

# KING COUNTY OPERATIONAL COST OF CARBON

## EXECUTIVE SUMMARY

King County's 2015 Strategic Climate Action Plan (SCAP) maps out priority actions to reduce greenhouse gas emissions by 50% by 2030 and 80% by 2050 in county operations and across the county geography, including the development of an internal 'cost of carbon' to be used in government processes and decision-making.

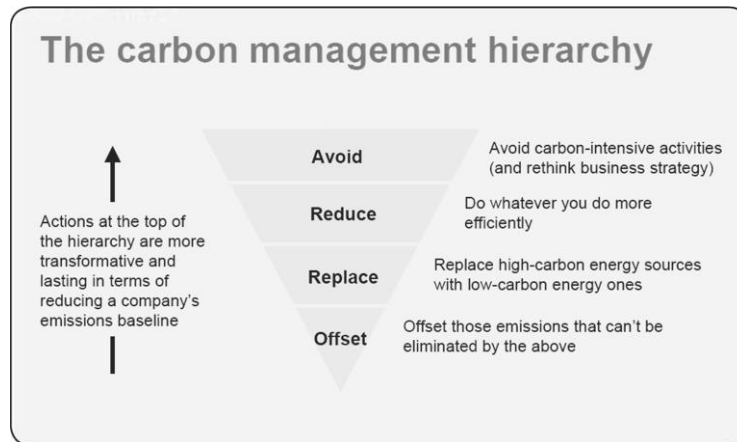
In 2017, a King County team developed guidance for agencies on use of a shadow price of carbon to inform analysis of capital projects, major fuel and vehicle purchases, resource efficiency investments, and other County operations decisions. The interdepartmental team developed recommendations after researching and analyzing organizational case studies of carbon pricing, and evaluating examples of carbon pricing already in use within the County.

Based on the analysis of existing application of a cost of carbon, the King County Executive recommended refining and developing three innovative programs, and continuing an existing program to apply an operational cost of carbon and accelerate the reduction of carbon emissions generated by King County operations.

- Expand application of a **carbon shadow price**—a non-cash cost—to lifecycle cost analyses developed for capital projects, evaluation of major fuel and vehicle purchasing decisions, and cost-benefit evaluation of select priority climate change actions in the 2020 SCAP update.
- Establish an **internal carbon fee for vehicle fuel use** to incent behavior changes that result in lowered carbon emissions. Fees will be charged to fleet users with emissions above a baseline emissions reduction goal and revenues will be invested in tree plantings that sequester carbon and reduce emissions.
- Establish an **internal carbon fee for Facilities Management Division** tenants, with funds to be reinvested in measures and projects that reduce energy use and carbon emissions.
- Continue the **Department of Natural Resources and Parks (DNRP) Carbon Neutral Accelerator Program**. DNRP generated \$1.65 million over 2014-2016 from an energy use set-aside. This set-aside was used in projects that also leveraged \$207,000 in utility rebates, and will result in over \$4 million saved and 55,000 MTCO<sub>2</sub> avoided over the lifetime of the improvements. The program has been successful to date and should continue, and it should assess the benefits of updating its current rates and investments.

## Key Terms

**Carbon Management Hierarchy:** A carbon management hierarchy prioritizes mitigation strategies based on their impact.



**MTCO<sub>2</sub>:** Metric ton of carbon dioxide, a standard measure of emissions.

**Social Cost of Carbon:** A 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. King County's analysis uses the State of Washington Office of Financial Management's methodology for the social cost of carbon.

**Shadow Price:** A price on carbon emissions used for analysis and evaluation of alternatives. As the name implies, no actual costs are incurred.

**Market Price:** A cost developed by a state or regional regulatory entity and imposed on carbon emitters, typically on a per ton basis.

**Internal Price:** A price established by an organization, typically per unit of energy user or emissions generated, that satisfies the goals of the organization. The price can be set by determining a price or range of prices for carbon emissions offsets, or can be determined by other factors as a means to change behavior in the organization.

**Carbon Reduction Fee:** A Carbon Reduction Fee is an actual cost charged for carbon emissions generated, either against a zero emission baseline or established volume cap. Funds generated from this fee can be reinvested in carbon reduction projects or offset programs.

## BACKGROUND

King County's 2015 Strategic Climate Action Plan (SCAP) maps out priority actions to reduce greenhouse gas emissions by 50% by 2030 and 80% by 2050 in county operations and across the county geography. The SCAP recommended that the King County Office of Performance, Strategy and Budget (PSB) "collaborate with King County agencies to develop and propose an internal 'cost of carbon' by the end of 2017" to be used in government processes and decision-making.

