



Ontario Power Generation Inc. Green Bond Second Opinion

November 19, 2021

Ontario Power Generation Inc. (OPG) is a Canadian company and electricity provider in Ontario also operating in US through a US-based wholly owned subsidiary OPG Eagle Creek Holdings LLC. OPG has as of December 31, 2020, an installed power generation capacity of 18.9GW, of which 18.27 GW is located in Ontario and the remaining in the United States. Approximately 43% of total installed capacity results from hydro plants, 30% from nuclear, 1% from other renewable energy sources and 25% from oil & gas power. OPG is responsible for the management of irradiated by-products, including used nuclear fuel and less radioactive material generated over the life of its nuclear facilities, and for the decommissioning of its nuclear generating and waste management facilities at the end of their useful lives.

The Green Bond Framework of OPG focuses on refurbishment of nuclear reactors to increase efficiency and extend the plant's lifetime by 30-plus years, but also includes renewable energy, energy efficiency and management, and climate adaptation and resilience. Refurbishment of nuclear reactors is a climate friendly power source with a low land use footprint. Including nuclear energy in the energy mix will make it easier to achieve the target in the Paris agreement of limiting global warming to well below 2°C, although it may be possible to achieve the target without nuclear power.

Some concerns related to nuclear power generation are uranium sourcing, final waste disposal, the potential for weapon proliferation and maximum credible accidental radiation with devastating regional consequences. Being subject to Canadian regulations mitigates the possibility for weapon proliferation and accidents. According to the issuer, no member of the public has been harmed since OPG started operation. Still, while the risk of a nuclear incident is remote, a maximum credible accident at any nuclear power plant could have devastating consequences. A Deep Geological Repository (DGR) is the scientifically accepted method for long-term storage of such waste approved in Canada, however a host site has yet to be selected. OPG maintains a portfolio of multi-year supply contracts for uranium concentrate with domestic and foreign suppliers including uranium commodity traders. OPG informs us that the typical countries of origin are commercially sensitive information and hence not publicly available. For new contracted volumes to be delivered from 2023 onwards, OPG is committed to have stricter requirements on ESG issues related to nuclear fuel procurement.

According to the regulation of the nuclear power industry in Canada, OPG carries out risk analysis covering a broad set of issues, including potential impacts from climate change and local environmental impacts, including on water. The intended reporting is comprehensive, and the issuer informs us that the intention is for an independent party to verify the allocation reporting. However, more could be done on reporting Scope 3 greenhouse gas emissions, in particular associated with uranium mining.

Based on the overall assessment of the project types that will be financed as well as governance, and transparency considerations, OPG's Green Bond framework receives a **CICERO Medium Green** shading and a governance score of **Good**. While refurbishment of CANDU reactors can achieve a Dark Green shading in the Canadian context, the lack of implemented long term solutions for spent fuel renders the shading Medium Green.

SHADES OF GREEN

Based on our review, we rate the OPG's green bond framework **CICERO Medium Green**.

Included in the overall shading is an assessment of the governance structure of the green bond framework. CICERO Shades of Green finds the governance procedures in OPG's framework to be **Good**.



GREEN BOND PRINCIPLES

Based on this review, this Framework is found in alignment with the principles.





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1 Terms and methodology

This note provides CICERO Shades of Green's (CICERO Green) second opinion of the client's framework dated November 2021. This second opinion remains relevant to all green bonds and/or loans issued under this framework for the duration of three years from publication of this second opinion, as long as the framework remains unchanged. Any amendments or updates to the framework require a revised second opinion. CICERO Green encourages the client to make this second opinion publicly available. If any part of the second opinion is quoted, the full report must be made available.

The second opinion is based on a review of the framework and documentation of the client's policies and processes, as well as information gathered during meetings, teleconferences and email correspondence.

Expressing concerns with 'Shades of Green'

CICERO Green second opinions are graded dark green, medium green or light green, reflecting a broad, qualitative review of the climate and environmental risks and ambitions. The shading methodology aims to provide transparency to investors that seek to understand and act upon potential exposure to climate risks and impacts. Investments in all shades of green projects are necessary in order to successfully implement the ambition of the Paris agreement. The shades are intended to communicate the following:

CICERO Shades of Green



Dark green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Ideally, exposure to transitional and physical climate risk is considered or mitigated.



Medium green is allocated to projects and solutions that represent steps towards the long-term vision, but are not quite there yet. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Physical and transition climate risks might be considered.



Light green is allocated to projects and solutions that are climate friendly but do not represent or contribute to the long-term vision. These represent necessary and potentially significant short-term GHG emission reductions, but need to be managed to avoid extension of equipment lifetime that can lock-in fossil fuel elements. Projects may be exposed to the physical and transitional climate risk without appropriate strategies in place to protect them.

Examples



Wind energy projects with a strong governance structure that integrates environmental concerns



Bridging technologies such as plug-in hybrid buses



Efficiency investments for fossil fuel technologies where clean alternatives are not available

Sound governance and transparency processes facilitate delivery of the client's climate and environmental ambitions laid out in the framework. Hence, key governance aspects that can influence the implementation of the green bond are carefully considered and reflected in the overall shading. CICERO Green considers four factors in its review of the client's governance processes: 1) the policies and goals of relevance to the green bond framework; 2) the selection process used to identify and approve eligible projects under the framework, 3) the management of proceeds and 4) the reporting on the projects to investors. Based on these factors, we assign an overall governance grade: Fair, Good or Excellent. Please note this is not a substitute for a full evaluation of the governance of the issuing institution, and does not cover, e.g., corruption.



