

CLIMATE-RELATED FINANCIAL RISKS AND OPPORTUNITIES: A PRIMER FOR LOCAL GOVERNMENTS



Amy Bailey, Center for Climate and Energy Solutions

INTRODUCTION

Local governments are facing negative and positive financial impacts from the changing climate and the transition to a low-carbon economy. Protecting their fiscal health and positioning their communities for a thriving future will rest on their ability to assess climate-related financial risks and opportunities in ways that improve decision-making and strategic planning. While this practice is not currently widespread among local governments in the United States, this type of assessment and the actions local governments are taking to manage climate impacts are of increasing interest to municipal bond holders, investors, residents, and companies.

This primer begins by outlining the ways local governments can benefit from understanding the impacts of climate-related risks and opportunities. It introduces the potential financial impacts from these risks and opportunities, as well as the assessment approaches, resources, and tools available to local governments and other public sector entities. It then explores the broader context of climate risk assessment and disclosure that may influence how this practice evolves for local governments in the United States. The primer concludes by highlighting critical gaps that need to be addressed in order to enable strong fiscal management at the local level as climate impacts and economic shifts accelerate.

This primer is intended to serve as an introductory resource for local governments of every size and means. We hope that it encourages new conversations within government organizations—particularly among chief financial officers and treasurers—so that they may work toward integrating climate considerations throughout their governance activities.

The insights offered here are based on interviews with a set of local jurisdictions across North America, leading city networks, and public sector finance experts, as well as a detailed literature review. The research builds on prior C2ES work around the economic competitiveness of climate-resilient cities and efforts to help companies identify their climate risks and opportunities in alignment with the Task Force on Climate-related Financial Disclosures (TCFD).¹

THE VALUE OF UNDERSTANDING THE FINANCIAL IMPACTS OF CLIMATE-RELATED RISKS AND OPPORTUNITIES

Identifying and assessing the potential impacts of climate-related financial risks and opportunities is valuable to local governments for several reasons. The process can:

- **build support for integrating climate resilience into financial planning** by informing key local decision makers of future negative consequences from physical and transition risks that may occur without climate action, as well as the financial benefits that can be realized by leveraging new opportunities.
- **improve local decision making** by increasing consideration of climate change risks and opportunities by those that manage budgeting and capital planning efforts. Better information supports local governments' ability to compare risks across assets or budget areas to improve prioritization of investments and risk management.² A clearer picture of the financial risks can also help inform “no-regrets” adaptation decisions.

- **build local capacity** to collaboratively identify, assess, and manage the local government’s climate-related financial risks and opportunities. A collaborative effort will also help integrate climate risk reduction, adaptation, and resilience action across government.
- **increase government transparency** by engaging the community in the development and communication of decision-relevant information.
- **prepare local governments for external requests for climate disclosures.** Climate risk management information is of increasing interest to investors, credit rating agencies, and businesses who are beginning to factor climate risk and resilience into their decision-making in ways that impact government investment opportunities and the cost of borrowing.³

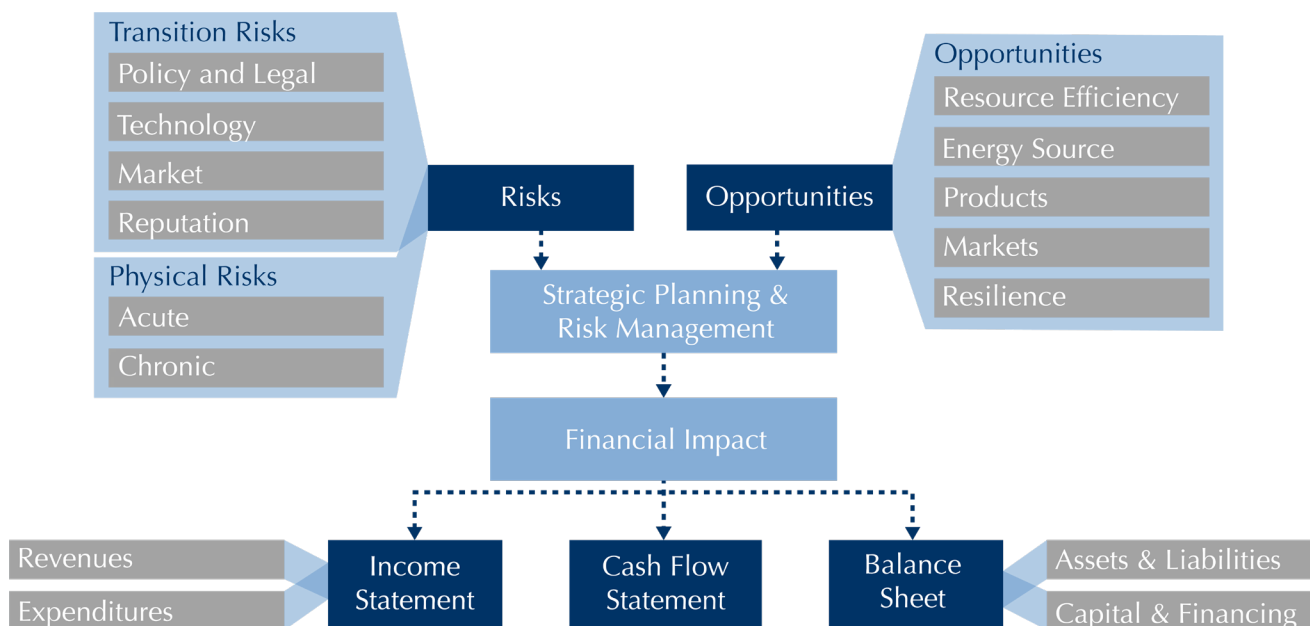
POTENTIAL FINANCIAL IMPACTS FROM CLIMATE-RELATED RISKS AND OPPORTUNITIES

With each extreme weather disaster, local coal-fired power plant closure, and new technology investment, the potential financial risks and opportunities that climate change presents to local governments become increasingly clear. This section explores the financial risks presented by the physical impacts of climate change, financial risks presented by the transition to a low-carbon economy, as well as financial opportunities from enhancing climate resilience and activities that support the transition to a low-carbon economy. Figure 1 illustrates how different climate-related risks and opportunities can impact an organization’s financial position and performance. A summary table of example financial impacts relevant to local governments is available in Table 1.

