LIGHTS ON THE PATH

A Compendium of Best and Promising Practices for Reducing Greenhouse Gas Emissions and Building Resilience in Government Operations

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Introduction

"In a low-carbon, clean growth economy, federal, provincial, and territorial governments will be leaders in sustainable, low-emission practices that support the goals of clean growth and address climate change."

— The Pan-Canadian Framework on Clean Growth and Climate Change

Under the Pan-Canadian Framework (PCF), federal, provincial, and territorial governments have agreed to lead the way toward a clean energy, low-carbon future. Governments are expected to adopt ambitious targets to reduce greenhouse emissions from their own operations, scale up efforts to transition to highly efficient buildings and zero-emission fleets, and implement new approaches to procurement that support Canadian businesses, demonstrate new technologies and practices, and create jobs (Government of Canada 2017a). The PCF also commits governments to strengthening institutional resilience to the effects of climate change.

Governments play influential roles as leaders, purchasers of goods, services and construction, drivers of innovation, and managers of critical infrastructure. The federal, provincial, and territorial governments in Canada together account for only 0.6 percent of the nation's greenhouse gas emissions (Government of Canada 2017a), but their leadership on clean growth and climate change can have a much larger impact. Leading by example provides many benefits beyond reducing emissions (U.S. Environmental Protection Agency 2009), including:

- Reducing operating costs (e.g., energy and maintenance costs)
- Increasing fuel diversity and energy system reliability
- Fostering markets for clean energy products, services, and technologies and green building methodologies, components and materials
- Demonstrating the economic competitiveness of clean energy
- Promoting sustainable alternatives to conventional practices

Governments also have a responsibility to assess and improve their resilience to the effects of climate change, which pose risks to public services and infrastructure.

Canada's federal, provincial, and territorial governments have already taken many steps to reduce their emissions and build resilience; each has made more progress in some areas than in others. This means every government in Canada has something to learn from the experiences of its peers, and each government has valuable lessons to share.

The best and promising practices described in this compendium are gathered from those experiences. They serve as lights along the path toward a low-carbon and resilient future, helping to guide governments toward effective approaches that reflect their own circumstances, available resources, and priorities.

About This Compendium

This compendium was commissioned by the Climate Change Committee of the Canadian Council of Ministers of the Environment (CCME), which issued a request for proposals on January 30, 2018. The project was overseen by a federal-provincial-territorial community of practice for government leadership. The contract to develop the compendium was awarded to ICF Consulting Canada, Inc.

ICF gathered the practices in this report from several sources: 1) A survey of federal, provincial, and territorial governments by the Centre for Greening Government, distributed in July 2017; 2) Interviews with federal, provincial, and territorial officials, conducted in March and early April 2018; and 3) Desk research on government lead-by-example efforts in the United States federal government, selected U.S. state governments, and several European national governments. Additional practices and examples were provided by reviewers of the first draft of this compendium.

Cross-Cutting Best Practices

The practices in this compendium are organized into six topic areas (setting ambitious targets, developing action plans, cutting emissions from buildings and fleets, building institutional resilience, scaling up green procurement, and other initiatives), but some important practices cut across all of these topics. Four are highlighted here:

1. Frame climate change as a cross-departmental economic and business priority

Climate change is much more than an "environmental" issue. The impacts of climate change pose economic risks to government investments in buildings and infrastructure, risks to public health and safety, risks to security, and risks to the government's ability to provide mandated services.

Most areas of government operations and assets will be affected in some way by a changing climate, and most government activities contribute directly or indirectly to greenhouse gas emissions. For these reasons, responsibility for reducing emissions and addressing climate risks should be shared and coordinated across departments.

Responsibility for coordinating government action on climate change often resides in the environment ministry, but a number of provinces, territories, and the federal government have established cross-departmental working groups to coordinate activities and share information.

For example, the Canadian federal government's Centre for Greening Government, which is housed in the Treasury Board Secretariat, chairs several interdepartmental committees and co-chairs a federal-provincial-territorial committee. One benefit of the committee is that it can bring together departments with similar areas of expertise and experience, allowing them to develop service offerings to other departments that require assistance. In a similar vein, British Columbia's Climate Action Secretariat holds an annual symposium for public sector organizations to share lessons learned and best practices.

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Priority Delivery Units

The government of New Brunswick has established Priority Delivery Units (PDUs) to oversee cross-departmental initiatives. The PDUs serve as a mechanism for coordination and collaboration across the government in five priority areas: jobs, education, families, federal and aboriginal relations, and the government's Smart Province innovation initiative.

The Federal and Aboriginal Relations PDU includes a climate change component, which will drive the implementation of a carbon pricing mechanism in New Brunswick and initiate adaptation planning across the government (Government of New Brunswick 2017).

2. Embed climate change considerations into procedures and decision making

Decisions made every day within government departments can affect emissions and institutional resilience for decades to come. To promote climate-smart decisions and maintain progress over the long term, climate change considerations should be embedded into procedures and systems for decision making, procurement, and operations.

Of all the practices described in this compendium, this one—typically referred to as embedding, integrating, or mainstreaming—is one of the most important. Embedding builds capacity within departments, captures important mitigation and adaptation opportunities that might otherwise be missed, avoids decisions that could lead to costly impacts in the future, and can promote sustainable shifts in culture within a department or agency. Deep embedding—down to the level of individual people and key functions in an organization—offers the strongest prospects for climate-smart decision making, or at least ensuring that climate is a core consideration at key decision points.

The first step in the embedding process typically involves a policy mandate and/or a commitment from the government's or department's senior leadership. This leadership doesn't have to be political: for some types of actions (e.g., changes to a transportation department's infrastructure planning procedures), it could be provided by anyone in a department with the authority to set or modify standards and protocols.

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Nova Scotia's Adaptation Workplan

Through its Adaptation Workplan, Nova Scotia's Climate Change Unit (CCU) helps government departments increase their capacity to anticipate and address climate change (Nova Scotia Environment 2016). CCU uses a pragmatic evidence-based approach to help departments learn to scan their operations and identify functions most sensitive to climate change, as well as their current capacity to address them. This is the foundation for developing strategic plans to help departments thrive in a changing climate. Key innovations in CCU's approach include:

- **Scan Teams, Champions, and Project Teams:** Deputy ministers assign a scan team for the initial assessment and subsequently nominate champions and an adaptation project team. Senior leadership provides support and removes barriers while the champion and team build bottom-up capacity.
- **Projects:** CCU collaborates with the department on individual projects that integrate climate change adaptation into the department's work.
- **Learning Modules:** CCU organizes online and in-person learning opportunities designed to strengthen capacity to address complex problems like climate change adaptation.
- **Experience Collection:** Baseline readiness and on-going progress are assessed using a novel mixed-methods approach. People share experiences (stories) via an online tool and participate in quantitative analysis (Nova Scotia Environment 2017).

Once opportunities for embedding are identified, the department needs to build the capacity of its staff (e.g., through training) to implement the new guidance and procedures.

The process of embedding should also involve incorporating climate change into management performance metrics. For example, the Canadian federal government is exploring options to apply a "climate change lens" in management performance assessment through the government's Management Accountability Framework. Policies and programs could be evaluated for their vulnerability to future climate risks (along with how they address those risks), along with the impact of the policy or program on greenhouse gas emissions and resilience.

3. Connect with others who face similar opportunities and challenges

Many government departments across Canada—and across the world—face similar challenges in developing emissions reduction plans or resilience strategies. The risks posed by thawing permafrost to buildings and transportation infrastructure, for example, are a concern in all northern jurisdictions. Similarly, Canada's Coast Guard, Navy, and ferry systems face similar challenges and opportunities as they explore ways to reduce greenhouse gas emissions associated with their operations.

When jurisdictions with similar circumstances collaborate, they can learn from each other's experience and expertise to develop common solutions. The cross-departmental working groups and communities of practice mentioned above can provide many opportunities for this sort of matchmaking and joint problem-solving, but jurisdictions can look farther afield to connect with other provinces, territories, communities, and national governments for advice and perspective. The Northern Premiers' Forum, for example, provides a venue for the three Canadian territorial premiers to work collectively on environmental, fiscal, and social issues of concern across the North.

Jurisdictions that have successfully achieved emissions reductions or resilience-building in specific applications may be able to help others with less experience in those areas. For example, many of Québec's public elementary and high schools have converted their buildings' heating systems from fuel oil to geothermal heat, but hospitals and clinics have not moved as quickly toward alternative heating sources. In contrast, hospitals in New Brunswick are leading the public sector's efforts to reduce greenhouse gas emissions from buildings, with sophisticated energy management systems and detailed plans in place. For example, the province's Horizon Health Network, which operates 12 hospitals and more than 100 medical centres, benchmarked its buildings' performance with ENERGY STAR Portfolio Manager and installed an energy management information system in most of its facilities (Natural Resourcess Canada 2017). Québec's healthcare sector thus might be able to learn from New Brunswick's experience, while public schools in New Brunswick might be able to learn from their counterparts in Québec.

A classic illustration of the value of connecting with other jurisdictions in similar circumstances comes from the United States, in which the U.S. Agency for International Development fostered a knowledge-sharing partnership between Peru and Nepal to reduce risks related to glacial lake outburst flooding. The high mountain areas of both Peru and Nepal experience these catastrophic floods, which occur when water from melting glaciers pools in moraine-dammed lakes that can release enormous quantities of water when the moraine is breached. Through this partnership, Peruvian scientists were able to share their country's 70 years of experience in controlling glacial lake outbursts with scientists and government officials in Nepal, which had very little experience with control measures (U.S. Agency for International Development 2015).

Another advantage to collaborating with others is the ability to coordinate pooled requests for expertise, studies, and data.

4. Consider an integrated approach to mitigation and adaptation

Greenhouse gas reductions and resilience-building are typically treated as separate priorities, and solutions are often considered in isolation. This can lead to unintended consequences—such as when an action to improve resilience ends up increasing emissions, or a mitigation option leads to increased vulnerability under a changing climate. It can also overlook synergistic opportunities that maximize benefits for both mitigation and resilience.

For example, some renewable energy sources, such as hydropower and biomass, are sensitive to climate change. While provinces and territories that rely heavily on these sources are already considering how they will be affected by projected changes in climate, their long-term greenhouse gas mitigation targets and action plans should consider these risks as well.

One way to encourage integration is to require explicit consideration and quantification of co-benefits in the analysis of mitigation and adaptation options. For example:

- Energy efficiency can offset higher cooling energy costs due to warming temperatures; it can also improve air quality.
- Actions to reduce water consumption to increase resilience to drought can also reduce energy use and emissions associated with water extraction, distribution, and use.
- Distributed generation of electricity can reduce reliance on the transmission grid and can lower peak demand (especially on hot days).

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Alberta's Climate Change and Emissions Management Fund

Because climate change mitigation and adaptation are often treated as separate priorities, they are typically funded separately. The division of funding can act as a barrier to addressing mitigation and resilience in integrated ways.

The Government of Alberta's Climate Change and Emissions Management Fund, funded by payments from large emitters in the province, supports investment in innovation and clean technologies to reduce greenhouse gas emissions and improve resilience to climate change. Including both adaptation and mitigation in one fund reduces competition for funding between adaptation and mitigation goals (Morand, Hennessey et al. 2015).

Integrated approaches to mitigation and adaptation are not yet widespread enough to be considered "best" practices, but they are active topics of discussion in a growing number of jurisdictions.

Setting Ambitious Targets

A specific target for greenhouse gas reductions or carbon neutrality serves as a driving force for policies and programs with measurable outcomes. Ambitious targets set the bar higher: they are "stretch" goals that require significant effort and innovation to achieve.

An ambitious target signals that a government takes the risk of climate change seriously and is willing to dedicate staff time and resources to address it. It can also demonstrate a government's determination to lead, especially in cases where a government adopts a more ambitious target for reducing its own emissions than a target set for the province, territory, or nation as a whole. In their efforts to meet targets, government can also help move markets and create demand for clean technologies.

In Canada, the federal government has committed to reducing its own greenhouse gas emissions to 40 percent below 2005 levels by 2030 or sooner and 80 percent by 2050 (compared with the nationwide target of 30 percent below 2005 levels by 2030). It has also established a goal of using 100 percent clean power by 2025, and set targets for reducing emissions from government buildings and fleets (see the section on Cutting Emissions from Buildings and Fleets). Several provinces and territories have also set targets specifically for reducing emissions from government operations; British Columbia's public sector has committed to carbon neutrality and has achieved that goal each year since 2010.

