

City of Portland Carbon Shadow Price Policy

Exhibit A: Framework for Application of Carbon Shadow Price

1. Background and Policy Intent

The scientific consensus is clear: immediate action is needed in order to combat the climate crisis. A human-made climate emergency threatens our city, our region, our state, our nation, humanity, and the natural world, and such an emergency calls for an immediate mobilization effort initiating greater action, resources, and collaboration.

The City of Portland's Climate Emergency Declaration (Resolution 37494, adopted June 30, 2020) resolved that:

The City of Portland will involve youth and other stakeholders in the development of a proposed climate test – such as an internal carbon fee or shadow price on carbon – by Fall 2020 that will ensure City bureaus are making informed decisions based on the best available climate science, particularly for major capital investments and high-carbon-impact decisions, such as fuel and vehicle purchases, and explore options for a lifecycle climate test that could apply to other areas where the City has environmental, safety, land use, zoning, or design review authority.

The Carbon Shadow Price policy is the mechanism by which City bureaus begin implementation of a climate test in major capital investments and select high-carbon-impact decisions.

The intent of the City's Carbon Shadow Price policy is to normalize the inclusion of climate impacts into project, planning and policy decision-making. It shall do so by institutionalizing a framework that steers organizational investment choices towards low-carbon alternatives. In so doing, the City will create a consistent mechanism for City staff to quantify actual or modeled costs associated with select projects and operational decisions that produce carbon emissions.

2. Current Scope

The policy's current scope applies to options analyses that use lifecycle cost analysis to inform decision-making with respect to the following City assets, operations, and end uses:

City-owned buildings:

- Developing new City buildings;
- Acquiring existing buildings;
- Procuring energy sources for City buildings;

Vehicles and mobile equipment:

- Procuring vehicles and other mobile equipment for City use;
- Procuring fuels and fueling infrastructure for such vehicles and other mobile equipment.

Resource management at Columbia Boulevard Wastewater Treatment Plant

- Management of methane emissions at CBWTP;
- Development of CBWTP Resource Recovery Plan

Ecosystem Services

- Avoided CO₂e emissions attributable to the protection and/or restoration of natural systems, such as trees and forests, wetlands, stormwater management, and park land.

3. Applicability to City Bureaus

This policy applies to all City infrastructure bureaus that manage City-funded projects and planning initiatives identified in the [Current Scope](#). Specifically, the policy is applicable to the following City bureaus:

- Office of Management and Finance, Division of Asset Management, specifically:
 - Facilities Services
 - CityFleet
- Portland Parks and Recreation
- Portland Fire and Rescue
- Portland Bureau of Transportation
- Portland Water Bureau
- Portland Bureau of Environmental Services

City staff in the Bureau of Planning and Sustainability shall play a complementary role in supporting the implementation of the policy in conjunction with staff from the infrastructure bureaus noted above.

Specific employee roles, responsibilities, and expectations are further described in Appendix A.

4. Definitions

Applicable Sources of Carbon Pollution is carbon pollution associated with City assets or operations (expressed in *Carbon Dioxide Equivalent*). Carbon pollution can be created through energy use, industrial processes, wastes, and those avoided through ecological carbon storage/sequestration.

Carbon Dioxide Equivalent (CO₂e) is the common metric used to quantify and compare different types of greenhouse gases. It is expressed in tons.

Carbon Shadow Price is a price on carbon emissions used for analysis and evaluation of alternatives, expressed as dollars per ton of CO₂e. As the name implies, no costs are incurred.

City-Owned Buildings include workspaces and structures that the City designs, builds, owns, operates, maintains, or supports through loans, grants, and/or other financial benefit.

Greenhouse Gases (GHGs) are the atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Less prevalent, but very powerful, greenhouse gases are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

Lifecycle refers to consecutive and interlinked stages of a goods or services system, from resource generation and raw material acquisition through production, use and final disposal. This is sometimes referred to as “cradle to grave.”

Lifecycle Cost Analysis (LCCA) is the method for calculating the costs of goods or services throughout their lifecycle. It includes total cost of ownership, including operating and maintenance costs, and positive or negative externalities which can be monetized both to the City and to society.

Mobile Equipment refers to motorized mobile equipment that requires fuel to operate and are not otherwise defined as typical City fleet vehicles. Examples may include, but are not limited to, riding lawnmowers, tractors, forklifts, and heavy construction equipment such as bulldozers, loaders, pavers, graders, excavators, etc.

Social Cost of Carbon (SCC) is an economic estimate of the present-day dollar value of future societal and environmental damage caused by carbon emissions. This value is typically used as a shadow price, meaning no money is exchanged, but the “cost” incorporates future impacts into decision analysis.