BOX 1: Common Definitions:

- **Climate-related opportunity:** “the potential positive impacts related to climate change on an organization. Efforts to mitigate and adapt to climate change can produce opportunities for organizations, such as through resource efficiency and cost savings, the adoption and utilization of low-emission energy sources, the development of new products and services, and building resilience along the supply chain. Climate-related opportunities will vary depending on the region, market, and industry in which an organization operates.”³³
- **Climate-related risk:** “the potential negative impacts of climate change on an organization. Physical risks emanating from climate change can be event-driven (acute) such as increased severity of extreme weather events (e.g., cyclones, droughts, floods, and fires). They can also relate to longer-term shifts (chronic) in precipitation and temperature and increased variability in weather patterns (e.g., sea level rise). Climate-related risks can also be associated with the transition to a lower-carbon global economy, the most common of which relate to policy and legal actions, technology changes, market responses, and reputational considerations.”³⁴
- **Financial impacts:** the positive or negative effects of climate-related risks and opportunities on an organization’s financial performance and position as reflected in its income statement, cash flow statement, balance sheet, and creditworthiness.
- **Greenhouse gas emissions reduction strategies:** actions taken by an organization to mitigate greenhouse gases that are part of a broader shift to transition to a low-carbon economy (e.g., electric vehicle procurement, energy efficiency investment, renewable energy adoption or deployment, decommissioning coal-powered generation).
- **Resilience and adaptation strategies:** actions taken by an organization that promote the ability to respond to physical climate change risks. Examples may include actions to reduce physical risks and prepare for impacts from extreme weather and chronic hazards such as flood mitigation investments, heat island reduction activities, increased emergency planning efforts, water conservation measures, zoning changes.

Figure 1: Impacts of climate-related risks and opportunities



This diagram shows how climate-related risks and opportunities can result in positive or negative financial impacts that affect an organization’s financial position or performance.

Source: *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures*

POTENTIAL RISKS AND FINANCIAL IMPACTS FROM PHYSICAL IMPACTS OF CLIMATE CHANGE

Physical climate change impacts are emerging as a significant threat to the fiscal health of local governments. In 2022 alone, 18 climate and extreme weather events caused \$165 billion in losses, marking the seventh consecutive year in which the United States experienced ten or more events each causing over \$1 billion in losses.⁴ Although some costs from federally declared disasters may be partially reimbursed or supported by federal disaster aid, local governments are not made whole, and do not receive aid for most impacts. Unmitigated risks from extreme weather and chronic hazards harm a government’s financial performance and position, ultimately jeopardizing its ability to provide public services and adequately invest in resilient infrastructure.⁵ A range of local government assets, expenses, and revenue streams are exposed to physical climate impacts, as described below.

Local Government Assets

The physical risks to public assets are likely the most direct category for local governments to identify and

evaluate for financial risk. At-risk assets can include public buildings, roads, utilities, communications networks, transportation systems, and natural resources. There are several levels of financial risk for assets: reduced lifespan, reduced value, stranded assets, and direct damage or loss. These risks can result in financial impacts including **write-down of asset values** or **reduced useful lives**.

Reduced effectiveness, inefficiencies, additional maintenance needs, and asset replacement are also possible and are considered in the next section on risks related to operational and capital expenses.

Local Government Expenses: Operations and Capital Expenditures

Extreme weather and chronic climate stressors, like sea level rise and drought, can hinder local governments’ ability to manage responsibilities, provide community services, support labor productivity, and protect residents and employees. It is well recognized that climate impacts disproportionately affect vulnerable populations, placing strain on local government social support systems. Given the variety of activities local governments manage,

the ways physical climate impacts affect government expenses are likely the most varied category of climate risk. Common financial risks can result in impacts on operational expenses, new capital costs, and impacts on liabilities. Below, we explore the impacts of these risks in more detail:

Operational and capital expenses presented by extreme weather events and physical climate impacts:

- **asset replacement and additional maintenance** to ensure continuity of service, meet operational and environmental standards, and repair damage (for example, downed trees, storm-caused erosion and landslides, damaged stormwater, and road infrastructure)
- **increasing heating/cooling costs** for government buildings
- **emergency provision of critical services** such as emergency response, public health services, and hazardous waste cleanup
- **reduced employee productivity** resulting from disruptive natural disasters or environmental conditions that present health challenges
- **reduced operational capacity of assets and technologies** that are directly affected by extreme weather or changing environmental conditions
- **additional public service needs** from changing public demands (i.e., higher demand for public health services, more interest in parks and recreational facilities in response to seasonal changes)
- **costs associated with grant writing and implementation** related to disaster response and recovery
- **costs to ensure worker safety** to harsh climate conditions and/or increased healthcare costs due to physical and human health impacts of climate events.
- **impacts on the capital budget** from new/increasing investments in risk mitigation such as upgrades, retrofits, and new infrastructure investments
- **relocation expenses** to avoid certain financial impacts, including moving public assets out of harm's way, and potentially employee relocation costs in the most extreme circumstances.

Other financial risks include a variety of costs and liabilities resulting from physical climate risks:

- **Increasing borrowing costs or liquidity thresholds** for favorable credit ratings or interest rates may

impact long-term debt services if investments are deemed risky. Although a 2021 Brookings analysis found no discernible influence of climate risk on local ratings yet, several localities have been downgraded following natural disasters and ratings agencies and investors are taking a more serious look at this risk category.⁶

- Local governments with third-party insurance may face “changes in **insurance liabilities and premiums** due to increasing climate-related damage payouts,” in addition to changes in **coverage**.⁷ Reduced access to insurance could require more self-insurance or reliance on financial bailouts from the state or federal government.

