


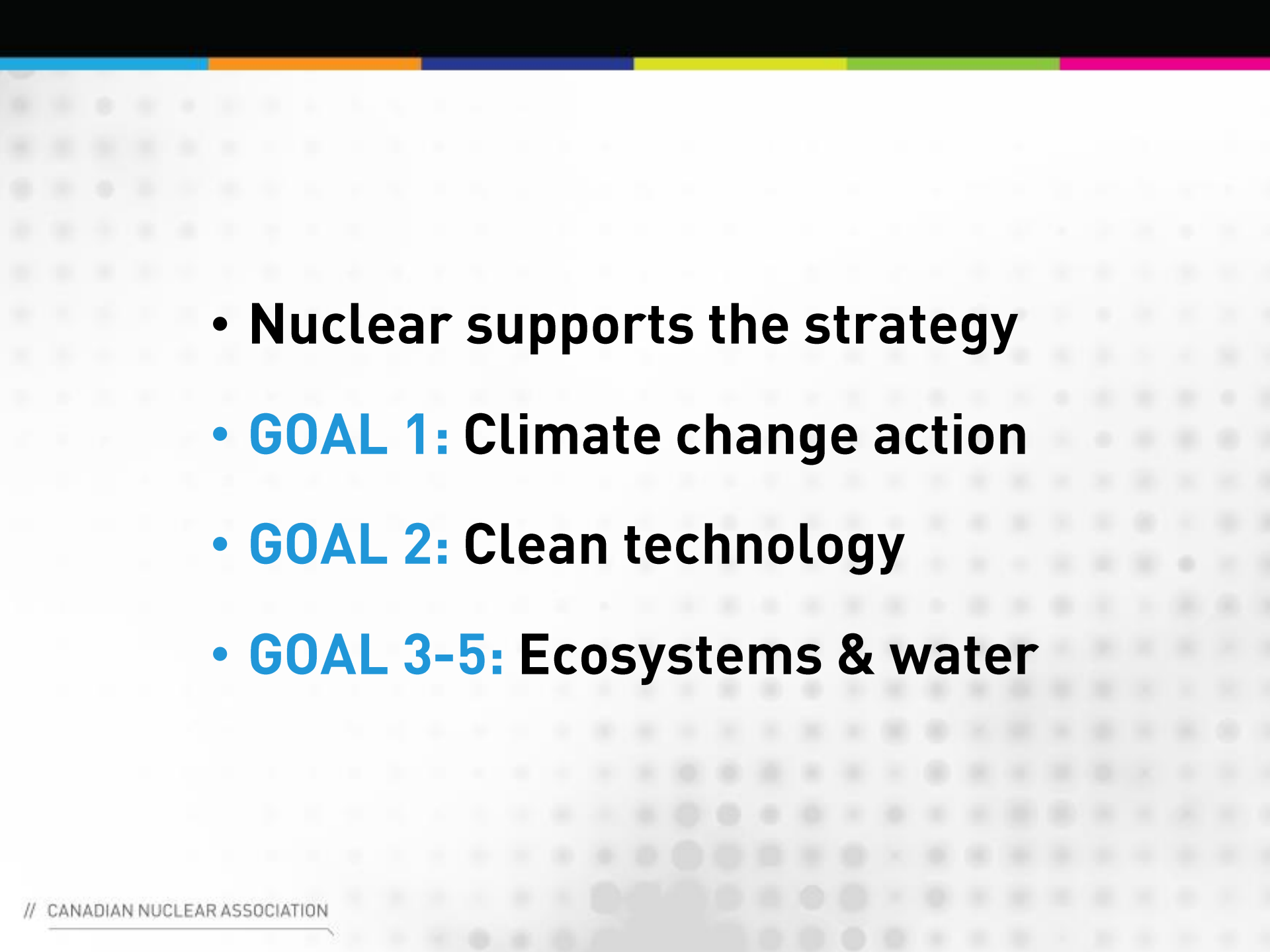


Nuclear Industry Comments on Canada's Draft

2016-19 Sustainable Development Strategy

Canadian Nuclear Association

June 2016

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- **Nuclear supports the strategy**
 - **GOAL 1: Climate change action**
 - **GOAL 2: Clean technology**
 - **GOAL 3-5: Ecosystems & water**

Nuclear supports the strategy

- Sound overall **structure and direction**.
- Has **visionary goals** (from the 2030 UN Agenda), yet focuses on finding **specific solutions**.
- Avoids over-reliance on R&D toward speculative technology fixes; stays **realistic** about how to get results by 2030.
- This implies **starting now**, using currently-proven methods and technologies.