In an effort to advance the next steps outlined in the report—including further development of guidance for agencies on use of a shadow price of carbon to inform alternatives analysis of CIP projects, major fuel and vehicle purchases, resource efficiency investments, and other County operations decisions—utilized an interdepartmental team to developed recommendations after researching and analyzing other organizational case studies of carbon pricing, and evaluating examples of carbon pricing already in use within the County. These case studies—Battery Electric Bus Procurement, Green Direct breakeven analysis, and DNRP's Carbon Neutral Accelerator Program—provide guidance for the development and administration of next steps.

### Cost of Carbon Options

An **operational cost of carbon** internalizes the cost and impacts of carbon pollution on environment and health.

Application of a **shadow cost of carbon** to inform decision-making can help to frame alternatives analysis and investments that advance climate and energy goals and meet broader county policy objectives for public health, equity, and mobility.

Application of an **internal carbon fee** can both influence behavior and create a funding set aside that is functionally related to greenhouse gas emissions and can be reinvested in actions that reduce emissions.

## KING COUNTY COST OF CARBON CASE STUDIES

King County has already applied an internal cost of carbon to specific decisions and lines of business. The interdepartmental team developed and analyzed case studies of these past and current applications to inform recommendations moving forward.

### Battery Electric Bus Feasibility Study

Metro Transit assessed the feasibility of converting the existing bus fleet to a zero-emission fleet. In addition to capital, maintenance and operating costs, the social cost of carbon from greenhouse gas emissions of each alternative was incorporated to evaluate the societal benefit of transitioning the fleet.

Metro used a life-cycle cost analysis (LCCA) approach to assess costs over the multi-decade life cycle of the entire fleet and for one 40-foot bus. To determine the social costs of emissions, the team used estimates of emissions from Metro bus fleet by type and miles traveled and applied a cost of carbon emissions. Emissions included both tailpipe<sup>1</sup> and upstream emissions<sup>2</sup> from the production of diesel fuel or electricity generation. Metro combined these rates with vehicle miles travelled (VMT) projections to calculate projected emissions, expressed in metric tons (MT).

Absent a social cost of carbon, the team found that the estimated total cost to Metro of acquiring, operating and maintaining battery buses would be 6 percent higher than for diesel-hybrid buses over the period from 2016 to 2047.

Using a social cost of carbon for CO<sub>2</sub> of \$43/MTCO<sub>2</sub>, plus costs for methane, air pollutants and noise pollution, the incremental cost for transitioning to battery-electric bus fleet was reduced to 2 percent above the diesel-hybrid cost. This analysis helped inform decision making by the County to pursue phasing in 100% battery-electric bus fleet by 2040.

### **Green Direct Breakeven Analysis**

The interdepartmental team developed a financial model to evaluate the potential additional cost incurred or savings realized if King County were to enter into a voluntary long-term contract for renewable electricity with Puget Sound Energy (PSE). This contract for zero greenhouse gas emissions renewable energy, called Green Direct, offers a fixed price per kilowatt hour (kWh) consumed, with a known escalation rate, for a ten-year term.

Instead of using carbon pricing as a market driver—to incentivize a different behavior or to make an otherwise cost-prohibitive decision viable—this case used a derived carbon price to affirm the fiscal prudence of a decision. The breakeven cost of carbon for each scenario was developed by dividing the incremental cost or benefit by the total amount of carbon emissions. In each case, including a highly improbable zero escalation of base electricity rates scenario, the breakeven cost of carbon is less than Governor Inslee’s 2017 proposed carbon fee of \$25/MTCO<sub>2</sub>; almost all scenarios are less than other proposed carbon fees of \$15/MTCO<sub>2</sub>. These values indicate that the purchase of renewable electricity in Green Direct would be cost effective if compared to purchase of a fossil fuel generated electricity that includes a carbon fee.

### **DNRP Carbon and Energy Accelerator Program**

The Department of Natural Resources and Parks implemented a program in 2014 called the “Beyond Carbon Neutral Accelerator Program” that created an internal funding mechanism to invest in energy and carbon-reduction projects.

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<sup>1</sup> To quantify the tailpipe emissions, we projected vehicle miles traveled (VMT) for Metro’s hybrid fleet from 2017 to 2047 and used emission rates per VMT based on industry standard values. The calculation included emission rates for carbon dioxide (CO<sub>2</sub>) obtained for two of the bus models used by Metro.

<sup>2</sup> Upstream emissions from the refining process that produces the diesel fuel used by hybrid buses is included. Upstream refining generates approximate 345 grams of CO<sub>2</sub> and 72 grams of methane (CH<sub>4</sub>) per hybrid-bus VMT.