Local Government Revenues: Taxes and Service Revenues

Revenue streams represent an area of risk exposure for local governments, which could also be affected by the physical climate impacts. The most likely points of exposure are **property taxes** and **service revenues**. Understanding the risks on property taxes could be very important, as they represent a significant source of tax revenue for many local governments. Property tax revenues may fall as private property values change in response to chronic impacts such as sea level rise and recurrent flood events, or acute events such as wildfires. Looking at sea level rise alone, researchers have identified that nationally, exposed homes sell for approximately 7 percent less than similar but unexposed homes. Further, real estate comparisons by First Street Foundation and Columbia University show that properties dealing with climate hazards are already suffering from eroded property values.⁸

In addition to potential property tax impacts, service revenues may fall in the event of public utility or public transportation service disruptions or decreasing demand because of extreme weather events or private sector changes (e.g., local steel or cement facilities that close in response to deteriorating environmental conditions). Insufficient service revenues may threaten a government's ability to pay back its revenue bonds.

For local governments dependent on other tax revenues such as **sales and hospitality taxes**, any drops in local economic activity resulting from physical climate impacts can present risks to the municipal budget. When

acute events such as hurricanes require local response and recovery activities, the local tax revenue generated from that economic activity may mask a faltering economy, though this is not a given. The impacts from chronic and long-term climate change can present risks to the local economy in the form of declining labor supply and labor productivity, population displacement and migrations out of the region, increased private sector production costs, reduced tourism, or reduced productivity of agricultural lands. When local economies are impacted in these ways, local governments may see declining tax revenues over the long-term. In fact, a 2021 National Bureau of Economic Research report that assessed the status of municipalities ten years after sustaining direct hurricane impacts found just this: In addition to immediate negative impacts on tax revenues, long term economic declines also reduced the municipalities' abilities to support local services.⁹

POTENTIAL RISKS AND FINANCIAL IMPACTS FROM THE TRANSITION TO A LOW-CARBON ECONOMY

Local governments should also be aware of the financial risks associated with a decarbonizing economy.¹⁰ These climate-related “transition” risks arise from policy changes (e.g., carbon taxes, renewable energy incentives), legal actions, technology changes, market responses, and reputational considerations. These economic shifts and regulations can devalue public and private assets, incentivize new activities or investments, and affect economic activity, presenting risks to government finances and the overall local economy, particularly in jurisdictions where a significant transition is likely (e.g., communities heavily reliant upon jobs from coal, oil, or gas). Here, we consider the instances how the transition will introduce financial risks to public assets, expenses, and revenue streams.

Local Government Assets

The transition to a low-carbon economy may result in **stranded assets** or lead local governments to pursue **early asset retirements** to replace assets before the end of their useful life. This risk can apply to fossil-fuel based energy generation infrastructure owned by municipalities, government vehicle fleets, and government buildings with aging or inefficient HVAC systems, for example.

Local Government Expenses: Operations and Capital Expenditures

As local governments facilitate and respond to the shift to a low-carbon economy, there may be climate-related transition risks arising from changing public programs and policies that result in increasing or new costs. These cost impacts may include:

- **Program or policy development and enforcement expenses may be needed** to respond to market changes and establish the appropriate policy conditions for low-carbon development in the community (e.g., developing codes for private electric vehicle charging stations).
- **Procurement of and investment in low-carbon assets, technologies, and products.** As governments work to bring their operations in alignment with climate goals, many are changing procurement and asset management practices. They are also investing in building energy retrofits, electric fleet vehicles, etc., as well as purchasing lower-carbon products. These decisions carry a risk of being unsuccessful or may come at a cost premium in comparison to other options.
- **New training costs** may be necessary to ensure fleet auto mechanics are prepared to maintain electric vehicles and building operators are able to manage electrified buildings. Local governments may also need to prepare public sector employees currently managing fossil fuel-based services for new clean energy roles.
- **Hiring staff to address climate issues** may be necessary if existing staff are at maximum capacity and work responsibilities cannot be expanded or shifted.

Pension liabilities may present a concern to local governments that control pensions, as they have a fiduciary duty to mitigate risks to investment portfolios on behalf of the funds' participants. With respect to climate-related risks, the transition to a low-carbon economy could mean that fossil fuel reserves and certain infrastructure that compose pensions may become stranded assets that hold decreasing value for investors. For example, recognizing climate risk and finding that pension investments in fossil fuels had been underperforming for years, the New York City pension system divested from its fossil fuel reserves in 2018.¹¹ This divestment decision was

motivated by the city's interest in covering its pension liabilities, as well as aligning its investments with its climate goals.

Finally, for municipally-owned utilities reliant on fossil fuels, **operational costs and/or capital expenditures** will rise if markets or state/federal policies place costs on carbon, which would require the utilities to retrofit equipment or invest in renewable energy options.

Local Government Revenues: Taxes and Intergovernmental Disbursements

In some locations, local **tax revenue** could be at risk from the shift to a low-carbon economy. This is of particular concern for communities reliant on fossil fuel-based sectors that may see decreased demand. For example, the decommissioning of investor-owned coal-fired power plants can result in diminished property value, eventually wiping out key property tax revenues that localities have relied on for decades.¹² Where carbon-intensive sectors represent a significant proportion of local economies, economic competitiveness may also suffer if future private-sector investment decisions are jeopardized.

In addition, local governments that are dependent on **state and federal disbursements tied to fossil-fuel extraction or related leases** are at risk of a long-term decline in funding as the shift away from fossil fuels continues over time.¹³

POTENTIAL CLIMATE-RELATED OPPORTUNITIES AND FINANCIAL IMPACTS

There are financial opportunities for local governments seeking to build climate resilience, reduce greenhouse gas emissions, and facilitate the low-carbon transition. For example, certain resilience solutions and new climate-related technologies and infrastructure can reduce government expenses in significant ways. In addition, changing policies, new financing approaches, demographic shifts, and other economic trends present revenue opportunities for local governments to improve their financial standing. Many of these solutions can also represent ways to mitigate or insulate against physical and transition risks, and thus present the additional opportunity of protecting or improving a government's risk profile and financial position.

Local Government Assets

Governments that proactively invest in resilient infrastructure can **protect the life of public assets** and reduce liabilities. Proactive investments offer the financial benefit of cost-effective disaster mitigation and risk reduction. To illustrate, resilient building practices can produce up to \$11 dollars of benefit for every \$1 spent.¹⁴

Local Government Expenses: Operations and Capital Expenditures

Climate-related technologies and resilient infrastructure present opportunities to reduce a government's operational costs. For example, energy efficiency investments and electric vehicles can **reduce existing operational costs** through resource efficiency, while also supporting greenhouse gas mitigation goals.

