

ALTERING PERCEPTIONS
Creating meaningful dialogue. **p02**

PANDORA'S PROMISE Behind the scenes with director Robert Stone. **p02**

NUCLEAR MEDICINE
Improving patient care. **p03**



Within Reach
Canada has never been closer to realizing its nuclear potential.

Starting the Conversation on Nuclear

"Modern society could not operate without the contribution of nuclear technologies," explains Dr. John Barrett, President of the Canadian Nuclear Association.

"Our homes and offices would not have smoke detectors, bridges would not bear weight as reliably, aircrafts would not fly as safely, pipelines would leak more often, and more of our friends and neighbours would die of undiagnosed heart disease and untreated cancers."

In short, the fruits of nuclear technologies are all around us—in clean and reliable energy production, food safety, manufacturing, medicine and much more.

Yet, despite the many and varied uses of nuclear technologies, Canadians are surprised at the extent to which nuclear contributes to sustaining our standard of living and quality of life. As such, building public awareness around the enormous benefits of nuclear technologies remains an important goal.

Clean, safe and reliable energy
Canada has a long history of nuclear generation. Since 1962 when the Nuclear Power Demonstration (NPD) re-

actor came online in Rolphton, Ontario, nuclear power has been an essential component of Canada's energy supply mix. Today, it provides nearly 17 percent of Canada's daily needs, and accounts for as much as 62.7 percent of the electricity used in Ontario.

This growth in nuclear generation has, by virtue of it being an emissions-free source of energy, helped to mitigate the impact of climate change, according to Dr. Barrett.

"People sometimes assume, mistakenly, that clean energy is renewable energy," says Dr. Barrett. "I think that's it's important to point out that if you're thinking of clean, with respect to pollutants or particles put into the air, or greenhouse gas emissions, by those standards, nuclear is very much a clean source of energy."

Multiple applications

Nuclear technologies contribute to our quality of life in other ways too. Take medicine, for example, where radiation and radioisotopes play a vital role in the diagnosis and treatment of various medical conditions such as cancer.

Similarly, nuclear technologies are used in manufacturing to assess the quality of workmanship, in



Dr. John Barrett
President & CEO,
Canadian Nuclear Association

food production to breed disease-resistant plants, and in civil engineering to create safer materials.

"The point is here that people have various views about the use of nuclear reactors to produce electrical power because that's where they see it most. But nuclear technologies are used in a great variety of ways," says Dr. Barrett.

"I met a group of researchers at Chalk River who were working on a project where they had discovered that by using neutron techniques, they could image the chests of premature babies who had trouble breathing. And that discovery

"Canada plays a significant role in improving the safety, efficiency and flexibility of nuclear technologies."

led to the development of a kind of pharmaceutical to help alleviate breathing problems," he says.

Innovations at home and abroad

Given our widespread use of nuclear technologies, it should come as no surprise that Canada plays a significant role in improving the safety, efficiency and flexibility of nuclear technologies.

These innovations have, in turn, had a positive effect on the quality of life in other countries around the world that have adopted our practices and technologies.

"Countries that have bought and are using CANDU reactors include South Korea, Romania, Argentina, and China," says Dr. Barrett.

"What's happening now with CANDU energy is they're negotiating with China to build a couple of new reactors that are called Advanced Fuel Reactors. And these new reactors can use fuel other

than enriched uranium, and can extract more energy than other reactors," he says.

Bright future

With nuclear generation playing an increasingly larger role in Canada's energy supply mix and the recently announced commitment by the Ontario government to refurbish ten reactors in Ontario, Canada's nuclear industry is poised for continued growth.

However, in order to maintain this growth, public awareness about the benefits of nuclear must increase.

As was declared at the 2014 Nuclear Industry Summit, "continued public confidence is essential for the application of nuclear technology, and the extensive benefits that it brings." ■

