year of wearing a luminous dial watch.
10	A day from background radiation (average, varies depending on location).
20	Having a chest X-ray.
65	Flying from Melbourne to London via Singapore.
300	Yearly dose due to body's Potassium-40.
460	Maximum possible off-site dose from Three Mile Island accident in 1979.
400-1,000	Average annual dose from medical sources.
1,000	Canadian Nuclear Safety Commission's allowable limit for residents for human-made radiation per year.
7,000	Having a PET scan.
8,000	Having a chest CT scan.
2 million	Typical single dose to cancer region from radiation therapy.
65 million	Typical total dose to cancer region from radiation therapy.

** DOSE IS IN MICROSIEVERTS*

By the numbers

8
Reactors

with
480
Fuel channels on each reactor

Holding
5,760
Fuel bundles

USED FUEL SAFETY

The CANDU system has a unique ability to refuel the reactor while it is still safely operating at full power.

Two identical fuelling machines rise from a fuelling duct under the reactor and latch onto opposite ends of a designated fuel channel (of which there are 480 on each reactor, holding 5,760 fuel bundles). Each machine is operated remotely in the Control Room by our highly trained Fuel Handling Operators.

With both machines latched on and brought up to system pressure, the ends of the fuel channel are opened and new fuel is exchanged for used fuel — one machine discharging and the other accepting.

Each bundle stays in the reactor for up to two years, depending on where it is located. Once removed, it enters the primary fuel bay. Fuel bundles are very radioactive after being removed from the reactor, yet just a few metres of water in a used fuel storage bay provides adequate shielding to protect workers and the public from radiation.

One year after removal from the reactor, a used fuel bundle gives off less than 0.1 per cent of the heat it emitted while in the reactor. Despite the dissipation of heat, fuel bundles will still spend 10 years in the primary and secondary fuel bays, which are about the size of an Olympic swimming pool, before being cool enough to be placed in a dry storage container. It is then transferred to Ontario Power Generation's Western Waste Management Facility, which is located on the Bruce Power site, for long-term, above-ground storage.


SAFETY
46T

STRONG, INDEPENDENT REGULATOR

Bruce Power keeps in constant contact with its independent regulator, the Canadian Nuclear Safety Commission (CNSC), in order to ensure our safety and operations standards remain at the highest level.

The CNSC also has staff permanently based at the Bruce Power site. The CNSC's mandate is to regulate the use of nuclear energy and materials to protect health, safety, security and the environment, and to implement Canada's international commitments on the peaceful use of nuclear energy, while disseminating objective scientific, technical and regulatory information to the public.

The CNSC was established in 2000 under the Nuclear Safety and Control Act and reports to Parliament through the Minister of Natural Resources. It was created to replace the former Atomic Energy Control Board (AECB), which was founded in 1946. The CNSC has up to seven appointed permanent members whose decisions are supported by more than 800 employees. These employees review applications for licences according to regulatory requirements, make recommendations to the Commission, and enforce compliance with the Nuclear Safety and Control Act, regulations, and any licence conditions imposed by the Commission.

In 2018, Bruce Power received a 10-year operating licence extension from the CNSC following a two-part public hearing.

Learn more about the CNSC and the industry oversight it provides at www.nuclearsafety.gc.ca.

Fun Fact

All aspects of the operation and maintenance of the reactors are monitored and managed from the Main Control Room.

SAFETY/EMERGENCY RESPONSE

As part of our operating licence, Bruce Power maintains a robust and multi-faceted emergency response program. This includes our Emergency and Protective Services department, which features an award-winning security service, a fully equipped fire department, an ambulance and an around-the-clock emergency response organization.

The company also has fire trucks that can provide an external source of water to station fire water systems, which, in turn, are used as an emergency cooling water source for critical systems. These five, specially designed firetrucks were purchased after the 2011 Fukushima nuclear event to add to our already significant layers of safety systems at both Bruce A and B.

In fact, we never stop improving the depth of our safety systems and our ability to respond in the unlikely occurrence of an emergency. Other upgrades we've made since Fukushima include:

- Purchasing nine back-up generators that are stored off site on high, dry ground. They can be deployed to either station and operational within 30 minutes in the unlikely situation that the two independent safety systems built into the station design were to fail.

- Upgrading off-site radiological monitoring equipment to provide real-time data.

