

Enabling Canada's net-zero journey

A system-wide, technology-neutral approach to decarbonize

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Building a world that works

Executive Summary

Canada should empower committed partners and harness its energy diversity by pursuing technology-neutral solutions to address climate change.

GE believes climate change is an urgent global priority, affecting all sectors of the economy. While the challenge is global, we must take aggressive action to develop and deploy innovative technology to decarbonize* the Canadian economy and help Canada meet its net-zero by 2050 target.

Decarbonization actions will be determined locally, based on resource availability, policy, current infrastructure, and demand for power. Canada is an illustrative case study in how a portfolio of innovative technology solutions, taking into consideration the diversity of energy sources, can accelerate decarbonization and secure a path to a lower carbon-emitting future.

Getting Canada to net-zero will require myriad technological solutions, consistent policy and regulatory frameworks, and collaboration between governments, the private sector, and non-governmental stakeholders. Such an approach promotes long term innovation, resulting in a sustainable, reliable, and affordable power sector that supports economic and environmental equity, including meaningful employment opportunities. To succeed, policies must focus on the most important objective: driving the deepest reductions in the shortest amount of time through a holistic approach utilizing a broad array of technologies. In doing so, GE strongly believes a successful policy will not pick winners and

losers among decarbonization tools for the world's complex energy systems by restricting the climate reduction technologies needed to achieve our ambitious goals.

GE has delivered cutting-edge technology solutions to Canadians since 1892, when Thomas Edison founded a manufacturing facility in Ontario. Today, we stand ready to collaborate with decisionmakers at all levels of government in any way that can be of assistance. To this end, GE respectfully submits this position paper for consideration.

*Decarbonization in this paper is intended to mean the reduction of carbon emissions on a kilogram per megawatt hour basis.

As a company whose technology produces nearly one-third of the world's electricity, GE is uniquely positioned to deliver global solutions to drive deep and quick CO₂ reductions through a technology neutral approach.



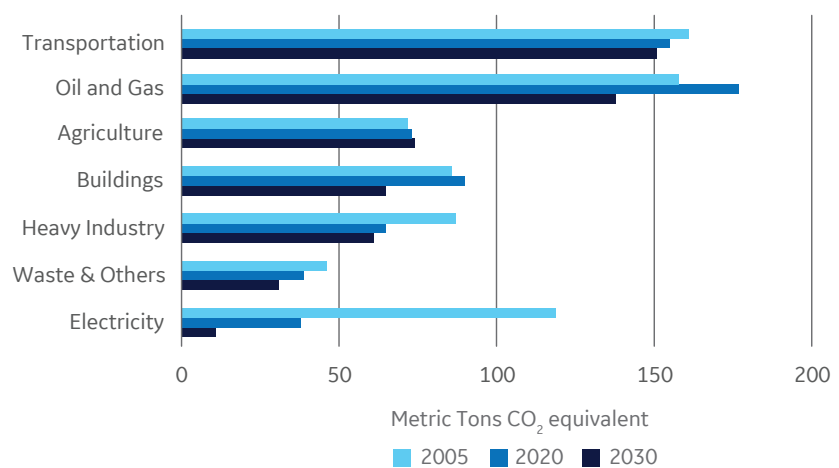
Our Perspective

With our deep expertise across the global and Canadian energy sectors, GE takes a system level view of the energy transition. As such, we are uniquely positioned to help governments in Canada achieve climate change and energy transition targets while creating jobs and promoting innovation. We are focused on a singularly important goal: deploying diverse technologies to drive the quickest reductions in the near term while creating a foundation for longer term innovation toward net zero carbon energy. To succeed, we know that we want to be part of the solution and take steps to advance ambitious climate goals by:

APPROACHING ENERGY
POLICY WITHOUT
PREJUDICE ACROSS
THE ENERGY SYSTEM

All sectors must accelerate decarbonization efforts while developing an efficient and integrated energy system to achieve net-zero goals. Under a base case scenario (see figure), Canada's electricity sector is expected to reduce emissions by 90 percent in 2030 compared to 2005 levels whereas other sectors are projected to make less progress. Increased electrification will enable decarbonization of harder to abate sectors such as transportation, buildings, and heavy industry. To increase electrification, advances must be made in power generation, transmission, distribution, and utilization while targeting minimal system-wide cost increases—as opposed to selectively favouring certain technologies in silos. Canada's carbon pricing scheme will increase predictability, foster innovation, and let technology enable emissions reductions. The overarching focus must be on achieving targets and timetables through a technology-neutral approach to realize the necessary reductions while creating the foundation for deeper reductions, further innovation, and increased jobs over time.

