AT WHAT CO$T ?

INCORPORATING THE SOCIAL COST OF CARBON INTO STATE-LEVEL POLICIES IN NEW JERSEY

A report prepared for the New Jersey Climate Adaptation Alliance

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List of Abbreviations

ALJ: Administrative Law Judge
APA: Administrative Procedures Act
BPU: Board of Public Utilities
CAFE: Corporate Average Fuel Economy
CARB: California Air Resources Board
CBA: Cost-Benefit Analysis
CEEEP: Center for Energy, Economic and Environmental Policy, Rutgers University
CEQ: Council of Environmental Quality
CO_2: Carbon Dioxide
EA: Environmental Assessments
EIA: Energy Information Administration
EO: Executive Order
EPA: Environmental Protection Agency
EPCA: Energy Policy Conservation Act
GHG: Greenhouse Gas
GWRA: Global Warming Response Act
IWG: International Working Group
NAS: National Academies of Sciences, Engineering and Medicine
NEPA: National Environmental Policy Act
NHTSA: National Highway Traffic Safety Administration
NJCAA: New Jersey Climate Adaptation Alliance
NJCEP: New Jersey Clean Energy Program
NJDCA: New Jersey Department of Community Affairs
NJDEP: New Jersey Department of Environmental Protection
NJDOT: New Jersey Department of Transportation
NJEDA: NJ Economic Development Authority
OAL: Office of Administrative Law
OECD: Organization for Economic Co-Operation and Development
OIRA: The Office of Information and Regulatory Affairs
OMB: Office of Management and Budget
OREA: New Jersey Department of the Treasury, Office of Revenue and Economic Analysis
OWEDA: Offshore Wind Economic Development Act
PUC: Public Utilities Commission
REC: Renewable Energy Credit
REV: Reforming the Energy Vision
RGGI: Regional Greenhouse Gas Initiative
RIA: Regulatory Impact Analysis
RITS: Rutgers Intelligent Transport Systems Laboratory
RTO: Regional Transportation Organization
SCC: Social Cost of Carbon
ZEC: Zero Emission Credit

Executive Summary

The most current and comprehensive scientific assessments conclude with extremely high confidence that human activity has increased the level of heat-trapping carbon dioxide (CO_2) in the Earth's atmosphere, leading to an increase in the global average temperature. This warming has led to widespread impacts on both human and natural systems, including intensified coastal flooding, more frequent heat waves, and more intense rainfall. In New Jersey, climate change has already resulted in heavier and more frequent rain storms, sea level rise at a current rate of one inch every six years, beach erosion, submerging lowlands, coastal flooding, and increased salinity levels in the state's estuaries and aquifers. These climate change impacts have real economic costs, however, that are not routinely considered in policy decisions across the state. As part of a comprehensive strategy to mitigate greenhouse gas emissions, policy-makers can employ the social cost of carbon (SCC) as an economic tool to monetize these effects and to improve state-level policy-making processes in New Jersey.

At the federal level, the SCC has been used for about a decade in cost-benefit analyses that accompany regulatory impact statements, while at the state level, policy-makers are now beginning to incorporate the SCC in their own decision-making processes. The state actors and policy mechanisms assessed in this project were first identified by a report entitled *An Examination of Policy Options for Achieving Greenhouse Gas Emissions Reductions in New Jersey*, written as a collaboration among researchers from the Georgetown Climate Center, Rutgers Climate Institute, Rutgers Edward J. Bloustein School of Planning and Public Policy, and World Resources Institute (Pacyniak, et al., 2017). This report further analyzes these policy suggestions to determine how the SCC could be implemented in New Jersey. The mechanisms examined were: (1) cost-benefit determinations made by state agencies with regard to investment of public monies in infrastructure and economic development and those made by the New Jersey Board of Public Utilities; (2) environmental impact statements/assessments; and (3) economic analyses that accompany state rulemaking.