By Benjamin Chacon

PROMATION

PAST 20 YEARS OF SOLID START, SOLID GROWTH, SOLID PERFORMANCE







FUTURE 20 YEARS OF SOLID START, SOLID GROWTH, SOLID PERFORMANCE





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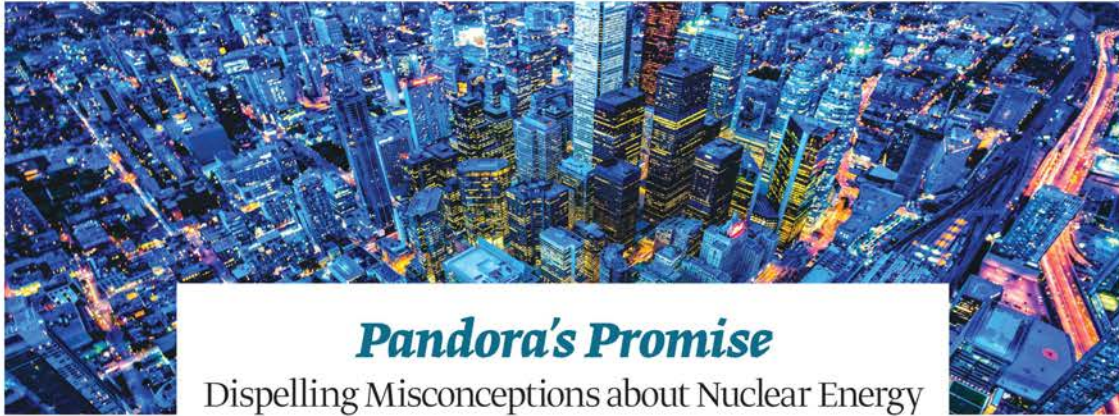
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**Pandora's Promise Official Trailer**

Nearly two years since the film's release, Robert Stone continues to spark meaningful discussion on the importance of nuclear energy.
Exclusive Video

**Nuclear Safety**

Understand how Canada makes safety a top priority when generating nuclear energy.
Exclusive Article



Pandora's Promise

Dispelling Misconceptions about Nuclear Energy

Mediaplanet caught up with Academy Award-nominated director, Robert Stone, to discuss his pro-nuclear documentary entitled Pandora's Promise and his on-going efforts to change people's perception about Nuclear energy.

Mediaplanet What was the overall goal that you wanted to accomplish with the film Pandora's Promise?

Robert Stone My purpose in making the film was directly to challenge that taboo subject of nuclear energy as it relates to the environmental movement, and to reintroduce it as a point of serious discussion as one of the most effective solutions to replace fossil fuels and to successfully mitigate climate change. It struck me as a supreme irony that the mainstream environmental movement is united against the one technology that offers perhaps the best hope of solving the world's most pressing environmental problem.

MP What initially drove you to create a documentary about, and spark discussion on, nuclear energy?

RS After making a previous film ("Earth Days") about the rise of the environmental movement, it became increasingly apparent to me that the tools and tactics that had worked so well to combat things like air pollution and water pollution have proven thoroughly inadequate in tackling a very different problem like climate change. The deeper I looked into this

I realized that much of the philosophy and basic understanding of the nature of the problem that forms the basis of today's environmental movement is thoroughly out of date and is based on ideas and concepts that no longer stand up to scrutiny.

MP It has been two years since the film's release – how have you seen misconceptions altered?

RS I've seen huge changes in the last couple of years. Obviously one film can't take credit for this change, but I think the film helped to open the door to a re-evaluation of nuclear energy among those who were formerly opposed to it and made it safe for those who did support this technology to be more vocal and open about it. That has had a cascading effect in that nuclear energy is now something that's more widely acknowledged as a clean energy technology that can play a major role in combating climate change. Differences in opi-

nion on this within the environmental movement are now out in the open and there's a fierce and vigorous debate going on about it. I don't think we're at a tipping point but I think we may be approaching one. Young people, in particular, have a completely different conception of this technology than the old guard who lead the environmental movement. This generational split will only become more apparent as time goes on.

MP What has been your favourite reaction to the film so far?

RS That's a hard thing to put my finger on because the whole experience has been incredibly rewarding on so many levels. People come up to me all the time telling me how the film has changed their life and how as a result of seeing it they're devoting themselves to seeing nuclear energy be more widely accepted among their peers. I think the most heartening thing has been to see how the film has been received by

rank and file environmentalists both at environmental film festivals (where it's won several awards) and on college campuses. The reaction has been overwhelmingly positive and people come away transformed in how they consider the role of nuclear going forward. Most documentaries tend to preach to the converted, but this one seems to have drawn an audience that is predisposed to oppose its premise and has actually turned them around. That's a rare thing of which I'm extremely proud to have accomplished.

MP What do you believe Canadian's fail to understand about nuclear energy?

