SOCIAL COST OF CARBON – GUIDANCE DOCUMENT
City and County of Honolulu Climate Change Commission
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PURPOSE

Pursuant to the Revised Charter of Honolulu ("RCH") Section 6-107(h), the City & County of Honolulu ("City") Climate Change Commission ("Commission") is charged with gathering the latest science and information on climate change impacts to Hawai'i and providing advice and recommendations to the mayor, City Council, and executive departments as they draft policy and engage in planning for future climate scenarios as well as reduce Honolulu's contribution to global greenhouse gas emissions.

The purpose of this document is to provide guidance to the City on operationalizing a carbon price to guide City decision-making; for example, to conduct more comprehensive cost-benefit assessments that incorporate the value of greenhouse gas (GHG) reduction. This document provides an overview of carbon pricing mechanisms and the "social cost of carbon" (SCC) and how this might apply to the City. SCC is a monetary estimate of economic damage that would result from emitting one ton of carbon dioxide into the atmosphere. This guidance was requested by the Mayor in a letter addressed to the Commission dated June 10, 2020.

RECOMMENDATIONS

The Commission has conducted research on operationalizing a carbon price to guide City decision-making that incorporates the SCC. The Commission finds the following:

1. The City should adopt a carbon price to guide decision-making. This would allow, for example, more comprehensive cost/benefit assessment of City infrastructure investments, and for island-wide programs and policy. Hereby this will be called an "internal carbon price."
2. The internal carbon price should be updated to align with emerging federal policies. In the interim, it should be set at the Obama Administration's federal Interagency Working Group on Social Cost of Carbon (IWG SCC) recommendations (see Table 1).
3. Higher carbon price pathways, to achieve Hawai'i's carbon negative target by 2045, should be considered and assessed in collaboration with State and relevant regional entities, as a collective action problem.
4. The City should develop a methodology for calculating the impact of the carbon price in its direct and indirect fossil fuel purchases; for example, in transportation fuels and electricity costs. This should be coordinated, where appropriate, with State Climate Commission efforts and conversations on this topic to align sub-national efforts.
5. A City carbon price would help to anticipate economy-wide carbon pricing programs at either state or federal levels and should be regularly re-evaluated. Adoption of a carbon price at state and/or federal levels would further enable City programs toward decarbonization.

I. INTRODUCTION

This document explores the use of a carbon price by the City & County of Honolulu to guide decision-making that incorporates present and future risk associated with greenhouse gas emissions (GHG). Generally, the term 'carbon pricing'' refers to market-based regulatory mechanisms that place a price on GHG emissions for the purpose of incentivizing their reduction. Numerous studies have found that levying a price on carbon is the most efficient way of reducing emissions because it directly discourages GHG-intensive activities, and promotes use of less GHG-intensive production processes and consumer behaviors.[1,2,3,4,5,6] Carbon pricing applied at the national level is more

effective than state or sub-state level because it covers a broader geographic and political area.[7,8,9,10,11] In the U.S. context, a national carbon price can minimize leakage[I] and mitigate[12] loss of domestic competitiveness through trade adjustment mechanisms,[13] such as a border carbon adjustment.[II] Without a strong or sustained national GHG reduction policy to follow, however, U.S. states and municipalities have moved forward with their own climate policies. Many of these policies (e.g., alternative transportation strategies) are complementary to carbon pricing at either the national or state levels.[14]