For the state of New Jersey, the degree of feasibility for each of these mechanisms is not equal. This report examines the mechanisms in terms of their applicability and feasibility within the state's policy processes. First, the SCC can be most easily employed in cost-benefit determinations made by state agencies currently being conducted in various capacities, including those involving infrastructure, economic development, and utility planning. The application of the SCC in existing decision-making processes does not require tremendous additional resources, especially where CBA is already mandated, since it would not necessitate the creation of new structures. Alternatively, environmental impact statements have not historically incorporated the SCC, thus posing some challenges to its implementation. However, including the metric could facilitate the evaluation of the positive and negative impacts of alternative project proposals for a more informed decision-making process in the future. Lastly, consistently employing the SCC across cost-benefit analyses that accompany state agency rulemaking proceedings — much like those conducted at the federal level — may pose a challenge to state policy makers. Two potential approaches to mandate the employment of the SCC within such analyses include: (1) an executive order by the Governor or (2) the passage of legislation. Each of these three policy mechanisms has tradeoffs — namely with respect to feasibility and consistency — that are considered in further detail in Section 5 of this report. Overall, the most significant challenges to successfully incorporate the SCC are the institutional and resource capacity of state agencies, and the political will of elected officials and other relevant state policy-makers.

Recommendations

Short-Term Recommendations:

Overall Recommendation: to achieve New Jersey's emissions reduction target by the year 2050, New Jersey could incorporate the SCC in cost-benefit and net benefit determinations made by state agencies and the BPU to account for climate impacts in state planning.

Supporting Recommendation 1: State agencies may want to consider expanding and improving the production, scope, and application of cost-benefit analysis to further develop the state's regulatory oversight capabilities.

Supporting Recommendation 2: State agencies may have to review institutional and resource capacity building to be able to conduct cost-benefit analysis that incorporates the SCC.

Supporting Recommendation 3: The state could institute the use of a standardized global SCC value to ensure consistent application across state agencies.

Supporting Recommendation 4: To facilitate the process of deciding upon the SCC value range that can be applied consistently within New Jersey, the Board of Public Utilities could convene a stakeholders group for that purpose.

Supporting Recommendation 5: More research is needed to evaluate the distributional effects of incorporating the SCC in cost-benefit analysis at the state level.

Long-Term Recommendations:

Recommendation 1: New Jersey can consider working towards incorporating the SCC in environmental impact statements and economic analyses that accompany rulemaking proceedings.

Recommendation 2: The creation of a regulatory agency or entity at the state-level could oversee the implementation and review of cost-benefit analyses done by state agencies.

Recommendation 3: The Governor or the New Jersey Legislature may want to examine the merits of mandating the use of the SCC in state rulemaking proceedings.

1. Introduction

1.1. Purpose of the Report

This report examines the potential uses and applications of the social cost of carbon (SCC) in New Jersey's state policy-making processes. The SCC is an economic tool that can aid decision-makers in choosing between various policy options, by providing greater information about the potential costs of climate change damages and by ensuring that the social costs of climate change externalities are accounted for in the policy-making process. This report explores these potential applications and makes the case for a broad incorporation of the SCC. The SCC is a helpful metric that can be employed in cost-benefit analyses. Through this application, the SCC has the potential to make a significant difference in decision outcomes despite it being just one factor among many under consideration when examining policy alternatives. This report explores: (1) the current climate policy landscape and the development of the SCC; (2) applications of the metric at the federal and state-level; (3) how it could be employed in New Jersey; and (4) short- and long-term recommendations for next steps into the future.

1.2. Climate Change: Causes and Consequences

The US Global Change Research Program Climate Science Special Report — one of the most current and comprehensive compilations of scientific and technical assessments regarding climate change — concludes that human influence on the Earth's climate system due to greenhouse gas emissions, e.g. carbon dioxide (CO_2), is extremely likely, with no existing observational evidence to support a convincing alternative explanation for the warming that has occurred over the last two centuries (Wuebbles, et al., 2017, p. 10). During this time period, human activity has increased the amount of heat-trapping CO_2 in the Earth's atmosphere by 40% (Wuebbles, et al., 2017, p. 82). As a result, widespread impacts on both human and natural systems, and unprecedented observed changes over decades to millennia have occurred globally since the mid-20th century. Such changes include higher sea levels and increases in heat waves, droughts, and floods (IPCC, 2014, p. 7).