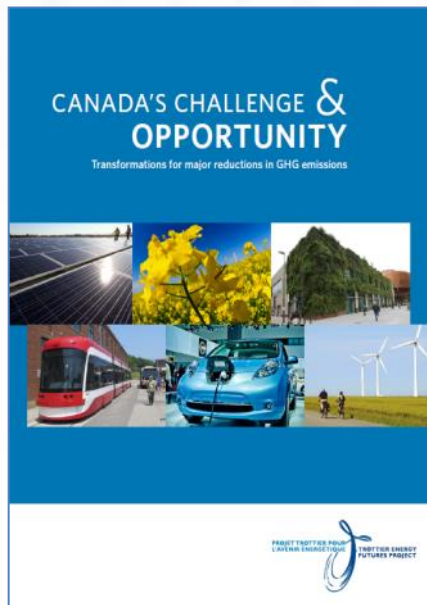


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GOAL 1: Climate change action

Climate success needs nuclear

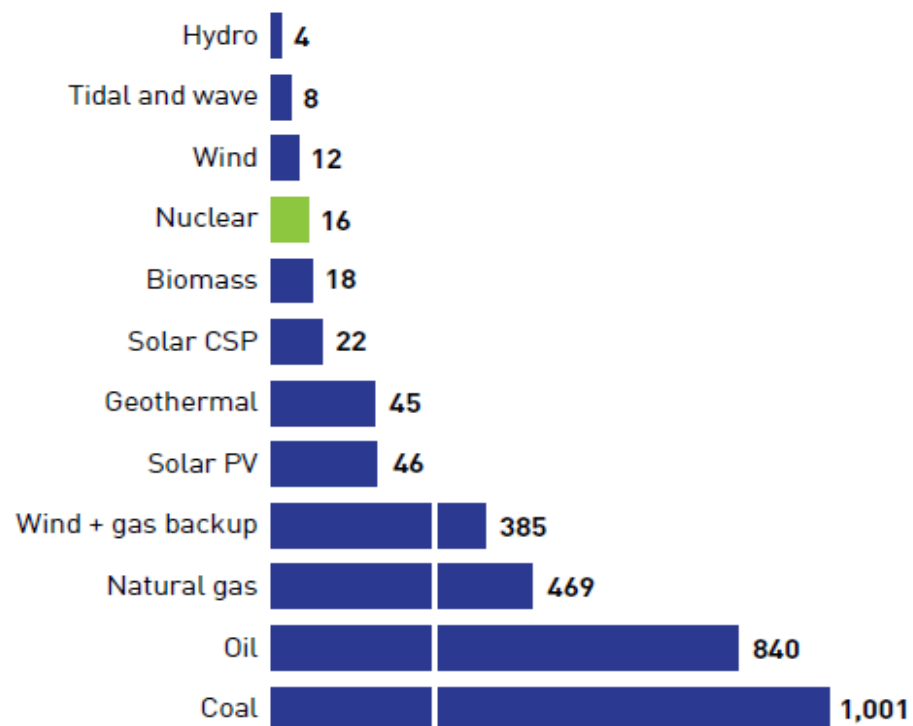
- GHG-reduction is an all-of-society project that will require **all available tools**
- An **aggressive but realistic** scenario for GHG reduction, based on current technologies with plausible improvements, sees “**very large increases in electricity use**” involving “proven technologies, such as hydro, **nuclear** and wind.”



Climate success needs nuclear



CO₂ EMISSIONS BY ENERGY SOURCE



Lifecycle Greenhouse Gas Emissions (g CO₂ equivalent/kWh)

SOURCE: Intergovernmental Panel on Climate Change.⁷

1.1 Nat'l leadership on climate change

- Nuclear energy has been used to produce electricity in Canada for over 50 years, **avoiding over 2.5 billion tonnes of GHG emissions** from coal.
- Nuclear is about **15% of Canada's electricity** and about 20% of our low-carbon electricity, despite being used in only two of ten provinces.
- Ontario's \$23B nuclear refurbishment program is one of the world's largest **clean energy investments**.



- Nuclear capacity let Ontario affordably eliminate coal from its supply mix; it's now **60% of Ontario's electricity supply**.
- Nuclear technology's capacity to deliver **low-carbon energy on a large scale** is a demonstrated fact.
- *And we can do much more.*

1.2 Resilience to climate change

- Nuclear is robust, resilient sustainable energy.
- Baseload power in cloud, rainfall, drought or cold
 - “[During last week’s polar vortex] in New England, natural gas electricity generation faltered so much that regional grid administrator ISO New England had to bring up dirtier coal and oil plants to try to make up the difference. **Nuclear energy didn’t have many problems** at all and actually became the primary provider of electricity.” – *James Conca, Forbes Energy, January 2014*
- Affordable power without commodity price swings
 - Other electricity sources are mostly natural resource, with some engineering. **Nuclear is mostly engineering**, with a very small amount of natural resource. Fuel costs and quantities are on the order of 15% of a nuclear plant’s operating costs – for a natural gas or coal plant, the proportion is about 90%.