- A state-of-the-art Emergency Management Centre at the Bruce Power Visitors' Centre. This facility acts as the control room for any emergency situation and allows for a clear and efficient chain of command. We also implemented the Incident Management System for emergency response, bringing us in line with professional organizations across the province.

- Receiving Canada's first emergency test broadcasting licence for portable AM units, which makes communicating during an emergency more effective than ever before. We collaborated with the Municipality of Kincardine to deploy ALERT FM radios in all homes within a 10 km radius of the site. The ALERT FM receiver is linked to the Emergency Alert Ready System and broadcasts an audible alert and text message within seconds.

- Providing potassium-iodide (KI) tablets to all residents within a 10 km radius of site in the unlikely event of a nuclear emergency.

- Continuously training staff to ensure our emergency response organization is prepared for a crisis caused by a natural disaster or nuclear emergency.

- In conjunction with the Municipality of Kincardine and Grey Bruce Public Health, we launched an emergency preparedness website at **www.bepreparedgreybrucehuron.com** so Bruce, Grey and Huron county residents have access to a single website that outlines what to do in the case of all types of emergencies, from tornadoes and floods to winter storms and nuclear incidents.

The effectiveness of Bruce Power's emergency response program is continuously assessed through a series of drills and exercises, which are evaluated by the Canadian Nuclear Safety Commission. The regulator consistently rates Bruce Power's capabilities as 'Fully Satisfactory', which is equivalent to an A+.

FOR MORE INFORMATION ON OUR EMERGENCY RESPONSE PROGRAM:

youtube.com/user/brucepower4you

Quick facts

2064
New Life expectancy of Site

2023
Unit 6 refurbishment scheduled completion, Unit 3 refurbishment begins

22,000 JOBS
Created and sustained annually

$4 BILLION
Annual investment in Ontario's economy

$1.2 BILLION
Annual investment in Ontario labour income

INVESTING IN THE FUTURE

Bruce Power's Life-Extension Program, which began on Jan. 1, 2016, will allow the site to operate through 2064. The program was ranked Canada's top infrastructure project in 2017.

The Life-Extension Program, which will extend the life of the units through inspections, asset investments and the advancement of the MCR Project, began with Unit 6 in 2020 and will upgrade Units 3-8 through 2033.

By expanding the life of the site until 2064, Bruce Power will inject $4 billion into Ontario's economy annually, while creating and sustaining 22,000 jobs across the province each year. The company will also continue to provide low-cost, clean and reliable nuclear power, good jobs and medical isotopes for decades.

That's fantastic news for Bruce Power, our 4,200 employees, the communities across Bruce, Grey and Huron counties, and the people of Ontario, where more than 90 per cent of our suppliers employ thousands of residents.

Fun Fact

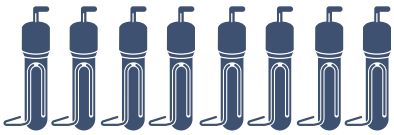
Bruce Power's Life Extension Program is one of the biggest infrastructure projects in the country.

MAJOR COMPONENT REPLACEMENT: ONE OF CANADA'S LARGEST INFRASTRUCTURE PROJECTS

The Major Component Replacement (MCR) Program will extend the life of Units 3-8 between 2020 and 2033. This will allow Bruce Power to provide safe, reliable, carbon-free and competitively-priced electricity for Ontario ratepayers through 2064.

The operation of the Bruce site through 2064 will create and sustain 22,000 direct and indirect jobs annually, while creating $4 billion in annual Ontario economic benefit through the direct and indirect spending on operational equipment, supplies, materials, and labour income.

MCR began in 2020 with Unit 6. These are the main path projects being completed during of the program, with the unit scheduled to return to service in 2023.



8 **steam generator** replacements — remove and install

960 **feeder tubes** — remove, supply and install

480 **fuel channels** and **calandria tubes** — remove, supply and install

16 **Bulkheads** — fabricate, install and remove

Subsequent MCRs in Units 3, 4, 5, 7 and 8 will occur between 2023 and 2033.

SAVING LIVES WITH MEDICAL ISOTOPES

Another way Bruce Power positively impacts millions of people is through the world's health care system.

Bruce Power produces Cobalt-60, which helps sterilize 40 per cent of the world's single-use medical devices and equipment. These supplies include sutures, syringes, gloves, surgical gowns and masks. Cobalt-60 is also used to sterilize pharmaceutical wares and cosmetics, and irradiate spices and other consumer products that include fruit, seafood, poultry and red meat.