1.3. Climate Impacts on New Jersey

In New Jersey, climate change has caused average temperatures to increase by approximately 3° Fahrenheit (1.6° Celsius) over the last 100 years and has resulted in heavier and more frequent rain storms. Rising sea levels, currently increasing along the New Jersey coast at a rate of about one inch every 6 years, have enhanced coastal flooding and beach erosion, submerged lowlands, and increased salinity levels in the state's estuaries and aquifers (US EPA, 2016, p. 1). Looking toward the future, continued emissions of greenhouse gases through the 21st century will cause enduring changes to the Earth's climate system, likely resulting in "severe, pervasive and irreversible impacts for people and ecosystems" (IPCC, 2014, p. 8).

For New Jersey, this means that as sea levels continue to rise, coastal homes and infrastructure will be highly vulnerable to storm surges, erosion, and flooding, as was experienced in the aftermath of Hurricane Sandy, which destroyed coastal homes and recreational facilities, flooded roadways and rail tunnels, and damaged essential wastewater management and power infrastructure. More frequent extreme heat is expected to impact human health, especially among vulnerable populations including children and the elderly, potentially causing dehydration and heat stroke, exacerbating cardiovascular, respiratory, and nervous systems. Changing seasonal

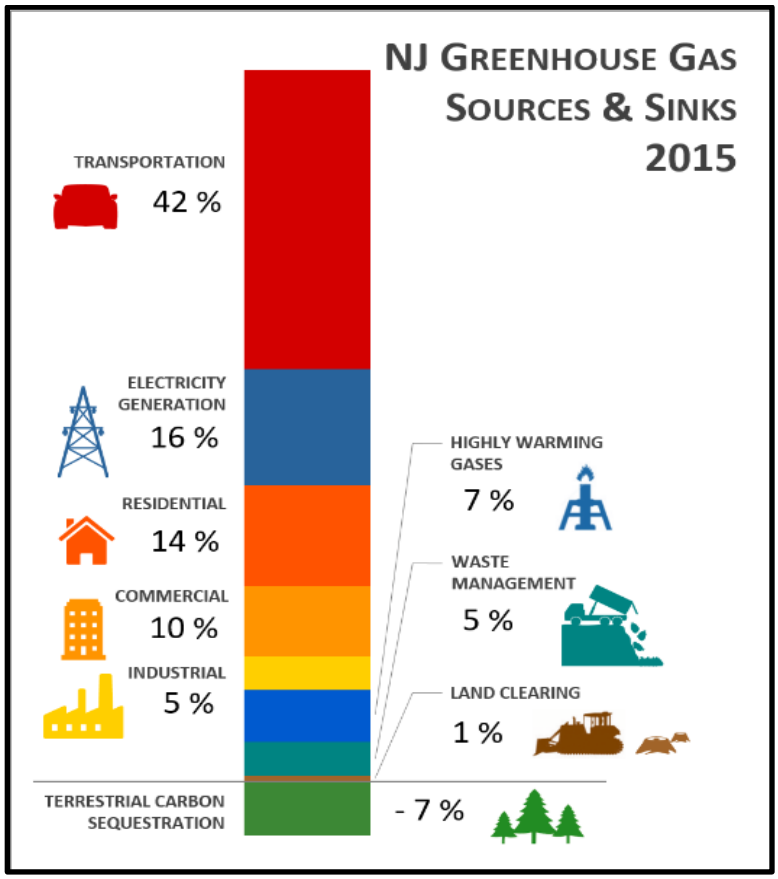
temperatures are also increasing the risk of insect-transmitted diseases such as West Nile virus and Lyme disease (US EPA, 2016, p. 2).

1.4. Energy and Climate Policy Landscape in New Jersey

As of 2017, New Jersey's utility-scale net electricity generation mix consists of natural gas (49.6%), nuclear (44.6%), coal (2.4%), and renewable energy (less than 5%), with solar power consisting of the majority of total renewable energy generation. Renewable energy production and consumption is expected to increase in New Jersey, as the state's renewable energy portfolio requires 25% of its electricity mix to consist of renewable energy by 2021 (US EIA, 2017).