RS I don't think Canadians are any different than anyone else in what they understand or fail to understand about nuclear energy. I don't think that many Canadians know that Toronto has one of the lowest per capita CO2 emissions of any major city in the world, thanks largely to its dependence on nuclear energy. I don't think many Canadians are aware of

how important a role Canada has played in the development of nuclear energy with the CANDU reactors being among the most highly regarded in the world. Canada is also leading the way with next generation advanced reactor development with companies like Terrestrial Energy. So I actually think Canada may outpace the United States in being at the forefront of the coming clean energy revolution, with advanced nuclear being a big part of that, along with renewables like advanced solar, hydro, and wind.

MP What is next for you?

RS I'm currently making a film about the political and cultural history of the race to the moon. It's a reflection on a time when there was genuine optimism about the future and about the promise of high technology to solve problems – a time when our vision as a society was expansive and aspirational. What's interesting is that this was not just a natural consequence of the time, it was in large part an outgrowth of determined leadership and follow-through on the part of our political leaders to set long range, seemingly impossible goals that inspired us to feel a part of something bigger than ourselves. It's not a nostalgia film about "the good old days," is an inspirational film about human possibility and optimism. In the pessimism and small bore thinking that dominates much of our political discourse today, I think there are some lessons to be learned from this last great collective experience at thinking big and dreaming of a brighter future. ■



"I don't think that many Canadians know that Toronto has one of the lowest per capita CO2 emissions of any major city in the world, thanks largely to its dependence on nuclear energy."

Education and Outreach: Vital to Creating Objective Conversation Around Nuclear

Canada was an early world leader in nuclear innovation, and our technologies and expertise have been exported worldwide.

We are also the world's second largest producer and exporter of uranium, which is used across the globe to fuel nuclear reactors. In fact, in many parts of the world, when you bring up Canada, nuclear power is one of the first things people think of, just after maple syrup, hockey, and Mounties.

And yet, within Canada, something has changed in the last fifty years. Fewer Canadians are identifying the nuclear industry as an important part of Canadian identity, and public support for nuclear power is at a low. If that doesn't change, it bodes ill for Canada's economic future.

Fear and seduction

"Fear and seduction come into decision making much more than is appropriate," says Neil Alexander, Executive Director of the Sylvia Fedoruk Canadian Centre for Nuclear Innovation at the University of Saskatchewan. "With some of the challenges the world has to face, we've got to start removing the fear from that equation. We need people to support technologies based on rational, factual, and contextually-relevant arguments."

No member of the public has ever

been harmed by a nuclear incident in the long history of the nuclear industry in Canada. But, as we work to eliminate the irrational fear of nuclear power, we must also work to temper the optimistic seductiveness of new technologies. People are drawn to renewables because of their promise to provide cheap clean power, supposedly devoid of drawbacks. The reality is quite a bit different. "People are being led to believe that certain things can be achieved with renewables that are just unrealistic," says Alexander. "With the technologies that we have available to us, and that we anticipate having available to us in the foreseeable future, options like wind and solar cannot provide the input that's needed to operate our electricity system in a way that allows us to keep our houses lit and our businesses operating."

Solar and wind are incredible technologies that can contribute strongly to the grid, but they remain intermittent and location dependent, meaning that other power sources must provide the bulk of our base load demand. Rather than replacing existing technologies, the role for renewables is to coexist with nuclear and natural gas to keep our power mix robust and flexible.

In Ontario particularly, nuclear has long been the go to answer for base-load generation. "In Ontario nuclear

provides roughly 60 percent of our power supply," says Heather Kleb, President of Women in Nuclear and Past President of the Canadian Nuclear Association. "It's a clean, reliable, low carbon power source that turns the lights on when you need them." And with the advent of new technologies like small modular reactors, we are seeing the possibility of a future where small-scale nuclear can add clean, safe, and reliable energy to the mix even in Canada's smallest and most remote communities.

Canada is a nuclear economy built on nuclear jobs

The contribution of the nuclear industry in Canada goes well beyond just energy generation, however. It is a vital part of our economy and a massive employer, which is more important now than ever before. If young Canadians and traditionally underrepresented groups like women consider a career in the nuclear industry, not only will they have incredible employment opportunities, but they will also get to help shape the direction of the industry and conversations surrounding it in the future.