There are several active carbon pricing programs in the U.S. For example, California has a Cap-and-Trade program that is administered by the California Air Resources Board. A cap-and-trade system sets up a market for permits to emit GHGs, and the allowance of permits is usually decreased over time to reach GHG reduction goals. In a cap-and-trade program, the price is determined by the market price for permits (measured in metric tons of carbon dioxide equivalent, MTCO2e). California's program is the most comprehensive among U.S. states, as it covers both electricity and ground transportation sectors. Most recently, the Washington State legislature approved a cap on GHGs, which would make it the second state to have such a cap-and-trade program once signed into law.[15] The Regional Greenhouse Gas Initiative (RGGI) is a cap-and-trade program among collaborating Northeastern states that only covers the electricity sector. The benefit of a more comprehensive, multi-sectoral approach such as California's is that it harmonizes GHG reductions between sectors, both lowering the cost of achieving reductions as well as mitigating leakage between sectors. Another common carbon pricing mechanism is a carbon tax. Although carbon taxing is as common as cap-and-trade globally, no carbon tax exists in the U.S. Several states have attempted, without success, to introduce an economy-wide carbon tax. Washington State, prior to the 2021 GHG cap legislation, had unsuccessfully put a carbon tax measure on the ballot in both 2016 and 2018. Proposals for a carbon tax in Hawai'i have been put forth to the State Legislature over multiple years. Canada adopted a federal minimum carbon tax of $22/MTCO2e in 2018 meant to complement existing programs administered by individual provinces. Mexico has a small, $3/MTCO2e national carbon tax that was initiated in 2014.[16] Globally, more than half of emissions covered by carbon pricing programs have rates under $10/MTCO2e.[17] Most carbon pricing programs have rates set at prices lower than needed to reach country emission targets established in the Paris Agreement.[18]

For U.S. municipal governments, comprehensive approaches to carbon pricing can be difficult to adopt and effectively administer. This is due to decreasing jurisdictional influence and increasing opportunities for leakage. For the City, the only existing direct taxation lever on fossil fuels is through gasoline. Ideally, a carbon tax would be levied economy-wide. However, in the absence of comprehensive policy, it is possible to take a more piecemeal approach to better incorporate the cost of GHGs to society in City decision-making. The latter is the concept of adopting an internal carbon price – one that is not necessarily levied on fossil fuels but rather incorporated into cost-benefit analyses conducted by the City when making public policy decisions and infrastructure investments.

This guidance will focus on the functioning of an internal carbon price for the City.

II. Determining a Carbon Price

There are two general approaches to determining an appropriate carbon price. The first is the concept of the "social cost of carbon" (SCC). In theory, a SCC sets a global carbon price that maximizes net benefits to society over time[19] by addressing two market failures related to climate change: 1) A SCC corrects for negative pollution externalities by setting a price that represents the private and public cost of burning fossil fuels; 2) A SCC corrects the "free-rider" problem, where actors have incentive to shirk their responsibilities in the protection of a global public good, which in this case is climate. A SCC is set to a global carbon price (rather than a domestic or regional price) to prevent creating an incentive for key actors to do much less than is needed for positive global outcomes.[20] This logic holds for

[I] The term leakage means the transfer of GHG emissions from one region (or sector) to another as a result of policy intervention.
[II] A border carbon adjustment can reduce emissions leakage by imposing the same carbon tax to foreign firms as domestic firms within terms of trade.

any U.S. state or sub-state specific values of a SCC.[21] Thus, any SCC should be based on a perspective of global rather than local damages.

In 2008, the U.S. Supreme Court ruled that government agencies must account for the costs and benefits of GHG emissions.[22] In 2009, under the Obama administration, the Office of Management and Budget (OMB) and the Council of Economic Advisers convened the Interagency Working Group on Social Cost of Carbon[III] (IWG) to develop estimates to be used government-wide. The IWG included representatives of federal agencies, including the Environmental Protection Agency (EPA) and the Departments of Energy and Transportation, and initially operated between 2009 and 2017. The methodology was based on several integrated assessment models (IAMs), which are global economic models that incorporate a damage function. The damage function increases as GHGs accumulate in the atmosphere. The model's damage functions include, for example, changes in agricultural productivity, impacts to human health, and property/livelihood damages due to increased flood risk and extreme weather events.[23] The IWG released its first SCC estimates in 2010 and revised their estimates in 2013. Table 1 shows IWG SCC estimates from 2020 to 2050, using varying rates of discount. The higher the discount rate, the more the burden is placed on future generations to address climate change impacts.[24,25] The IWG adopted a baseline discount rate of 3%, shown in bold.