5. Policy Statement

City staff responsible for conducting options analyses for projects and plans within the [Current Scope](#) will apply a carbon shadow price to represent the value (expressed as a project cost or credit) of [applicable sources of carbon emissions](#) associated with each option. The shadow price value will be included in the [lifecycle cost analysis](#) for each option, alongside all other relevant costs (e.g. capital, operating and energy costs) and potential revenue streams (e.g. federal, state, or local grants and incentives).

The carbon shadow price shall inform the lifecycle cost of project options for evaluation purposes. Reducing carbon impacts may not necessarily be the exclusive priority for all decision-making; staff must weigh multiple priorities, and there may be other priorities that take precedent over carbon emissions on individual projects.

6.1 Carbon Shadow Price Level

The carbon shadow prices that bureaus will use is based on established values for the social cost of carbon (See Appendix A.3). Table 1 provides the carbon shadow price bureaus will use each year from 2020 through 2050:

Table 1: City of Portland Carbon Shadow Price (2020-2050)

Year	Carbon Shadow Price
2020	\$117 per ton CO2e
2025	\$130 per ton CO2e
2030	\$143 per ton CO2e
2035	\$156 per ton CO2e
2040	\$170 per ton CO2e
2045	\$182 per ton CO2e
2050	\$194 per ton CO2e

The carbon shadow price is subject to review and adjustment via the [continuous maintenance process](#) as City staff apply the policy, develop lessons learned and gauge impacts across a larger sample size.

6.2 Applicable Sources of Carbon Emissions

For City assets and operations in the [Current Scope](#), the shadow price will be used to calculate a value for applicable sources of carbon pollution associated with the following categories of emissions:

- **Scope 1** emissions are those that are directly released from an activity (e.g. the tailpipe emissions from a gasoline or diesel vehicle).
- **Scope 2** emissions are those that are directly released from the production of electricity and/or heat supplied for an activity (e.g. the emissions from generating the electricity needed to power an electric vehicle, or the natural gas emissions associated with burning gas in a boiler).
- **Scope 3** are indirect emissions for an activity other than those covered by scope 2 (e.g. the carbon released through the manufacture of the concrete and steel used in a building).

If scopes 1, 2 or 3 emissions are unavailable, unreliable, or not applicable across all options, staff will have the discretion to exclude one or more scopes from the analysis.

6. Policy Compliance and Reporting

City employees are responsible for complying with this policy, utilizing applicable tools and resources, and providing data relating to the application of the carbon shadow price on end uses identified in the [Current Scope](#) upon request.

The application of the carbon shadow price shall be tracked by BPS staff to facilitate feedback to bureaus on policy implementation performance, and to inform subsequent scope development and continuous maintenance of the policy.

For each of the targeted impact areas identified in the [Current Scope](#), the [applicable City bureau](#) shall provide a complete list of applicable projects that employed the carbon shadow price in options analysis, the impact of the carbon shadow price to the life cycle cost analysis, and the decision that was adopted. Additional narrative that explains the rationale for the decision and other relevant documentation may also be included in the report.

The Bureau of Planning and Sustainability staff shall create an annual report that compiles the above information.

7. Policy Updates and Continuous Maintenance

7.1 Policy Updates

Bureau of Planning and Sustainability (BPS) staff shall periodically bring together both internal and community-based stakeholders to review and update this policy to evaluate effectiveness, including but not limited to carbon shadow price level, applicable scope, and availability of carbon emissions measurement tools. Given the role of local youth climate advocates in the initial development of this policy, City staff must ensure that these stakeholders continue to have a strong voice in the continued development of this policy.