2 Brief description of OPG's green bond framework and related policies

Ontario Power Generation Inc. (OPG or “the Company”) is a Canadian company and electricity provider in Ontario also operating in US through a US-based wholly owned subsidiary OPG Eagle Creek Holdings LLC. OPG has as of December 31, 2020 an installed power generation capacity of 18.9GW, of which 18.27 GW is located in Ontario and the remaining in the United States. Overall, the company currently operates 66 hydroelectric stations, 2 nuclear stations, 1 biomass station, 1 solar facility as well as 4 natural gas-fueled stations and 1 oil & gas station in Ontario. For the year ended December 31, 2020, approximately 53% of electricity generation was from nuclear, 43% from hydro and other renewables and 3% from gas power.

Environmental Strategies and Policies

OPG released its Climate Change Plan in November 2020 that includes a plan to reach net-zero carbon emissions including the use of offsets by 2040. OPG states that they assume that they would not need to buy significant amounts of offset credits from third parties and would only apply this in extreme cases where they are having difficulty meeting their commitment in 2040. According to OPG, Ontario's grid had an emissions intensity of 30gCO₂/kWh in 2019. OPG states that it strives to be an energy innovation company, advancing technologies and solutions to help the markets where it operates to achieve net-zero carbon economies by 2050. In 2019, the company had Scope 1 emissions of 506ktCO₂e from its generating stations and Scope 2 emissions of 3.5ktCO₂e. Most of its emissions result from its thermal power plants. 7.9ktCO₂e result from its nuclear facilities. Scope 1 emissions have been volatile over the past years and are now 11% higher than in 2017, but 4% less than in 2015. This is mainly due to the flexible nature of its natural gas power supply in response to changing electricity market demand according to OPG. OPG is not including expenditures into their CCGT fleet into the Green Bond Framework (other than potential investments on CCS). No CCS expenditures have been planned in the near term. OPG is currently not quantifying Scope 3 emissions. However, given its increasing investor and social interest, they endeavor to better understand the standards/practices for Scope 3 emissions quantifications going forward. However, it is largely expected that Scope 1 and 2 emissions are more impactful than Scope 3 for power generation companies.

OPG has an environmental policy to meet all compliance obligations with the objective to exceed these obligations. It has established an environmental management system and maintains registration for this system to the ISO 14001 Environmental Management System standard.

OPG operates large hydro power plants, e.g., the Sir Adam Beck hydroelectric power stations with close to 2,000MW of capacity in Niagara Falls. This is expected to be expanded by approximately 125MW by 2022. Generally, reservoir greenhouse gas (GHG) emissions are temporary and peak two to four years after the reservoir is filled. According to the issuer, during the ensuing decade after the in-service of the reservoir, GHG emissions gradually diminish and return to within the range of background levels. The majority of OPG's fleet are decades old and fall into this category (average age of over 80 years); hence OPG has not been measuring reservoir GHG emissions.

OPG has an ongoing partnership and collaboration regarding the deployment of CCS to gas generating stations. No CCS projects will, however, be financed under their current Green Bond Framework. According to OPG's climate change plan, the company sees natural gas as an enabler and important part of their climate change plan to



enable flexible response to electricity demand. OPG will put in place an internal carbon pricing system to enhance project decision making by 2025.

In 2019, OPG operated nine out of its ten nuclear reactors, producing 43.5 terawatt hours (TWh) of electricity (Unit 2 at the Darlington Nuclear (DN) station was under refurbishment in 2019 and was returned to service June 2020)¹. OPG is expecting to shut down Pickering's units 1 and 4 in 2024 and units 5 to 8 in 2025. OPG's plan requires approval from the Canadian Nuclear Safety Commission. After commercial operations cease, the station will first be placed in a safe storage state (removal of fuel and water) and eventually decommissioned, beginning in 2028. OPG also launched the Centre for Canadian Nuclear Sustainability²: The Centre will integrate collaboration and research to identify innovative solutions in the nuclear sector while also supporting the work underway to prepare for decommissioning the Pickering Nuclear Generating Station.

OPG's nuclear fuel supply chain involves the purchase of uranium concentrate, services for the conversion of uranium concentrate into uranium dioxide and services for the manufacture of nuclear fuel bundles containing uranium dioxide pellets. OPG's nuclear fuel bundles are supplied by a Canadian-based manufacturer. OPG currently establishes contractual arrangements with each of these distinct components separately and, as appropriate, maintains ownership of the uranium throughout the supply chain. Risks associated with movement of uranium remains with OPG's converter and fuel supplier until such time the finished fuel is delivered to OPG. The Canadian suppliers maintain their own Emergency Response Assistance Plans to comply with transportation of dangerous good regulations and have been established to ensure adequate response to events such as release of hazardous material to the environment. OPG's current main uranium suppliers have performed sustainability screening to identify ESG risks and opportunities. These include screening criteria and/or sustainability survey to assess their suppliers.

OPG maintains a portfolio of multi-year supply contracts for uranium concentrate with domestic and foreign suppliers including uranium commodity traders. The current uranium supply agreements contain a supplier covenant that the concentrates supplied under the agreement shall be of any origin which can be legally imported into Canada and used by OPG. However, OPG is currently putting in place commercial mechanisms to enable it to procure uranium from countries or sites that meet the applicable ESG criteria.

On an annual basis, OPG will internally review the adequacy of uranium suppliers' most recent proposal responses with respect to their most recent ESG submissions. Part of this internal evaluation process will evaluate the need to potentially exclude other countries of origin based on documented and justifiable indications of unacceptable ESG performance of any specific miner / country of origin.