The World Health Organization (WHO) estimates more than 640,000 major surgeries are performed each day around the planet , and sterile disposable medical devices are used in virtually all of these procedures. Cobalt-60 is supplied to over 200 gamma irradiators in 55 countries.

Bruce Power also produces medical-grade Cobalt-60, which treats brain tumours and other cancers. For many brain cancers, Cobalt-60 is one of the most precise and advanced forms of radiation treatment available. One of the technological advancements is Gamma Knife surgery, which uses an innovative tool that allows for non-invasive treatment of brain disorders. Stereotactic Radiosurgery using Cobalt-60 allows doctors to deliver higher doses of radiation to tumours, while limiting damage to the surrounding healthy tissue and organs.

For more about the role Bruce Power plays in providing medical isotopes to keep our hospitals safe and save lives, visit **brucepower.com/isotopes.**

INNOVATIVE NEW ISOTOPE SYSTEM READY TO JOIN CANCER FIGHT

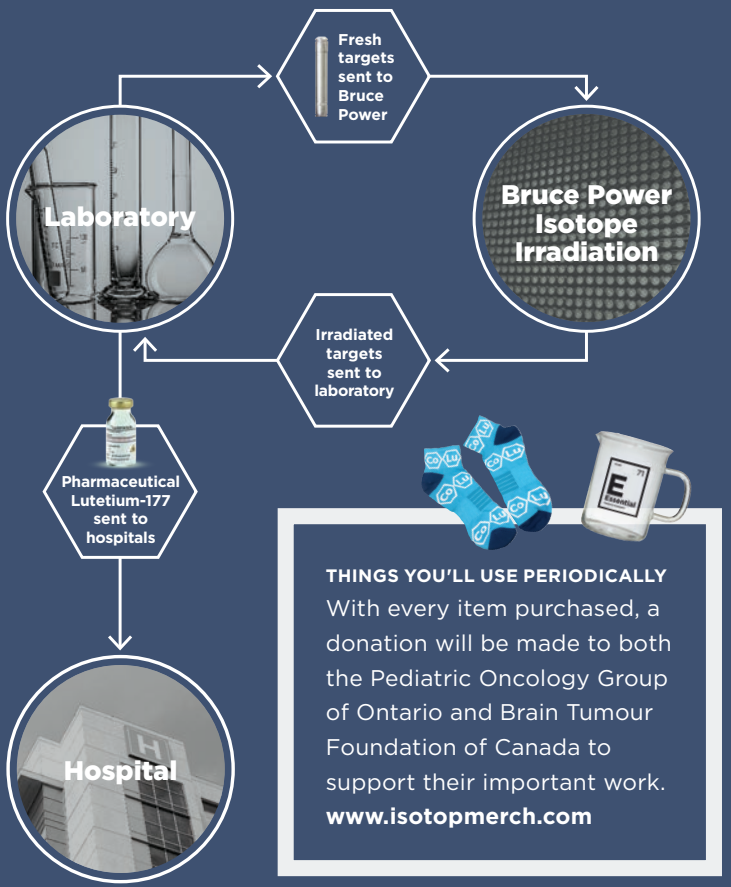
The installation of an innovative new Isotope Production System (IPS) has been completed on Bruce Power's Unit 7, and it will begin producing Lutetium-177, a medical isotope used in the treatment of various cancers in 2022, pending regulatory approval.

The IPS is a groundbreaking innovation by Bruce Power and Isogen (a partnership between Kinectrics and Framatome) that will make Unit 7 the first power reactor in the world with installed capability to produce Lutetium-177, used primarily in treatment of neuroendocrine tumours and prostate cancer.

The IPS will eventually be installed in other Bruce Power units and has the ability to produce other isotopes for medical uses.

Bruce Power will market the new isotope supply in an historic collaboration partnership with Saugeen Ojibway Nation (SON).

The partnership project with SON, named "Gamzook'aamin Aakoziwin," which means 'We are teaming up on the sickness' in the traditional Anishinaabe language, includes an equity stake for SON and a revenue-sharing program that provides a direct benefit.



WHAT IS COBALT-60?

Cobalt-60 is an isotope that emits gamma rays essential to the medical community for cancer treatments, as well as sterilization of medical devices.