Resilience solutions present financial opportunities when they **mitigate increasing or new expenses** and reduce the physical risks outlined above. For instance, resilience and adaptation solutions can reduce public service disruptions, protect employee productivity, and reduce unbudgeted demands for emergency services. In addition, local governments that are seen as "climate-ready" could see material benefits for capital investments; specifically, around long-term debt service in the form of **improved credit rating** that can help **reduce costs to borrow**.

In some cases, changing environmental conditions could even present operational benefits in the form of fewer workdays lost to cold temperatures, winter storms, and cold-related illnesses and accidents, although this benefit is not expected to outweigh the cost of workdays lost to extreme temperatures and other extreme weather events.¹⁵

Local Government Revenues: Taxes, Service Revenues, Grants, and Contributions

There are a variety of climate-related opportunities for local governments to generate or access increased revenue. Certain sectors that are responsive to the climate crisis (e.g., engineering, architecture, low-carbon construction and technology, risk and environmental management consulting) represent climate-related opportunities. Prosperity in these sectors can be highly beneficial to the financial wellbeing of local

governments. A local government's recognition and support of these sectors can boost the overall image of the community as a good place to invest and create a positive feedback loop of more prosperity and employment.

However, there are several tangible revenue-related impacts that could be realized through climate-related opportunities, which can benefit the fiscal health of any local government, regardless of the local economic profile:

- **Tax and service revenues could improve** under certain circumstances. Local governments could see increased property taxes or service revenues from population growth and economic activity due to climate migration or increased livability resulting from climate risk management (although this factor could become a problem if population growth outpaces available housing, infrastructure, and public services).
- Local governments may see opportunities for **increased/new revenue streams** from activities such as renewable energy generation or leasing public lands for third-party clean energy projects. Some communities even have citizen support to establish climate taxes and fees to fund local climate strategies, effectively creating an entirely new revenue stream for the local government.
- Local governments can also pursue **innovative climate financing** vehicles for resilience or greenhouse gas reduction projects, such as green bonds, climate bonds, etc., which have growing investor interest. Some local governments have found that green bonds allow for a lower rate of interest to be paid, resulting in cost savings for access to capital.
- Finally, perhaps the most apparent opportunities local governments can leverage to access funding are **state and federal grants and loans** to improve climate resilience or advance emissions reduction activities. A broad array of long-standing agency programs offer local governments grants and loans, but the new federal opportunities created by the Infrastructure and Investment Jobs Act (IIJA) and the Inflation Reduction Act (IRA) are providing billions of dollars more to accelerate investment in resilience and the low-carbon economy. Local governments can position themselves for these funding opportunities by investing in equity initiatives, aligning grants with pre-existing planning efforts, and

being prepared to co-invest in new programs and infrastructure. In addition, a community's inherent vulnerability to certain climate hazards based on location may also position the local government for access to new funding resources when climate vulnerability is a key criterion.

ASSESSING CLIMATE-RELATED FINANCIAL RISKS AND OPPORTUNITIES: EMERGING PRACTICES AND TOOLS

This section focuses on how local governments can identify relevant hazards and trends, and then assess the financial risks and opportunities they present. Local governments should avail themselves of existing resources to identify climate hazards and trends. These resources include state and local climate action plans, climate vulnerability assessments, hazard mitigation plans, city networks, science-based tools like the Climate Resilience Toolkit and those included below, energy market data, and credible sources for macroeconomic trends. In this section, resources and science-based tools for local governments are provided for each step.

GRANULARITY OF FINANCIAL IMPACT ASSESSMENTS: WHAT LEVEL OF DETAIL IS USEFUL?

The assessment process will be guided by the level of detail that is most beneficial and feasible for local governments. Qualitative information can convey the type and extent of climate risks and opportunities on a scale (e.g., high, medium, and low impacts), whereas quantitative information conveys specific dollar amounts or ranges for risks and opportunities. Whether quantitative or qualitative information is most beneficial depends on how a local government plans to use the outputs of their assessment. Specific dollar amounts or ranges are often the most informative to capital planning and budgeting decisions, but qualitative information can still be useful for comparing potential impacts across different government revenues and expenses or informing prioritization efforts. Narratives may be sufficient for general disclosures and public reports.

In addition, local governments may choose to assess financial impacts across the government enterprise or on a project/department level. In the United States, local governments that consider climate-related financial impacts tend to do so as part of project-specific

Table 1: Example financial impacts from climate-related risks and opportunities

POTENTIAL IMPACTS FROM PHYSICAL RISKS
<p>Assets</p> <ul style="list-style-type: none"> • write-down of asset value (including unvalued natural assets) • reduced useful life <p>Expenses: Operations and Capital Expenditures</p> <ul style="list-style-type: none"> • operational expenses <ul style="list-style-type: none"> – asset replacement costs – additional maintenance costs – higher heating/cooling costs for government buildings – emergency provision of critical services – reduced employee productivity – reduced operational capacity of assets and technologies – additional public service needs – costs associated with disaster/recovery grant writing and implementation – higher costs to ensure worker safety • impacts on the capital budget <ul style="list-style-type: none"> – upgrade and retrofit costs – new infrastructure investment costs – relocation expenses • other financial impacts <ul style="list-style-type: none"> – increasing borrowing costs or liquidity thresholds – changing insurance liabilities, premiums, and coverage <p>Revenues: Taxes and Service Revenues</p> <ul style="list-style-type: none"> • declining property tax revenues • negative impacts on sales and hospitality tax revenues • insufficient service revenues
POTENTIAL IMPACTS FROM TRANSITION RISKS
<p>Assets</p> <ul style="list-style-type: none"> • stranded assets (a particular concern for communities with municipally-owned utilities) • early asset retirements <p>Expenses: Operations and Capital Expenditures</p> <ul style="list-style-type: none"> • costs to develop and manage new policy and programs • new training costs • pension liabilities • operational and capital costs for municipally-owned utilities <p>Revenues: Taxes and Intergovernmental Disbursements</p> <ul style="list-style-type: none"> • reduced tax revenues • reduced state and federal disbursements tied to fossil-fuel extraction

Table 1: Example financial impacts from climate-related risks and opportunities (cont.)

