

PARTNERSHIPS FOR A BETTER TOMORROW



Just ahead of the world meeting on COP21, the United Nations laid out seventeen Sustainable Development Goals. These goals are designed to ensure the prosperity of developed countries and to improve living conditions in developing countries by 2030. Thanks to the work of nuclear science, we can meet nine of these seventeen goals. From the food we eat to the water we drink to the energy we use; our lives have been made safer and healthier because of nuclear science and its innovative applications. This is nuclear's important, yet often forgotten about, contribution to global sustainable development. The supporting facts are set out below.

2 zero hunger

- The Food and Agriculture Organization of the United Nations (FAO) reported that up to **40% of crops are lost** on a yearly basis because of disease and pests.
- Applying nuclear science techniques like crop mutation breeding (using small amounts of radiation to alter the DNA of plants) is a proven effective method for producing plants that are more resistant to the impacts of climate change.
- A nuclear science technique known as the Sterile Insect Technique (SIT) has proven effective to help eradicate crop destroying pests without the use of pesticides, which are harmful to both humans and the surrounding environment. As one example, the codling moth program in the Okanagan-Kootenay region of British Columbia has seen a dramatic reduction in apple worms or codling moths thanks to the SIT technique. Because it doesn't involve the use

of harmful chemicals, it is also able to protect the surrounding greenspace and waterways, while saving local fruit crops. The Sterile Insect Technique can address many different types of pest issues and, in fact, it has been used in **six continents for more than 60 years**, helping to protect agriculture commodities.

 Nuclear science can also detect micronutrient deficiencies which means helping hundreds of millions of children every year. The World Bank has highlighted the importance of nutrition in babies and children, pointing out that investments in nutrition can save one million lives and help 260 million more by preventing stunted growth and impaired brain development. Micronutrients such as iron, zinc and vitamin A are all key building blocks for development. Stable isotope techniques can assess the availability of these micronutrients in our bodies and a child's ability to absorb them.



DID YOU KNOW?

One hundred countries use radiation- based plant breeding techniques to improve their food and industrial crops. In fact, worldwide over 3000 new varieties of crops have been officially developed by countries using such techniques.

3 good health and well-being

- According to the World Nuclear Association (WNA), over 40 million nuclear procedures are performed every year and the demand for nuclear medicine is forecast to double by 2020.
- Diagnostic nuclear medicine is a critical component to diagnosing health problems based on the function of organs, tissues or bones.
- Nuclear materials are also used in biotechnology, analyzing specific molecules inside the body to improve human health. They are an essential research component for chronic illnesses like **AIDS and Alzheimer's**.
- Radioactive isotopes are integral to nuclear medicine and the healthcare system, due to their ability to diagnose and even **treat various cancers**, cardiovascular disease, tuberculosis and other infections. They can also be used to screen for bone structure and blood circulation amongst many others.

DID YOU KNOW?

The nuclear by-product cobalt-60 plays an important role in nuclear medicine. Low-grade cobalt-60 is excellent at killing off potentially harmful and deadly bacteria making it an effective solution to sterilize medical equipment such as syringes and catheters to keep patients safe. High-Speed Activity (HSA) medical-grade cobalt-60 has been widely used for over half a century to treat cancer patients. Over 70 million people have been helped thanks to cobalt-60 radiation therapy and these machines are still in use today.



6 clean water and sanitation

- Clean and available water supplies are critical to economic development and human health.
 UNICEF estimates that billions of people, most of them children under five, are directly impacted by water and sanitation issues.
- A nuclear science technique that involves the use of electron beams (e-beams) can break apart the chemical bonds of clothing dyes, allowing for such toxins to be removed and the water to be recycled for re-use. The largest textile industry in the world, China, opened an **e-beam wastewater treatment facility** in 2017 to treat and reuse industrial wastewater.
- Nuclear reactors, in addition to providing electricity, can also be a source of clean water supply for communities and countries in need. Approximately 96% of the planet's water lies in the ocean where it is full of salt and not suitable for drinking. Additionally, one in three people are affected by a lack of drinking water. Nuclear plants produce tremendous heat which drives steam turbines to make electricity. They are capable of using this leftover heat to boil ocean water and then when the steam condenses, it becomes pure, clean water; the salt can be returned to the ocean.

DID YOU KNOW?

It is estimated that upwards of 20% of global industrial water pollution comes from the textile dyeing industry which heavily relies on water in the production of clothing If not cleaned properly, these toxic chemicals can end up in local water ways, permanently polluting them.



7 affordable and clean energy

- Sustainable development is achievable only with access to clean, reliable and affordable energy. Energy is connected to all human activities and is the engine for economic sectors like agriculture, industry, commerce and even transportation. Still, one billion people live without access to electricity.
- Adding to this, current IAEA projections forecast energy demand rising by an astonishing 60-100% by 2030. If the world is to meet the Sustainable Development Goals and help lift people out of poverty, as well as meet energy demands while at the same time not running away from our

COP21 commitments on reducing greenhouse gas emissions, then we must continue to invest in low-cost, low-carbon, baseload (available day or night) energy.

• Canadian company Cameco is a world leader in the supply of uranium. Most of Canada's uranium is mined in Northern Saskatchewan, home to the highest-grade deposits in the world. For decades, the communities have **sustainably mined** the resource and have used the benefits of this resource to develop livable northern and indigenous communities in which the uranium is found.

DID YOU KNOW?