Thus, OPG will enter the uranium market in the future to ensure adequate coverage of their requirements by implementing updated ESG focused strategies as part of the procurement of new uranium contracted volumes to be delivered in 2023 onwards.

The ESG requirement will cover (where relevant) inter alia: Water use, dump/tailings management, groundwater quality monitoring, radioactive waste management plan, pollution prevention and control compliant with licenses

¹ The Darlington generating station (GS) comprises three operating units and one unit, Unit 3, which is undergoing refurbishment since September 2020. All four Darlington units have been in service since the early-1990s. As of December 31, 2020, the total in-service generating capacity of the three operating units was 2,634 MW. Unit 3 has a generating capacity of 878 MW. The Pickering GS comprises six operating units and two units in a permanent safe shutdown state. Four of the eight Pickering GS units originally went into service in the 1970s. A decision was made by Ontario Hydro in the late 1990s to place these four units in voluntary lay-up. In 2003 and 2005, respectively, two of the four laid-up units were returned to commercial operation, with the two remaining units placed in a permanent safe shutdown state. The other four operating units have been in service since the mid-1980s.

² https://www.opg.com/media_releases/opg-opens-centre-for-canadian-nuclear-sustainability/



or done with best available techniques, that supplier and all of the Concentrates miners from which the supplier is proposing to supply the Concentrates are certified to an internationally recognized environmental standard.

In addition, social risks are addressed by requiring that the supplier's submission demonstrates evidence of policies and procedures which address the issues of anti-bribery / corruption, grievance mechanisms, whistle blower policy, and procurement practices to an extent that meets the applicable requirements of OPG's Supplier Code of Conduct. OPG informs us that the typical countries of origin are commercially sensitive information and hence not publicly available.

As of December 31, 2020, approximately 2.83 million bundles of used fuel had been produced from the operations. Total nuclear used fuel across Canada will fill about 8 hockey rinks up to the boards and are currently stored in dry storage containers that are rated safe for 100 years. The fuel bundles in dry storage containers came from wet storage bays from the stations.

OPG has been able to safely operate its stations over the last 4 decades, all regulatory safety reviews by multiple agencies and organizations continue to confirm good performance and practices (CNSC/WANO).

Environmental Risk Assessments (ERA) are completed every five years. The last ERAs for Pickering and Darlington Nuclear Facilities were prepared and submitted to the Canadian Nuclear Safety Commission (CNSC) in 2017 and 2021 respectively. The conclusion of the reports is that there are no significant adverse environmental effects resulting from the operation of these facilities. The Environmental Monitoring Program (EMP) is a program which is executed annually to meet a number of objectives including determining the dose to the public resulting from the operation of the nuclear facilities. The EMPs comply with the Canadian Standards Association (CSA) N288.4-10 standard for Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills. The program scope encompasses protection of both the public and the environment from nuclear substances, hazardous substances, and physical stressors resulting from the operation of DN and PN sites, including on-site waste management facilities. Additionally, environmental sampling and analyses for the EMPs, support the calculation of annual public dose resulting from operation of OPG nuclear facilities, as required by Canadian Nuclear Safety Commission (CNSC) REGDOC-3.1.1, Reporting Requirements for Nuclear Power Plants.

OPG's goal is to keep nuclear emissions as low as reasonably achievable and to meet annual targets for tritium emissions to air³ and carbon-14 emissions to air⁴. In 2020 the targets for that year were largely achieved, and nuclear emissions and public radiation doses remained small fractions of the legal limits. Tritium emissions to air were marginally worse than the internal target, but emissions remain a small fraction of the regulatory limits. OPG sets stringent targets which are a fraction of the regulatory limits.

OPG also works to reduce the effect of low and intermediate level radioactive waste on the environment. They have annual targets for the amount of such waste produced⁵, and in 2020, the amount of low and intermediate level radioactive waste produced (3,509 m³) was well below the annual target of 5,512 m³. OPG continued to explore solutions for the safe long-term management of low and intermediate level radioactive waste. Natural Resource Canada is actively working on modernizing Canada's Radioactive Waste Policy Framework, with the goal of having the revised policy issue by year-end. OPG and the broader Canadian Nuclear Industry are awaiting the outcome of this process, which is a key input to inform on next steps.

³ The targets are 21,130 curies in 2019, 21,000 curies in 2020 and 19,950 curies in 2021.

⁴ The targets are 140 curies in 2019, 123 curies in 2020 and 116 curies in 2021.

⁵ The targets are 5,420 m³ in 2019, 5,512 m³ in 2020 and 6,086 m³ in 2021. The higher amount of waste in later years was a result of the refurbishment activities to extend the station service life for 30 years.



OPG monitors conventional substances emitted to air and water as a result of DN and PN site operations. Reports on emissions of both conventional hazardous and non-hazardous substances are prepared in accordance with regulatory requirements and submitted to provincial and federal agencies throughout the year. OPG have standby diesel generators to provide back-up electrical power to the station if required, which is associated with the emission of greenhouse gases. In 2019 Scope I greenhouse gas emissions from nuclear were 7,872 tonnes of CO₂ equivalents, a 55% reduction from 2015⁶. These emissions are primarily the result of regular Standby and Emergency Generator testing as part of nuclear licensing requirements for system availability and reliability.

Hydrazine and ammonia are used in station water systems to prevent corrosion. These chemicals are released when steam is vented to the atmosphere and when water is drained to Lake Ontario. Hydrazine along with all other chemicals found in the facility's effluent streams comply with release limits defined in the Environmental Compliance Approval (ECA) issued by the Ministry of Environment Conservation and Parks (MECP). There has not been a hydrazine/ammonia exceedance in the last three years.