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Third-Party Verification and Reporting

The Government of Yukon and the Government of the Northwest Territories report their greenhouse emissions annually through the Climate Registry—currently the only jurisdictions in Canada to do so (Government of the Northwest Territories 2017, Government of Yukon 2017). Yukon additionally invests in third-party verification of its emissions reports.

Third-party reporting and verification can enhance rigor, transparency, and accountability, and using a reporting provider's existing system may be less resource-intensive than developing a reporting process in-house.

Apart from carbon neutrality, emissions targets are typically expressed in terms of a percentage reduction from a past base year, by a future target year: e.g., 40 percent below 2005 levels by 2030. Recognizing that many factors outside of government control can affect emissions in any given year (e.g., economic activity, annual variations in weather), some countries have established targets to be achieved over a multi-year period; this was the approach used in the Kyoto Protocol targets under the UN Framework Convention on Climate Change. Targets can also be set using alternative metrics such as emissions intensity, which is usually expressed as emissions per unit of economic activity. The United States adopted an emissions intensity target under the Bush administration in 2002, and several Canadian provinces (e.g., Saskatchewan) have adopted emissions intensity targets for energy use in buildings.

Best and Promising Practices for Setting Ambitious Targets

Jurisdictions can use any of the following practices to help guide their development of targets.

1. Consider establishing a separate emissions target for government operations

As noted above, a separate target for government sends a signal of leadership, and can be used to test new approaches such as carbon neutrality. In cases where a government adopts a more stringent goal for itself than the one that applies to its overall jurisdiction, the target also makes it clear that the government is walking its own talk and shouldering more responsibility. In Canada, the federal government, British Columbia, New Brunswick, Northwest Territories, Ontario, Québec, Prince Edward Island, and Saskatchewan have all established or are working on government-specific greenhouse gas emissions targets or carbon neutrality. For example, British Columbia's target for the province as a whole is a 40 percent reduction from 2007 levels by 2030, rising to 80 percent reduction by 2050, whereas the public sector target is for carbon neutrality starting in 2010.

Targets should be based on scientific advice, or at least consistent with existing international targets that are based on science.

2. For emissions targets, consider the base year

The elements of an emissions target (e.g., the base year, target year, and reduction percentage) may need to be consistent with other existing targets within or across jurisdictions, but if flexibility exists it's a good idea to choose the base year carefully. Greenhouse gas emissions are affected by many factors, including economic and weather conditions. Choosing a base year in which the government consumed an unusually low amount of energy, for example, may make it more challenging to achieve a given percentage reduction target. In practice, jurisdictions typically use a base year that is compatible with national or international targets, but they should still take time to understand the implications of that particular base year in terms of its impact on the efforts they will need to make to meet their target.

Some jurisdictions use normalization techniques in emissions reporting to better understand the impacts of annual variations in weather. For example, British Columbia's government determines weather-normalized emissions from building energy use to improve its management of that energy by providing a more accurate picture of building performance over time. Buildings account for about 75 percent of BC's public-sector emissions, and BC normalizes its emissions reporting to remove the effect of weather on heating and cooling requirements in buildings (British Columbia Ministry of Environment and Climate Change Strategy 2017) to facilitate more accurate understanding of their year-over-year performance. Note that BC offsets its **non**-normalized emissions to achieve carbon neutrality.

3. Consider the jurisdiction's unique circumstances

Every jurisdiction relies on a different mix of energy sources, experiences different climate and economic conditions, and faces different constraints and opportunities. Targets—especially those for specific departments within government (see below)— should reflect those circumstances.

For example, the mix of sources used to generate electricity varies widely by region and province. Alberta's electricity is currently generated mainly by burning coal and natural gas, and each kilowatt-hour (kWh) of electricity consumed in the province results in emissions of 820 grams of carbon dioxide equivalent (CO_2e). In Québec, by contrast, each kWh of electricity results in just 3 grams of CO_2e since most electricity is generated from hydropower. A target to shift government fleets to all-electric vehicles by a given date could, for example, have a greater impact on greenhouse gas emissions in Québec than in Alberta or in northern and remote communities, including those in the territories, where nearly all electricity is produced by diesel. (While regional emission factors should be considered, it is important to note that electrification of fleets provides a range of environmental benefits—including air quality and public health benefits in urban areas—and as a general rule will decrease greenhouse gas emissions compared with conventional fuel fleets.)

4. Break down the target by year and department

A target for a distant year such as 2030 or 2050 communicates little urgency, and it can be easy for progress to fall behind in the intervening years. Some provincial governments, such as Saskatchewan's, have broken their long-term target into annual reduction rates to help keep themselves on track. Another approach, adopted by the Canadian federal government and some other jurisdictions, is to set a near-term target, e.g., for 2020, and a longer-term target for 2030 or 2050.

A uniform target can be imposed top-down across the entire government, with each department responsible for meeting the same target, but this approach fails to account for differences in individual departments' ability to meet it. A more effective approach may be to work with departments to establish targets and actions by department that together will meet the jurisdiction's target. The Canadian federal government and a number of provincial governments have established specific targets for buildings and fleets in addition to a government-wide emissions reduction target. Alberta, for example, has established annual targets for reducing the energy intensity of its buildings.

In the case of carbon neutrality, targets are typically set as a recurring annual goal once neutrality is attained (i.e., a jurisdiction may set a future target date for reaching carbon neutrality, and then maintain carbon neutrality as an annual target thereafter). See below for additional considerations related to carbon neutrality.

5. Develop a system for measuring and monitoring progress

To measure progress, quantitative targets require quantitative monitoring and reporting systems. The most widespread best practice in this area is to develop a greenhouse gas inventory and reporting system. Most—but not all—Canadian provinces and territories have developed province-wide or in some cases government-specific emissions inventories, as have the central governments of industrialized nations, many U.S. states, and hundreds of municipalities around the world.

An inventory establishes a baseline, reveals areas where opportunities for emissions reductions may be greatest, and provides a crucial tool for monitoring progress.

Developing an inventory and tracking system for government buildings and fleets can be relatively straightforward compared with developing a province- or territory-wide inventory, but it still requires time and effort. The Province of British Columbia has developed best-practices guidance on developing a government-wide inventory and measuring greenhouse gas emissions; links to additional guidance on inventory development—including links to example inventories—are available in Appendix 2 of this compendium.

Governments that want to go further in documenting their carbon footprint may also capture data on activities such as business travel and commuting using data on travel receipts and employee surveys on commuting.

Inventories can be developed for the public service as a whole, or by individual departments/agencies. In British Columbia, for example, each provincial public sector organization including school districts, health authorities, crown corporations, post-secondary institutions, and the provincial government prepares its own inventory using a centrally provided tool to standardize and facilitate reporting.

Developing a government emissions inventory follows the same basic approach used to develop provincial, territorial, or federal inventories, which can be broken down into the following high-level steps (U.S. Environmental Protection Agency 2017b):

- Define the inventory's boundaries (e.g., organizational and operational)
- Define the inventory's scope (i.e., which greenhouse gases and categories of sources will be included)
  - Scope 1 emissions are greenhouse gases produced directly from sources owned or controlled by the government, such as from the combustion of fuels in vehicles or in heating buildings. Scope 2 emissions are those generated indirectly from the consumption of purchased energy (electricity, heating, and cooling). Scope 3 emissions include indirect emissions in the value chain (e.g., upstream or downstream) (Treasury Board of Canada 2018).
  - Most government greenhouse gas emissions inventories focus on carbon dioxide, although inventories that include Scope 3 emissions will include other gases (e.g., methane, nitrous oxide, and hydrofluorocarbons).
- Choose the quantification approach (top-down data, bottom-up data, or some combination of the two)
- Set a baseline year
- Engage departments/agencies in data collection
- Consider third-party verification

6. Employ offsets carefully in carbon neutrality targets

Jurisdictions can achieve carbon neutrality through any combination of emissions reductions and offsets to counterbalance the effect of the remaining emissions. The atmosphere doesn't distinguish between the two: from the climate's perspective, a carbon-neutral goal achieved entirely through offsets is just as good as carbon neutrality achieved by reducing emissions all the way to zero—as long as the carbon offsets are based on rigorous protocols and have the same effects on climate as

greenhouse gas reductions achieved in the government's operations. But it's still important to find a way to discourage departments from relying too heavily on offsets, because emissions reductions provide so many co-benefits—such as reducing energy costs, improving public health through reduced air pollution, supporting markets for clean technologies, and moving government toward more sustainable technologies and practices. Furthermore, emission reductions provide certain climate benefits without the longevity concerns and uncertainties associated with some types of offsets, particularly those that rely on afforestation or forest protection.

Offsets may appear to be the lowest-cost solution, but energy efficiency measures should be assessed based on the payback over their lifetime or net-present value. In many cases, the lifetime costs may be lower than those of offsets. Retrofits to Canadian crown-owned buildings facilitated by NRCan's Federal Buildings Initiative have resulted in 15 to 20 percent energy savings on average, with annual savings of $44 million (Natural Resourcess Canada 2018).

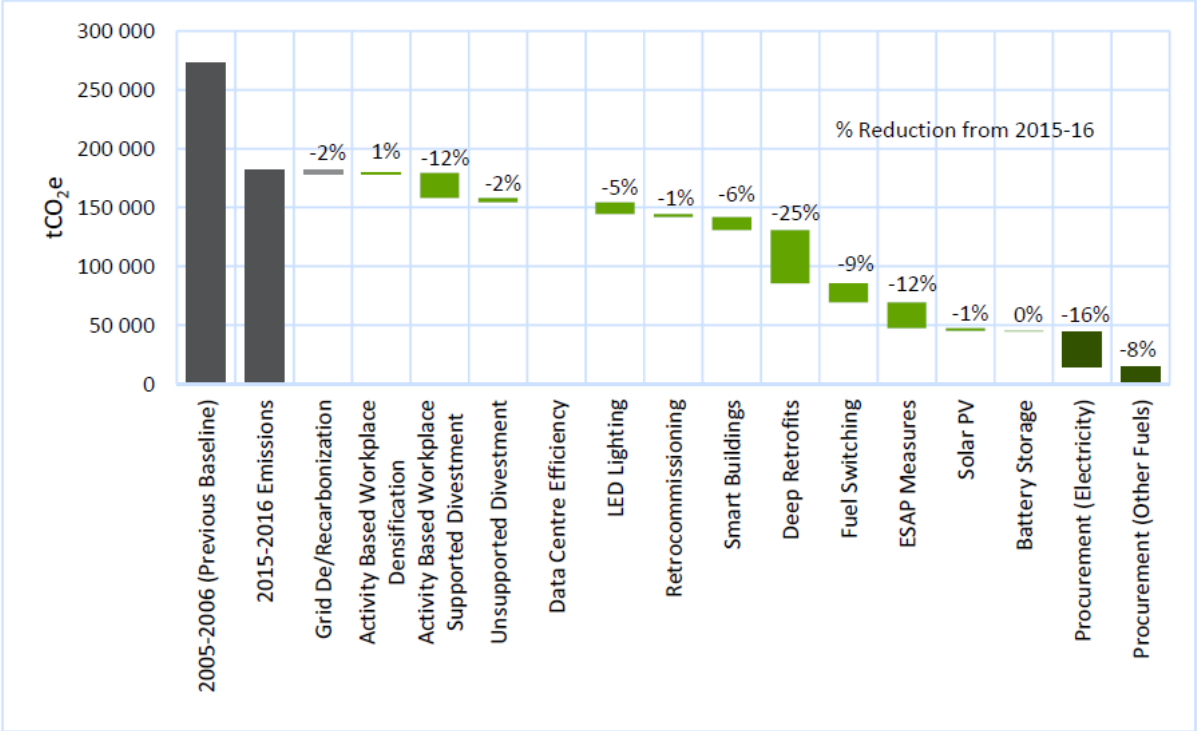
Jurisdictions with carbon neutrality targets may consider being prescriptive about percentages of the carbon neutrality target that can be achieved through emissions reductions versus offsets, or establishing a hard target for emissions reductions and using offsets for the remaining emissions to achieve carbon neutrality.