About 60% of the cost of nuclear is die to construction of the facility. Once built, nuclear has tremendously low fuel and maintenance prices, providing stable electricity prices during the plant's lifetime of up to 60 years or more. According to the Ontario Energy Board, in 2016, nuclear costs just under seven cents per kilowatt hour, far below the 48 cents for solar and just marginally off the six cents for hydro.

9 industry, innovation and infastructure

- The nuclear industry is pursuing innovative research and development in the area of nuclear energy options for the future. These involve more efficient fuels and new fuel cycles,
 Generation IV reactors, hydrogen fuels, small modular reactors (SMRs) and fusion energy.
 These innovative technologies focus on achieving dramatic improvements in safety, cost and environmental footprint, to name a few.
- Nuclear techniques and innovation in their application are helping to make **roads and air travel safer** thanks to non-destructive testing. As one example, Nray Services in Dundas, Ontario, has been testing engine turbine blades for 95% of the entire aerospace industry using a neutron beam for the last 20 years.

DID YOU KNOW?

There are 12 major nuclear research centres in Canada. Seven of them use research reactors and five are based on cyclotron technology. These research centres are key facilities for promoting innovation.



13 climate action

- In 2014, the world hit a record high 37 billion tonnes of CO₂ emissions. Using low-carbon energy sources helps to limit the amount of emissions produced. In Canada, reactors operate in the provinces of New Brunswick and Ontario. It is estimated that nuclear power generation in Canada avoids over 45 million tonnes of carbon dioxide emissions every year. Globally, nuclear power avoids 2.5 billion tonnes of CO₂ emissions every year, equal to taking approximately half of all (520 million) cars off the world's roadways.
- Nuclear power is the largest non-hydro source of low-carbon, clean energy worldwide, providing almost 12% of global electricity production.

In fact, according to the Intergovernmental Panel on Climate Change (IPCC), nuclear power produces a mere 16g of CO₂ per kilowatt hour (kWh), making it one of the **cleanest forms of energy**. Only tidal, wind and hydro produce less. Because the average Canadian household consumes approximately 30 kWh of electricity each day, electricity from low-carbon sources like nuclear reduces the impact of our activities on the climate.

• Nuclear energy also minimizes the amount of CO₂ and other noxious gases produced in electricity generation thereby reducing harmful air pollution and GHG emissions.



14 life below water

- Ocean acidification is a change in the chemistry balance of our oceans due to an increase of CO₂. Our oceans are excellent carbon sinks/storage tanks. It is estimated that our oceans have absorbed nearly half of all CO₂ emitted in the last two centuries.
- Increasing amounts of carbon dioxide leaves less carbonate in the oceans. This carbonate is a **fundamental building block** for numerous marine organisms. Increasing amounts of carbon have a negative impact on both corals and other marine organisms, such as shellfish. This increase in ocean acidity also impacts

humans as the **shellfish we consume** relies on healthy coral reefs to build their shells.

 As was pointed out by The National Centers for Coastal Ocean Science (NCCOS), it also results in lower oxygen levels in the ocean and higher risks for red tide. Red tide is a colony of harmful algae blooms that can produce potentially fatal toxins (brevetoxins) which can wipe out fish and marine life by attacking the nervous system. Ingesting shellfish infected with brevetoxins can **potentially kill humans** through something known as Paralytic Shellfish Poisoning (PSP).

DID YOU KNOW?

Nuclear science techniques relying on the use of radioisotopes can diagnose the impacts of ocean acidification on the food chain, giving scientists a better understanding of how rising acidity impacts shellfish health.



15 life on land

 Our forests serve as a canopy for the habitat of numerous animal and plant species. They also serve as **natural carbon sinks**, sucking in carbon and producing oxygen. Clearcutting and other activities can cause widespread damage to various ecosystems that call the forest their home. A nuclear technique known as **stable isotopes** is a valuable environmental risk assessment tool. These isotopes can identify various contaminants; thereby assisting with monitoring and remediation.

DID YOU KNOW?

Nuclear is the most efficient power source by land area. It is at least 15 times more efficient than renewable sources for overall land area usage.



17 partnerships for the goals

- Partnerships are at the very core of our success in the nuclear industry. A key partnership in Canada is the refurbishment project, a collaborative effort between the government of the province of Ontario and industry. This effort will ensure the successful life extension of ten reactors. The refurbishment project, which will last approximately 15 years, will create thousands of jobs and extend the life of the reactors for another 30 years.
- The global nuclear community has a long list of partnerships including various UN agencies such as the Food and Agriculture Organization (FAO), the World Health Organization (WHO) and many others.

- By combining the skills and expertise of various stakeholders in search of a common goal, the nuclear industry works collaboratively with other stakeholders to **find solutions to some of the world's most pressing problems**.
- Our commitment to the world community includes working with various communities to build stronger relationships and to be able to work together to ensure sustainable development. As one example, Cameco Corporation, the largest employer of First Nations people in Canada, has spent over 30 years partnering with communities in Northern Saskatchewan. This has included everything from ensuring sustainable business practices, investing in needed community resources, job-training and employment.



DID YOU KNOW?

The nuclear industry has a long list of partnerships with various industries and organizations. Some of our partnerships have included:

- ✓ Asthma Society of Canada
- ENGO's such as Energy for Humanity
- ✓ Indigenous Northern Communities
- \checkmark Universities



canadian nuclear association