Table 1. IWG Social Cost of Carbon, 2020-2050 (in 2017 dollars per metric ton CO_2)[26]

	Discount Rate and Statistic			
Year	**5% Average**	**3% Average**	**2.5% Average**	**High Impact (95th pct at 3%)**
2020	$14	**$50**	$74	$148
2025	$17	**$55**	$82	$166
2030	$19	**$60**	$88	$182
2035	$22	**$66**	$94	$202
2040	$25	**$72**	$101	$220
2045	$28	**$77**	$107	$236
2050	$31	**$83**	$114	$254

IAMs have pioneered investigations of the economic consequences of climate change. However, it is widely recognized that IAMs underestimate damages because they do not include a complete assessment of physical, ecological, human, and non-market impacts.[27,28,29,30] This has resulted in projected temperature pathways that climate scientists find dangerous to humanity and therefore intolerable.[31] Updating and improving estimates of the SCC means better incorporating uncertainty, as this leads to substantially higher estimates of global SCC.[32,33]
The Trump Administration disbanded the IWG and, in Executive Order 13783, changed the calculation to consider only domestic U.S. damages and with a higher rate of discount.[IV] However, President Biden has reversed course and re-established the cross-departmental working group to update and operationalize a more robust federal SCC. As limitations of prior IAMs are examined and improved, it is expected that the federal estimate of a SCC will increase.[34,35]

[III] Later called the IWG on the Social Cost of GHG Emissions, though the "SCC" term endures in popular usage.
[IV] Taking a domestic-only approach substantially lowered the estimate. At the same 3% rate of discount, this brought the federal SCC to just $11 in 2050 ($2018). A higher rate of discount erodes it even further. However, this domestic-only U.S. estimate is substantially lower than independently derived values; for example, see the article, "Country-level social cost of carbon" published by Ricke et al. in 2019.

The second method to determine a carbon price is through target-setting.[36,37] The idea here is that once a jurisdiction has determined its GHG reduction target, the carbon price it adopts should be set such that it puts the jurisdiction on the path to achieving that target. The price can be set in the near-term and updated through iteration.[38] Established by Bill 65 (2020), the City's GHG reduction target is to achieve net negative carbon emissions by the year 2045. A recent study on carbon pricing for Hawai'i, across the State, finds that a carbon price pathway that starts at $240/MTCO2e in 2025 and rises to $1,000/MTCO2e (2012) by 2045 would result in Hawai'i's GHG emissions being 80% below 2019 levels of GHG emissions. This is 70% below estimated baseline emissions levels[V] in 2045.[39,VI]

II. APPLICATIONS OF SUB-STATE CARBON PRICES

In addition to the two active regional cap-and-trade programs for GHG reduction in the U.S., there are numerous examples of sub-national application of the IWG SCC, mainly as an internal carbon price. This means that the price is not explicitly levied, but rather used in analysis to guide decision-making. Below is a summary of how select U.S. states have, in various areas of government, implemented a SCC into decision-making processes.

Table 2. Examples of How a SCC has been used by State and Municipal Decision-makers in the U.S.

STATE	HOW THE SCC IS BEING APPLIED
California	- In 2017, the California Air Resources Board used the IWG SCC with a range of discount rates (from 2.5-percent to 5-percent) in their scoping plan to assess climate change policies.[40] For each policy option in the plan, such as a statewide emissions trading system, the board used the SCC to estimate the monetary benefits of avoided emissions.[41] - The California Public Utilities Commission adopted the IWG estimates of a 3-percent discount rate on a trial basis for potential use in integrated resource planning, particularly as it applies to distributed energy resources to help meet the state's carbon reduction objectives.[42]
Colorado	- In 2017, the Colorado Public Utilities Commission mandated that the electric utility company, Public Service Company of Colorado (Xcel Energy), include the IWG's SCC in its Energy Resource Plan (ERP).[43]
Illinois	- In 2016, Illinois passed an energy bill, also known as the "zero emissions credit" (ZEC) policy, that uses the IWG SCC estimates to calculate the social benefits of energy from zero-emissions facilities.[44]
Maine	- In 2014, Maine passed legislation that includes calculating "the societal value of the reduced environmental impacts of the energy" to determine the value of distributed solar energy using the federal SCC estimate of a 3-percent discount rate.[45]
Minnesota	- In 2018, the Minnesota Public Utility Commission developed SCC estimates for utility resource planning and requires utilities to use these estimates in their resource plans to account for the cost of carbon dioxide emissions. Their SCC estimates are based on the IWG estimates but with modifications, including shortening the time period for projected climate damages.[46]

[V] The term "baseline emissions levels" means the level of GHG emissions in 2045 if no effort were made to decrease them.