Developing Action Plans

A climate action plan lays out a jurisdiction's approach to implementing a climate change mitigation and resilience strategy. Action plans vary widely in their scope, but usually include specific goals and targets, along with a set of policies, programs, and projects whose combined impact is estimated to achieve the targets (see **Figure 1**).

As with greenhouse gas emissions inventories, the process of developing a government-specific action plan is similar to that for developing a provincial, territorial, or federal action plan; the main distinction in a government-specific plan is that the stakeholders involved in the consultation process are mainly government departments and agencies.

Figure 1. The elements of Public Service and Procurement Canada's carbon neutral action plan, showing the contribution of each toward the department's target (Public Services and Procurement Canada 2017).



The process of developing a climate action plan typically includes the following steps (U.S. Environmental Protection Agency 2017a):

- Establish priorities: Use the greenhouse gas inventory to identify key departments and areas to target for emission reductions; use vulnerability and risk assessments to identify priority areas for building resilience
- Collaborate with departments and agencies to identify proposed actions and translate overall targets into department-specific goals and targets

- Establish evaluation criteria for action options (e.g., effectiveness in reducing emissions, economic costs and benefits, political feasibility, legal constraints, measurability, co-benefits that contribute to other governmental priorities)
- Identify a range of options, based for example on activities proposed by departments, implemented by other jurisdictions, or recommended through expert advice
- Evaluate, rank, and select options using the evaluation criteria
- Include monitoring and reporting mechanisms in the action plan to ensure consistent reporting of results

Best and Promising Practices for Developing Action Plans

The following practices, gathered from interviews with government officials and desk research, can be used to help guide the development of effective action plans.

1. Prioritize actions and take an iterative approach

Instead of trying to tackle climate change mitigation and adaptation comprehensively from the start, many jurisdictions—including the Canadian federal government—have found it more feasible to prioritize, expanding the scope of activities over time. New Brunswick, for example, analyzed options based on the cost per ton of emissions avoided or reduced, and prioritized actions that way (see **Figure 2** for an example of a matrix that could be used to compare options based on initial investment and life-cycle cost per ton of emissions reduced).

Figure 2. Sample table for comparing costs (including life-cycle costs per ton of emissions reduced) across options in an action plan. Adapted from Public Services and Procurement Canada (2017).

Plan Element	Number of Projects	Anticipated GHG Reduction (tCO2e)	Incremental Capital Costs	Annual O&M Cost Change	Life Cycle Cost	Average LCC per GHG Emissions Reduction ($/tCO2e)
Grid de/re-carbonization						
Activity-based workplaces (Densification)						
Asset divestment						
LED lighting						
Recommissioning, Audit, No- and low-cost energy conservation measures						
Smart buildings						
Deep energy/GHG retrofit						
Fuel switching						
Solar PV						
Battery storage						
TOTAL						

Many jurisdictions start by targeting emissions reductions from buildings and fleets, since the options are mostly well known and tested, methods for estimating costs are readily available, and emissions reductions are relatively simple to measure and report. Once programs to capture the low-hanging fruit are in place, action plans can evolve and expand to capture other opportunities such as materials

management (i.e., a life-cycle approach to waste reduction), drinking water and wastewater, business travel, etc.

A related practice is to establish a new list of priority actions to work on each year. Establishing an annual "top 10" priority list helps keeps implementation teams focused and shrinks the change to a manageable number of activities.

2. Require monitoring and reporting

A legislative or other policy mandate to report on progress in reducing emissions and/or building resilience will ensure that a jurisdiction and its individual departments put a priority on establishing and implementing a measuring and reporting system. New Brunswick, for example, has a legislative requirement to report annually on progress toward its emissions target.

3. Develop guidance and a structure for implementation before the action plan is released

Working with departments ahead of time to develop a structure for implementing the action plan will help ensure an efficient transition to implementation once the action plan is released. Developing guidance and training for department staff is also important for engaging staff in the process and ensuring they understand how to implement new procedures.

4. Create a mechanism for evolving the plan

Given limited staff time and agency resources, each jurisdiction needs a way to keep new ideas coming. For example, Newfoundland and Labrador's core departments and agencies are required to submit an annual list of actions that they plan to take to reduce the environmental impact of their operations. They submit their plans to their deputies for approval each year and report on previous year's actions. The government's climate change branch provides feedback and creates a synthesis report on action across all departments and agencies.

5. Collaborate across departments

When multiple departments and agencies (e.g., environment, energy, transportation) work together to plan and implement climate and clean energy policies, they are more likely to achieve their goals. Involving staff from multiple departments helps identify, access, and leverage existing expertise, programs, resources, and tools. Climate change action plans can also involve collaboration across provinces and territories; for example Ontario and Québec developed a Joint Work Plan on Economic Development Through Climate Change Innovation (Government of Canada 2017b).

6. Consider impact of changing circumstances over time

When estimating the future greenhouse gas impacts of actions, it's important to incorporate forecasted trends that may affect an action plan's effectiveness over time. For example, the electricity generation mix is expected to change over the next several decades throughout Canada, leading to lower emissions per kWh in most provinces and territories by 2030, with the exception of British Columbia and Québec, where emissions intensity is expected to increase, and Ontario, where emissions intensity is expected to remain relatively flat (Public Services and Procurement Canada 2017).

7. Incorporate and call out co-benefits of climate actions

Actions to reduce greenhouse gas emissions and improve resilience have many benefits apart from those related to climate change. Among other positive impacts, they can produce economic savings, create jobs and support Canadian businesses, improve air quality and public health, and enhance public safety. Identifying and calling out these benefits in an action plan can raise awareness of these co-benefits and increase support for climate actions within and outside of government.

Cutting Emissions from Buildings and Fleets

For most governments, buildings and fleets represent the largest and most cost-effective opportunities for reducing greenhouse gas emissions associated with their operations. The Canadian federal government's emissions inventory, which currently tracks emissions from these two sources only, shows 88 percent of emissions coming from buildings, with the remaining 12 percent from fleets (Government of Canada 2018).

The Pan-Canadian Framework commits federal, provincial, and territorial government to scale up their efforts to transition to highly efficient buildings and zero-emission vehicle fleets. Because governments are major owners of buildings and fleets (Canada's federal government is one of the largest real property owners in the country), their efforts to reduce greenhouse gas emissions can have enough impact to create Canadian jobs and increase demand for clean products and services.

Emissions from the operation of buildings come from the combustion of fuels used to heat them, and from the electricity they use. For fleets, emissions come from the fuels burned to operate vehicles. There are also indirect emissions associated with the full lifecycle of buildings and fleets, from raw materials extraction through construction and on to demolition and disposal, but most current government efforts to reduce emissions focus on the *operation* of buildings and fleets.

Governments around the world have been focusing on reducing emissions from buildings and fleets for decades, motivated by reduced energy use and maintenance costs as well as environmental benefits. As a result, there are many well-tested options available—with documented costs and benefits—and established standards and protocols to choose from. Options to reduce energy use can include behavioral and procedural changes as well as technological solutions.

BRIGHT IDEA

LEED in the North and Remote Locations

Attaining LEED Silver or Gold certification can be a challenge in northern jurisdictions and in remote areas of any province or territory, for reasons such as the lack of access to alternative transportation. But it's not impossible. Alberta, for example, has several remote buildings with LEED silver and gold certification.

The Boreal Centre for Bird Conservation (LEED Gold, near Slave Lake) and Crop Diversification Centre Greenhouse (LEED Gold, near Brooks) include sustainable sites, efficient fixtures, local and/or green materials, and innovative multi-functional designs.

Manitoba's University College of the North campus at Thompson is another example of a northern building that achieved LEED Gold.

Adopting standards that are customizable and understanding the local context are keys to success in reaching LEED certification in remote areas (McKay 2014).

Best and Promising Practices for Cutting Emissions from Buildings and Fleets

Buildings

1. Establish energy standards and rules for new buildings

Every new building represents a long-term commitment to future emissions, and minimizing those emissions at the outset (e.g., in the building design stage) is one of the most effective steps a government can take to control its carbon footprint. A number of provincial and territorial governments address this by requiring all new government buildings to meet specified standards such as Leadership in Energy Efficiency and Design (LEED) Silver, Gold, or Platinum, and/or the Building Owners and Managers Association of Canada's BOMA BEST certification. Alberta, British Columbia, Manitoba, Ontario, Nova Scotia, New Brunswick, and the U.S. state of Colorado are examples of some of the many jurisdictions with this type of requirement.

Some jurisdictions, such as California, go so far as to establish their own green building codes that go beyond LEED standards or have a broader scope. Others set rules and targets, such as Québec's requirement that all new public buildings must be heated with renewable energy and that their efficiency performance must be 20 percent better than required by the 2011 national building energy code or the 2010 ASHRAE 90.1 standard, or the Canadian federal commitment to make all new government buildings net-zero-carbon ready starting in 2022 at the latest. The federal government will prioritize low-carbon investments in major real property investment decisions by applying a shadow price on carbon.

NRCan provides a summary of best energy efficiency practices to consider when developing new buildings. In general, best practices for improving the energy performance of existing buildings, as described below, also apply to the design and operation of new buildings.

2. Capture opportunities to reduce emissions from existing buildings

A government's existing building stock likely represents its single largest source of emissions. Efforts to reduce those emissions focus on three areas:

- Reduce electricity use.
- Reduce heating energy use.
- Shift to low- or zero-carbon energy sources.

The priorities for these activities will vary depending on a jurisdiction's circumstances: in areas where the emissions intensity of electricity is low, such as Québec, governments will place a higher priority on heating energy efficiencies and fuel-switching than on electricity efficiency measures. In areas where electricity is more carbon-intensive, the focus will shift more toward electricity efficiency and renewable electricity product. For example, Alberta has committed to installing 854.7 kilowatts of solar electric generating capacity on government-owned buildings.

Energy audits are a widely used practice for understanding a building's energy use and identifying opportunities for savings. Audits also typically provide cost information to help departments prioritize their investments. Retrofit activities can be separated into tiers based on initial costs, with the first tier devoted to activities with the lowest up-front costs (e.g., lighting retrofits), a second tier with higher costs to achieve deeper savings and emissions benefits (e.g., insulation or HVAC system upgrades), and a final tier with the highest-cost initiatives (such as installing on-site renewables).

Using audit information as a benchmark, jurisdictions can track and report on their progress over time. Providing building performance information to building occupants can help increase their climate awareness and may lead to behaviour changes.

To maintain efficiency gains and greenhouse gas emissions reductions, jurisdictions should develop procedures for monitoring and verification, along with providing training and guidance to facility managers and staff. Québec, for example, has published an updated 9-step guide to improving energy performance and reducing greenhouse gas emissions in institutional buildings.

The cost-effectiveness of specific measures varies across jurisdictions, depending on factors such as electricity prices and the specific existing technology that is being upgraded or replaced. Most energy efficiency investments have negative costs over their lifetime, but some (e.g., conversion from conventional incandescent lights to LEDs) have much earlier paybacks than others and can pay for themselves many times over. Improving energy efficiency is usually more cost-effective than fuel-switching, but there are exceptions, such as fuel-switching from heating oil to biomass.

Most government departments use or operate data centres, which consume considerable amounts of energy. Special attention should be focused on opportunities to reduce emissions from their operation; since data centres can in most cases be operated remotely, consider moving them to jurisdictions with less carbon-intensive electricity generation (Public Services and Procurement Canada 2017).

With respect to switching to low- or zero-carbon energy sources, biomass from waste wood products has emerged as a popular alternative to oil and other fuels for heating public buildings in some Canadian provinces and territories. The Government of the Northwest Territories has a target to double its use of biomass heating by 2030 in government buildings, rising from the current 20 percent of its building stock to 40 percent. Prince Edward Island has had success using biomass heating plants in hospitals and other public buildings and also wants to expand its use. Note that transportation of biomass fuels will contribute to their carbon footprint, which may be a concern depending on the source of energy they are replacing. Geothermal energy is a popular choice in Québec, with wide adoption among primary and secondary schools. District energy is also an important alternative in some jurisdictions (e.g., federal office buildings in Ottawa; district heating is also used in some communities in Nunavut).

NRCan provides a summary of best practices for improving energy efficiency in existing buildings.