**GHG Emissions by Industry:
2005 Baseline vs. 2020 and 2030 Estimates**



Source: Environment and Climate Change Canada, Canada's Greenhouse Gas and Air Pollutant Emissions Projections 2020, http://publications.gc.ca/site/archivee-archived.html?url=http://publications.gc.ca/collections/collection_2021/eccc/En1-78-2020-eng.pdf

ENABLING FURTHER RENEWABLE ENERGY DEPLOYMENT

Two-thirds of Canada's electricity comes from renewable sources, including the 30 GW of GE Renewable Energy hydro power plants operating alongside partners across the country. Hydro can continue to play an important role in Canada's energy transition because of the balancing function it provides acting as energy storage and facilitating the integration of intermittent renewables, but upgrades are required to aging infrastructure. For non-hydro renewables to continue thriving in Canada, policymakers should remove barriers to new deployment and allow higher penetrations of non-hydro renewables on the grid. We support policies that increase research, development, and demonstration budgets for renewable energy technologies as well as the advanced manufacturing capabilities required to produce renewable energy components.

MODERNIZING THE GRID WITH NEW INFRASTRUCTURE AND DIGITAL TOOLS

Ninety percent of Canadian transmission utilities have been equipped with GE solutions. Physical upgrades (to increase efficiency) and digital solutions (to increase overall capacity and resilience) will be critical to accelerating deployment of renewables across the country as well as ensuring reliable and secure electricity for Canadians. Moving forward, the power grid's importance will only grow as electricity demand increases from new and versatile uses of power such as electric vehicles, smart buildings, and energy storage. To combat limitations, improvements to the interprovincial transmission planning process, strategic build-out of interties (both between provinces/territories and between Canada and the U.S.), and grid modernization efforts are vital, including digital tools for a reliable and secure grid.

Our Perspective Continued

SUPPORT THE EXISTING NUCLEAR FLEET AND INVEST IN SMALL MODULAR REACTORS (SMRS)/ ADVANCED NUCLEAR TECHNOLOGY

GE was part of a consortium that developed Canada's first nuclear plant (the Nuclear Power Demonstration unit) in 1962, which became the basis for the entire CANDU fleet. Nuclear power is an important source of clean energy, with 15 percent of Canada's electricity coming from nuclear. Maximizing the lifetime of the existing installed base is critical to reducing emissions and can be achieved through physical refurbishments of generating equipment combined with digital solutions to enable outage planning, analytics, and asset performance management. The future of nuclear energy will be small and modular, as outlined in Canada's Small Modular Reactor Action Plan. In provinces where coal provides substantial electricity, small modular reactors can replace coal-fired generation with zero-carbon, reliable, baseload electricity. Canada is poised to become a global leader in SMRs—a worldwide market the federal government estimates can be worth \$150 billion annually by 2040.

MAKING RAPID PROGRESS ON DECARBONIZATION THROUGH UTILIZING EFFICIENT GAS TODAY WHILE INVESTING IN TECHNOLOGY TO FULLY DECARBONIZE IN THE FUTURE

Canada is a leading producer of natural gas and gas power can be a force multiplier for decarbonization by enabling renewables and battery storage systems. In provinces such as Alberta, Saskatchewan, New Brunswick, and Nova Scotia—which continue to rely on coal for power generation—gas-fired power plants can offer immediate emissions reductions in line with Canada's plan to phase out coal by 2030. Natural gas can also



We firmly support the growing emphasis on environmental justice. A holistic approach that enables technology to realize the quickest greenhouse gas reductions globally allows for the accelerated retirement of high greenhouse gases emitting systems, and deployment of reliable, sustainable energy to communities most in demand.

provide reliable, dispatchable and affordable back-up power during extended periods or seasonal swings when renewable options are unavailable, and battery systems are often uneconomical. Canada can lower lifecycle emissions through strong methane controls at the source and deployment of state-of-the-art efficient turbines, and upgrades to the existing generation fleet. At the same time, Canada should build on the Low-carbon and Zero-Emissions Fuels Fund and the Clean Fuel Standard to invest in opportunities to decarbonize gas for power generation and cogeneration industrial applications. For example, hydrogen and the utilization of carbon capture, utilization, and storage (CCUS) systems make gas turbines a no-regrets investment for the long term.