POTENTIAL IMPACTS FROM CLIMATE-RELATED OPPORTUNITIES
<p>Assets</p> <ul style="list-style-type: none"> • protected useful life of assets <p>Expenses: Operations and Capital Expenditures</p> <ul style="list-style-type: none"> • reduced operational expenses across a variety of activities • improved credit rating and reduced costs to borrow • longer asset lifetime <p>Revenues: Taxes, Service Revenues, Grants, and Contributions</p> <ul style="list-style-type: none"> • greater access to state and federal dollars • increased tax and service revenues • increased revenue streams • new revenue streams from innovative climate financing

cost-benefit assessment processes (which is generally recommended or required during the consideration and design of capital projects), and/or after a major natural disaster to understand the costs incurred from that specific event. Department-focused assessments also occur, particularly for public utilities. Comprehensive efforts to identify and assess the full slate of climate-related financial risks and opportunities across the government enterprise are not currently common among local governments, and there are no reporting requirements to incentivize this activity.¹⁶ However, early-stage work on local-government-wide climate-related financial risk assessment is occurring in some Canadian cities.

ENGAGING THE RIGHT STAKEHOLDERS

Understanding the potential financial impacts of the risks and opportunities presented by climate change starts with identifying the relevant climate hazards and economic trends. This process requires coordination with government staff, external experts, and community members who know how government activities are affected by climate-related and environmental risks and opportunities. Government experts can include chief financial officers, climate and sustainability directors, public works departments, public utilities, economic development experts, energy managers, and others. Engaging state and local agencies, power companies, universities, and community stakeholders will surface critical information as well. External consultants can support this process but are not required.

Broad expert and stakeholder engagement can help government staff understand how physical climate change impacts present potential financial risks (and, to a lesser extent, opportunities). This engagement process can also help staff identify and understand how transition risks and opportunities that arise from climate change (i.e., financial risks resulting from changing market dynamics, demographic changes, new or changing policies and regulations, litigation costs, technological improvements or lack thereof, and reputational costs) may impact the government’s financial standing.

PRACTICES AND TOOLS FOR FINANCIAL RISK ASSESSMENT

Climate Hazard Identification

Climate-related financial risk assessment requires first identifying how extreme weather and chronic impacts will change under different climate change scenarios. Reviewing how previous extreme weather and climate-related events impacted the community and local government may help identify the relevant climate hazards. However, as future climate conditions may differ significantly from historical conditions, science-based climate projections should be a foundational information source. Various climate tools and resources are provided by federal government agencies, state governments and climate centers, universities, private sector providers, and non-profit organizations. These resources synthesize data from climate models developed by academic and

Table 2: Resources for Physical Climate Hazard Identification

RESOURCE NAME	RESOURCE PROVIDER	RESOURCE TYPE	DESCRIPTION
<i>National Climate Assessment</i> ³⁵	United States Global Change Research Program (USGCRP)	Information	National Climate Assessment provides the state-of-the-science synthesis of climate impacts and trends that can be used by policymakers to understand regional trends and projections and potential impacts in different climate scenarios.
<i>U.S. Climate Resilience Toolkit</i> ³⁶	National Oceanic and Atmospheric Administration (NOAA)	Tool Library	The U.S. Climate Resilience Toolkit website is designed to help users find and use tools, information, resilience framework and subject matter expertise to build climate resilience. The tools also offer region-specific climate baseline and projection overviews.
<i>The Climate Explorer</i> ³⁷	NOAA	Mapping Tool	The Climate Explorer tool provides county-level climate conditions including temperature, precipitation and others projected through 2099. The tool is available through the U.S. Climate Resilience Toolkit.
<i>Climate Resilience Evaluation and Awareness Tool (CREAT)</i> ³⁸	Environmental Protection Agency (EPA)	Mapping Tool	CREAT provides drinking water, wastewater, stormwater utility owners and operators with scenario-based climate change projections for temperature, precipitation, storms, extreme heat and sea level.
<i>Extreme Water Levels</i> ³⁹	NOAA	Mapping Tool	Extreme Water Levels map provides annual and monthly exceedance probability levels for select NOAA Center for Operational Oceanographic Products and Services (CO-OPS) water level stations with at least 30 years of data.
<i>Flood Insurance Rate Maps</i> ⁴⁰	Federal Emergency Response Agency (FEMA)	Mapping Tool	The Flood Insurance Rate Maps provide data to identify flood hazards and assess flood risk at the community level. The maps are part of FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program.
<i>Sea Level Rise Viewer</i> ⁴¹	NOAA	Mapping and Visualization Tool	Sea Level Rise Viewer provides visualization of community-level impacts from coastal flooding or sea level rise. Photo simulations of how future flooding might impact local landmarks are provided, as well as data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss and migration, and mapping confidence.
<i>Wildfire Risk to Communities</i> ⁴²	United States Department of Agriculture (USDA)	Mapping Tool	Wildfire Risk to Communities website includes interactive maps to help cities understand their wildfire risk. Direct and indirect exposure type, wildfire likelihood and vulnerable populations are provided in these maps.

governmental organizations and include physical climate scenarios under several Representative Concentration Pathways (RCPs) that represent possible future emission trajectories. Local governments can consider the impacts of multiple warming scenarios, such as RCP 4.5 and 8.5, which translate to 2.4 degrees C and 4.3 degrees C warming, respectively.

Prominent publicly available tools on climate hazards include the National Climate Assessment and the Climate Explorer. Tools that provide information on specific climate hazards (e.g., flooding, drought, wildfire) are also available. Other sources of information, like the Federal Emergency Management Agency's (FEMA) flood insurance rate maps, provide risk information based on prior extreme weather events but do not incorporate future climate projections. A sample of available climate hazard tools is provided in Table 2.