"The nuclear industry offers highly-skilled, well-paying jobs, and it's important that we draw the attention of women and young people to the opportunities that are becoming available, especially with the aging workforce

and existing gap in the skilled trades," says Kleb. "And given that women are an underrepresented group, they serve as a particularly opportune pool of potential workers for these great jobs." And these aren't just technical jobs. "In an industry this large, support roles are a huge segment of the overall workforce. "We do try to promote an interest in engineering, science, technology, and the trades," says Kleb. "At the same time there are a whole series of other disciplines that support this industry, from legal to administrative and beyond."

A future where Canada is nuclear and proud

For all these reasons, organizations like Women in Nuclear and the Fedoruk Centre are working to change the public perception of nuclear power in Canada. Education is at the heart of this initiative, as the better people understand nuclear power, the more supportive of it they become. It's all about washing away the fear and uncertainty with knowledge and involvement. "With greater involvement, you get greater awareness and support for the industry," says Kleb. "If you look at the communities where nuclear facilities are operating, you find greater support for the industry locally."

The Fedoruk Centre particularly is working to provide balanced, fact-based information about nuclear power and issues such as radiation, with the

goal of empowering people to make their own informed decisions. At the same time, the Fedoruk Centre is also supporting social sciences research about how to best communicate about complex technical issues like nuclear power. "There is a lot of opportunity for innovation in the nuclear sector – not just in terms of technology but in how the industry communicates with people," says Alexander. "Canada could lead the way in this area."

The truth is that the nuclear industry has deeply and positively impacted the lives of everyone in this country. It not just energy and jobs; the technological evidence is all around us. The smoke detectors in our homes work through the use of nuclear byproducts. The buildings we work in are made safe through radiographic nuclear structural imaging. And our hospitals are filled every day with more nuclear medical technology to help us image, assess, and treat our illnesses.

The Canada of today is one that was built in no small part on the nuclear industry, and the brightest vision for the Canada of the future relies on that industry remaining strong and able to continue providing us with electricity, jobs, and new technological advancements. It is past time for Canadians, especially young Canadians, to re-embrace Canada's nuclear legacy as a source of national pride. ■

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How Nuclear Medicine is Advancing the Diagnosis and Treatment of Disease and Illness

By Ken Donohue

It has the sound of science fiction. Small amounts of radioactive material inserted into a patient to diagnose and determine the severity, or treat a variety of diseases. It's called nuclear medicine and its use is saving lives and improving the quality of life for those struggling with illness. You might also not know that Canada is a leading producer of the radioactive material, called a medical isotope, with about one-third of the world's supply produced at Ontario's Chalk River Laboratories.

"Nuclear medicine has been used for more than 50 years, and it's a safe procedure with low radioactive exposure," says Dr. Christopher O'Brien, President of the Ontario Association of Nuclear Medicine. "In fact, it's less exposure than you'd get from an X-ray or CT scan."

The medical isotope emits a small amount of energy after being inserted into the body, which is detected by a special camera, and with the assistance of a computer produces images that assess the function of organs and tissues. This non-invasive and painless procedure has revolutionized the way doctors diagnose and treat diseases.

How nuclear medicine is benefiting patient care

"A typical X-ray would show us the anatomy of an organ or other part of the body," says O'Brien, "but nuclear medicine is much more precise in telling us where the disease is at." This information is valuable to patients and doctors, so the illness can be properly treated.

Nuclear medicine is commonly used in the diagnosis of bone infections or

fractures, cancers, heart disease, blood clots in the lungs, inflammatory bowel disease and Crohn's, stroke and Alzheimer's. Increasingly it's being used for patients with lung disease, providing a better tool to detect and diagnose the disease early to prevent further lung deterioration and to individualize treatment for patients.

According to O'Brien, studies suggest that in 30 percent of cases, nuclear medicine is able to offer more appropriate diagnosis and treatment than what was originally thought.

Dr. Andrew Ross, Division Head, Nuclear Medicine at Halifax's QEII Hospital and President of the Canadian Association of Nuclear Medicine says nuclear medicine is sort of like the Sherlock Holmes of medicine. "We can see the subtleties really well," he says. "A twisted ankle might look normal on an X-ray, but there may be small fractures that get overlooked, or patients with a history of breast or prostate cancer come to us with back pain. With a simple test we can solve the mystery, and determine if it's structural pain, or if the cancer has spread."

Ross adds that while less than 10 percent of diagnostic imaging uses nuclear medicine technology, it is indispensable for the difficult cases that a CT scan or X-ray can't figure out. Additionally, given that it is non-invasive, it is safer than other procedures, because it doesn't have the same kinds of potential side effects that other procedures have. It's a better option, for example, than feeding a catheter into someone's heart when assessing blood supply to the heart.