3. Develop plans and schedules for equipment replacement and deep retrofits

Several jurisdictions emphasized in interviews that it is important to establish a process to ensure low-carbon solutions are employed when appliances and other equipment need to be replaced. This can be accomplished by implementing procurement standards. Setting internal protocols and procedures can also be helpful: for example, efficiencies can be gained by deferring maintenance tasks to coincide with major retrofits (e.g., replacing or upgrading a roof while installing solar panels). The best practice is to develop a plan for how equipment will be replaced *before* it needs to be replaced. In the absence of a plan, departments may be forced to rush into hasty and non-optimal decisions.

4. Consider a recommissioning plan for energy-optimized buildings

All buildings drift away from optimal performance over time. The process of re-optimizing a previously optimized building's performance and operation is called recommissioning. This can be conducted periodically (every 3–5 years) depending on use.

Recommissioning begins with an audit of the system's design and current requirements and performance, which forms the basis for recommendations to optimize controls, retrofits, and maintenance. A Lawrence Berkeley National Laboratory analysis of recommissioning efforts in 643 buildings found that recommissioning yielded an average energy savings of 16 percent and an average payback of 13 months (Public Services and Procurement Canada 2017).

NRCan provides a guide to recommissioning.

5. Invest in smart building technologies

Smart buildings programs use a variety of technologies to monitor and manage building performance, commonly referred to as ongoing or monitoring-based commissioning. These technologies can play a key role in maintaining energy savings over time, as well as monitoring building performance for the purposes of reporting on progress toward targets. Smart building technologies can also be used to identify new energy-saving opportunities. The government of Saskatchewan, for example, has been running a pilot smart building project that applies clamp-on sensors to all electrical panels in a building. The system allows the building's energy managers to see in real time when equipment and lights are turned on and off, allowing them to take a more proactive approach in determining peak load and understanding how the building operates.

One way to promote smart building technologies in government facilities is to revise planning and procurement protocols to require their use, along with advanced building energy modelling and integrated project delivery practices.

6. Consider workplace densification measures and teleworking

Denser workspaces, which focus on flexibility, adaptability, and collaboration, can provide energy savings compared with traditional fixed office layouts: they reduce lighting density and may allow divestiture of unused office space. Laptops are typically used in these environments, which are more energy-efficient than desktops, and teleworking can further decrease the need for office space.

7. Explore ways to address common barriers to energy efficiency and renewables

Although energy efficiency and renewable energy measures typically have net benefits over their lifetimes, their up-front costs stand as a barrier to implementation for departments with limited operations and maintenance funds. Other common barriers include lack of in-house expertise and the risk tolerance of financiers. Jurisdictions have used a variety of approaches to overcome these barriers.

For example, the government of the Northwest Territories operates a Capital Asset Retrofit Fund, a revolving fund that funds energy efficiency improvements in the territory's assets and then invests the cost savings into further energy efficiency improvements.

Québec has made extensive use energy services companies (ESCOs) in its energy efficiency projects. ESCOs offer expertise, supplier networks, and staff to complete projects, and can package multiple measures into one project to lower the risk level of investments. They can also provide an investment performance guarantee.

BRIGHT IDEA

Backward Reprofiling

One innovative (but as yet untested) approach to funding the up-front costs of energy efficiency improvements is to bring forward the cost savings from future years and use them as capital.

This concept is the reverse of traditional reprofiling, in which money not spent this year is rolled over into the next fiscal year. Backward reprofiling would apply the projected savings from efficiency measures to the year in which the investments are made, and decrease the annual operating budget of the department in future years by the amount it would save.

Fleets

Government fleets are typically the second-largest source of emissions from government operations, after buildings. In Canada, fleets are not just on-road vehicles but also airplanes, ships, ferries, and snowmobiles. As with buildings, efforts to reduce emissions from fleets should focus on standards for new vehicle purchases as well as efforts to improve the efficiency of the existing fleet.

Many of the actions taken by federal, provincial, and territorial governments to reduce transportation emissions across their jurisdictions will also contribute to reducing emissions from government fleets. For example, government investments in alternative fuel infrastructure, such as Ontario's network of electric vehicle charging stations, BC's Low Carbon Fuel Standard, and Québec's Transportation Electrification Plan (Government of Québec 2015), will make alternative-fuel vehicles more practical in government fleets as well. Prince Edward Island has been installing roundabouts—which have demonstrated greenhouse gas emission reduction benefits compared with traffic lights—as intersection controls, a strategy that is not specifically aimed at reducing emissions from government fleets but will play a role in government emission reduction efforts simply because fleet vehicles will use those roundabouts as well.

1. Establish emissions targets or other objectives for fleets

Jurisdictions can consider establishing targets and goals for greening their fleets, such as reducing emissions by a specified amount or increasing the uptake of zero-emission vehicles. For example, the Canadian federal government has set the following targets under its Greening Government Strategy (Treasury Board of Canada 2018):

- Starting in the 2019 to 2020 fiscal year, 75 percent of new light-duty administrative fleet vehicle purchases will be zero-emission vehicles (ZEVs) or hybrid, with the objective that the government's administrative fleet comprises at least 80 percent ZEVs by 2030. Priority is to be given to purchasing ZEVs.
- Starting in the 2018 to 2019 fiscal year, all new executive vehicle purchases will be ZEVs or hybrids.
- Fleet management will be optimized including by applying telematics to collect and analyze vehicle usage data on vehicles scheduled to be replaced.
- Alternative energy options and their potential use in fleet operations related to national safety and security will be examined.

2. Develop a fleet inventory and track consumption

One of the first steps in reducing fleet emissions involves developing a fleet inventory to characterize the existing fleet (including information on vehicle classifications—such as light-duty, heavy-duty, off-road, etc.—vehicle ages, technologies, fuel types, and fuel consumption) and estimate baseline emissions. Emissions are best derived directly from fuel consumption data, rather than from odometer readings, since fuel consumption per distance travelled varies widely by environment (urban vs. highway), terrain, and other factors. Emission factors for vehicle fuels are available from Environment Canada in its national greenhouse gas inventory report, or in BC's Best Practices Methodology for Quantifying Greenhouse Gas Emissions.

To establish consistency, it is a good practice to survey departments to learn how they currently track vehicle fuel consumption and other data. Québec, for example, conducted a survey in 2015 that found a diversity of recordkeeping approaches across departments and institutions, with most collecting data on both fuel costs and consumption, while a few collected only cost data or only fuel consumption data.

3. Establish standards and procedures for buying or leasing new vehicles

Explicit policies and guidance provide a framework for purchasing decisions, and can be used to ensure the purchase of fuel-efficient, low-emission, or zero-emission vehicles. For example, Prince Edward Island's Transportation Efficiency Standard requires that any leased or purchased fleet vehicle, 1 ton or less, must be more fuel efficient than at least 70 percent of the vehicles in its class. Québec requires all new vehicle purchases to be 100 percent electric or rechargeable hybrid (i.e., plug-in hybrid or extended-range electric). Parks Canada requires new vehicle purchases to be made from a preauthorized list of vehicles, which includes those that are the most fuel-efficient in their

class, hybrid and alternative-fuel vehicles, and those meeting specific fuel consumption requirements.

Guidance and tools can facilitate implementation. For example, the government of Newfoundland and Labrador has developed an interactive online vehicle efficiency cost calculator that calculates and compares total costs (including lifetime fuel costs) when comparing vehicles for purchase.

4. Adopt fuel efficiency policies, operational strategies, and guidance for existing fleets

Governments can employ a wide range of measures to improve fuel efficiency in their existing fleets, such as idling reduction policies, fleet right-sizing, route planning, vehicle sharing (to reduce the need to purchase new vehicles), driver training, and the use of technologies to track fuel use.

Idling reduction and efficient driving techniques can be promoted through employee awareness and training programs. Technologies such as telematics can also be used to report and discourage idling. Saskatchewan's climate change strategy, Prairie Resilience, commits the province to increasing the use of idle time limiters in government trucks to reduce fuel use.

Fleet right-sizing involves analyzing tasks that require fleet use, and selecting the most fuel-efficient vehicles for those tasks. In another example from Saskatchewan, the province's Ministry of Government Services has published a guide to vehicle replacement and right-sizing to help fleet managers choose vehicle replacement, redeployment and right-sizing decisions.

Route planning is another technique that can be used to reduce emissions from existing fleets. For example, routes can be planned to minimize left-hand turns, which typically require more time to execute in high-traffic areas than right-hand turns, and trips can be planned to avoid rush-hour traffic or congested areas.

5. Develop plans to improve efficiency of non-road vehicles

As noted above, the concept of "fleets" is broad and can include many types of non-road vehicles, ranging from tractors and snowmobiles to ships and airplanes. There are opportunities to reduce emissions in many of these areas. For example, Parks Canada recommends the use of four-stroke engines in off-road equipment, as they are up to 40 percent more fuel-efficient than two-stroke engines. Similarly, for its marine fleet, Parks Canada also recommends the use of four-stroke or direct-injection two-stroke engines (Parks Canada 2015). The government of Newfoundland and Labrador has developed an energy efficiency management plan for its ferry fleet, and is also requiring coatings on vessel hulls to reduce drag and improve fuel efficiency.

Building Institutional Resilience

Climate change poses risks to governments' ability to deliver services, along with economic risks to government investments in assets such as transportation infrastructure, buildings, and parks. Governments thus need to identify areas of potential vulnerability in their operations and assets, and build their institutional resilience to the effects of a changing climate.

The process of assessing vulnerabilities, characterizing risks, and developing resilience strategies is complex, and is made more difficult by two fundamental challenges:

1. Most areas of government operations, and most asset types, will be affected in some way by climate change. Evaluating potential impacts and developing responses across the full breadth of government operations and assets can seem like an overwhelming task.
2. While impacts of climate change are already being experienced in most parts of Canada (especially in the North), projections of future climate are uncertain—especially at regional and local scales. This makes it challenging to plan for adaptation.

Fortunately, a number of strategies and practices are available to address these challenges, many of which are already being implemented or considered by jurisdictions in Canada, the United States, and Europe.

Best and Promising Practices for Building Institutional Resilience

1. Conduct risk assessments to guide priorities

Given limited time and resources, no jurisdiction can build resilience in every area of its operations and assets at once. Risk assessments can provide a sound basis for prioritizing a government's work. They can also help departments view climate change in terms of its risks and the potential costs of those risks to their operations, instead of treating it as an environmental problem.

A risk assessment reveals priorities by examining the probabilities and consequences of impacts on operations and assets. For example, the loss of a bridge that provides the only evacuation route for a coastal community could have serious consequences in terms of public health and safety; if the bridge is located in a flood-prone area, the risk of it being damaged or flooded could be high under a future climate change scenario. Since both the risk and consequence are rated as high, addressing this bridge's vulnerabilities would be a clear priority for action. Assets or operations with lower risks and/or lower consequences would be ranked lower in the priority list.

A growing number of jurisdictions in Canada have undertaken or are currently developing overall risk assessments, such as Alberta, British Columbia, and Ontario; a province- or territory-wide risk assessment can include consideration of government assets and operations—and often does to some extent, since transportation infrastructure is usually considered in climate change risk assessments. Individual departments may also conduct their own risk and vulnerability assessments; for example, at least 14 U.S. state departments of transportation have conducted risk assessments

for their transportation infrastructure under pilot projects funded by the U.S. Department of Transportation.

The order of the steps involved in developing a risk assessment vary, but typically involve the following activities:

- Identifying important assets
- Obtaining regional climate change projections under a range of scenarios
- Assessing current and future vulnerabilities
- Assessing current and future risks
- Prioritizing risks

Most of these steps require input from departments, and involve a combination of qualitative and quantitative information. Vulnerabilities are determined by assessing an asset or service's sensitivity (the degree to which it is affected by climate stressors), exposure (the extent to which it is exposed to climate stressors), and adaptive capacity (its ability to adapt to new climate conditions, including weather extremes).

The assessment of climate risks and vulnerabilities has been shifting to a "decision-first" approach in recent years: instead of starting with a comprehensive vulnerability assessment, the process begins by identifying the information needs of decision-makers and then working backward to determine data requirements based on those needs. This strategy shifts the focus—and frees up resources—from data collection toward finding practical and effective solutions. Some Canadian jurisdictions have embraced this approach; British Columbia, for example, is employing it in its current province-wide risk assessment. Decision-first assessment acknowledges that decisions on resilience improvements can be made in the face of uncertainty and in the absence of complete data.