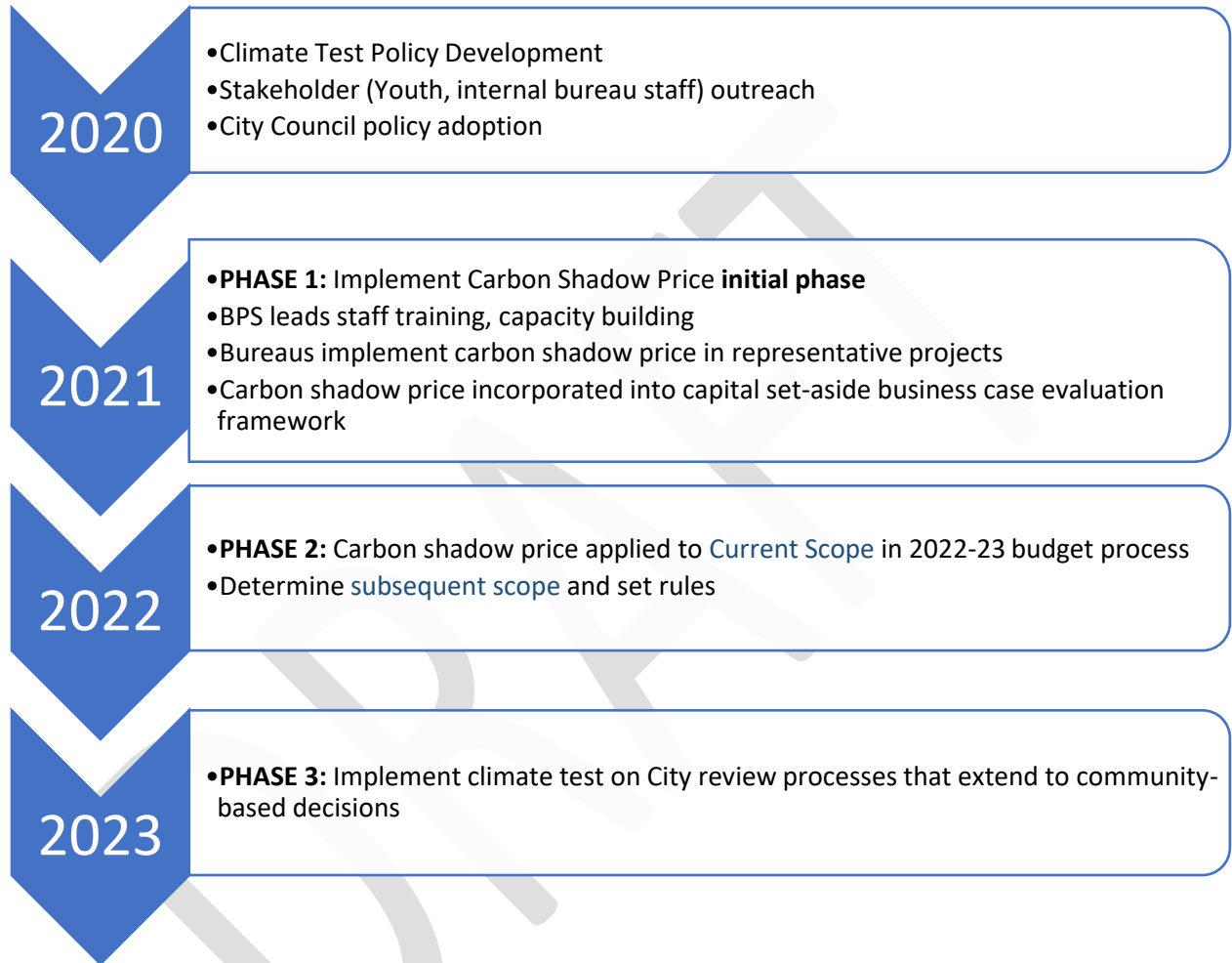
7.2 Continuous Maintenance Process

Sections of this policy subject to continuous maintenance may be revised in between policy update cycles in order to incorporate adjustments to the shadow price, new applicable emissions measurement tools, best practices, capabilities and processes, and removal of outdated references. Updates made to this policy through continuous maintenance will be posted on the BPS website. Month and year of updates will be noted. A cross-bureau working group shall be convened to regularly review bureau recommendations for continuous maintenance and make updates to the policy. Approval of updates is at the discretion of the BPS Director. Continuous maintenance updates shall occur no more frequently than once a year.

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8. Timeline

The following timeline represents the policy rollout schedule. Given the timing of capital budget decision making, the need to train staff on implementation, and the development of carbon emissions calculation tools, a phased approach to policy implementation is required.



Appendix A – Supplemental Information

A.1 Shadow Price calculation methodology

When staff conduct lifecycle cost assessments as part of options analysis related to the [Current Scope](#), the carbon shadow price shall be calculated as follows:

1. Identify [applicable sources of carbon emissions](#) for the project.
2. Calculate annual CO₂e emissions of each project alternative using appropriate [carbon emissions calculation tool](#).
3. Determine the estimated lifecycle of the project being evaluated. The lifecycle is the amount of time (in years) that the project or plan is expected to be in operation and/or creating CO₂e emissions.
4. Multiply the annual CO₂e emissions value (in tons) by the expected lifecycle term (in years) to determine the lifecycle CO₂e emissions for each option under consideration.
5. Multiply total lifecycle emissions value (in tons) by current [carbon shadow price level](#) (\$USD per ton) to determine total carbon shadow price. Add carbon shadow price to all other applicable project costs to perform lifecycle cost analysis.
6. Conduct options analysis to determine preferred project option.

A.2 Carbon emissions calculation tools

As part of the [continuous maintenance](#) process, BPS staff will develop and maintain a library of approved carbon emissions calculators that City staff shall use to calculate [applicable sources of carbon emissions](#) relating to their projects. As new calculation tools emerge in the marketplace, BPS shall review, approve, and add these resources to the library. The library will be made available to all bureaus via a dedicated page on the Portland.gov website for ease of access.