Climate Vulnerability and Risk Assessment

Once a local government identifies relevant physical climate hazards, the next step is to assess the potential impacts on the government and the surrounding community. Vulnerability and risk assessments can evaluate, for example, how more intense and frequent hazards like hurricanes or wildfires may cause physical damage to government-owned buildings, infrastructure, and equipment, and impact the continuity of municipal operations or employee health and safety. These assessments seek to understand how the projected climate hazards will affect the community and often include a community stakeholder engagement process. Certain assessment approaches can also help identify important systemic interdependencies that climate impacts may imperil.¹⁷ Although public natural resources and the ecosystem services they provide are not commonly assigned value as municipal assets, they should also be considered. Natural assets are vulnerable to climate impacts and therefore should be assessed for risk, especially those expected to provide climate resilience and mitigation solutions.

Tools and frameworks are available to help local governments apply climate projections and risk information to their own contexts. Some resources provide expected impact information of hazards on specific aspects of communities and local economies such as public health or water utility systems. Available tools are generally focused on broader economic risks as opposed to those directly impacting the finances of the local government, but they

still may provide useful data to inform assessments for government revenue streams and expenses. For example, FEMA's National Risk Index calculates expected fatalities, damages to buildings, and agricultural losses. A sample of resources is provided in Table 3.

Assessing Risks and Opportunities from the Low-Carbon Transition

Assessments of transition risks are largely based on energy market data—from sources such as the International Energy Agency—and macroeconomic studies on a low-carbon transition that limits warming to 1.5 degrees C.¹⁸ Useful energy market resources can also include the U.S. Energy Information Administration and local electric utility plans, among others. Local governments should also consider how local or state climate and energy goals and plans could affect the government's finances.

Local governments can consider macroeconomic studies and whether specific industry trends present risks or opportunities for the surrounding community and for the government's financial position. For instance, in communities where carbon-intensive industry plays a significant role in the regional economy, local governments could assess how a low-carbon transition may affect the finances of the community and government. Alternatively, in communities where the automotive industry plays a critical role, local governments could consider near- and long-term automotive market trends around vehicle electrification, as well as engage local automotive companies to understand their corporate strategies in order to assess the local government's financial exposure to potential climate risks and opportunities that are likely to arise.

Conversely, communities that are already investing in low-carbon energy or producing low-carbon technologies could be well-positioned to thrive when demand for those energy sources and services grow due to changes in the market, policies, and consumer preference.

Internalizing Climate Impacts: Financial Risk and Opportunity Assessment

Finally, to quantify the financial risks and opportunities facing the local government, an evaluation of government assets, expenses, revenue streams, and other financial concerns is required. This step involves gathering

Table 3: Resources for Physical Climate Vulnerability and Risk Assessments

RESOURCE NAME	RESOURCE PROVIDER	RESOURCE TYPE	DESCRIPTION
<i>Climate Risk and Adaptation Framework and Taxonomy (CRAFT)</i> ⁴³	C40 Cities and Arup	Framework	CRAFT is a standardized reporting framework that enables cities to perform robust and consistent reporting of local climate hazards and impacts, risk and vulnerability assessment, and adaptation planning and implementation as part of their compliance with the Compact of Mayors.
<i>Climate Change Risk Assessment Guidance</i> ⁴⁴	C40 Cities	Guidance	Climate Change Risk Assessment Guidance aids cities in developing a climate risk assessment report, including methodology and components of the assessment. The focus of this guidance is on compatibility with C40 and Global Covenant of Mayors requirements.
<i>Infrastructure Interdependencies and Climate Risks report</i> ⁴⁵	C40 Cities	Guidance	This report describes the approaches used by a selection of city governments to identify their infrastructure interdependencies and climate impacts on these systems, as a first step in reducing systemic risks.
<i>Assessing Health Vulnerability to Climate Change: A Guide for Health Departments</i> ⁴⁶	Centers for Disease Control and Prevention (CDC)	Guidance	This guide helps health departments assess local vulnerabilities to the health hazards associated with climate change.
<i>The TNFD Nature-related Risk and Opportunity Management and Disclosure Framework Beta v0.3 Annex 3.2</i> ⁴⁷	Task Force on Nature-Related Financial Disclosures (TNFD)	Guidance	The TNFD guidance on how to understand and respond to nature-related risks and opportunities. The loss of ecosystem services could represent substantial nature-related risk to governments. Wetlands, for example, provide extensive ecosystem services, notably disaster risk resilience.
<i>Temperate</i> ⁴⁸	ICLEI-USA	Planning Tool	Temperate tool is built for small- to medium- sized cities to identify climate hazards, assess vulnerabilities, and build an adaptation plan. The indicator data covers the majority of cities and towns across the United States.
<i>Neighborhoods at Risk</i> ⁴⁹	Headwaters Economics	Mapping Tool	Neighborhoods at Risk tool uses U.S. Census Bureau data to map all neighborhoods linking socioeconomic data to climate vulnerabilities to understand which communities are most at risk.
<i>National Risk Index Map</i> ⁵⁰	FEMA	Planning Tool	National Risk Index Map provides both county and census tract-level data that includes expected annual loss due to natural hazards, social vulnerability, and community resilience.
<i>Aqueduct</i> ⁵¹	World Resources Institute	Mapping Tool	The Aqueduct tools use open-source, peer-reviewed data to map baseline and future water-related risks such as water stress and coastal flooding risk.
<i>Risk Factor – Flood & Fire</i> ⁵²	First Street Foundation	Mapping Tool	The Risk Factor tool visualizes flood and wildfire risk at the property level across the United States for historic, current, and future risk projections.

and developing financial impact data, and depending on the scope of the assessment, can include comprehensive information about the government's current and anticipated assets, expenditures, revenues, liabilities, and more. As the relevant financial data is gathered, information gaps can be identified that may be addressed later or by other stakeholders.¹⁹

With the relevant climate scenarios and decarbonization trends, local governments can evaluate existing financial data to quantify the climate-related financial risks and opportunities. The potential impacts of certain risks are likely more challenging to assess than others. For example, impacts on revenues may be difficult to assess because there are so many other factors that affect revenue streams. However, risks to revenue streams may be the most strategic area of climate risk to understand: Without reliable revenue streams, local governments are hard-pressed to maintain operations and pay debt.