While nuclear medicine is effective at diagnosing disease, or bone and tissue damage, it can also be used to treat

cancer and other medical conditions. If there is cancer in the liver, doctors can shoot tiny amounts of the radioactive material into the liver, shrinking the tumor and destroying the cells. This technology allows doctors to assess if the treatment is working, and in some cases, it might mean patients wouldn't require multiple sessions of chemo or hormone therapy. This is better for patients' quality of life, and reduces the cost to the health system.

New advances lead to better treatment

There have been significant advances in the use of nuclear medicine. The medical isotopes are much more sophisticated, and the equipment and cameras used are much better. One of the biggest evolutions in recent years is the use of hybrid imaging, which combines the benefit of seeing the anatomy with a CT scan with a nuclear imaging camera. "This is tremendously helpful," says Ross. "With more accurate diagnosis and treatment we can prevent debilitating treatment or surgery that is not necessary."

The next breakthrough in nuclear medicine is finding applications for new medical isotopes, and expanding their use. One example, according to Ross is a new medical isotope approved for use in Europe and the U.S. that is more accurately diagnosing Alzheimer's disease. "The burden of this particular disease is rising, and it's difficult to diagnose," he says. "This is an especially exciting time for nuclear medicine. New isotopes will lead to new clinical options by identifying the right patient with the right treatment, and absolutely this will improve treatment and save lives." ■

INSIGHT



Bob Chiarelli
Ontario Minister of Energy

Powering Ontario

Medioplanet sat down with Ontario Minister of Energy, Bob Chiarelli, to discuss the bright future of nuclear energy in Ontario and nationwide.

Medioplanet What should Ontarians know about the role that nuclear energy plays in their energy mix?

Bob Chiarelli A major advantage of Ontario's supply mix is the diversity of our generation: 90 percent of the grid-connected power generated in Ontario in 2014 came from emissions-free sources of energy such as water, nuclear, and renewables. Nuclear provided approximately 60 percent of our round-the-clock, year-round energy in 2014.

The refurbishment of Ontario's nuclear fleet, for example, represents a multi-billion-dollar investment and our continued support of the province's nuclear supply chain and operations for decades to come. Refurbished nuclear is one of the most cost-effective options in the long-term planning of the electricity system, and is creating a strong foundation where Ontario's nuclear suppliers are in a strong position to market their products and services to a global nuclear industry that could reach over 500 reactors by 2030.

MP Ontario is home to world-class nuclear innovation and know-how. What strides can be made to help develop and keep top talent?

BC We have made important investments in nuclear generation, which continues to be the backbone of Ontario's supply, and have been successful in exporting Canadian technology such as the CANDU reactor around the world to countries including Argentina, China, India, Pakistan, Romania, and South Korea. Nuclear power is also part of Canada's science and innovation advantage, involving more than 30 universities and six major research centres, many of them in Ontario. Ontario strongly supports a long-term strategy that continues to ensure that Canada maintains its national capability and global recognition as a leader in nuclear innovation.

Earlier this year, my ministry launched two requests for bids on studies on advanced nuclear opportunities: one on small modular reactors, and one on the recycling of used CANDU fuel. We are currently evaluating the bids and look forward to seeing the reports.

MP A commitment has been made to refurbish a number of the province's existing reactors. What does this mean for Ontario?

BC Ontario will ensure a reliable supply of electricity by proceeding with the refurbishment of the province's existing nuclear fleet. The refurbishment of units at the Bruce and Darlington generating stations is expected to begin in 2016 and has the potential to renew 8,500 MW over 16 years.

Ontario's nuclear industry creates jobs and growth across many sectors. The nuclear industry generates \$2.5 billion in direct and secondary economic activity in Ontario annually. An additional 9,000 jobs are expected to be created as a result of the proposed refurbishment, bringing the total number of people employed in Ontario's nuclear energy sector to approximately 25,000.

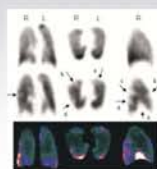
Read more from Minister Chiarelli
industryandbusiness.ca

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Nuclear Power Offers Ontario The Most Benefits



By DON MACKINNON
President
Power Workers' Union

Today's decision-makers are faced with the challenges of sustaining and creating jobs while tackling climate change. Concurrently, energy security has assumed greater importance as developing economies compete for non-renewable, carbon-emitting fossil fuels. A cacophony of special interests advocating the merits and benefits of their preferred energy solution(s) add another layer of complexity.