Moreover, ozone-depleting substances (ODS) are used in refrigeration systems. Refrigerant leaks to air are minimized through routine inspections and maintenance of equipment. There were no releases of ODS that were reportable as spills in 2018 for DN or PN. Later, there were releases that have been reported to the Ministry of the Environment, Conservation and Parks. Investigations have been completed to understand the failure mechanism and corrective actions have been instituted to minimize recurrence.

OPG issued four green bonds since June 2018 totaling CAD 2.15 billion. Most of the proceeds were allocated to hydro power related projects such as construction, upgrades, acquisitions and equity injection, e.g., for Eagle Creek Renewable Energy LLC. No controversies or negative impacts from the investor communities have been registered to date according to the issuer. In May 2021, OPG's wholly-owned Lower Mattagami Energy Limited Partnership (LME) completed a private placement bond offering of CAD \$375 million of green bonds. The net proceed from the issuance was used for refinancing LME's outstanding bonds at maturity and funding the Little Long Dam safety project. LME owns and operates certain of OPG's contracted hydroelectric facilities located along the Lower Mattagami River.

OPG is reporting GHG emissions using GRI Standards as a guideline. OPG leverages the established risk management process to evaluate the impact of climate change on existing risks and identify new risks. Risk owners have access to centralized tools through the Climate Resilience Toolkit to support the evaluation of the impact of climate change on their risks. One such tool is OPG's Climate Atlas. The atlas provides projected climate change data for multiple emission pathways from the Global Climate Models, downscaled for OPG watersheds. This data can be used to validate assumptions on the characterization of the risk and development of treatment plans. It can also be used to inform engineering design and operational planning assumptions.

In 2020, OPG undertook an enterprise-wide transition risk workshop, using OPG's four planning scenarios to identify transition risks and climate-related opportunities. The identified risks and key discussion points from the workshop were used to update applicable existing risks and will be monitored over the medium to long term as part of the existing risk review process. Guidance on how to apply scenario analysis in assessing discrete risks and developing risk treatment plans is provided through the OPG Resilience Guide in the Climate Resilience Toolkit.

OPG is currently developing additional disclosures to meet the continuous reporting requirements as set out by the Ontario Capital Markets Modernization Taskforce (Taskforce). As it relates to climate change-related disclosures,

⁶ Reported GHG emissions reductions were not a result of a program to reduce the emissions for standby or emergency generators. It resulted from a change to the emissions quantification methodology to increase the accuracy of estimated emissions.



OPG is compliant with most of the Taskforce on Climate-Related Financial Disclosures (TCFD) recommendations to date.

Use of proceeds

Green bonds can be issued by OPG and its subsidiaries to finance and/or refinance Eligible Projects in Renewable energy, Nuclear, Energy efficiency and management, and Climate adaptation and resilience as set out in the Green Bond Framework. The green bond proceeds can also be used to finance the acquisition, including minority equity participation, of Eligible Projects. Share of proceeds going to the different categories and to finance/re-finance may not be known beforehand. The look-back period for Eligible Projects is 36 months prior to the date of issuance.

OPG commits to not knowingly use the proceeds for financing of assets/projects for that involve the generation from fossil fuels as its primary source of fuel. Emergency or back-up fossil fuel generators would be an example of a fossil fuel source that would not be excluded.

Selection

The selection process is a key governance factor to consider in CICERO Green's assessment. CICERO Green typically looks at how climate and environmental considerations are considered when evaluating whether projects can qualify for green finance funding. The broader the project categories, the more importance CICERO Green places on the governance process.

OPG's Treasury group will be responsible for review and selection of the green projects that will qualify as Eligible Projects. The Treasury group will verify the suitability and eligibility of such investments in collaboration with internal experts and stakeholders, including OPG's Operations and Environment groups.

Management of proceeds

CICERO Green finds the management of proceeds of OPG to be in accordance with the Green Bond Principles 2021⁷. The green bond proceeds will be deposited to OPG or its subsidiaries' general account and an amount equal to the net proceeds will be earmarked for allocation to Eligible Projects. Unallocated proceeds could be held in cash and/or short-term money market instruments such as term deposits, banker's acceptance, etc., prior to allocation. OPG does not deal with non-bank counterparties on money market instruments. OPG and its subsidiaries intend to fully allocate the green bond proceeds to eligible projects within 36 months from the issuance date.

Reporting

Transparency, reporting, and verification of impacts are key to enable investors to follow the implementation of green finance programs. Procedures for reporting and disclosure of green finance investments are also vital to build confidence that green finance is contributing towards a sustainable and climate-friendly future, both among investors and in society.

The issuer commits to annual reporting of use of proceeds including a list of major Eligible Projects, a brief description of major Eligible Projects, amounts allocated and the amount of unallocated proceeds. Where feasible (e.g., for 'large' projects), the report will include qualitative and quantitative environmental performance indicators (e.g., greenhouse gas emissions reduced/avoided, renewable energy and nuclear generation, capacity of renewable

⁷ <https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf>



energy and nuclear plant constructed or rehabilitated). The reporting will be available at <https://www.opg.com/investor-relations/green-bonds/>.



3 Assessment of OPG's green bond framework and policies


The framework and procedures for OPG's green bond investments are assessed and their strengths and weaknesses are discussed in this section. The strengths of an investment framework with respect to environmental impact are areas where it clearly supports low-carbon projects; weaknesses are typically areas that are unclear or too general. Pitfalls are also raised in this section to note areas where OPG should be aware of potential macro-level impacts of investment projects.