The cross-functional nature of this process necessitates cross-departmental collaboration and could involve external engagement with local universities, consultants, other partners, and even neighboring governments that may have already engaged in the process.²⁰ Efforts are underway to help build local expertise and capacity, in part driven by leading climate networks for cities, such as C40 for Cities, ICLEI, and others. Resources related to aspects of this activity are provided in Table 4.

CLIMATE RISK DISCLOSURE & REPORTING: EMERGING CONSIDERATIONS FOR LOCAL GOVERNMENTS

Understanding financial risks and opportunities presents valuable internal benefits to an organization, but also matters for external reporting and disclosure activities. For local governments in the United States, reporting and disclosure is required in several instances, most notably when pursuing credit ratings and issuing municipal bonds. For bond sales disclosure, the Government Finance Officers Association (GFOA), a professional association of government finance officers in the United States and Canada, recommends “that governments evaluate the development and disclosure of information regarding the primary environmental risks applicable to municipal issuers and their bonds in their preliminary and final official statements.”²¹ Governments have a

fiduciary responsibility to disclose all material information at these points, but the question of what is material, or “applicable,” and how much detail to disclose is unclear. A discussion of this issue and examples of climate risk disclosures from public debt offerings are provided in the Ballard Spahr brief, “Climate Change Disclosure in Municipal Offerings.”²²

Although there are currently no mandatory requirements and standards for how local governments report their climate-related risks and opportunities, market demands are spurring the development of disclosure approaches and mechanisms in the private and public sectors.

Companies around the world have begun reporting on the risks and opportunities associated with climate change through corporate sustainability reports, financial filings, and voluntary reporting frameworks. As demands to publicly report on climate risks and opportunities have grown, initiatives such as the Task Force on Climate-Related Financial Risk Disclosure have sought to standardize private-sector reporting. The TCFD Framework recommends organizations disclose climate-related information across four common areas: governance, strategy, risk management, and metrics and targets (this primer on identification and assessment aligns with the TCFD framework's strategy and risk management areas). An increasing number of companies are now using this framework to analyze and voluntarily disclose how climate change presents strategic risks and opportunities to their organizations.

Federal regulations are building on this foundation by requiring climate-related financial risk reporting:

- The EU [Corporate Sustainability Reporting Directive](#) (CSRD) requires companies to disclose their climate change mitigation and adaptation action plans and the resources allocated for their implementation.²³
- In the United States, the [2022 Proposed Ruling/Plan to Protect Federal Supply Chain from Climate-Related Risks](#) stands to drive disclosure by private sector businesses that contract and supply the federal government, representing a major market driver.²⁴
- Other countries have or are passing legislation for climate-related disclosures including but not limited to Canada, Singapore, and New Zealand.

Table 4: Resources for Assessing Climate-Related Financial Risk and Opportunity

RESOURCE NAME	RESOURCE PROVIDER	RESOURCE TYPE	DESCRIPTION
<i>"ESG" Best Practice - "E" Environmental</i> ⁵³	Government Finance Officers Association	Guidance	Best Practice guidance provides environmental disclosure considerations for governments including primary risks identified and policy actions taken for the broader municipal market.
<i>Enhancing Climate-related Disclosure by Cities: A Guide to Adopting the Recommendations of the Task Force on Climate-related Financial Disclosures</i> ⁵⁴	Chartered Professional Accountants of Canada	Guidance	This guide has been developed to enhance the transparency of a city's climate-related risks and opportunities, strategies, and governance in line with TCFD recommendations. This guide is designed to help cities determine what climate-related information is valuable for internal decision-making to support short-term budgeting and long-term capital planning. It is also intended to enhance the usefulness of a city's general-purpose financial reports for external stakeholders.
<i>Municipal Natural Assets Initiative</i> ⁵⁵	Municipal Natural Assets Initiative	Initiative	This initiative partnered with KPMG and a university and Canadian cities to develop a non-binding initiative that values natural assets and informs public sector accounting standards board.
<i>Hazus</i> ⁵⁶	FEMA	Planning Tool	This tool is a part of FEMA's methodology for estimating potential losses from disasters and is a model that estimates potential losses from climate hazards such as earthquakes, floods, and hurricanes.
<i>Climate Budget</i> ⁵⁷	C40 Cities	Planning Tool	Climate Budgeting tools can be used to support transition risk assessment/greenhouse gas mitigation goals that can be integrated into a city's daily operations and policies.
<i>Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)</i> ⁵⁸	EPA	Planning Tool	The COBRA screening model allows cities to explore how changes in policies and programs can affect human health, estimate the economic value of health benefits, and map air quality, human health, and health-related economic benefits resulting from clean energy policies and programs.
<i>City Performance Tool (CyPT) Portal</i> ⁵⁹	Siemens	Planning Tool	The CyPT Portal helps city representatives and decision-makers determine the impact of technologies on city emissions reductions targets. Cities can explore the environmental and economic benefits of infrastructure choices in energy, building, and transport.

While the TCFD framework was developed for the private sector, application of the framework and its underlying principles are extending into the public sector. In the UK, some public entities have been disclosing climate risk and adaptation plans for some time. And in the United States, a 2021 Executive Order by the Biden-Harris Administration established the expectation for federal agencies to address climate-related risk in order to ensure “prudent fiscal management” of the federal government.²⁵

There are also efforts to apply the TCFD framework to the local government context. In 2019, the Chartered Professional Accountants of Canada released a TCFD-aligned guidebook for cities that provides a general process framework for local governments wishing to follow the TCFD recommendations.²⁶ The guide describes the TCFD framework and how it can be applied to city processes. It also offers TCFD resources and strategies to overcome internal barriers unique to local governments.