A \$0.58/MMBTU fee, equivalent to approximately \$5.80/MTCO<sub>2</sub>, was imposed on all DNRP divisions with funding being used to support investments in energy efficiency, renewable energy, and other projects that would not have happened without the funding.

Over the 2014-2016 time frame, DNRP used \$1.65 million through this program, and leveraged \$207,000 in utility rebates to invest in projects that will save the department over \$4 million and an estimated 55,000 MTCO<sub>2</sub> over the life of the improvements.

## FINDINGS

As illustrated by these case studies, the application of a cost of carbon price by the County has varied depending on the purpose of its application and the policy and business goals of the agency and funding sources. Table 1 below summarizes the price and mechanism each case study and proposed program used. Details of recommended programs can be found in the Recommendations section.

**Table 1: Classification of Case Studies and Programs**

		Price Used	
		Social Cost of Carbon	Internal or Market Price
Mechanism	Shadow Price	Battery Electric Bus Case Feasibility Study Capital Project Planning Shadow Price	Green Direct Purchase Decision
	Carbon Reduction Fee	N/A	DNRP Carbon Neutral Accelerator Program FMD Carbon Accelerator Program Fleet Carbon Fee

The interdepartmental project team found that:

- Application of a shadow price of carbon helped to provide a framework for consideration of broader impacts of battery bus purchasing decisions on health and environment-related policy aims, influenced investment decisions and favored lower-carbon choices.
- Application of the energy set-aside and re-investment of the proceeds as part of the DNRP Carbon and Energy Program resulted in real energy and utility cost reductions that are projected to exceed investments over the lifecycle of the improvements. Moreover, establishment of the set aside and the identification of investments catalyzed conversations and actions within DNRP divisions to further reduce energy and fuel use and identify strategies for reducing emissions.

- Having consistent and robust approaches to conducting Life Cycle Cost Assessment (LCCA) on Capital Improvement Projects (CIPs) and other major purchase and investment alternatives analysis is foundational to the success of applying an operational cost of carbon. County efforts to expand application of a shadow price of carbon need to be well coordinated with broader efforts to train staff and provide guidance to agencies on development and use of LCCA to inform alternatives analysis.
- Establishing a consistent assumption for a shadow cost of carbon that ties back to state recommendations for a cost of carbon would help to encourage consistent approaches to LCCA across county agency CIP programs. However, the use of the output of these analyses with the social cost of carbon should still be informed by other policy objectives and the financial health of specific funds.
- With respect to carbon reduction fees, proposals should make a functional linkage between emissions, fees, and investment of revenue. However, the level of the fee and investment of revenues is a policy decision that should be tailored to the financial health, customer needs, and opportunities for agency reinvestment of funds to reduce emissions. In other words, the internal carbon reduction fee in DNRP can be different than that for FMD given the relative financial health of component funds; likewise, the types of investments made should be focused on actions that will be most impactful on reducing emissions given the building and operational profile of each department or division.

## RECOMMENDATIONS

### SHADOW PRICE OF CARBON

**Expand application of a carbon shadow price—a non-cash cost—to lifecycle cost analyses developed for capital projects, evaluation of major fuel and vehicle purchasing decisions, and cost-benefit evaluation of priority climate change actions in the 2020 SCAP update.**

King County should proceed with expanding the application of a consistent shadow price of carbon on investment decisions, including capital project planning and other large investments. A shadow price on carbon provides structure in steps to apply a consistent lifecycle cost analysis. For consistency, PSB recommends that King County use Washington State’s SCC as developed by the Office of Financial Management per the Executive Order 14 - 04 signed by Governor Inslee in 2014. The value calculated for 2018 is \$71/MTCO<sub>2</sub>; this value will be reviewed prior to application.

As mentioned earlier, a 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. The SCC is most commonly used as a “shadow price,” meaning no actual money is exchanged. A shadow price

incorporates a theoretical cost of harms to social welfare and climate impacts into decision-making or policy analysis.<sup>3</sup>

The team recommends incorporating a shadow cost of carbon on investments, including:

- Alternatives analysis for major capital projects. Learnings from each project will further inform development of best practices and standards to be applied to future projects.
- Recommendations for alternative fuels in future fuel contracts.
- Evaluation of major vehicle purchases, for both revenue and non-revenue fleets.
- Cost-benefit evaluation of select priority actions for the 2020 SCAP update.
- King County evaluation and comment on major regional planning efforts and fossil fuel infrastructure siting proposals.