City staff may use their discretion in determining the appropriate emissions calculator to apply to a particular project analysis. To ensure the options analysis is using the same set of carbon emissions assumptions, the same calculator must be employed for all options being evaluated in the analysis.

A.3 Relationship between Social Cost of Carbon and Carbon Shadow Prices

The shadow price is based upon the social cost of carbon (SCC), which is an economic estimate of the present-day dollar value of future societal and environmental damage caused by carbon emissions. There is a wide range in calculated SCC values from a variety of economists and climate research professionals. A survey of existing research, and the recommendations of existing state and local government policies with adopted SCC values has been taken into account to establish the City's price level. The primary sources of research used to establish the City's carbon shadow price are outlined below.

Leading economic research that surveys existing professional SCC models ([Pindyck, *The Social Cost of Carbon Revisited*, National Bureau of Economic Research, 2016](#)) indicates a central estimate of \$108-\$138 / ton CO₂e. The research develops cost ranges using multiple parameters used to survey the data; the central estimate used for the City's purposes is defined by the author as those SCC studies with high confidence in their responses, cost range in the 5th to 95th percentile.

The [Washington State Energy Office](#) recommendation for standardizing the SCC when used for public decision-making processes indicates a 2020 value of \$78 / ton CO₂e (in 2020\$), based upon the federal

central estimate at a 2.5% discount rate. The federal values were published by the [Environmental Protection Agency \(EPA\) in 2016](#); it is derived from a federal Interagency Working Group on Social Cost of Greenhouse Gases that calculated the SCC at various discount rates and impact scenarios. [King County, Washington](#) developed an Operational Cost of Carbon report that adopted the Washington State Energy Office recommendation for their application of an internal SCC for evaluation purposes.

City of Vancouver, British Columbia, Canada adopted an [Internal Corporate Carbon Pricing policy](#) in December 2018. The 2020 value is the equivalent of \$117 USD (\$155 CAD).

The King County Operational Cost of Carbon report and the Vancouver BC Internal Corporate Carbon Pricing policy served as invaluable models for municipal government application of a carbon shadow price.

A.4 Training and Internal Capacity Building

The following internal capacity building plan will be used to support the Policy's implementation:

- BPS staff will lead workshops throughout 2021 with the staff tasked with developing options analyses that fall under the [Current Scope](#). Workshops will be scheduled in CityLearner and be made available to all City staff with interest in the learning how to implement the policy. BPS staff will specifically communicate with bureau management to ensure that appropriate bureau staff is identified to attend the training sessions, and training is built into staff workplans.
- BPS staff will provide support on lifecycle carbon calculations as needed for staff working on decisions impacted by the policy. Where support is provided, it shall be documented so that it is available to a broader range of staff to build capacity. When common questions surface during support sessions, additional tools and support will be formally developed.
- BPS staff will provide briefings on the policy to Planning and Development (P&D) directors and the Citywide Asset Managers Group (CAMG) so that bureau directors and relevant senior management become familiar with the policy and how it impacts their work.
- BPS staff will document case studies developed during the Year 1 pilot phase for different types of decisions to show how the policy was used and if/how it impacted the final decision.
- Sustainability staff will work with the City Budget Office (CBO) to explain the policy and update CBO guidance as needed.
- Sustainability staff will work with Procurement Services to explain the policy and update the Sustainable Procurement policy to refer to the Carbon Shadow Price policy.

A.5 Communications

The following high-level communications plan will be used to support policy implementation:

- The carbon shadow price policy will be included in the next Climate Emergency Declaration update to City Council.
- City staff will share the policy with other local governments to encourage adoption of similar approaches that further government leadership in addressing climate change.
- City staff will share the policy with interested local businesses to encourage adoption of similar approaches within the business community to advance climate action at the community level.
- City staff will share the credit for program success with the youth climate advocates that provided valuable feedback in the development of the policy.

A.6 Subsequent Scope

The initial scope of decisions subject to the carbon shadow cost policy is relatively limited. City staff are committed to developing a robust policy over time that is successful in meeting the [policy intent](#), and ramping the policy over time is an essential strategy to achieving success. Staff will continue to investigate how to apply the policy to other areas where the City has environmental, safety, land use, zoning, or design review authority.

The following have been identified as priorities for additional research and possible stakeholder consultation. Note that potential scope expansion that affects privately owned buildings, residents and the greater community in general may require adjustments to the policy design.

- Land use planning decisions
- Transportation planning
- Solid waste management
- Waste to energy projects, such as the generation of renewable natural gas from organic food waste
- Electric vehicle charging infrastructure for public use
- City employee air travel
- City permitting requirements