Several major Canadian cities have initiated TCFD-aligned efforts and included disclosures in their annual financial reports. For example, the cities of Vancouver and Montreal have identified and disclosed how climate change is presenting physical risks to the governments. The city of Vancouver’s 2021 Annual Financial Report describes the projected timeframes and impacts on city assets and services when physical climate impacts affect human, natural, and built environment systems.²⁷ The city of Montreal’s 2021 Annual Financial Report includes a concept map of how acute and chronic physical climate hazards lead to a variety of direct and indirect impacts on the community.²⁸ The concept map illustrates that the city administration expects to see reduced revenues, increased expenses, positively and negatively impacted assets, and increased liabilities. Assessment and disclosure efforts such as these are uncovering alignments with the original private-sector focused TCFD process, while establishing adaptations for local government use and identifying needs to expand adoption by other cities.

There are also efforts in Canada to establish guidance and training on climate informed municipal asset management practices through a group known as Asset Management Ontario. This is relevant to climate-related disclosure because of the high proportion of local government assets affected by climate and the high dollar and service value of those assets. Furthermore, the TCFD framework is being mainstreamed through its inclusion

in commonly used voluntary climate reporting portals such as CDP. CDP and ICLEI have added the TCFD-aligned “CDP-ICLEI Track” to the CDP city reporting platform to encourage and facilitate comparable climate-related disclosures by city governments around the world. This development is meant to establish a consistent framework, inclusive of financial considerations, for cities to report on their climate risks and management activities. The track includes 11 questions tailored for the local government context based on the TCFD’s four recommendation areas of climate governance, strategy, risk management, and metrics and targets.²⁹

CRITICAL GAPS AND NEEDS

Four significant gaps must be addressed to advance local governments’ ability to understand and assess their climate-related financial risks and opportunities:

- There are no external forcers for local governments to take on this additional planning step, outside of occasional (but increasingly common) external requests for climate disclosures.
- There is no common framework for local governments to integrate climate assessments with financial planning activities. Specifically, there is no widely accepted process to translate climate-related financial risks and opportunities into actionable information that can inform common financial decisions by local governments, such as project design and prioritization, capital planning, and annual budgeting.
- A lack of accounting standards, assessment guidance, and tools means that each local government must develop their own process, which can be a time-consuming and costly effort. Other existing accounting and financial management responsibilities take priority in the absence of industry guidance on assessing climate risk and opportunity.
- Limited staff capacity and expertise is likely a critical gap for many governments, especially those of resource-constrained localities. Without resources to address these limitations, the likelihood that local governments in the United States will adopt this practice in a meaningful way is small.

Although these gaps are significant, the solutions are coming into clearer focus and in some cases may already be in development.

First, there is reason to expect that the local government practice of assessing financial risks and opportunities from climate change will become more common in the coming years. Growing interest from credit rating agencies and municipal investors, coupled with the addition of the CDP-ICLEI track in the CDP climate reporting platform, are introducing the question of climate risk management to a broad set of local governments. While neither of these examples represent mandates for local government action, they do indicate interest in mainstreaming the practice, and there is room for continued leadership to encourage more action. Federal entities, including the Federal Reserve and the U.S. Treasury Department (building on its efforts to support community climate transitions) could also build awareness among local governments about the potential financial risks, including private disinvestment in certain communities, as well as financial tools and resources that may be available for local decision-makers.³⁰

Secondly, the development of a framework that helps local governments integrate climate planning into their financial management practices would be a significant step forward. The framework can build on lessons learned by leading local governments that are already applying TCFD principles, some of which are captured in the Chartered Professional Accountants (CPA) guidance document.³¹ It should integrate emerging insights from city climate networks that are beginning to address this area of need. The framework should align with (needed) costing tools to lay out a process for local governments to translate climate risks and opportunities into actionable information that can inform government financial decisions. Such a framework should also include best practices for internal collaboration, especially between sustainability and climate staff with financial officers.

Third, industry-accepted accounting methodologies would promote adoption by financial officers and support the development of accessible costing tools that would streamline the process for local governments. Our research uncovered consistent interest in accounting standards and guidance to help local governments evaluate and quantify their climate risk and opportunities. There is some indication that efforts from international accounting organizations such as the International Financial Reporting Standards (IFRS) Foundation are beginning to explore this area, but the need remains

unmet. In addition, as investors may spur more climate risk disclosures by communities, the U.S. Financial Stability Oversight Council (FSOC) should seek to guide the development of municipal bond disclosure frameworks (within existing federal regulatory constraints) which can also speak to accounting guidelines.³²

Finally, for localities with limited government resources and internal capacity, external support in the form of planning grants, technical assistance, and partnerships with private entities or neighboring governments would facilitate capacity building. Local governments could use such external resources to pay for the staff time to develop expertise, or leverage relevant information developed by neighboring governments to begin to integrate climate considerations into their financial planning. The federal government, philanthropies, and city climate networks are the most likely sources for this external support.

CONCLUSION

Climate change is impacting nearly every aspect of local governments' financial health, from government assets and expenses to liabilities and revenue streams. Local government leaders equipped with information on their climate-related financial risks and opportunities can improve their decision-making, risk management, and project prioritization. By developing and communicating the information in a transparent way, local governments can support community engagement, and position themselves to respond to external requests for risk disclosures from investors and credit ratings agencies.

Despite these benefits, there is currently no consistent practice to account for climate-related risks and opportunities in the United States. Gaining a clear picture of the financial risks and opportunities remains out of reach for most local governments because there is no integrated framework, standard guidance, or capacity-building resources. These are critical gaps hindering broad adoption of the practice, especially for under-resourced governments.

In this primer, we have offered a high-level introduction to the potential financial risks and opportunities that local governments in the United States may face as physical climate hazards increase and the transition to a low-carbon economy accelerates. We have identified a

spectrum of financial risks and opportunities that may apply to local governments and public sector entities. We have provided an overview of the assessment process for these risks and opportunities and offer leading science-based resources and industry guidance. Finally, we have explored emerging climate risk disclosure and reporting frameworks that may become increasingly relevant and noted the critical gaps hindering broader action by local governments in the United States.

Although each local government faces unique circumstances and capabilities, this primer shows that climate change presents them with some common financial risks and opportunities. Future industry guidance and collaborative efforts should focus on these commonalities and address critical gaps. When communities are able to integrate climate change into local fiscal management practices, they can improve their resilience, and it is key that communities of all sizes and capacities are able to do so as climate impacts and economic shifts accelerate.

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