While total energy consumption has increased in New Jersey, the state has simultaneously reduced its greenhouse gas emissions through a shift in its energy mix. New Jersey has reduced its power sector emissions by 42% since 2005, primarily by shifting from coal-fired generation to gas-fired generation. Given that electricity from natural gas has a lower carbon emission intensity per megawatt-hour than electricity from coal, this power sector trend has significantly contributed to emissions reductions over the last decade. The 2017 report *An Examination of Policy Options for Achieving Greenhouse Gas Emissions Reductions in New Jersey* states that the transportation sector contributes the largest share of emissions in the state (42%), followed by electricity generation (16%) and fossil fuel consumed in the residential (14%), commercial (10%), and industrial (5%) sectors, primarily for heating (Pacyniak, et al., 2017, p. 2).

Figure 1: Greenhouse Gas Emissions in NJ



Source: NJDEP, Air Quality, Energy & Sustainability

New Jersey has recently taken steps towards reducing its greenhouse gas (GHG) emissions, but there are still many policy gaps to fill in order to achieve the emissions goals set forth by the 2007 New Jersey Global Warming Response Act (GWRA), which sets a target for limiting state GHG emissions to 80% below 2006 levels by 2050. While New Jersey has already met its 2020 emissions reduction target, it has not yet lowered its emissions at a rate necessary to achieve its more ambitious 2050 goal (Pacyniak, et al., 2017, p. 1). Given the majority share of transportation emissions in New Jersey, meaningful policy solutions to reduce emissions in this sector will be necessary to meet the 2050 target.

Recent policy initiatives suggest that New Jersey is progressing toward further reducing its GHG emissions. In January 2018, Governor Phil Murphy rejoined the Regional Greenhouse Gas Initiative (RGGI) — an interstate partnership to reduce GHG emissions in the power sector — and issued an executive order to implement the 2010 Offshore Wind Economic Development Act (OWEDA). OWEDA sets a short-term 1,100 MW target for offshore wind development by 2020 and a longer-term 3,500 MW target by 2030 (The State of New Jersey, 2018). These examples suggest that New Jersey is enacting meaningful climate change policy, but a diverse and comprehensive portfolio of policy solutions will be necessary to meet its 2050 GHG emissions reduction goal.

2. The Social Cost of Carbon

2.1. Policy Metric: The Social Cost of Carbon

Given the serious consequences of climate change, limiting its impacts will demand a concerted and sustained range of technological and policy solutions to substantially reduce greenhouse gas emissions through the coming decades. Economic policy approaches to mitigate climate change hold great potential in establishing a policy-making process that would consistently and transparently incorporate the costs of climate change as a factor in public policy decisions. Specifically, cost-benefit analysis (CBA) could incorporate the *social cost of carbon* (SCC) to estimate the costs of incremental carbon emissions as climate impacts intensify over time. The SCC is "an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year," and in the US, estimates of the SCC are reported in dollars per metric ton of carbon dioxide (IWG, 2010, p. 1). In other words, the SCC is a metric used to assign a dollar value to the costs of damages attributable to climate change, or conversely, the benefits of avoiding climate change damages through mitigation, i.e. reducing or preventing greenhouse gas emissions. The SCC is just one of the policy options available to account for the costs of climate externalities. For further details regarding the technical development and calculations of the SCC, see Appendix 2.

2.2. Governmental Applications of the SCC

The Administrative Procedures Act (APA) of 1946 is a federal law that establishes the way in which federal administrative agencies may propose and establish regulations, while granting judicial oversight over all agency actions (US Code, 2011). The fundamental purposes of the APA are: (1) to require all federal agencies to keep the public informed of their organization, procedures, and rules; (2) to allow for public participation in the rulemaking process; (3) to establish uniform standards for agency rulemaking; and (4) to restate the law of judicial review (Clark, 1946, p. 9). APA thus establishes the procedure of judicial review of federal agency rulemaking, with the authority to remand agency actions it deems to be "arbitrary and capricious, an abuse of discretion, or otherwise not in accordance with the law" (US Code, 2011).