2. Require consideration of climate change risks in new project development and capital planning

New infrastructure with long design lifetimes will still be in use decades into the future, when climate extremes and averages are projected to differ from past or current conditions. Establishing requirements for the consideration of climate change risks (and

BRIGHT IDEA

PIEVC

The Public Infrastructure Engineering Vulnerability Committee (PIEVC) of Engineers Canada has developed engineering guidance to support "the design, construction, maintenance and regulation of safe, reliable and financially sustainable public infrastructure in Canada to address the risks of a changing climate."

PIEVC works to mainstream climate risk assessment into the decision process for existing and new public infrastructure. The PIEVC protocol is a five-step process to analyze the engineering vulnerability of individual infrastructure to current and future climate variables such as heat and rainfall (Public Infrastructure Engineering Vulnerability Committee 2018).

requirements for documenting how those risks were considered) can ensure that new infrastructure and buildings are designed to be resilient to climate change effects. For example, Ontario amended its Infrastructure for Jobs, and Prosperity Act to include requirements with respect to demonstrating climate resilience in requests for infrastructure funding. Similarly, in British Columbia, the Ministry of Transportation and Infrastructure has issued a policy (Technical Circular T-06/15) and guidance requiring engineers to consider climate change in any new transportation infrastructure design project, and to report on how they addressed climate risks.

BRIGHT IDEA

Resilience Mentoring for Healthcare Authorities

The Canadian Coalition for Green Health Care offers a mentoring program to health authorities throughout Canada to help them evaluate and improve their resilience to the effects of a changing climate.

The program trains "resiliency champions" to work within their health authorities, and offers an online toolkit and checklist for self-assessments. Staff from 25 health authorities received training in 2017 (Canadian Coalition for Green Health Care 2018).

Newfoundland and Labrador was one of the first jurisdictions in North America to integrate climate change projections into flood risk maps, which would be considered in the siting of any new provincial buildings or infrastructure. Similarly, Nunavut is taking steps to incorporate hazard mapping, particularly with respect to permafrost, in infrastructure planning. The Standards Council of Canada is leading work to develop standards for northern infrastructure given the North's increasing vulnerability to the impacts of climate change; northern governments and stakeholders are participating in this process (Standards Council of Canada 2018).

Climate change can also be incorporated into capital asset management planning, a practice that could be encouraged by requiring public sector entities to publicly disclose how they are addressing climate change, and how climate considerations are reflected in their investment decisions.

3. Embed climate considerations into existing procedures and asset management systems

As discussed above in the section on cross-cutting best practices, embedding climate resilience considerations into procedures and management systems is key to effectively capturing opportunities to address climate risks at decision points. For example, the National Research Council is leading an effort to update Canadian codes and standards to incorporate climate change considerations (e.g., for highways and bridges, buildings, fenestration, and electrical systems), and departments can work to ensure the most current standards are being applied.

4. Use pilot projects and case studies to test adaptation measures

Pilot projects are a popular and effective way of testing and refining resilience-building measures in the field. In the United States, for example, the Federal Highway Administration and Federal Transit Administration have funded pilot projects and case studies to help develop and test methodologies for assessing vulnerability and evaluating adaptation measures.

5. Work with the surrounding community to improve resilience

It makes sense for federal, provincial, and territorial governments to work with their surrounding communities on adaptation plans because the community's resilience will also ensure the resilience of government facilities located there. For example, the Canadian federal government plans to work with the City of Ottawa on resilience-building activities. Working with the surrounding community is an effective practice for greenhouse gas mitigation as well, since government employees are major users of a community's transportation and other infrastructure.

6. Consider flexible adaptation pathways

Climate change adaptation planning requires decisions to be made today based on imperfect information about the future. This can create opportunity costs in the case of over-engineered solutions (if future climate doesn't change as much as projected) or public safety and economic risks in the case of under-engineering. Climate projects are based on a range of scenarios, but only one scenario will unfold in the real world. Nobody can predict that scenario with certainty.

The concept of flexible adaptation pathways, first tested in the United Kingdom and adopted by the City of New York and a growing number of other jurisdictions worldwide, helps reduces the risk involved in committing to adaptation measures today in order to address impacts that might or might not occur in the future. Adaptation pathways allow adaptation to be taken in an iterative, step-by-step fashion, with measures changing as more information becomes available

Under this approach, adaptation measures can be sequenced over time. This allows planners and managers to protect against near-term impacts while leaving options open to protect against the wide range of possible changes emerging later in the century.

Adaptation pathways employ the following features (Moss and Martin 2012):

- Use a risk-based decision framework based upon acceptable and unacceptable levels of risk; assume that flexible adaptation will keep risk at an acceptable level;
- Set limits and decision criteria (triggers) for risks that identify when critical thresholds or tipping points are likely to be reached, leading to very severe impacts and potentially irreversible consequences; identify alternative adaptation pathways for risks should thresholds be approached;
- Use pathways consisting of robust adaptation actions that work reasonably well across a wide range of circumstances both now and in the future (as opposed to measures optimized for present-day conditions or a single future outcome that ignores uncertainty);
- Identify low- and no-regrets actions that can be implemented now, while conducting research to inform flexible pathways that address the longer-term perspective.

A simple example of a flexible pathway would be constructing a dike for flood protection that has a sufficiently wide base to allow it to be elevated over time as needed. The dike could be part of an integrated system of engineered and natural flood control measures, each of which could be adjusted to accommodate new information on climate risks.

Scaling Up Green Procurement

Every purchase of goods or services represents an opportunity for governments to avoid greenhouse gas emissions and support clean technologies. The sheer scale of public purchasing across Canada—which accounts for slightly more than 13 percent of Canada's GDP (Baron 2016)—has turned this opportunity into a national priority. The Pan-Canadian Framework commits federal, provincial, and territorial governments to modernize procurement practices, adopt clean energy and technologies, and prioritize opportunities to help Canadian businesses grow, demonstrate new technologies, and create jobs.

What does that mean in practice? In a nutshell, it means looking beyond "buying green" to take a more strategic approach to procurement.

Traditional green procurement focuses on driving sustainable product development by identifying preferred products based on their attributes or certifications, such as purchasing only 100 percent post-consumer recycled paper with the intent of spurring growth in the paper recycling industry.

Using procurement strategically means applying a variety of procurement mechanisms to help, or hasten, the achievement of sustainability goals. For example, aggregating demand—such as the pooled tender model used by the City of Paris, France (see text box at right)—not only saves money and provides consistency to buyers, it offers secure long-term contracts that clean tech companies can leverage for investment. As another example, creating centralized procurements for goods or services required for greenhouse gas reduction projects can save hundreds of organizations the time it takes to run a procurement. Strategic procurement is about using existing and new procurement best practices to realize climate action goals.

BRIGHT IDEA

Aggregation

Smaller jurisdictions may have trouble obtaining favourable pricing or spurring innovation in clean technologies because they don't represent a large-enough market. Coordinating with other like-minded jurisdictions can allow them to pool their tenders. In France, for example, the City of Paris worked with 10 other European cities to coordinate the procurement of alternative-fueled garbage trucks. The cities issued individual tenders that all included the fuel requirement, generating sufficient demand for vendors to develop a solution at reasonable cost (Baron 2016).

In a similar vein, the government of the Northwest Territories facilitates the bulk procurement of wood pellets from British Columbia and Alberta to ensure a reliable and affordable supply of biomass fuel for institutional buildings, such as schools, that would otherwise rely on oil for heating.

A newer procurement model, known as "outcomes-based" or "solutions-based" procurement, offers a promising approach. Outcomes-based procurement specifies the desired outcome rather than the means used to achieve it. It essentially says to prospective vendors: "here's our problem, give us your best-value solution, within the context of our circumstances and constraints," instead of "we need 250,000 widgets with these specifications; give us your best price." In this way, governments can use the

power of procurement to drive innovation and creative solutions while helping to bring new approaches and technologies to market, create jobs, and support Canadian businesses.

Outcomes-based procurement can also encourage shifts from the provision of products to services, which generally have lower emissions and other impacts (Baron 2016). Outcomes-based procurement has received considerable attention in Canada's health care sector—which recognizes that patient outcomes should be considered along with cost as evaluation criteria for tenders (The Conference Board of Canada 2015)—but it has not yet been widely applied to achieve sustainability goals. An example of using it in this context would be to ask prospective vendors to "help us to achieve the most greenhouse gas reductions from our facilities, for the best price."

Modernizing green procurement could also involve redefining the concept of "total cost of ownership" (TCO) to include environmental costs along a product's life cycle before and after ownership. TCO is a best practice itself: an example being energy-efficient products, which may cost more up-front but eventually pay for that difference in energy savings, after which the net cost is lower than competing alternatives. A modernization of TCO could involve the incorporation of life-cycle assessment (LCA) in procurement decisions. LCA quantifies environmental and economic costs and benefits along a pre-defined life cycle for a product, which could include original materials extraction and processing, manufacturing and assembly, wholesale distribution and retail sales, and ultimate disposal—and all the transportation involved between each step, as well as the time it is used by the buyer.

In 2016, a coalition of labor and environmental groups launched the Buy Clean California initiative to advance policies that would ensure California's procurement processes for infrastructure support the state's greenhouse gas emission reduction targets. This work led to the Buy Clean California Act (signed into law in October 2017), and an associated executive order, which require full life-cycle cost accounting of certain construction materials (carbon steel rebar, flat glass, mineral wool board insulation, and structural steel), along with a maximum carbon emissions level for each.

LCA can seem daunting in the amount of additional information required to evaluate, but applications and resources are available to calculate typical life-cycle costs. For example, Québec's government sponsored the development of a life-cycle inventory database, integrated into the existing international Ecoinvent database, which provides province-specific data in 12 key sectors. The United Nations Environment Programme's Life Cycle Initiative provides links to resources, reports, and training materials.

The Canadian federal government and some Canadian provinces and territories have green procurement policies that require environmental performance to be considered in procurement decisions. For example, the Government of Newfoundland and Labrador developed an environmental procurement guide (Buying Green: A Guide for Purchasing Environmentally Preferable Products) in 2015–2016, accompanied by online and in-person training. It also proclaimed a new Public Procurement Act on March 24, 2018 to modernize procurement by provincial public bodies. The Act includes a provision to integrate environmental considerations into the development of general procurement policies, and the provincial government is in the early stages of identifying potential options.

The federal Centre for Greening Government has signaled shifts in the existing federal approach to green procurement, outlining the following steps in its Greening Government Strategy:

- integrating sustainability and life-cycle assessment principles in procurement policies and practices, including the government's supply chain;
- working with major vendors to encourage the disclosure of their GHG emissions and environmental performance information;
- supporting departments in adopting clean technology and clean technology demonstration projects;
- increasing training and support on green procurement to public service employees.

Best and Promising Practices for Scaling Up Green Procurement

1. Make green procurement easy

Integrating standard environmental criteria into procurement procedures can streamline the process of green purchasing, eliminating barriers of research time and expertise. For example, British Columbia has developed green procurement criteria plus evaluation guidelines that can be copied and pasted directly into RFPs. It also developed several centralized supply arrangements that can be used by all provincial public sector organizations and local governments, to purchase LED street lights and more recently electric vehicle charging stations. This eliminates the need for each of those public organizations to run a time-intensive and potentially costly procurement; they can simply purchase through the existing supply arrangements.

The Sustainable Procurement in Manitoba Working Group developed a *Quick Guide for Sustainable Purchasing* to help purchasers understand how to choose sustainable goods and services. The guide describes minimum recommendations for 40 types of commodities and services commonly purchased by the public sector, including apparel and promotional items; materials and products used in building maintenance, repair, and operation; electronics; food and kitchen products and services; paper office products and packaging; products and services essential for businesses; and waste management services.

2. Publish green procurement rules, targets, or guidance

Creating and publishing procurement regulations (see the example from Newfoundland and Labrador described above) or targets provides a clear incentive for the adoption of green procurement practices. For example, the Canadian federal government's Greening Government Strategy includes procurement guidelines. Federal departments establish their own targets in departmental plans.