## CARBON REDUCTION FEE PROGRAMS

**Establish a carbon fee for Facilities Management Division tenants, with funds to be reinvested in measures and projects that reduce energy use and carbon emissions.**

A key barrier to identifying and planning energy and water resource efficiency projects in County buildings and facilities managed by FMD is the lack of resources to support real-time energy monitoring, energy audits, and development of energy efficiency project proposals. Creation of an “FMD Carbon Reduction Accelerator Program” supported by a fee tied to carbon emissions from County owned and managed facilities would advance development of projects that reduce energy consumption and greenhouse gas emissions. Implementation of this program could accelerate climate action goals in the SCAP. For example, pending King County Council approval, a new fee built into central rates in the 2019-2020 budget could be used to advance the Executive’s goal to have all county buildings retrofitted with LED lights by the end of 2020 and to make investments in building energy efficiency necessary to achieve the new efficiency goal of 7.5% reduction by 2020 while reducing building operating costs.

A specific proposal has been prepared through the 2019-2020 budget development process. Establishment of this internal carbon fee and accelerator program is subject to recommendation by the Executive and approval by the Council through the budget process.

FMD plans to propose a carbon fee on a per-square-foot basis that would generate revenue used to support resource conservation and green building programs essential to carbon reduction. Pending Council approval of the 2019-2020 budget, proposed fees are \$10/ MTCO<sub>2</sub> of energy use per building

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<sup>3</sup> The cost of carbon is a subjective value dependent on the breadth of inputs and costs considered. King County developed its cost of carbon using values established in 2010 by the U.S. Interagency Working Group on Social Cost of Greenhouse Gases (IWG) and Washington State’s Office of Financial Management, which relies on the IWG findings. The UWG value, updated in 2013 and again in 2016<sup>3</sup>, includes the cost of climate change impacts on agricultural productivity, human health, loss of property and harm to ecosystem services, among other things. The IWG attempts to capture the uncertainty of future cost estimates by developing 4 SCC values that establish a range of potential costs. The Washington State OFM analysis differs from the IWG in that it establishes only one value for each year, not four.

portfolio resulting in a rate increase of approximately \$0.09/square foot, generating approximately \$250,000 annually for reinvestment in carbon reduction activities. While this is not enough to fully implement the strategies and measures outlined in the 2015 Strategic Climate Action Plan (SCAP), it is sufficient to begin advancing SCAP, Green Building Ordinance, and other efficiency and sustainability initiatives. Potential activities, projects, and tools that could be funded include, but are not limited to:

- Energy Audits
- Energy Conservation Measures
- Building Tune-up and Retro-Commissioning
- Retrofit and Capital Projects
- Program and Training Support

**Establish an internal carbon fee for fleet fuel use to incent behavior changes that result in lowered carbon emissions. Fees will be charged to all non-revenue vehicles. Fleet customers with emissions above a baseline emissions reduction goal and revenues will be invested in tree plantings that sequester carbon and reduce emissions.**

The Fleet Carbon Fee program, subject to Executive recommendation and Council approval through the 2019 – 2020 budget process, proposes to charge an actual fee for emissions incurred above an annual “cap for all non-revenue fleets. The purpose of a carbon fee in this program is to incent actions that avoid and reduce emissions, without adversely impacting service or operations. If emissions cannot be avoided, the program seeks to incent behavior that reduces emissions via efficiency or replacement with lower-carbon options. Finally, if all other options are not available, a carbon fee provides funding to sequester emissions via tree planting. This action both reduces net carbon dioxide emissions and accelerates the SCAP’s one-million trees commitment.

Using 2014 as a baseline year, the Fleet Administration Division modeled fleet vehicle emissions for its five largest customers to evaluate the impacts – Parks, Roads, Sheriff, Wastewater, and Public Health – to show a linear path to achieving the 10 percent reduction goal by 2020. Actual fleet emissions by agencies will be compared to the baseline. The difference between actual emissions and baseline are called incremental emissions, against which a carbon reduction fee will be levied. The value of the fee and other details on the proposal will be determined through the 2019-2020 budget process.

**Continue the DNRP Carbon Neutral Accelerator Program.**

This existing program, which has been implemented since 2014 and has generated over \$1.65 million from a per-ton or carbon dioxide set-aside, has been successful in identifying and funding carbon and energy reduction projects. The program is projected to result in over \$4 million in utility savings and 55,000 MTCO<sub>2</sub> avoided over the life of the improvements. The program has generated discussion and awareness in DNRP about energy efficiency and resource conservation. The program, while successful, should analyze the impact and potential benefit of updating the current per-ton rate and criteria for investment of proceeds.