Overall shading

Based on the project category shadings detailed below, and consideration of environmental ambitions and governance structure reflected in OPG's green bond framework, we rate the framework **CICERO Medium Green**.

Eligible projects under the OPG's green bond framework

At the basic level, the selection of eligible project categories is the primary mechanism to ensure that projects deliver environmental benefits. Through selection of project categories with clear environmental benefits, green bonds aim to provide investors with certainty that their investments deliver environmental returns as well as financial returns. The Green Bonds Principles (GBP) state that the "overall environmental profile" of a project should be assessed and that the selection process should be "well defined".

Category	Eligible project types	Green Shading and some concerns
Renewable Energy Generation 	<ul style="list-style-type: none">✓ Solar Energy<ul style="list-style-type: none">○ Construction of new solar energy facilities○ Maintenance and/or refurbishment of existing solar energy facilities✓ Wind Energy<ul style="list-style-type: none">○ Construction of new wind energy facilities○ Maintenance and/or refurbishment of existing wind energy facilities✓ Hydroelectricity<ul style="list-style-type: none">○ Construction of new run-of-river hydroelectricity projects○ Refurbishment, repowering, modernization, and/or maintenance of existing	Dark Green <ul style="list-style-type: none">✓ Some OPG projects are close to biodiversity sensitive areas and are identified and managed using a variety of on-site and corporate based screening tools and governance. OPG's Environment Policy states that "OPG shall work to prevent or mitigate adverse impacts on the environment.", and "OPG shall manage its sites in a manner that strives to maintain, or enhance where it makes business sense, significant natural areas and associated species of concern." At the corporate level, OPG adheres to its Biodiversity Conservation Standard which describes how significant natural areas are designated and managed. There has been no recent experience and future plans that would lead to displacement of people.✓ OPG informs us that large hydro refurbishment or construction with additional land flooded beyond current parameters will not be included based on the current framework. OPG complies with site-



hydroelectricity facilities with the purpose of increasing generation efficiency, operational life span and/or renewable energy output while maintaining or improving the level of operational safety ✓

specific permits to manage flows and levels, fisheries, recreational interests, public safety, etc. (e.g., OPG has installed fish ladders in some stations to facilitate migration).
Note that access roads to construct an asset that otherwise qualify under the framework, will be eligible under the framework.

Nuclear



- ✓ Maintenance and/or refurbishment of existing nuclear energy facilities ✓

Medium Green

- ✓ Proceeds can be allocated to OPG's refurbishment of Darlington to enable nuclear power supply for at least 30 more years. The majority of the proceeds will be for this activity.
- ✓ While the refurbishment of CANDU reactors can achieve a Dark Green shading in the Canadian context, the lack of strong socially acceptable long term solutions for spent fuel renders the shading Medium Green.
- ✓ Development and/or construction of new nuclear energy facilities are not eligible under the current framework. The assessment of new facilities would substantially deviate from the assessment of refurbishments and would take other factors into account. OPG informs us that no new conventional nuclear reactors are currently planned.
- ✓ OPG stores high-level waste in dry storage containers (DSCs) which are located at the three Nuclear generating sites. The permanent disposal of this high-level waste is being managed by the Nuclear Waste Management Organization (NWMO), as governed by Canada's Nuclear Fuel Waste Act. The NWMO is currently in the process of citing a location for a Deep Geological Repository (DGR) to permanently dispose of high-level waste (irradiated fuel).
- ✓ OPG does not participate directly in the mining/milling of uranium but instead sources its uranium from uranium vendors around the world. In arranging the uranium supply, OPG's uranium purchase and sale agreements include language that stipulate that the seller must ensure that supply must comply with applicable local laws including those that are applicable to safety and to the ecological protection and environmental control of soil, vegetation, water and air. These could, however, have varying degree of stringency and enforcement levels. OPG states that OPG's current



		main uranium suppliers have performed sustainability screening to identify ESG risks and opportunities. These include screening criteria and/or sustainability survey to assess their suppliers.	
		<ul style="list-style-type: none"> ✓ OPG is currently putting in place commercial mechanisms to enable it to procure uranium from countries or sites that meet the applicable ESG criteria. OPG states that they are incorporating a continuous improvement process in its procurement practices and is expected to continue to incorporate screening criteria and assessing suppliers' ESG practices. As industry market practices on ESG expectations continue to evolve, OPG will revisit its process to meet expectations. ✓ The issuer informs us that public support or resistance is an important factor in site selection for nuclear waste and spent fuel. 	
Energy Efficiency and Management 	<ul style="list-style-type: none"> ✓ Transportation efficiency/electrification ✓ Industrial Efficiency ✓ Climate change and eco-efficient products, production technologies and process 	Medium to Dark Green <ul style="list-style-type: none"> ✓ This category includes projects such as development of electric vehicles related infrastructure and projects such as energy storage or charging facilities. ✓ Industrial efficiency process with fossil fuels will be excluded. Still the climate footprint of such projects could be uncertain. ✓ No minimum improvement threshold has been defined. 	
Climate adaptation and resilience 	<ul style="list-style-type: none"> ✓ Flood protection and stormwater management ✓ Extreme weather resistant infrastructure and other forms of flooding mitigation. 	Medium to Dark Green <ul style="list-style-type: none"> ✓ The wide scope of this category with uncertain climate footprints, introduces the Medium Green shade in an otherwise Dark Green shading. ✓ Projects could relate to adaptation projects associated with OPG's nuclear, hydroelectric, and solar facilities, but not with the fossil fuel powered facilities. 	