3. Use certification labels and programs in specifications

Incorporating existing certification labels into procurement specifications, such as ENERGY STAR equipment, EPEAT electronics, and LEED certification for new buildings, is one of the most widely

adopted practices in green procurement (OECD 2015). This is another way to take the guesswork out of green procurement and facilitate the process of choosing vendors and products.

4. Establish a green procurement team

An interdepartmental team devoted to green procurement can take on the roles of developing new policies and procedures, identifying strategic opportunities, supporting departments, sharing ideas and best practices, and monitoring and reporting on progress.

5. Use well-known procurement best practices to save time and money, and create opportunities for innovation and clean tech development

Demand aggregation (see the text box on aggregation above), supply arrangements (agreements that include a set of predetermined conditions that apply to bid solicitations and contracts), pre-qualified lists, pilot programs, and early government-market engagement are all well-known practices that can be harnessed to meet sustainability goals in a measurable way.

6. Consider outcomes-based procurement as a promising practice

As discussed above, outcomes-based procurement can foster innovative solutions. Canada's healthcare sector is leading the transition to outcomes-based procurement, and British Columbia is exploring how it can be used to meet sustainability goals.

Québec uses a form of outcomes-based procurement when selecting energy services companies (ESCOs) to implement energy efficiency projects in buildings. The province has developed a sophisticated phased approach to bidding, in which multiple ESCOs are first asked to develop early project designs, and then compete based on net present value (i.e., the present value of annual energy cost savings minus the cost of the project) rather than initial cost only.

7. Incorporate life-cycle assessment into procurement

As also described above, life-cycle assessment takes past, present, and future environmental costs (e.g., resource extraction, processing, transportation, decommissioning) into account when comparing the economics of multiple procurement options. Some jurisdictions in Canada are encouraging the use of or incorporating life-cycle criteria into their contracts, including BC and the federal government.

8. Establish systems for data collection and reporting

Identifying, capturing, and tracking metrics on the impacts of government green procurement will facilitate strategic planning and promote continuous improvement.

Federal, provincial, and territorial governments are taking steps to build metrics for tracking the impact of government green procurement activities, and to collect better data on the clean technology market. The release of pan-Canadian data by Statistics Canada provided the first comprehensive snapshot of the nation's clean technology landscape (Statistics Canada 2017).

9. Establish a system for tracking surplus items that can be transferred across departments

In some cases, purchases can be avoided altogether by using surplus products or materials already purchased by governments. Canada's federal government operates the GCTransfer service, which allows surplus assets to be identified and transferred across departments instead of being sold to the public through GCSurplus. Similarly, the government of Newfoundland and Labrador has established a system for tracking and transferring surplus items across departments.

Other Initiatives

The best and promising emissions reduction practices discussed so far focus on Scope 1 and Scope 2 emission sources: Scope 1 emissions are those from government-owned or -controlled sources, and Scope 2 emissions are indirect emissions from the generation of purchased energy.

Some jurisdictions are also working to reduce Scope 3 emissions, which include all upstream and downstream indirect emissions not included in Scope 2. Examples of Scope 3 emissions include those related to business travel and waste.

Best/Promising Practices for Scope 3 Emissions

1. Monitor and offset employee business travel

Canada's federal government plans to track emissions from air travel by public service employees by 2019–2020, and already promotes lower-carbon alternatives such as teleconferencing. Tracking business travel is most feasible when all employees are required to use a central travel service. In jurisdictions where this is not the case, reimbursement receipts can be used for tracking.

2. Monitor and reduce drinking water use

The extraction, treatment, and distribution of drinking water uses energy, so even cold-water use contributes to greenhouse gas emissions. Statistics from the United States show that drinking water and wastewater facilities can account for as much as 35 percent of a municipality's energy costs (U.S. Environmental Protection Agency 2013). Canada's federal government will require all government buildings to track potable water consumption by 2022, and new buildings and major renovations will be required to have best-in-class water-use practices and implement effective storm water management technologies (such as green roofs, rain gardens, and permeable pavements).

3. Monitor and reduce waste, including materials management

Waste is a significant contributor to government carbon footprints, especially when the full lifecycle of products is considered from extraction of raw materials through production and distribution and on to waste disposal or recycling. Food waste and other biological waste can lead to methane emissions in landfills.

The government of Newfoundland and Labrador conducted waste audits of six core government buildings to establish a benchmark of its waste profile, and is developing targets for waste reduction. Canada's federal government has set a target of diverting from landfills at least 75 percent of all non-hazardous operational waste and 90 percent of construction renovation and demolition waste by 2030. Manitoba has published guidelines on the management of waste from construction, renovation, and demolition activities.

4. Monitor and reduce emissions related to employee commuting

Canada's federal government will begin tracking employee commuting emissions by 2021–2022, and will encourage employees to use low-carbon forms of transportation to get to and from work. Québec's government has abolished subsidized parking for government employees (to reduce the incentive to drive to work), and requires each provincial department to develop a program to reduce greenhouse gas emissions generated by employees commuting to work (Government of Québec 2008).

Appendix 1: Summary Tables

The tables below summarize best and promising practices described in this compendium, along with additional practices that were not described in detail but may be useful to consider. The practices below were gathered through reviews of government materials, interviews with federal, provincial, and territorial officials, and desk research on initiatives in the United States and Europe. Several practices were added by federal, provincial, and territorial officials who reviewed an earlier draft of the compendium.

Table 1. Cross-Cutting Best Practices

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Frame climate change as a cross-departmental economic and business priority	The impacts of climate change pose economic risks to government investments in buildings and infrastructure, public health and safety, security, and the ability to provide services. These risks extend beyond environmental ministries, affecting most departments.	A number of jurisdictions in Canada (including the federal government and some of the provincial and territorial governments) address climate change from a cross-departmental perspective. For example, New Brunswick uses Priority Development Units to oversee and connect cross-departmental initiatives, including those related to climate change.
2. Embed climate change considerations into procedures and decision making	Including climate change considerations into the decision-making processes of all departments promotes sustainable, long-term shifts in policies and procedures across operations, planning, and procurement.	Several jurisdictions are embedding climate change considerations into their decision making procedures, such as Newfoundland and Labrador, Nunavut, Ontario, and the Federal Government of Canada.
3. Connect with others who face similar opportunities and challenges	Collaborating with other actors in similar circumstances enables joint problem solving on common challenges and opportunities. Lessons learned, data, studies, and expertise can be easily shared.	Canada's Territories collaborate through the Northern Premiers' Forum. The Forum focuses on Pan-Territorial collaboration in many areas, including environment and climate change.
4. Consider an integrated approach to mitigation and adaptation	Considering mitigation and adaptation activities in isolation can fail to account for their positive or negative impacts on one another. Examining the co-benefits of mitigation and adaptation actions can ensure that selected initiatives contribute toward both priorities.	Alberta's Climate Change and Emissions Management Fund supports work related to both mitigation and adaptation, which reduces competition between the two interrelated areas.

Table 2. Setting Ambitious Targets

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Consider establishing a separate emissions target for government operations	Jurisdiction has an emission reduction target defined specifically for government operations. Well-defined targets include a reference year, reduction goal, and target year. Government can set an example of climate leadership by adhering to a more stringent target than the target set for its jurisdiction as a whole.	About half of all provinces or territories have government-specific emission reduction targets. British Columbia has had a carbon-neutral government since 2010, which differs from its province-wide emission reduction target. Ontario and New Brunswick, among others, are aiming to achieve carbon-neutral government operations in the future.
2. For emissions targets, consider the base year	The base year is the reference against which the emission reduction target is being compared. Most base years are selected for consistency with other targets (e.g., national or international), but if there is flexibility for selecting the base year, avoid selecting a base year in which emissions were anomalously high or low. Extreme weather or unusual economic situations can make any year unrepresentative of typical historical conditions. Unusual conditions can also affect reported emissions, and some jurisdictions normalize emissions reports to remove the effect of weather variations.	British Columbia weather-normalizes emissions from buildings to facilitate more accurate understanding of their year-over-year performance. Note that BC offsets its **non**-normalized emissions to achieve carbon neutrality.
3. Consider the jurisdiction's unique circumstances	Jurisdictional circumstances (e.g., electricity mix, location, transportation networks, weather) differ by region, and affect the feasibility and availability of emission reduction and adaptation opportunities. Consider these circumstances when developing targets and action plans.	Canada's territories are considering targets that are realistically aligned with the challenges associated with their remote location and limited resources. Canada's Maritime provinces collaborate through the New England Governors and Eastern Canadian Premiers' Conference to take collective action.

Practice	Description	Example
4. Break down the target by year and department	Breaking a long-term target into shorter increments can create near-term deadlines and allows for more frequent measurement of progress. Not all departments contribute equally to a government's emissions, and breaking down targets by department can give individual departments more ownership of their target.	In addition to setting a target for 2050, Canada's federal government intentionally set a shorter-term target for the year 2030 to provide a pathway to reaching the long-term goal. Saskatchewan breaks its infrastructure emissions targets into annual reduction rates. Several jurisdictions in Canada break down targets by department or sector. Alberta has a separate target specifically for its buildings, for example. Some departments (e.g., Defense, at the federal level) have special circumstances or considerations.
5. Develop a system for measuring and monitoring progress	Regular monitoring, measurement, and reporting of government emissions aids in understanding whether jurisdiction is on track to meet its emission reduction target. This progress should be regularly and publicly reported.	Some jurisdictions in Canada separately report their government emissions. BC publishes annual Carbon Neutral Action Reports, which document the emissions and offsets of each of its 126 public sector organizations.
6. Employ offsets carefully in carbon neutrality targets	After emission reduction activities are implemented in one jurisdiction or sector, carbon offsets can neutralize the atmospheric impact of any remaining emissions by reducing emission in another jurisdiction or sector. See the main body of this report for more details on the cautionary implementation of offsets.	In March 2018 the Newfoundland and Labrador government purchased its first offsets (these were the first known carbon offset credits to be generated, certified and sold in the province). BC has established a regulatory framework to ensure that offsets approved for use by its government departments/agencies are incremental and verified; it is considering approaches to reduce reliance on offsets.
Additional Best and Promising Practices		
7. Set a jurisdiction-wide target	Jurisdiction has an emissions reduction target. Consider the jurisdiction's target when setting a government target.	Almost every province or territory in Canada has an emission reduction target. Québec has some of the most stringent reduction targets in North America, aiming for a 20% reduction in emissions from 1990 levels by 2020, and 80-95% by 2050.

Table 3. Developing Action Plans

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Prioritize actions and take an iterative approach	Prioritizing actions is a crucial element of their near-term implementation. Consider which prioritization metrics best match the jurisdiction's resources and priorities. Iterating on the selection and prioritization of actions within a plan provides flexibility.	Jurisdictions interviewed mentioned several metrics, including but not limited to: ▪ Cost (present and/or future) ▪ Emission reduction potential ▪ Ease of implementation (political, knowledge, resources)
2. Require monitoring and reporting	Regular reporting on actions tracks progress so that action plans can be adjusted as necessary. Attributing emission reductions to each action within a plan can highlight the effectiveness of different actions. Reporting to an emissions registry and using third-party verification can improve robustness and confidence in emissions estimates.	Many of the jurisdictions in Canada measure and report on action plan progress. Some also report to an independent emissions registry. New Brunswick has released annual progress reports on its Climate Change Action Plan since 2007. The Government of Yukon and the Government of Northwest Territories report their emissions annually through The Climate Registry. The Government of Yukon invests in third-party verification of its emissions. British Columbia requires each of its 126 individual public sector organizations to report annually on emissions, plans and action taken to reduce emissions, and offsets purchased for residual emissions.
3. Develop guidance and structure for implementation before the action plan is released	Creating a structure on the implementation procedure for the action plan ensures efficient execution. Guidance for staff makes them aware of their role in the implementation of new actions.	Parts of a thorough implementation structure include: ▪ Outline the steps involved in implementing the action ▪ Create timelines, including start dates, for each action (e.g. Ontario's CCAP) ▪ Assign a responsible party to each action ▪ Quantify the costs of each action (e.g., Québec's CCAP) and build those into the department's budget

Practice	Description	Example
4. Create a mechanism for evolving the plan	Scheduling regular reassessment allows for new ideas to be incorporated into action plans. Based on feedback from progress reports, assess which actions are effective and adjust the plans as necessary to ensure that jurisdiction is on track to meet targets.	Several jurisdictions in Canada have iterated or plan to regularly iterate on their action plans. Québec and BC have released multiple action plans. Several other provinces intend to iterate on their action plans.
5. Collaborate across departments	Collaborating across government agencies benefits planning and implementation of climate actions. This leverages the full range of expertise, resources, tools, and programs available.	Climate actions can span multiple agencies, such as environment, energy, and transportation.
6. Consider the impact of changing circumstances over time	When planning, make sure action plans account for future forecasts of data when available. This helps ensure an accurate estimation of an action's future impacts.	Examples of data points that are expected to change in the future are electricity emission intensity, climatic conditions, size of government, and public transportation demand.
7. Incorporate and call out co-benefits of climate actions	Documenting the co-benefits of climate actions can build support for climate initiatives.	Examples of co-benefits of climate mitigation and resilience-building actions are air quality improvements, economic savings, enhanced public safety, and job creation.
Additional Best and Promising Practices		
8. When brainstorming potential actions, consider best and promising practices used by other jurisdictions	Considering innovative ideas and lessons learned from other jurisdictions enhances and accelerates the brainstorming process.	Best practices can be gathered and considered in various ways. PEI contracted a consultant to gather best practices for mitigation and adaptation actions, which are informing its upcoming Climate Change Action Plan.