[VI] In comparison, a carbon pricing pathway that follows the Obama Administration's IWG recommendation for SCC would result in 2045 levels of GHG 40% below 2019 levels. This is 13% below baseline estimates for 2045.

Nevada	- In 2018, the Nevada Public Utility Commission (PUC) identified the IWG's SCC estimates as an example that utilities may use to meet state requirements of accounting for the environmental costs of carbon dioxide emissions when submitting energy resource plans. After workshops that spanned over a year, the commission decided that utilities have the flexibility to use estimates other than the federal estimate to represent the environmental cost of carbon dioxide emissions, as long as they justify why the estimates they use are representative of the best available science and economics.[47]
New York	- In 2016, the New York State Public Service Commission first used an SCC in a cost-benefit analysis of a resource portfolio to monetize marginal climate damage costs. The commission adopted the federal SCC of 3-percent discount rate in 2017, which was adjusted to the 2-percent estimate in 2020.[48] New York's Clean Energy Standard and Zero Emissions Credit also uses the SCC to compare the values of emission-free nuclear power and carbon-emitting fossil fuel power.[49] - The New York State Energy Research and Development Authority uses the SCC estimates to conduct studies that inform state energy policy and program investment decisions, to determine if energy policies will benefit the state, and to consider whether the energy resources considered are feasible. An example study is the analysis for New York's 2018 Offshore Wind Master Plan.[50] - The Department of Environmental Conservation has also used the SCC estimates to account for avoided emissions in internal policy analyses.[51]
Washington	- In 2014, Governor Inslee issued Executive Order 14-04 which requires state agencies to "ensure the cost-benefit tests for energy-efficiency improvements include full accounting for the external cost of GHG emissions." As a result, the Washington State Energy Office recommended that all state agencies use federal SCC estimates that have been reduced to a 2.5-percent discount rate to capture the total cost of future climate damages.[52]

There are numerous motivating factors for sub-national actors to operationalize an internal carbon price. The first is that, without a federal carbon pricing program, sub-national carbon pricing can serve to internalize GHG externalities that are otherwise being unaccounted for within markets, regulatory processes and decisions affecting government operations. This is particularly important within state regulatory processes governing electricity generation, as this is squarely within state and municipal jurisdiction. A second motivation is to benefit from being a first-mover in GHG reduction. If there is an expectation that there will be a federal carbon price, there can be early advantages for firms, households and the government to have already made some of these adjustments. This is particularly important in sectors with long-lasting durable goods, like transportation infrastructure and building capital. Adopting an internal carbon price can also help guide regional GHG reduction goals in a cost-effective way.

III. IMPLICATIONS OF A SCC FOR THE CITY & COUNTY OF HONOLULU

The City has limited direct taxation authority over fossil fuels other than the gasoline tax. Although it is certainly possible for the City to pursue an increase in the gasoline tax, an economy-wide approach provides greater benefits as it harmonizes sectoral interactions and achieves reductions more cost-effectively. In addition, a State and/or Federal approach could pair an explicit carbon price (i.e. actually levied in the form of a tax) with payments back to residents, making it a more equitable decarbonization policy.[53] For these reasons, the Commission focuses its recommendations on the City operationalizing an internal carbon price.