STERILIZATION COBALT-60

Sterilization Cobalt-60 is the first and most widely used type of Cobalt-60. It is employed by industry to sterilize medical devices such as sutures, gloves and syringes. This type of Cobalt-60 is typically sourced from nuclear companies like Bruce Power in great quantities. Cobalt-60 from Bruce Power helps sterilize 40 per cent of the world's single-use medical devices.

MEDICAL-GRADE COBALT-60

Medical-grade Cobalt-60 is used worldwide to battle cancer and for radiation therapy for the treatment of complex brain conditions. Bruce Power has recently begun producing this new source of Cobalt-60, which ensures doctors and their patients have treatments when they need them, and access to new and innovative machines.

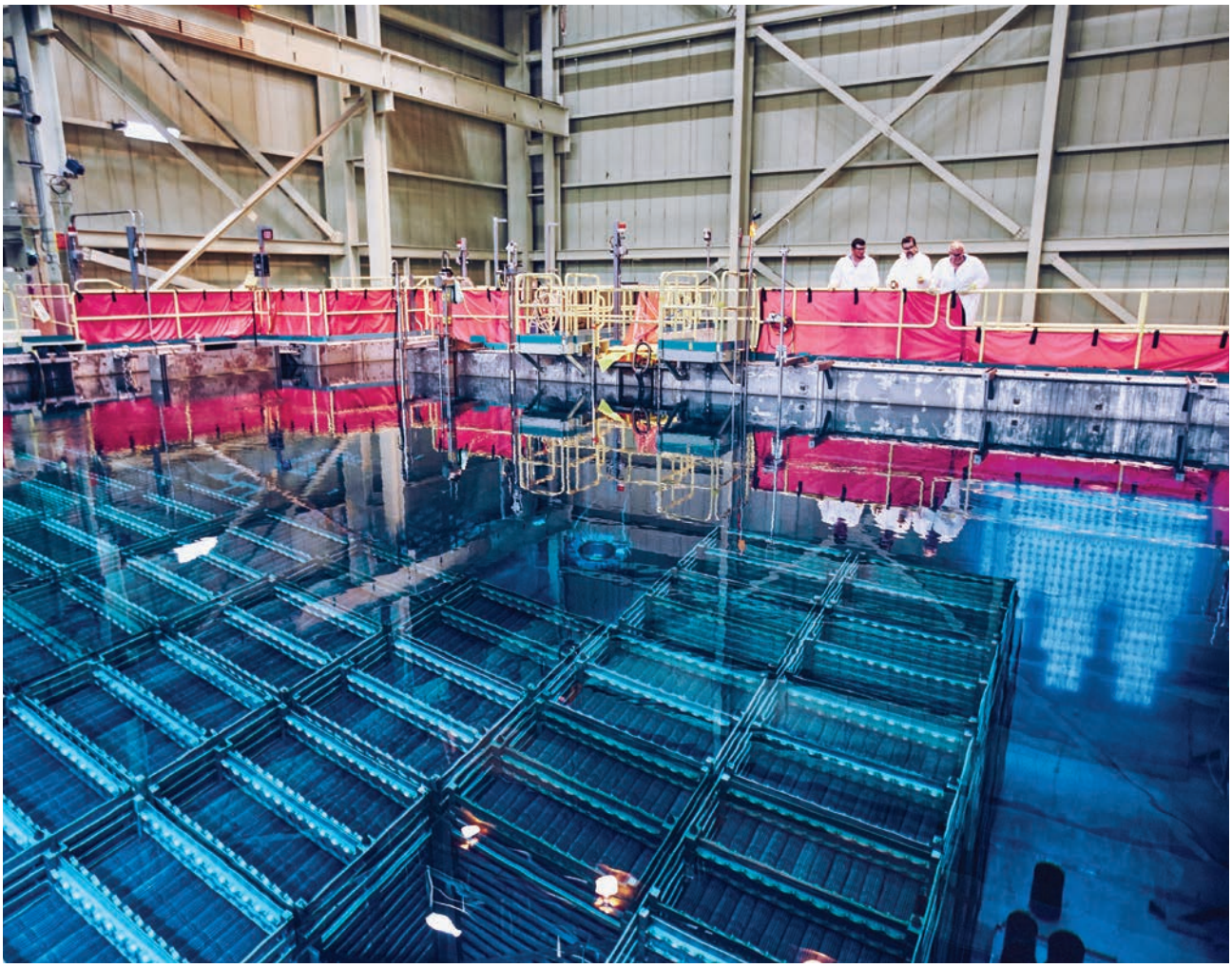
Fun Fact

An industrial-strength underwater camera provides a clear and unique perspective of the Cobalt rods. The rod on the far right contains medical-grade Cobalt-60 and is clearly identified by the zebra striped etching on the individual pencils. In each set of 24 rods, only four contain medical-grade Cobalt-60.