Table 4. Cutting Emissions from Buildings

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Establish energy standards and rules for new buildings	Standards can require a variety of building features for newly constructed buildings, such as materials, site, electricity, HVAC, water, building envelope, and more.	Many jurisdictions in Canada are enhancing their standards for new buildings to require greener performance. Several have adopted LEED or BOMA BEST standards. Alberta has achieved Gold and Silver LEED certification for some buildings in remote locations, demonstrating the flexibility of the standard. Nova Scotia is testing the BOMA standard in some of its buildings.
2. Capture opportunities to reduce emission from existing buildings	Existing building emissions can be reduced in three main ways: ▪ Reduce electricity demand (e.g. conservation, energy-efficient appliances) ▪ Reduce heating demand (e.g. adjust HVAC operation, upgrade the building envelope) ▪ Switch to low- or zero-carbon energy sources (e.g., away from fossil fuels toward renewable energy sources)	ENERGY STAR certifies a wide variety of products as energy-efficient. Similarly, EPEAT certifies electronics for sustainable performance. Right-sizing HVAC systems and decreasing leakage through the building envelope can reduce heating demand. In NWT and PEI, biomass (waste wood) is being used to heat some public buildings. Québec schools are using geothermal heat pumps. Alberta has committed to installing solar energy on government-owned buildings.
3. Develop plans and schedules for equipment replacement and deep retrofits	Many building elements (e.g. appliances, windows, doors) often have long lifespans and high capital costs. Develop plans for upgrading to more energy-efficient models when replacing them.	Many jurisdictions in Canada consider energy efficiency when replacing building equipment.
4. Consider a recommissioning plan for energy-optimized buildings	Recommissioning involves fine-tuning the operation of an existing energy-optimized building to continue improving its performance over time. Retrofitting (or retro-commissioning) involves updating features of pre-existing buildings.	Some jurisdictions in Canada are recommissioning their buildings; many are retrofitting exiting buildings to make them greener.

Practice	Description	Example
5. Invest in smart building technologies	Smart building technologies include sensors and automation. Installing automatic sensors to monitor and report building occupancy and utilization can reduce building energy use through automation of lighting, HVAC, and/or window covering systems to conserve energy. Reported data can also be used to forecast future demand and use.	Few jurisdictions in Canada discussed smart building automation in interviews. In Saskatchewan, a pilot project using clamp-on electrical sensors is underway to allow energy managers to study building operation. The end goal is to identify opportunities to save energy. Forecasted use can be used to implement demand management and peak shifting techniques, which smooth heat and/or electricity demand.
6. Consider workplace densification measures and teleworking	Denser workplaces have reduced energy demand compared with traditional office space. They focus on flexibility, adaptability, and collaboration. Teleworking involves working from home or another location remote from offices.	Advantages of denser workplaces include: ▪ Reduced lighting demand ▪ Increased use of laptops (more energy efficient) Teleworking can reduce the need for a large floor area by having employees work remotely.
7. Explore ways to address common barriers to energy efficiency and renewables	Innovative funding models may be needed to fund the initial costs of current actions that will reap future savings. Revolving funds may be used to reinvest money from energy savings into other energy saving measures.	Québec has made extensive use of performance contracting by energy services companies to address up-front costs of retrofits.
Additional Best and Promising Practices		
8. Consider implementing district energy	District energy generates heating (and in some cases cooling energy) and in some cases electricity in a centralized location and distributes the energy to buildings. Energy can be generated from clean sources.	Some jurisdictions in Canada are using district heating or heat pump technologies. Nunavut has district heating systems in several communities. Canada's federal government makes extensive use of district energy in Ottawa; Ontario's government makes use of district cooling in Toronto from Lake Ontario.

Practice	Description	Example
9. Measure, monitor, and report on building performance publicly and regularly	Building performance can be measured through energy audits, or regular energy management. By gathering data tracking performance, emission sources and patters can be identified. This information can aid in selecting climate actions, designing retrofits, or iterating on targets and action plans. This information also aids in understanding the impact of occupant activity on a building's operation; communicating this increases climate awareness.	Many jurisdictions in Canada are measuring and monitoring building performance to various degrees. Manitoba is piloting a Portfolio Manager program to stimulate awareness and energy management activities in public buildings and housing.
10. Create guidance documents for use by departments; share and document tips	Sharing transferrable knowledge about buildings between departments increases impact and learning. Guidance documents can streamline the process, reduce uncertainty, and ensure common standards.	The Government of Nunavut published a guideline on good building practices for the North. Natural Resources Canada published best practices for new buildings regarding energy efficiency.
11. Establish pricing mechanisms to encourage emission reductions	Use of shadow prices and carbon offset purchase requirements can provide additional strength to the business case for emission reductions.	The federal government will prioritize low-carbon investments in major real property investment decisions by applying a shadow price on carbon. BC's commitment to carbon neutrality requires its public sector organizations to purchase offsets at $25 per metric ton, over and above the Province's carbon tax.

Table 5. Cutting Emissions from Fleets

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Establish emissions targets for fleets	Establishing specific targets and goals for emissions reductions within the vehicle fleet gives government's something tangible to work towards.	Examples of targets related to fleets include: ▪ Portion of the light-duty fleet that zero-emission vehicles will comprise by a given target year ▪ Starting year in which all new vehicle purchases will be zero emission or hybrids ▪ Adopting fleet management practices to optimize usage and replacement
2. Develop a fleet inventory and track consumption	A complete fleet inventory allows for characterization of a given context. Once the fleet inventory is established, the fuel consumption of each vehicle can be applied to quantify the fleet emissions. Understanding current emissions is key to achieving future reductions.	A fleet inventory includes information for each vehicle regarding: ▪ Classifications ▪ Ages ▪ Technologies ▪ Fuel types ▪ Fuel consumption
3. Establish standards and procedures for buying or leasing new vehicles	Enacting policies and guidance for the purchase or leasing of new vehicles can ensure that fuel-efficient, low-emission, or zero-emission vehicles are incorporated in the fleet. Standardizing such procedures also simplifies the purchasing process.	Price Edward Island's Transportation Efficiency Standard sets fuel efficiency requirements for new vehicles joining the fleet. Parks Canada has a preauthorized list of vehicles for new purchases.
4. Adopt fuel efficiency policies, operational strategies, and guidance for existing fleets ▪ Idling reduction ▪ Route planning ▪ Fleet right-sizing ▪ Vehicle sharing ▪ Driver training ▪ Fuel tracking	Some driving techniques are more fuel efficient, including reducing idling, steady acceleration, keeping tires properly inflated. Right-sizing a fleet removes vehicles that are unnecessary, over-sized, or fuel-inefficient. Factors considered in a vehicle allocation study include: mileage, trip frequency, use vs. downtime, seasonality, and vehicle condition	Natural Resources Canada lists fuel efficient driving techniques. In the U.S., Minnesota offers web-based training course for employees to become certified Eco-Drivers. Reports have found energy reductions of 5-25%. In a 2015 U.S. document on federal sustainability, Vehicle Allocation Methodology is listed as an approach for achieving clean fleets. California is implementing VMA as well.

Practice	Description	Example
5. Develop plans to improve efficiency of non-road vehicles	Fleets include various types of vehicle classifications, including typical road vehicles. However, a fleet inventory may contain other types of non-typical vehicles (e.g. off-road, air, water, snow). These vehicles also contribute to fleet emissions. Consider collaborating with other stakeholders who share that vehicle type when developing actions.	The Government of Newfoundland and Labrador is taking steps to reduce the environmental impact of its ferry fleet, including advanced ship hull coating, automated mooring, and efficient vehicle operation.
Additional Best and Promising Practices		
6. Create guidance documents for use by all departments; share and document tips	Sharing transferrable knowledge about fleets between departments increases impact and learning. Guidance documents can streamline the process, reduce uncertainty, and ensure common standards.	The Treasury Board of Canada Secretariat published a guideline on fleet management. Such guidelines can be expanded upon and circulated amongst government agencies to share best practices and streamline learning.
7. Track and regularly maintain fleet vehicles	Tracking maintenance ensures that vehicles are being maintained correctly and allows for maintenance practices to be optimized. Good maintenance has vehicles operating at peak efficiency without using extra fuel.	Several jurisdictions are considering tracking and improving maintenance practices, including Saskatchewan; in the U.S. the federal government and Colorado are two examples.
8. Consider vehicle modifications or upgrades	Simple vehicle upgrades or modifications can reduce emissions while driving. For example, low rolling-resistance tires reduce excess friction while driving, improving fuel efficiency.	Colorado is starting to use low-rolling resistance tires in its fleet, which will improve fuel economy.

Table 6. Building Institutional Resilience

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Conduct risk assessments to guide priorities	A risk assessment evaluates the probability and consequence of an event occurring. In this context, events are induced by climate change and have an impact on government operations. Once the risk of various events is understood, priority areas can be identified.	Some jurisdictions in Canada have undertaken or are conducting risk assessments, such as Alberta, BC, and Ontario.
2. Require consideration of climate change risks in new project development and capital planning	Adaptation can be integrated into project planning processes by evaluating future potential climate impacts in addition to current ones. Processes can include funding application, engineering guidance, hazard mapping, and many more.	Some jurisdictions in Canada have incorporated climate change into their project development process, such as Ontario and BC. The government of Newfoundland and Labrador has integrated climate change projections into its flood risk mapping. Nunavut is incorporating permafrost thaw into its hazard mapping.
3. Embed climate considerations into existing procedures and asset management systems	Asset management plans can include climate considerations to ensure ongoing adaptation and resilience building.	Few jurisdictions in Canada have formally embedded climate change considerations into their asset management systems. Canada's National Research Council is investigating this for key infrastructure.
4. Use pilot projects and case studies to test adaptation measures	Pilot projects are small-scale low-risk opportunities where adaption measures can be tested. This allows for iteration and improvement of measures before they are rolled out on a larger scale.	Few jurisdictions in Canada have conducted pilot projects for adaptation measures. The US Federal Highway Administration is using pilot cases to assess adaptation measures.
5. Work with surrounding community to improve resilience	Municipal governments control infrastructure and services used by federal, provincial, and territorial governments. Different levels of government will need to work together to achieve a common goals of climate resilience.	Some jurisdictions in Canada have engaged with communities to build resilience. Canada's federal government is planning to work with the City of Ottawa. Nunavut is engaging with communities about climate change risks.
6. Consider flexible adaptation pathways	Flexible adaptation pathways provide an approach for adjusting adaptation measures over time as more information about future climate is gathered.	The UK and New York City have tested and applied this approach; other jurisdictions are considering it, and it is becoming a common recommendation in climate change adaptation.