In the 2008 case *Center for Biological Diversity v. National Highway Traffic Safety Administration*, the Ninth Circuit Court of Appeals remanded the Final Rule issued by the National Highway Traffic Safety Administration (NHTSA) to set corporate average fuel economy (CAFE) standards for model years 2008-2011, as set forth under the Energy Policy and Conservation Act (EPCA). According to the Court, NHTSA acted arbitrarily and capriciously by failing to monetize the benefits of GHG reductions in its cost-benefit analysis of the rule. Additionally, the Court concluded that the Agency's environmental assessment (EA) was inadequate under the National Environmental Policy Act (NEPA) because it failed to evaluate the rule's actual environmental impact on climate change. This decision thus remanded the rule to NHTSA, requiring the agency to prepare a full environmental impact statement (EIS) monetizing the benefits of emissions reductions for improved CAFE standards (Lewis & Clark Law School, 2018).

As a result, this case set the precedent for federal agencies to employ the SCC in cost-benefit analyses for EAs and EISs in all future rulemakings covered under NEPA (National Academies of Sciences, Engineering, and Medicine, 2017, p. 21). Accordingly, beginning in 2008, federal executive branch agencies began using the SCC in regulatory impact analyses (RIAs). These RIAs include benefit-cost analyses and are required in the US for all proposed regulations under a series of

executive orders issued in the Reagan (EO 12291, 1981), Clinton (EO 12866, 1993), and Obama (EO 13563, 2011) administrations.

2.3. SCC Values

As explained by the Interagency Working Group (IWG) research of the SCC, the central estimate for the metric utilizes a 3% discount rate to quantify the present discounted value. However, in order to account for uncertainty regarding the SCC estimates in RIAs, the IWG emphasizes the importance of using SCC values at various discount rates. Most state applications of the SCC utilize these estimates. Please reference Appendix 3 for more details regarding discount rates.

Table 1: Federal SCC estimates, 2010-2050 from the Interagency Working Group (in 2007 dollars per metric ton of CO_2)

Discount Rate				
Year	**5% Average**	**3% Average**	**2.5% Average**	**High Impact (95th percentile at 3%)**
2010	$10	$31	$50	$86
2015	$11	$36	$56	$105
2020	$12	$42	$62	$123
2025	$14	$46	$68	$138
2030	$16	$50	$73	$152
2035	$18	$55	$78	$168
2040	$21	$60	$84	$183
2045	$23	$64	$89	$197
2050	$26	$69	$95	$212

Source: Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013, Revised August 2016)

2.4. Recent Trump Administration Updates to the SCC

The Trump Administration recently reconsidered some of the key choices made by the Obama Administration related to discounting and the inclusion of global damages. In its 2017 *Regulatory Impact Analysis for the Review of the Clean Power Plan: Proposal*, the United States Environmental Protection Agency (EPA) introduced interim values for the SCC developed under Executive Order 13783 for use in regulatory analyses. EO 13783 directs federal agencies to employ the interim SCC values until “an improved estimate of the impacts of climate change to the US can be developed

‘based on the best available science and economics,’” consistent with guidance in the Office of Management and Budget (OMB) Circular A-4, notably “with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates” (US EPA, 2017, p. 42). Circular A-4 analysis suggests that proposed and final regulations focus on costs and benefits for US citizens and residents, using the existing 3% discount rate (societal discount rate) and 7% discount rate to represent the average before-tax rate of return to private capital in the US economy (US EPA, 2017, p. 43).

It is important to note that, in the words of the National Academies, “the return to investment (i.e. the 7% discount rate) is the correct discount rate only under very restrictive assumptions” and is not theoretically justifiable for use in calculation of the SCC. Rather, in their view, “if the central parameterization for discounting is associated with a near-term 3% rate, as in the current IWG approach, then the low and high values would be on either side of 3%” (National Academies of Sciences, Engineering, and Medicine, 2017, p. 181).