Table 1. Eligible project categories

Background

Electricity needs are poised to rise substantially in the decades to come. An analysis of over 400 recent long-term energy scenarios suggests a 20% to 330% increase in electricity consumption by 2050. An increasing role for nuclear power is seen across many scenarios. For example, in the IPCC's special report on 1.5 degrees scenarios⁸,

⁸ <https://www.ipcc.ch/sr15/>



the majority of pathways assessed to limit global warming to 1.5 degrees with no or limited overshoot include a strong increase in nuclear energy. Typical increases are 59-98% from 2010-levels by 2030, or by 150-501% by 2050 – depending on the scenario. There are, however, also scenarios compatible with limiting global warming to 1.5 degrees that include a full phaseout of nuclear power by 2060, and scenarios where it increases by 400% by 2030, relative to 2010 levels. Among the 1.5-degree scenarios deemed most realistic⁹, only a few shows reduced nuclear power supply compared to today's level (~10 EJ). We also note that the recent IEA Net Zero Emission 2050 scenario¹⁰ show has roughly a doubling of nuclear power to 2050.

But whilst some countries are investing heavily in increasing their nuclear energy supply, others are taking their plants offline. The role that nuclear energy plays in the energy system is therefore very specific to the given country. What sets nuclear energy apart from other electricity generation technologies is its association with ionising radiation and radioactive waste, an association which attracts considerable public attention.

Globally, in 2019, around 10% of electricity comes from 442 operable nuclear power plants. France, the USA, China, Russia and Canada all produce relatively large amounts of nuclear power. Four active nuclear power plants are in operation in Canada, with 19 operating nuclear reactors. Three plants are located in Ontario and one in New Brunswick. In 2017, an estimated 15% of all electricity production in Canada came from nuclear power. In Ontario, nuclear is the largest source of power generation, accounting for an estimated 58% of total electricity produced in 2017.

Analysis of levelized cost of electricity in Europe and the USA indicates that costs of nuclear power is comparable to the cost of solar and wind power, in particular when the cost relates to extension of the operating lifetime of nuclear reactors. However, this cost does not take into account the cost of decommissioning. Other reviews report that “Nuclear power plants are expensive to build but relatively cheap to run. In many places, nuclear energy is competitive with fossil fuels as a means of electricity generation. Waste disposal and decommissioning costs are usually fully included in the operating costs.”¹¹

We note that in Europe there are examples of huge cost overruns in construction of new reactors.

The European Union Taxonomy Regulation sets up a framework for the development of an EU classification system (“EU Taxonomy”) of environmentally sustainable economic activities for investment purposes. For an economic activity to be included in the EU Taxonomy, it must contribute substantially to at least one environmental objective and do no significant harm to five other defined objectives¹². The Joint Research Centre was tasked with assessing the Do-No-Significant-Harm aspects of Nuclear energy. In their report, which also received some public criticism, they concluded¹³:

“It can be concluded that all potentially harmful impacts of the various nuclear energy lifecycle phases on human health and the environment can be duly prevented or avoided. The nuclear energy-based electricity production and the associated activities in the whole nuclear fuel cycle (e.g., uranium mining, nuclear fuel fabrication, etc.) do not represent significant harm to any of the TEG objectives, provided that all specific industrial activities involved fulfil the related Technical Screening Criteria.”

⁹ <https://doi.org/10.1088/1748-9326/abfeec>

¹⁰ <https://www.iea.org/reports/net-zero-by-2050>

¹¹ <https://world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power.aspx>

¹² The objectives are: Climate change mitigation; climate change adaptation; the sustainable use and protection of water and marine resources; the transition to a circular economy; pollution prevention and control; and the protection and restoration of biodiversity and ecosystems.

¹³ https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/210329-jrc-report-nuclear-energy-assessment_en.pdf



With regard to Ontario, next to hydro, nuclear is the cheapest form of baseload energy Ontario has. Ontario's Financial Accountability Office has stated "there is currently no portfolio of alternative low-emissions generation which could replace nuclear generation at a comparable cost." The federal government has also recognized the inherent value of nuclear energy's role in the fight against climate change. In 2020, Natural Resources Minister Seamus O' Regan has stated "there is no path to net-zero without nuclear power."

Public polling shows a very high-level support for nuclear power in Ontario, with more than three-quarters of respondents supporting refurbishment of Ontario's existing nuclear units. While some continue to criticize a proposed Deep Geologic Repository to help manage the industry's spent fuel, this concept is considered the gold standard internationally, and a federally led, fully transparent consultation process is continuing regarding final site selection.

OPG's reactors use CANDU (Canada Deuterium Uranium) technology. CANDUs have a number of unique design features and characteristics not seen in other reactor designs. They include:

- A reactor core comprising of several hundred small diameter fuel channels rather than one huge pressure vessel.
- Heavy water (D₂O) for moderator and coolant.
- Separate low-pressure moderator and high-pressure fuel cooling systems.
- Reactivity devices that are located in the cool low-pressure moderator, and not subjected to high temperatures or pressures.
- Natural uranium fuel, which is not enriched and cannot be used for weapons.
- Reactors can be refuelled while still safely operating at full power.
- Two fully capable shutdown systems, independent from each other, which are designed to act automatically in the unlikely situation a reactor requires immediate shutdown.

Overall, CANDU reactors use 30–40% less mined uranium than light-water reactors per unit of electricity produced. This is a major advantage of the heavy-water design; it not only requires less fuel, but as the fuel does not have to be enriched, it is much less expensive as well.