Nothing scales up as well

- **Renewables (hydroelectricity, wind, solar and biofuels) are land-intensive.**
- Power system engineers anticipate limits on the share that intermittent sources (wind, solar) can have in the supply mix. **A base-load anchor is needed.** Nuclear can be designed to respond quickly as other generation comes and goes.
- The use of nuclear power **swiftly decarbonized** the power sectors in Sweden and France in past decades.



Energy security based on clean & reliable sources is essential for India's future. Nuclear energy has a key role in India's energy strategy.

— Narendra Modi —

- More countries are choosing nuclear energy for **innovation benefits, clean air, small footprint, and low emissions.**
- While there are about 440 reactors operating world-wide, even more are being built, planned, or proposed.

1.3 Sustainable energy, worldwide

- Canada is one of the world's leading suppliers of uranium, which fuels nuclear power plants, which **displace fossil fuels on a large scale.**
- Canada has exported nuclear technology to six countries, including the biggest developing markets, **China and India.**
- By displacing coal and natural gas, nuclear **helps avoid about 2.5 billion tonnes of GHG emissions annually.**
 - This is what's produced by more than half the world's cars.
 - Canada's nuclear exports deserve 10-15% of the credit.



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GOAL 2: Clean technology

It's the energy source that *doesn't* have a waste problem!

- We control our whole fuel life cycle.
- **Nuclear emits low GHGs, SOX, NOX, and particulates**, and has a tiny land footprint for the amount of power generated (it's very “energy-dense”).
- **Used reactor fuel is very small in volume**; future reactors can greatly reduce it.
- It is very **safe in surface storage**, and even better deep underground.
- Used reactor fuel is a **high-quality asset** that can be re-mixed and re-burned.
- All human activity produces waste.
- *Why tell the only industry that keeps, pays for, and manages its waste that it has a “waste problem?”*



2.1 Sustainable energy, at scale

- Many fossil fuel-fired plants built before 2000 (about 20 in Alberta and Saskatchewan) need replacing. Nuclear fits.
- The **replacement power must be clean**, and should be in units of similar size to what is being displaced (to minimize changes to transmission). It should **integrate well with renewables and emerging energy storage methods**, and create thousands of highly skilled, well paid, stable jobs.
- PLAN: Develop and license new, **small reactors** for these sites.
- PAYOFF: Cut some or all of **62 Mt/yr of GHGs**. Like taking 21 million cars off the road.



Anchoring the clean power mix

- **Low carbon power demand will grow**, driven partly by a need to support electric vehicles and building heat. Nuclear fits.
- The **new power capacity must be clean**, not just in GHG emissions, but in land use and habitat impacts. It should **enable renewable energy** and work with emerging energy storage methods. It should create thousands of highly skilled, well paid, stable jobs.



- **PLAN: Prepare to use reactors of appropriate sizes** to anchor the clean power mix.
- **PAYOFF: A completely clean power system** that is affordable, stable and reliable – and environmentally sustainable. Electrification of vehicles and buildings could be 100% supported, without fossil backups.

2.8 Mineral development

- Many current and future mineral developments (oil sands, Ring of Fire) are hard for the electricity grid to reach and/or use large amounts of high-cost fossil fuels.
- PLAN: Over the coming decade, **build consensus for small or very small reactors** (nuclear batteries), and build the regulatory and technical platform for an efficient, affordable fleet.
- PAYOFF: Millions of tonnes of GHG emissions annually.
- A transformative clean energy solution for industries and communities worldwide; **a clean tech industry for Canada.**



2.1 (again) Green infrastructure

- Provinces' & Territories' **#1 priority** for Distributed Power Generation is “advancing technology-based energy systems **for northern, remote, or First Nations** communities.”*
- **Very Small Modular Reactors** (VSMRs or “nuclear batteries”) are an answer.
 - **Eliminate the use of diesel** vs. only diluting it with renewables.
 - Energy-dense reliable nuclear could **enable more regional development**.
- PLAN: Build **community consensus** for VSMRs in an efficient number of locations, and build the **regulatory and technical basis** for siting and operating a fleet with low operating costs.
- PAYOFF: On the order of **1 million tonnes of GHG emissions annually**. A transformative, clean energy solution for remote communities worldwide, and a clean tech industry for Canada.