A coalition of over 30 Canadian science, health care and nuclear sector organizations launched the Canadian Nuclear Isotope Council (CNIC) to ensure Canada remains a world leader in the production of life-saving isotopes by raising awareness and supporting long-term policies at the domestic and international level. Medical isotopes are an important part of Canada's innovation agenda, and, beyond medicine, the nuclear sector contributes to a wide range of other scientific and economic activities, including energy, human health and safety, material testing, food safety, and even space exploration.

CNIC
CANADIAN
NUCLEAR ISOTOPE
COUNCIL

LEARN MORE AT:
www.canadianisotopes.ca



NUCLEAR CRUCIAL TO FIGHTING CLIMATE CHANGE

With Ontario, Canada and many countries around the world having committed to fighting climate change and achieving Net Zero carbon emissions over the next 30 years, nuclear has a major role to play as a clean-energy source.

In reality, there is no path to Net Zero without nuclear as it will be critical in providing baseload power as we harness all clean energy sources and new technologies.

The Canadian nuclear industry has a proven track record, helping to phase out coal in Ontario, resulting in the largest greenhouse gas reduction in North America.

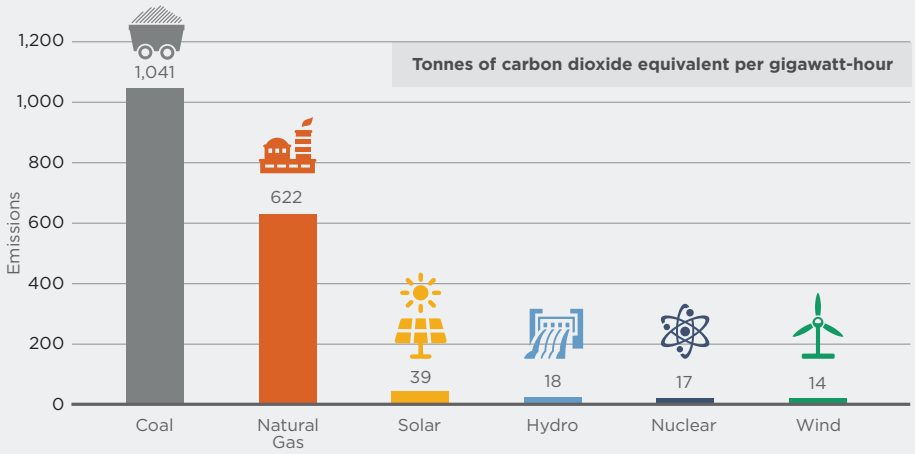
In the 1990s, when Bruce A's four nuclear units were shut down by the former Ontario Hydro, coal-fired generation rose from 12 per cent of the province's supply mix in 1995 to 29 per cent in 2000. This resulted in a high number of smog days and increased lung-health problems, including asthma exacerbations.

Since 2003, Bruce Power has refurbished these four nuclear units and doubled its output, providing 70 per cent of the energy the province needed to shut down all coal-fired generating stations — a feat that was accomplished in 2014, and is still considered one of the largest clean-air initiatives in North America.

Ontario's electricity system accounts for about 2 per cent of our carbon emissions, due to nuclear power providing 60 per cent of Ontario's power every day. Gram-for-gram, nuclear fuel contains one million times more energy than fossil fuels and to generate the same amount of energy as nuclear, solar would require about 100 times and wind about 500 times more land area.

Bruce Power has committed to become the first nuclear operator in North America to be a Net Zero company by 2027 and aims to meet its target by implementing energy and emission-reduction projects in its operations, finding alternatives to high-emission energy sources and, where further reductions are not feasible, pursuing emission offsets.

Comparison of Life-Cycle Emissions



Fun Fact

70 per cent of the energy the Province of Ontario needed to shut down coal plants was provided by Bruce Power.