Governance Assessment

Four aspects are studied when assessing the OPG's governance procedures: 1) the policies and goals of relevance to the green bond framework; 2) the selection process used to identify eligible projects under the framework; 3) the management of proceeds; and 4) the reporting on the projects to investors. Based on these aspects, an overall grading is given on governance strength falling into one of three classes: Fair, Good or Excellent. Please note this is not a substitute for a full evaluation of the governance of the issuing institution, and does not cover, e.g., corruption.

For the year ended December 31, 2020, approximately 53% of electricity generation was from nuclear, 43% from hydro and other renewables and 3% from gas power.

OPG plans to reach net-zero carbon emissions, including offsets, by 2040. OPG assumes that they would not need to buy offset credits from third parties and would only apply this in extreme cases where they are having difficulty meeting their commitment in 2040. OPG's Treasury group will be responsible for review and selection of the green projects that will qualify as eligible projects. The Treasury group will verify the suitability and eligibility of such investments in collaboration with internal experts and stakeholders, including OPG's Operations and Environmental groups. Presumably, decisions are by consensus. CICERO Green finds that the management of proceeds is in accordance with the Green Bond Principles. Reporting is good and covers a reasonable set of key

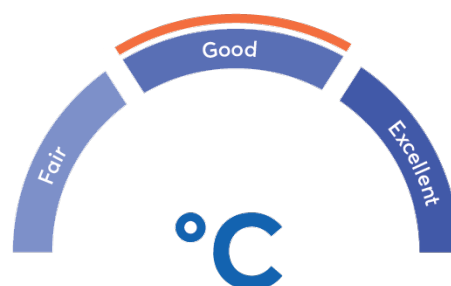


performance indicators, but it is unclear whether methods used for e.g., estimations of emissions avoided will be made public.

Given the heavy regulation of the nuclear power industry in Canada, OPG carries out extensive risk analysis covering a broad set of issues, including potential impacts from climate change. Although not totally aligned with the TCFD guidelines, we find OPG to fulfil some of the intention of the guidelines.

A concern with OPG's governance structure is the monitoring and control of environmental impacts of the nuclear fuel supply chain. Currently, this is mainly covered by contractual language to the effect of following applicable local laws and regulations in the respective jurisdictions. Going forward, however, OPG is currently putting in place commercial mechanisms with the aim of strongly improving requirements related to the ESG governance of fuel suppliers and mining operations. Hence, among other things, OPG will try emulating the do-no-significant-harm criteria in the EU taxonomy when it comes to the six environmental objectives of the taxonomy. OPG says it is incorporating a continuous improvement process in its procurement practices and is expected to continue to incorporate screening criteria and assessing suppliers' ESG practices. As industry market practices on ESG expectations continue to evolve, OPG says they will revisit its process to meet expectations. There is currently no reporting on Scope 3 greenhouse gas emissions.

The overall assessment of OPG's governance structure and processes gives it a rating of a strong **Good**. An Excellent grading would require some of the following requirements: TCFD alignment, transparency on countries supplying the fuel and/or Scope 3 emission accounting.



Strengths

The main use of proceeds is expected to be for OPG's hydroelectric fleet and the refurbishment of existing CANDU type reactors. The refurbishment prolongs the life of an important low carbon power source in Ontario, while at the same time avoiding emissions associated with decommissioning the plant. Nuclear power plants in Canada are heavily regulated, leading to a strong risk management culture, including the impacts of climate change. These are all clear strengths of the framework. The CANDU technology used in Canada also have some advantages compared to ordinary and commonly used light-water reactors, in that natural uranium is used as a fuel reducing the chances for weapon proliferation. In our opinion, refurbishment of CANDU reactors is by itself a valuable climate change mitigating activity. However, the solution for final disposal of spent fuel is still not in place, which together with residual risks and broader concerns reduces the acceptability of the nuclear technology for the general public. Similarly, we find the upgrading and maintenance of existing hydro power plants and construction of run of river stations are strengths of the framework.

OPG also launched the Centre for Canadian Nuclear Sustainability¹⁴: The Centre will integrate collaboration and research to identify innovative solutions in the nuclear sector while also supporting the work underway to prepare for decommissioning the Pickering Nuclear Generating Station.

Weaknesses

Within the limited scope of the framework and the general responsibilities of OPG we find no material weaknesses in the Green Bond Framework of OPG.

¹⁴ https://www.opg.com/media_releases/opg-opens-centre-for-canadian-nuclear-sustainability/



Pitfalls

The reporting from a highly regulated activity such as nuclear power generation is extensive and comprehensive. Still, it is not formalised along the guidelines recommended by TCFD, so it can be challenging to get a clear picture of the climate related risks confronting OPG.

OPG is taking steps to ensure it minimizes and offsets emissions to achieve Net Zero status by 2040. OPG assumes that they would not need to buy offset credits from third parties and would only apply this in extreme cases where they are having difficulty meeting their commitment in 2040. We note that Scope 1 + 2 emissions have been volatile over the last few years and include the company's thermal power operations. OPG has no comprehensive approach on its Scope 3 emissions.

The issuer has direct influence on the fuel sourcing and clearly exposed to risks from mishandling of fuel sourcing operations. Also, extending the operating life-time of nuclear reactors implies continued mining of uranium for fuel with its associated greenhouse gas emissions and social and environmental impacts. We encourage the issuer to be extra transparent on fuel suppliers and supply chain risks.