In Ontario's case, independent analyses continue to show that nuclear power is our province's best option for delivering low-carbon, affordable, reliable electricity while generating high-value jobs and economic wealth.

Recently, the International Energy Agency concluded that nuclear power generation capacity will need to double by 2050 for the world to meet the international 2°C (3.6°F) warming goal. Annually, Canada's nuclear reactors help avoid about 90 million tonnes of greenhouse gas (GHG) emissions, about the same as taking 81 percent of Canada's cars off the road. This contribution will decrease significantly in 2020 when the 3,200 MW Pickering Nuclear Generating Station is scheduled to cease operation. Any decrease in low-carbon nuclear generation translates into increased reliance on high-carbon natural gas generation.

In contrast, an analysis by Strategic Policy Economics (Strapolec) underscores the GHG reductions that can be achieved by refurbishing Ontario's nuclear reactors and building new reactors at Ontario Power Generation's Darlington site. These investments would reduce incremental GHG emissions after 2023 by 108 million tonnes, which represents 80 percent less emissions than continuing to build intermittent wind generation backed up by natural gas.

Opponents like to characterize nuclear power as an expensive source of electricity generation. Expert analyses show this to be incorrect from a number of perspectives. According to the Ontario Energy Board, the cost of electricity production in 2014 ranged from: 4.8 cents/kWh for hydroelectric, the cheapest; followed by nuclear at 6.0 cents/kWh; 12 cents for wind; 12.6 for bioenergy; 13.4 cents for natural gas (most sold at peak rates); and, solar at 48.9 cents/kWh.

While upfront costs can be high for the refurbishment or building of new nuclear reactors, expenditures can be spread out over decades of operation. This ensures price stability, sustaining a competitive advantage for our businesses and industries. The likelihood of some form of carbon pricing further enhances nuclear's advantage. A 2014 Intergovernmental Panel on Climate Change report indicated that nuclear power compares favourably with renewable energy sources and is well ahead of fossil fuels on a carbon emissions/

kWh basis. For example, natural gas emits 29 times as much carbon as nuclear power.

Ontario's nuclear reactor fleet has been our province's electricity workhorse, safely and reliably providing 24/7 baseload electricity for more than 45 years. In the last seven years, nuclear power has met more than half of Ontario's electricity demand, reaching a high of 62 percent last year.

Several economic studies show that additional investments in the province's nuclear fleet and industry will help sustain and grow Canada's \$6 billion-per-year nuclear industry, most of which is located in Ontario. Ontario's nuclear industry supports more than 160 supply chain companies, 60,000 direct and indirect jobs and hundreds of millions per year in Research and Development at our province's universities and colleges.

The earlier referenced Strapolec analysis also demonstrated that refurbishing Ontario's reactors and building two new ones would result in a \$60 billion net incremental benefit, including \$27 billion in savings to electricity ratepayers and \$29 billion in direct investments in our province. The latter would mean 100,000 more person years of good paying employment opportunities, with many of these positions being in the advanced manufacturing sector.

Ontario's nuclear advantage also promises a bright future of innovation: powering zero-emission electric vehicles; low-carbon electricity exports to our fossil fuel dependent neighbours; more advances in nuclear medicine and materials sciences; and world-leading technology and service exports.

Nuclear – Ontario's Low-Carbon, Affordable, Reliable, Job Creating Electricity Workhorse

For more than 45 years, Ontario's nuclear fleet has safely provided electricity for our homes and businesses.

Last year low-carbon nuclear power supplied 62% of our electricity, making it the largest contributor to reducing Ontario's GHG emissions.

It's the second least expensive source, next to waterpower, and is the best way to generate 24/7 baseload electricity year after year.

Today, Ontario hosts a nuclear industry that supports:

- Tens of thousands of high-value jobs
- Hundreds of millions in R&D at our universities and colleges
- More than 160 nuclear supply chain companies in Ontario
- Advances in nuclear medicine and materials sciences, and
- World-leading technology and service exports.

Refurbishing Ontario's nuclear fleet, and building new reactors as electricity demand grows, are the best ways to sustain and grow these benefits in the future.

For more information please go to: www.pwu.ca

FROM THE MEN AND WOMEN WHO HELP KEEP THE LIGHTS ON.