An internal carbon price can be used in cost-benefit analyses of City operations and investments, as well as incorporated into decision-making that guide O'ahu-wide policies and programs. An internal carbon price for the City

should be set, at a minimum, at the recommended 2016 federal IWG SCC and updated based on additional research and policy adoption expected within the Biden Administration. Higher carbon price pathways to achieve the State's carbon net negative target before 2045 should be assessed in collaboration with State and other regional entities. To do this, the City would need to develop and adopt a methodology for estimating how the carbon price would be experienced by key sectors. For fossil fuel purchases like gasoline and diesel for City fleets, the Commission suggests taking the current fuel price net of taxes and to assume that there is pure price pass-through of the carbon price (i.e. a competitive market assumption) in order to calculate a new fuel price. This would allow the City to do an ownership and operating cost comparison between fossil fuel vehicles and alternative fuel vehicles, a cost comparison that would better reflect holistic societal costs. The electric sector is more complex because of the interaction with the regulatory and contracting process. The simplest way for the City to proceed would be to assume that the carbon price passes through the fossil-based generation mix, using the current generation mix as a baseline and projecting forward in time based on the State's Renewable Portfolio Standard goal. The City could, for example, then better assess the cost-benefit of investing in on-site renewable energy generation. In the case where there are substantial upstream GHG emissions that are not well-reflected in either out-of-stack emissions or based on regulatory/accounting protocols – mainly in the burning of gas or bio-based fuels – additional methods should be determined to make adjustments informed by lifecycle analysis.

Lastly, GHG's are an important consideration within City decision-making and they could be better internalized through a carbon price. There are also other non-market co-benefits of GHG reduction that should be considered to achieve more comprehensive cost-benefit analysis and a more holistic approach to decision-making. Examples include co-benefits related to human health from mitigating exhaust emissions, where PM 2.5 and PM 10 have been well documented to have numerous deleterious effects on human health.[54] By reducing vehicle miles traveled[VII] as well as moving to "zero emissions vehicles," multiple benefits from mitigating climate change to improving health outcomes can potentially be achieved.[55] [56] Another example is the multiple benefits of urban trees, which serve as a carbon sink, can slow down stormwater and mitigate urban water runoff, and provide urban cooling benefits.[57] Adopting an internal carbon price is one step towards enabling more long-term, comprehensive decision-making by the City that incorporates a multi-view of values.

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Glossary

Border Carbon Adjustment: Imposition of the same carbon tax to foreign firms as domestic firms within terms of trade to reduce carbon leakage.

Carbon Pricing: A market approach to encourage GHG emission reduction by shifting the cost of emissions onto the emitter.

Carbon Tax: A form of carbon pricing. Tax levied per unit of GHG emitted.

Cap-and-trade system: A form of carbon pricing. Establishes a quota on GHGs and a market for tradable permits. Permits can either be granted freely or via an auction.

[VII] Reduction of vehicle miles traveled also reduces exhaust and non-exhaust emissions, where non-exhaust emissions can account for the vast majority of total emissions.

Co-benefits (of GHG mitigation): Additional positive societal impacts resulting from GHG reduction.

Damage Function (in economic models): Economic damages expressed as a function of various climate inputs.

Discount rate: A rate of time preference.

Externality: A cost or benefit of an activity that is experienced by a third party, i.e. unaccounted for within a market transaction.

Free-Rider Problem: A market failure that results when those who did not pay or underpaid for a good or service still benefit from said good or service.

Integrated Assessment Models: Models that attempt to incorporate society, economy, environment, and climate into one framework.

Internal carbon price: A carbon price that is used to aid in decision-making, in contrast to being levied as a tax (or via a quota) in market transactions.

Leakage (of GHGs): Transfer of GHG emissions from one region (or sector) to another as a result of policy intervention.

Public Good: A good or service that is non-rivalrous and non-excludable.

Out-of-stack GHG Emissions: GHG emissions resulting from combustion.

Social Cost of Carbon: A monetary estimation of damages resulting from each additional ton of GHG emissions.

Acronyms

EPA: Environmental Protection Agency

GHG: Greenhouse gas

IAM: Integrated Assessment Model

IWG: Interagency Working Group

MTCO2e: Metric tons of carbon dioxide equivalent

OMB: Office of Management and Budget

PUC: Public Utility Commission

RGGI: Regional Greenhouse Gas Initiative

SCC: Social coast of carbon

ZEC: Zero emissions credit

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