OPG's current contracts with uranium suppliers require that the suppliers must comply with all applicable environmental laws, statutes and regulations of the jurisdiction in which they operate and meet all legal requirements and strive to prevent or mitigate adverse effects on the environment with a long-term objective of continual improvement. OPG states that they monitor suppliers' compliance with contractual requirements and proactively reviews trade publication news for any items that may provide additional information respecting such compliance. OPG is not aware of any breaches of the Supplier Code or failure to comply that resulted in suspension or termination, in whole or in part, for the uranium fuel portfolio of the current suppliers. As mentioned, OPG is currently putting in place commercial mechanisms with the aim of strongly improving requirements related to the ESG governance of fuel suppliers and mining operations. These criteria will evolve consistent with acceptable practices over time to encourage suppliers to improve their ESG footprint. Some of such criteria in the future may include scope 1 and 2 emission measurements and thresholds from mining operations. The ambition of the Supplier Code as it pertains to ESG will depend in part on how it is implemented.

While nuclear power is a low-carbon source of electricity, three main concerns related to nuclear power generation that remain are final waste disposal, the potential for weapon proliferation and accidental radiation from the operation of the plants.

While a Deep Geological Repository (DGR) is a scientifically accepted method for long-term storage of spent nuclear fuel¹⁵, there has not yet been found a final socially acceptable site in Canada. The Nuclear Waste Management Organization (NWMO) is responsible for developing Canada's plan for such storage. The NWMO is currently undertaking a site selection process for the used fuel DGR and has indicated that it expects to complete the process by about 2023. While OPG is not directly responsible for spent fuel storage, and also for the mining and conversion of uranium into nuclear fuel, OPG is still exposed to some risks from mishandling during these operations, a pitfall which is reflected in the governance score and the shading of the Nuclear category.

We note that the CANDU technology mitigates the possibility for weapon proliferation and that no significant controversies have been recorded. Still, there is a residual risk associated with a maximum credible accident with devastating regional consequences. This is leading to resistance to the nuclear technology as such in part of the population. While it is not within the scope of this second opinion to assess and weight all potential risks associated with nuclear technology, we note that to some, it will be a concern that refurbishing the reactors will lead to a lock-in of a controversial technology for many more decades.

¹⁵ See e.g., <https://www.gov.uk/government/collections/demonstrating-the-safety-of-a-geological-disposal-facility-gdf>



OPG commits to not use the proceeds for financing of assets/projects for that involve the generation from fossil fuels as its primary source of fuel. Emergency or back up fossil fuel generators would be an example of a fossil fuel source that would not be excluded.

OPG can invest in hydro plants that are considered very large. OPG's investments in hydro power can have broader environmental impacts and we note that access roads to construct an asset that otherwise qualify under the framework, will be eligible under the framework.

While a great many physical risks have been mapped out for OPG, it is unclear whether this also covers risks to major suppliers.



Appendix 1: Referenced Documents List

Document Number	Document Name	Description
1	OPG's Green Bond Framework (November 2021)	
2	OPG's Climate Change Action Plan (November 2020)	
3	OPG sustainability report	https://www.opg.com/reporting/sustainability-reporting/
4	OPG Environmental Policy	https://www.opg.com/about-us/corporate-governance-and-leadership/our-operating-principles/our-board-policies/
5	OPG sustainability goals and targets	
6	Q4-2020-AIF-FINAL_2	Ontario Power Generation Inc. Annual information form for the year ended December, 2020
7	OPG Code of Business Conduct	https://www.opg.com/about-us/corporate-governance-and-leadership/our-operating-principles/code-of-business-conduct/
8	OPG Nuclear	https://www.opg.com/powering-ontario/our-generation/nuclear/
9	OPG Darlington Refurbishment	https://www.opg.com/strengthening-the-economy/our-projects/darlington-refurbishment/
10	OPG Hydro	https://www.opg.com/powering-ontario/our-generation/hydro/
11	OPG Solar	https://www.opg.com/powering-ontario/our-generation/solar-power/
12	Stakeholder attitudes	https://cna.ca/2021/02/18/canadians-support-government-investment-in-renewables-and-clean-nuclear-energy-to-fight-climate-change-despite-competing-economic-priorities-reveals-new-study/



Appendix 2: About CICERO Shades of Green

CICERO Green is a subsidiary of the climate research institute CICERO. CICERO is Norway's foremost institute for interdisciplinary climate research. We deliver new insight that helps solve the climate challenge and strengthen international cooperation. CICERO has garnered attention for its work on the effects of manmade emissions on the climate and has played an active role in the UN's IPCC since 1995. CICERO staff provide quality control and methodological development for CICERO Green.

CICERO Green provides second opinions on institutions' frameworks and guidance for assessing and selecting eligible projects for green bond investments. CICERO Green is internationally recognized as a leading provider of independent reviews of green bonds, since the market's inception in 2008. CICERO Green is independent of the entity issuing the bond, its directors, senior management and advisers, and is remunerated in a way that prevents any conflicts of interests arising as a result of the fee structure. CICERO Green operates independently from the financial sector and other stakeholders to preserve the unbiased nature and high quality of second opinions.

We work with both international and domestic issuers, drawing on the global expertise of the Expert Network on Second Opinions (ENSO). Led by CICERO Green, ENSO contributes expertise to the second opinions, and is comprised of a network of trusted, independent research institutions and reputable experts on climate change and other environmental issues, including the Basque Center for Climate Change (BC3), the Stockholm Environment Institute, the Institute of Energy, Environment and Economy at Tsinghua University and the International Institute for Sustainable Development (IISD).