Table 7. Scaling Up Green Procurement

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Make green procurement easy	Including standard environmental criteria into procurement documents in additional to typical criteria (e.g., price performance) makes green procurement simpler for buyers and vendors. Buyers can use criteria reliably without added effort, and vendors are not asked to respond to differing criteria across departmental competitions.	Manitoba has developed sustainability criteria to be placed in bid documents to support sustainable purchases. BC has developed criteria and evaluation guidelines for environmentally preferable goods and services, which buyers can copy into RFP documents.
2. Publish green procurement targets	Creating and publishing procurement targets provides a clear incentive for clean procurement practices.	The Canadian federal government publishes procurement targets in its Greening Government Strategy, and departments set their own targets in departmental plans.
3. Use certification labels and programs in specifications	Many green standards currently exist for a variety of products and services. A short but wide-reaching list of environmental standards is now well established and can be used to easily discern between certified products and those with “greenwashing” claims that have no accreditation.	Implementation of the federal Green Procurement policy includes standards requirements, such as ENERGY STAR and EPEAT; BC’s policy also does this.
4. Establish a green procurement team	Teams should include procurement practitioners with expertise in sustainability and the clean tech market. Tasks include developing new policies and processes, identifying opportunities, facilitating cross-departmental collaboration and knowledge sharing, and reporting on impact.	Since 2007, Manitoba has had a Sustainable Procurement Working Group made up of public sector representatives who maintain an online database of resources for public purchasers.

Practice	Description	Example
5. Use well-known procurement best practices to save time and money and create opportunities for innovation and clean tech development ▪ Demand aggregation ▪ Government-market engagement	Demand aggregation (e.g. sourcing like products in bulk) can realize cost savings. Collaboration between departments or even among different jurisdictions can facilitate aggregation. Communication between buyers and vendors prior to contracts reduces information asymmetry and provides forecast opportunities to vendors. Other well-known practices include supply arrangements and lists of pre-qualified vendors that can be used to save time across departments in fulfillment of climate action objectives.	See NWT example (Buildings 2) above on biomass fuel for heating buildings, where pellets are sourced in bulk. The UK Office of Government Commerce published guidance on early government-market engagement, including principles and examples of good practices.
6. Consider outcomes-based procurement as a promising practice	Outcomes based procurement shifts the focus in contracts from "how" to achieve an outcome to "what" the outcome. This puts the onus on figuring out the "how" on the supplier, rather than the organization. Outcomes can be evaluated on best environmental performance.	BC is launching a procurement concierge program that will use an outcomes-based procurement model.
7. Incorporate life-cycle assessment into procurement	Life-cycle assessment takes the full life cycle environmental costs (e.g., resource extraction, processing, transportation, decommissioning) into account when comparing the economics of multiple procurement options.	Some jurisdictions in Canada are encouraging or incorporating life-cycle criteria in their contracts, including BC and the federal government.
8. Establish systems for data collection and reporting	Collecting procurement-related data allows the effectiveness of the procurement process to be evaluated. These data facilitate strategic planning and continuous improvement.	BC is actively collecting data on its procurement processes to learn and improve.
9. Establish a system for tracking surplus items that can be transferred across departments	Reduce waste by sharing or re-using overlapping or surplus resources between departments.	Newfoundland and Labrador transfer surplus items across departments to reduce waste. The Federal Government of Canada also does this through GCTransfers and GCSurplus.

Practice	Description	Example
Additional Best and Promising Practices		
10. Provide training	Training can make employees more aware of their procurement options and green practices.	Newfoundland and Labrador have delivered training sessions and developed online modules for employees.
11. Consider location (remote challenges; buying local)	Location affects procurement processes. For example, remote locations can exacerbate procurement challenges. Alternatively, where possible, buying local can reduce transportation emission associated with procurement.	The Government of NWT (Buildings, example 2) conducts bulk procurement of wood pellets from BC and Alberta to ensure a reliable supply and affordable supply of biomass fuel for heating buildings.
Using Procurement to Spur Green Innovation		
12. Be aware that government contracts are valuable to innovators	By contracting with clean tech companies, governments can offer important "first customer" references and assured cash flow. This supports growth of the green workforce.	Clean Energy Canada explains that government procurement provides a stable source of demand, which can help to attract private investment.
13. Consider incorporating performance incentives in contracts	Including incentives (e.g., for demonstrated annual reductions in greenhouse gas emissions) encourages suppliers to continue innovating over the term of a contract.	Public Works and Government Services Canada reviewed the defense procurement strategy, and found that the US, UK, and Australia all have incentives for performance over the required specifications.

Table 8. Other Initiatives

Practice	Description	Example
Best and Promising Practices Featured in the Report		
1. Monitor and offset employee business travel	Business travel by government employees adds to the emissions associated with government operations. Holding virtual meetings and webinars, rather than travelling between office locations, can reduce travel-related emissions.	Using a central travel service can streamline the monitoring of business travel.

Practice	Description	Example
2. Monitor and reduce drinking water use	Extracting, treating, and distributing drinking water are all processes that consume energy, and thus produce emissions.	Tracking water use and reducing water demand can help reduce water use in government buildings.
3. Monitor and reduce waste, including materials management	The full lifecycle of products, from the raw material extraction, to production, and end of life disposal or recycling, can contribute to a government's carbon footprint.	Waste tracking and auditing yields information to aid in reduction efforts.
4. Monitor and reduce emissions related to employee commuting	Commuting by government employees adds to the emissions associated with government emissions. Information on employee commutes can provide data on the forms of transportation used, which can aid in calculating resulting emissions.	Cleaner commuting methods include public transit, carpooling, biking, and walking. Québec's departments have developed strategies to reduce greenhouse gas emissions from employee commuting, and Canada's federal government plans to begin tracking employee commuting emissions.

Appendix 2: Sources for More Information

Cross-Cutting Best Practices

- Matrix of Measures Integrating Mitigation and Adaptation. The Climate Alliance has compiled example strategies that address both greenhouse gas reduction and climate change adaptation together.
- Carbon Fund Ordinance. The City of Watsonville, California provides an example of a local municipality employing development regulations (establishing a carbon fee on development projects) to encourage implementation of renewable energy in development while building a fund for municipal greenhouse gas reduction projects.

Setting Ambitious Targets

- Science-based Targets. This website offers methodologies for developing science-based greenhouse gas reduction targets. It is aimed at businesses, but can be applied to governments as well.
- Quick Start Guide for Setting a Greenhouse Gas Reduction Target. (PDF, 2010). This guide, developed by California's Statewide Energy Efficiency Collaborative, focuses on the needs of cities and counties and provides specific steps, along with estimated staff time and example methodology. While some components of the guide are specific to California (such as providing an overview of relevant legislation), the overall steps themselves are broadly applicable.
- Best Practices Methodology for Quantifying Greenhouse Gas Emissions. This guide from BC's government provides information on how emissions factors have been determined, what they are and how to apply them to calculate emissions from a given activity/source.
- How to Set Emission Reduction Targets, Partners for Climate Protection, Federation of Canadian Municipalities (PDF, 2016). This guide is part of a five-milestone, performance-based model for reducing greenhouse gas emissions. The prior step in this framework is creating a greenhouse gas emissions inventory and forecast. Although this guide is aimed at municipalities, the techniques can be scaled up to the provincial, territorial, or federal level.
- Developing Inventories for Greenhouse Gas Emissions and Energy Consumption: A Guidance Document for Partners for Climate Protection in Canada (PDF, 2008). This guide explains how to complete inventories and forecasts of greenhouse gas emissions, primarily aimed at local government staff.

Developing Action Plans

- Community Emissions Reduction Planning: A Guide for Municipalities (PDF, 2017). This guide, developed by the Government of Ontario for Ontario communities, includes guidance and resources that may also be useful to provincial, territorial, and federal governments.
- Developing and implementing a local action plan, Partners for Climate Protection, Federation of Canadian Municipalities (online). This website outlines the major steps involved in developing and implanting a local action plan for reducing greenhouse gas emissions. Although this guide is aimed at municipalities, the techniques can be scaled up to the provincial, territorial, or federal level.

- Annual Reports, Government of British Columbia (online). BC reports its government emissions annually. This is broken down by the total public sector (listed at the end of Carbon Neutral Government reports) and by specific public service organizations (separate documents online). A provincial emissions inventory (including non-government sources) is also available online.

Cutting Emissions from Buildings and Fleets

- NRCan's Greening Government Support Services. This site links to a variety of tools and resources for buildings and fleets, while aimed at federal departments and agencies, could also be used by other jurisdictions.
- Zero Energy Buildings: A Critical Look at the Definition (PDF, 2006). This paper by the U.S. National Renewable Energy Laboratory explores a variety of ways to achieve net-zero energy use in buildings.
- Commission for Environmental Cooperation's Green Building Library. A collection of resources from Canada, the U.S., and Mexico on green building.
- L'efficacité énergétique des bâtiments institutionnels en neuf étapes (2016). Québec's detailed guide to energy efficiency in institutional buildings, along with sample contracts and frequently used energy efficiency measures.
- Actions for Civic Buildings. This site provides information on the what, why, and how of reducing emissions from civic buildings, including guidance on policies, projects, and processes to help accomplish this.
- Actions for Fuel Efficient Fleets. This site provides information on the what, why, and how of reducing emissions from government fleets, including links to guidance on plans, policies, projects, and processes for accomplishing this.
- Metro Vancouver Design Guide for Municipal LEED Buildings (PDF, 2008). This design guide reviews the LEED Green Building Rating System and considerations and strategies for designing LEED-qualifying buildings.
- Guidelines on Fleet Management, Treasury Board of Canada (PDF, 2015). This guideline details practices related to: planning, acquisition, operation, insurance, and replacement of vehicles. Guidelines exist for Light Duty and Executive vehicles.

Building Institutional Resilience

- Climate Change Adaptation Community of Practice. This online community of practice, facilitated and maintained by the Ontario Centre for Climate Impacts and Adaptation Resources, serves as a hub for Canadian climate change impacts and adaptation activities, events. and resources.
- Guide to Climate Change Risk Assessment for NSW Local Government (PDF, 2011). This guide, while specific to New South Wales in Australia, provides overarching steps that can be applied to any local government seeking to assess their climate change risk.
- ICLEI Canada's Resources page provides links to case studies, an Adaptation Library, and other resources to support local governments' adaptation efforts.

Scaling Up Green Procurement

- Federal Policy on Green Procurement (2006). This policy "seeks to reduce the environmental impacts of government operations and promote environmental stewardship by integrating environmental performance considerations in the procurement process."
- Green Procurement. The Green Procurement section of Public Services and Procurement Canada's website provides links to information that help purchasers learn about green products and services or define their requirements in terms of environmental considerations.
- Procuring Green in the Public Sector: A Checklist for Getting Started (2011). This checklist by the Manitoba-based International Institute for Sustainable Development includes 21 elements that together lay out an approach to sustainable public procurement.
- Municipal Collaboration for Sustainable Procurement. A network of 20 Canadian municipalities, colleges, and universities that collaborate and share resources to further sustainable purchasing.
- Responsible Purchasing Network. An international network of buyers dedicated to socially responsible and environmentally sustainable purchasing.
- The Power of Procurement: How Governments Can Drive Clean Growth, Cut Carbon, and Create Jobs (PDF, 2017). This report by Clean Energy Canada describes best practices in outcomes-based procurement and other approaches to using procurement as a tool to help jurisdictions meet their climate change targets.
- The Role of Public Procurement in Low-Carbon Innovation (PDF, 2016). This paper by Richard Baron of the Organization for Economic Cooperation and Development (OECD) provides background on procurement's role in helping jurisdictions meet climate change goals, and offers suggestions for increasing the effectiveness of green procurement.

Other Initiatives

- British Columbia Best Practices Methodology for Quantifying Greenhouse Gas Emissions. Geared to provincial and local governments, but the methods are also applicable to other jurisdictions (federal and territorial).
- The Greenhouse Gas Protocol for the U.S. Public Sector (PDF, 2010). While this was developed for the United States' public sector, much of it will be applicable to governments worldwide.
- Partners for Climate Protection Milestone Tool (2013). Developed for local governments by the Federation of Canadian Municipalities and ICLEI, this tool could be useful for provincial and territorial governments in developing inventories and tracking progress.
- Becoming Carbon Neutral: A Guidebook for Local Governments in British Columbia (PDF, 2014). This document provides guidance for local governments seeking to follow the Green Communities Committee's (GCC) Carbon Neutral Framework, including options such as investing in GCC-supported projects and purchasing carbon offsets.
- Bill 27 Resource List (PDF, 2010). This document provides links to resources for local governments seeking to comply with British Columbia's Bill 27, which requires local governments to include targets, policies and actions for the reduction of GHG emissions in their Official Community Plans.

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