PROMOTING THE NEXT GENERATION OF BREAKTHROUGH AVIATION TECHNOLOGIES

GE Aviation's jet engines power over 80 percent of Air Canada Mainline & Air Canada Rouge airplanes as well as 100 percent of WestJet's jet airplane fleet. As part of the aviation community, GE embraces our role in ensuring the industry finds low-carbon solutions and believes that a holistic approach is vital to achieving ambitious emissions reduction targets, as well as helping its customers achieve sustainable flight operations. This will occur by advancing propulsive efficiency, next generation thermal efficiency, and hybrid electric technology. Beyond technological advancements in engines and aircrafts, sustainable aviation fuel (SAF) and improvements to air traffic management provide opportunities for near-term emissions reductions.

How GE's Global Leadership and Deep Canadian Roots Can Support Policymakers in Canada

GE is dedicated to being a constructive partner, offering zero and low-emission technology today and innovative future solutions to facilitate the achievement of policy goals, including:

GLOBAL TECHNOLOGY LEADERSHIP

Our innovative technology, engineering expertise, and global reach helps our customers meet their decarbonization goals. From the BWRX-300 small modular reactor, which requires significantly less capital cost per MW than other water-cooled small modular reactor designs, to GE Hydro turbines and generators that represent more than 25 percent of the total installed capacity worldwide, to the Haliade™-X, the world's most powerful offshore wind turbine; to onshore wind, with more than 49,000 turbines installed globally and an industry leading 53 percent of new wind turbine installs in the US in 2020; to the 7HA.03 gas turbine, which will power the first plant in the U.S. with a large-scale turbine fired by a blend of hydrogen and gas; to digital solutions that help utilities modernize and manage more renewables onto the grid; to the GE9X Aircraft Engine, the world's largest and most powerful aircraft engine, which is also the most efficient engine we have ever built and is designed to deliver 10 percent greater fuel efficiency than its predecessor—we are enabling substantive reductions in emissions while continuing to accelerate technologies for low or near zero-carbon power generation.

INNOVATION

Climate change cannot be solved without substantial advancements in technology. GE Research is GE's innovation engine where new ideas become commercial realities to create a better world. GE is investing in R&D and pursuing next generation products and breakthroughs in clean energy technology through innovation, commercialization, and deployment. GE Research collaborates with several universities in Canada and looks forward to doing more.

J O B S

GE is proud of our footprint in Canada and we continue to invest in Canadian manufacturing, R&D, design, engineering, sales, and service capabilities, creating jobs employing approximately 3,000 people at twelve locations from coast to coast including four manufacturing facilities. GE also has more than 8,000 existing supply chain partners in Canada. And we are continuing to grow in Canada—most recently, we established GEH SMR Technologies Canada, Ltd., standing up the entity that will host our growing small modular reactor business. GE strongly emphasizes and values a diverse workforce, and is positioned well to develop, encourage, train, and provide positions for new employees in the future.

ENVIRONMENTAL JUSTICE AND INDIGENOUS RECONCILIATION

GE is committed to ensuring that all communities where we operate realize the strongest environmental protection from our activities. We impose our heightened standards globally for our employees and communities regardless of the local regulatory regime. We strongly believe that access to affordable, reliable, sustainable

electricity is critical to reducing poverty and hunger, and promoting access to education and healthcare for all people. Our technology plays a key role in helping governments reach their Paris Agreement goals, while also promoting the UN's Sustainable Development Goals (UN SDGs), which we believe are the blueprint to achieving a better and more sustainable future for all. Inclusive of all our activities in Canada, GE is committed to engaging, and collaborating with Indigenous communities by respectfully engaging Indigenous groups and working to identify opportunities to work with Indigenous suppliers and service providers.

A UNIQUE GLOBAL LENS TO THE ENERGY TRANSITION

GE is unique as a company with a large footprint and lengthy history in Canada as well as a global reach throughout the full power generation lifecycle. Through this lens, we see that accelerated and strategic deployment of renewable energy, nuclear, energy storage, hydrogen, CCUS, and gas power can help change the global trajectory of climate change, enabling substantive reductions in emissions while continuing to accelerate technologies for low or near zero-carbon power generation.