NUCLEAR INNOVATION INSTITUTE

is proud to work with Bruce and Grey Counties to achieving Net Zero carbon emissions

$4.03 BILLION

contributed to Ontario's GDP from direct, indirect and induced effects

A NET ZERO ECONOMY

and clean energy future in Ontario and across Canada

Quick facts

CLEAN ENERGY FRONTIER REGION TO LEAD THROUGH INNOVATION

The Clean Energy Frontier Region, including Bruce, Grey and Huron counties, is home to Bruce Power, more than 60 nuclear companies, Ontario's Nuclear Innovation Institute (NII) and key electricity transmission lines that are connected to the fastest growing parts of the province, all bolstered by strong community support.

The region has what the rest of Ontario needs: clean energy technologies — starting with nuclear power — and the skills and expertise around new energy sources that can lead the transition to a robust, Net Zero economy.

This aligns with Bruce Power's Net Zero 2050 strategy that will see the Bruce Power Centre for Next Generation Nuclear at the Nuclear Innovation Institute expand exciting new opportunities for the region.

Bruce Power and its partners are exploring the ways in which nuclear innovation, including existing and new nuclear and fusion energy technology, alongside energy storage technologies such as hydrogen, battery, and pumped storage, can reduce electricity grid emissions while enhancing grid reliability and flexibility.

www.nuclearinnovationinstitute.ca/clean-energy-frontier

$2 MILLION
invested locally through various community-based programs

$400,000
annually in environment & sustainability programs

$100,000
in annual elementary, secondary and post-secondary educational scholarships

Invested in our community

GOLD CERTIFICATION
in the Canadian Council of Aboriginal Business (CCAB) Progressive Aboriginal Relations program

SOCIAL RESPONSIBILITY

Bruce Power and our employees are extremely active in our communities across Bruce, Grey and Huron counties.

Every year, we invest about $2 million into our communities through our Sponsorship and Community Investment Program, our Indigenous initiatives, an Environment and Sustainability Fund, and more than $100,000 in elementary, secondary and post-secondary educational scholarships.

Through the COVID-19 pandemic, Bruce Power has provided more than three million pieces of personal protective equipment to frontline workers, businesses, Indigenous communities and schools — the largest announced donation from a private-sector business in Canada. Bruce Power also provided financial, logistical, setup and volunteer support throughout southern Ontario, helping to vaccinate tens of thousands of people through its hockey hub clinic model.

Bruce Power also works closely with the Indigenous communities, on whose Traditional lands our site is located. We are an active member of the Canadian Council for Aboriginal Business and have three times been awarded a Gold certification in its Progressive Aboriginal Relations program, which is the highest level offered. We are only one of 15 companies in Canada to receive this designation.

We also hold many events each year, including National Indigenous Peoples Day celebrations, which welcome First Nation communities to our site to teach employees about their culture. Our employees have also continued to grow our Multicultural Day celebrations, where community members are introduced to different customs, arts, crafts and foods unique to dozens of different cultures from around the world, but whose descendants live in the Kincardine area.

Bruce Power employees are also very active in their communities, providing countless hours as volunteers for non-profit and sports organizations, community betterment projects, and more.

Fun Fact

During renovations during the COVID-19 pandemic, the Visitors' Centre removed or updated over 15 of its exhibits.

PUBLIC EDUCATION

Bruce Power believes access to factual information is an important part of understanding and trusting nuclear power generation.

That's why our Visitors' Centre welcomes thousands of people through its doors annually, providing interactive and educational presentations and exhibits for all ages. It's also why we introduced our Summer Bus Tour Program in 2014, which has been a major success, drawing about 30,000 participants from across Ontario, Canada and the world for a look at our site.

During the COVID-19 pandemic, the Visitors' Centre was closed to the public. This gave us the opportunity to revamp the facility and the exhibits, bringing a fresh perspective to our public outreach initiatives.

Visit **brucepower.com/visit** for more information or to sign up for a tour.

Fun Fact

The turbine halls at Bruce A and Bruce B house four turbine generator units apiece. At 450 metres in length, each turbine hall could contain four regulation-sized soccer pitches.


5-3SE
5-3SW
5-4ASE
5-4ANE
NO STORAGE OF MATERIAL WITHIN 1 METERS

Fun Fact

CANDU reactors are designed to run at full power for long periods using the heat from fission to boil water into steam. Each reactor outputs one million horsepower of steam pressure, which converts to kinetic energy inside massive turbines. Each unit has a series of turbines connected to a generator, which converts the rotational energy to electricity.

BrucePower™
Innovation at work

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