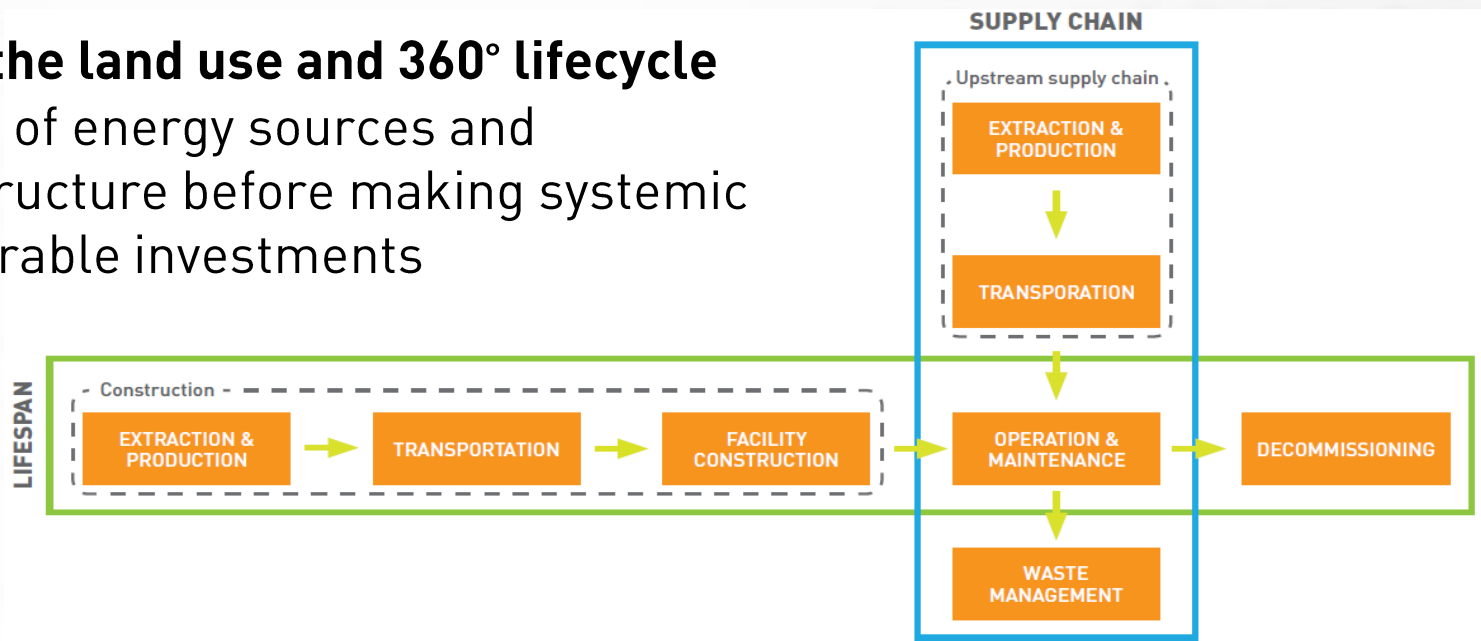




GOALS 3-5: Ecosystems & water

3.3 Habitat conservation & lifecycle ecosystem impacts

- Understand the **total environmental cost** of energy alternatives.
- **Don't assume** what is “clean” and what isn't.
- **Study the land use and 360° lifecycle impact** of energy sources and infrastructure before making systemic and durable investments



Oversight and engagement

- Nuclear has met or exceeded rigorous independent regulation for **over 50 years**.



This scrutiny supports our drive for:

- Innovation
- Best practices
- Top quality
- Lowest impacts
- Safety without compromise

Is it really clean? Always ask...

- How much **land** is needed?
- What **alternatives** are foregone?
- What **habitat** is lost?
- What **minerals** are used and where do they come from?
- How much **concrete and steel** (and thus GHGs) are required?
- How long does this **investment last** and how is it **disposed of**?
- What commodity **price** / supply **risks** are involved?
- Does this require **fossil fuel back-up** (e.g. gas)?
- Does this require new **transmission lines**? Who pays for them? And how much land do they use?



4.2 Great lakes & 4.10 Water resources

- By getting Ontario off coal-fired generation, nuclear made one of the **biggest recent improvements** in air and water quality in the Great Lakes basin.
- Nuclear plants can be designed for **minimal water usage**.
- Nuclear does not require rivers to be dammed, reservoirs to be flooded, or farmland to be used for growing biofuels.
- The world's largest currently operating nuclear plant occupies **less than 10 sq km of land** to produce 6,200 MW of power.
- **No energy source better conserves water and habitat.**



5.0 Health and life quality

- Nuclear is **clean air** AND **low carbon** AND **affordable power**
- It works with renewables to make Ontario's electricity system strong and clean. We can **leverage this excellence** through new generations of reactors and extend these benefits to major AND remote communities all over Canada.



- Displace fossil fuels
- Purify / desalinate water
- Treat wastewater
- Enable local economies
- Improve quality of life



Thank you