Rendering of the BWRX-300 Small Modular

Creating the Frameworks to Support Canada's Energy Transition

GE believes addressing climate change must be an urgent priority for policymakers in Canada. In a country with an energy system as diverse as Canada, the energy transition will look different depending on where you live or work. Canada's energy transition will need to harness existing infrastructure, leverage expertise across the energy sector, and deploy innovative technology-neutral solutions to reduce emissions. GE would like to collaborate with governments, industry, and non-governmental stakeholders to ensure Canada's decarbonization journey protects reliability and affordability for Canadians. In particular, we would like to discuss frameworks that establish a technology-neutral approach that avoids picking winners and losers but instead identifies the most sustainable and economic way to reduce emissions, promote innovation, and create jobs. This could include, but is not limited to, the following suggestions:

ENABLING DEPLOYMENT OF TECHNOLOGY-NEUTRAL SOLUTIONS TO ADDRESS CLIMATE CHANGE

- Optimize existing tax incentives designed to support greater deployment of renewable energy without giving preference to one form of renewable energy over others and consider establishing tax credits to incent production of, and investment in, clean electricity
- Incentivize energy efficiency improvements of existing zero-carbon electricity generation equipment including refurbishing nuclear plants, repowering onshore wind turbines, and upgrading aging hydro infrastructure
- Increase funding for small modular reactor development and commercialization to support Canadian jobs; develop robust capabilities across the advanced nuclear supply chain; and lay the groundwork for Canada to become a global leader in small modular reactor technology to ultimately benefit from export opportunities.
- Establish an offshore wind sector in Canada through robust policy and regulatory mechanisms, including a predictable permitting process and incentives to develop offshore wind projects

Canada can continue to be a global leader in addressing climate change. But it will take all of us—governments, energy producers, original equipment manufacturers, utilities, research institutions, Indigenous communities, and other non-governmental stakeholders—to work together to make this vision a reality.

HEATHER CHALMERS, PRESIDENT AND CEO, GE CANADA

- Improve the strategic use of transmission interties (between provinces/territories and Canada and the U.S.), identify regional or interprovincial grid infrastructure projects in need of upgrades, and invest in grid modernization to improve reliability and security of electricity transmission and distribution
- Convene stakeholders across the SAF value chain and develop programs to support production, transportation, and storage of SAFs at scale
- Promote increases in Canada's research, development, and demonstration budgets for advanced wind, solar, battery storage integration, and grid technologies as well as advanced manufacturing processes and sustainable materials
- Work closely alongside Canadian and U.S. officials to identify and pursue shared energy transition priorities

ADOPTING POLICIES AND MAKING INVESTMENTS TO SUPPORT THE DECARBONIZATION OF GAS

We believe policies and regulations should support infrastructure that reduce emissions without excluding technology such as state-of-the-art gas turbines, which have a future path to low- or zero-carbon generation through CCUS and hydrogen, complementing clean energy solutions in Canada's decarbonization journey. Policy makers should consider:

- Developing a national CCUS strategy and convening stakeholders across the CCUS value stream to identify the best way to deploy CCUS solutions at scale in power generation and industrial applications
- Ensuring the proposed federal investment tax credit for CCUS projects and tax incentives for clean hydrogen are optimized to unlock investment; enable

deployment of CCUS technologies at scale; production, transportation, and storage of hydrogen at scale; and improve Canada's international competitiveness

- Providing federal and provincial support for demonstration projects showing the use of hydrogen in power generation and industrial applications as well as the installation of carbon capture technology in gas-fired power plants and industrial facilities
- Expanding support for methane emission controls, including through global initiatives and partnerships, as well as feasible standards for criteria pollutants to reduce the greenhouse gas lifecycle impacts of natural gas.

Addressing climate change will require government and consumer action. GE is uniquely positioned to play a key role through its scale, breadth, and technology depth.

We have been a key player in the power industry since its inception more than a century ago and have a suite of complementary technology including gas-fired power, onshore and offshore wind, hydro, small modular reactors, battery storage, hybrids, and grid solutions needed for the energy transition. More importantly, we believe it is our responsibility to support this transition through our relationships with customers, policymakers, and consumers, collaborating to build an energy system that works for everyone.



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