Generation Energy: Nuclear in Canada to 2050

Canadian Nuclear Association
August 2, 2017

The Government of Canada asked the Canadian Nuclear Association (CNA) to consult with Canada's nuclear industry, including women, youth and Indigenous Canadians, and make a submission to Natural Resources Canada's Generation Energy policy development process on this subject:

What will Canada's nuclear energy sector look like in 2050?

CNA held discussions with industry-engaged Canadians during June and July 2017. Here's our distillation of what they told us.

NUCLEAR ENERGY BY, AND FOR, CANADIANS

Canadians – including women, youth and Indigenous Canadians – see a nuclear energy sector that offers opportunities to:

Make sustainable choices for the health and safety of their families and children

Have thousands more sustained, high-skilled careers with security and benefits

Market goods and services to industry

Moderate the cost of living

Partner with NGOs and participate in sustainable energy policymaking

Grow their capacity to engage on energy projects and policy

Build solutions to climate change in Canada and worldwide

NUCLEAR ENERGY BY, AND FOR, CANADIANS (2)

Additionally, nuclear energy provides opportunities in areas of interest to Indigenous Canadians:

Participate in decarbonizing government facilities and operations

Become equity owners of energy technology that is a sustainable success

End energy poverty & low energy quality that constrain their possibilities

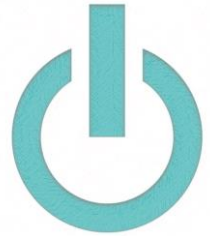
Have thousands more sustained, high-skilled careers with security and benefits

Produce base-load energy with dramatically lower social, economic and environmental costs than in the past

This comes through having no flooding, no mercury leaching, very small land footprint, negligible effects on fish and game, and low atmospheric emissions

ENERGY AND CLIMATE FOR CANADA AND THE WORLD

Canadians working with nuclear see themselves helping develop and implement a major low-carbon technology that Canada will need in 2050, that the developing world is already embracing, and that supports GHG reductions of 25% +



- **Sustaining safe operating life of our reactors and building the next generation**
- **Using recycled nuclear material in the fuel cycle in Canada, and also developing fuel cycles that eat more waste and reduce waste volumes further**
- **Complementing renewables in power generation – lowering Canada's GHG emissions substantially while delivering clean power of the quality and scale a low-carbon society needs**
- **Having effective decommissioning and repository programs working to manage all radioactive waste**

ENERGY AND CLIMATE FOR CANADA AND THE WORLD (2)

- Leading the world in the heat applications of nuclear energy, such as small reactors in district energy systems. This brings powerful solutions to a major and hard-to-address emission source (buildings are >10% of GHG emissions)
- Producing not only electricity at scale for battery storage and vehicles, but also hydrogen as an energy carrier for transport and other uses
- Decarbonizing our oilsands (lowering Canada's GHG emissions 4-7%)
- Decarbonizing today's developing countries by bringing them nuclear technology at the scale they need.

Industry cannot necessarily achieve all of this at the same time – Multiple visions are represented!

DECARBONIZING CANADA WITH NUCLEAR: 2050 AND BEYOND

Applications

- Transport is decarbonized through nuclear-to-electricity and/or nuclear-to-hydrogen
- Mine sites and government facilities powered by very small modular reactors (VSMRs)
- Microgrid, edge-of-grid and off-grid communities powered by VSMRs
- Large building and district heat supplied by VSMRs
- Oilsands decarbonized through nuclear-to-heat and/or nuclear-to-hydrogen
- Large-scale capture & storage of atmospheric carbon, powered by nuclear?

Reactor types

- Refurbished and new CANDU reactor units remain safe, clean and competitive
- Advanced Fuel CANDU Reactors (AFCRs) use recycled nuclear material
- Small modular reactors (50-300 MWe) generate to grid
- Very small reactors (under 50 Mwe) in diverse sites
- Integrated molten salt and other innovative fission reactor designs are licensed
- Fusion reactors are demonstrated

2017 → 2050 and beyond

BEYOND ENERGY

Deliver clean water from desalination where people need it

Enable still greater Canadian excellence and innovation in medical imaging, diagnosis, cancer treatment and across the life sciences

Build synergies with advanced manufacturing – nuclear research makes better materials, which then make better nuclear systems

Continue to grow and strengthen Canada's universities and the rest of our country's science, technology and innovation ecosystem, preparing to overcome future challenges with R&D performed here

BEYOND CANADA

Export clean electric power cross-border on a large scale, earning revenue and helping our neighbours decarbonize

Export our clean-tech nuclear technologies to other countries, with benefits for Canada's workforce and trade balance

Bring revenues and capital gains to government from IPR in nuclear

Make Canada's natural resources more marketable, and our national brand more valuable and sustainable

Fulfill Paris Agreement commitments, reduce global climate change and improve environmental quality – as Canada's exports of reactors and nuclear fuels have already done for decades

GLOBAL LEADERSHIP FOR CANADA

Few countries have this strategic asset to bring to the diplomatic table

Nuclear capability will sustain Canada's weight in world affairs in 2050

We will stay in the small top tier of nuclear technology countries, working together to promote nuclear's human benefits

We will also stay in the top tier of clean technology providers

We will grow our role as a technology and commercial partner, a nuclear governance mentor, and a diplomatic leader for the many other countries that seek to enter the nuclear technology space

THE PATH TO 2050

Industry developed its vision in the Nuclear Leadership Forum since 2012.
Deep decarbonization studies establish the case for much more nuclear.

Now we need government to work with us to:

- **Grow Canadian excellence in sustaining safe reactor life**
- **Review policies & regulations to support advanced designs/applications**
- **Resume new reactor build in Canada - because without it, we cannot stay at the global leaders' table, nor maintain our base of skills and suppliers**
- **Market Canadian reactor technology globally**
- **Market a VSMR design with Canadian content globally - because the only possible customer for realizing the benefits of VSMRs in Canada's remote, northern and Indigenous communities is government, with its responsibility for energy and emissions in these regions**

AND . . .

Nuclear may be challenged to obtain and maintain social license unless Canadians hear government asserting the positive role for nuclear in a low carbon economy.

Government must lead Canadians more quickly toward pragmatic, not dogmatic, views of the climate challenge - including where GHG emissions really come from, how they can realistically be reduced on a large scale, and how much change this implies.

Canada's nuclear energy sector does not have the resources to communicate to tens of millions of Canadians. Only government can better counter myths and misunderstandings that slow the public's embracing realistic paths forward.

The Canadian Nuclear Association thanks Minister Jim Carr and Natural Resources Canada for the opportunity to share our views.