3. Pathways to Employ the SCC

3.1. Cost-Benefit Analysis (CBA) at the Federal and State Level

Federal-Level

CBA is a tool that involves both quantifying and monetizing the variables impacted by a proposed policy and routinely considers a degree of risk and uncertainty (Revesz & Livermore, 2013, p. 88). Specifically, these analyses are required to include: (1) an account of the potential costs and benefits; (2) an evaluation of the rule's net benefits; (3) a description of alternative approaches; and (4) a reasoning as to why those alternatives were not selected (Carey, 2014, p. 3). As a regulatory oversight tool, CBA is used to inform regulatory decision-making, and, for example, has been widely practiced in the fields of environmental policy, transportation planning, and healthcare in the United States (Organization for Economic Co-Operation and Development, 2007).

Under Executive Order 12866, federal agencies are required to perform cost-benefit analysis on major rules, which are defined as "any regulation likely to result in (among other things) an annual effect on the economy of $100 million or more," (Carey, 2014, p. 3). CBA is often employed to satisfy a rule's regulatory impact analysis requirement and can be mandated through legislation or the regulatory rulemaking process (Revesz & Livermore, 2008, p. 124). Since 2008, for example, the SCC has been used in CBA for RIAs to more comprehensively evaluate the scope of costs and benefits of alternative policy measures. The White House Office of Management and Budget, more specifically The Office of Information and Regulatory Affairs (OIRA), is the office responsible for overseeing and assessing cost-benefit analyses. The presence of OIRA can ensure that the metric is included in the assessments of all major rules at the federal level.

State-Level

The Pew Charitable Trust identifies ten states leading the way in the use of cost-benefit analysis, namely Florida, Kansas, Minnesota, Missouri, New York, North Carolina, Utah, Virginia, Washington, and Wisconsin (The Pew-MacArthur Results First Initiative, 2013, p. 6). These ten states excelled in three primary categories: (1) the number of studies conducted in the designated period of observation (January 2008 - December 2011); (2) the breadth of the studies in assessing alternative options; and (3) the way in which the states incorporated the results to inform budget and policy decisions (pp. 2-6). In the study, these three criteria served as a baseline assessment of states' commitment to conducting and using the results of cost-benefit analyses in decision-making processes (p. 3). In regard to New Jersey's ranking among the other states, New Jersey conducted five cost-benefit analyses in the four-year period, which is considered a "mixed rating" since it falls in the middle of the rank (p. 15). New Jersey is also considered "trailing behind" in terms of conducting cost-benefit analyses that assess multiple policy options (p. 19). Lastly, New Jersey is regarded as "leading the way," along with 29 other states in terms cost-benefit analyses impacting legislative or executive actions (p. 22).

Thus, as the Pew study suggests, the implementation of CBA is different in every state, particularly in terms of production, scope, and application. To this end, the study also concludes that implementing CBA poses distinct challenges to state governments. The Pew Charitable Trust study's review of cost-benefit analysis across the 50 states cited that state officials regularly reported political and practical obstacles in performing cost-benefit analysis and applying the results of the analysis to policy-making (The Pew-MacArthur Results First Initiative, 2013, p. 8). Irrespective of the potential

challenges, New Jersey may want to consider expanding its use of cost-benefit analysis, which would be particularly beneficial for the application of the SCC in the state.

Alternatively, when the data necessary to complete a cost-benefit analysis is unavailable, analysts often use cost effectiveness analysis. Cost effectiveness analysis compares the relative costs to the outcomes (the effects) of different policy alternatives. Cost effectiveness analysis is distinguished from cost-benefit analysis because it does not assign monetary values to the potential outcomes of a project or regulation. However, the SCC necessitates the use of cost-benefit analysis because the dollar value assigned to environmental externalities requires the quantification of potential impacts in order to be effective.

3.2. Application in Other States

At present, the SCC has been implemented in seven states to differing degrees and through a variety of policy mechanisms. California was the first state to implement the SCC in its energy resource planning. The six other states examined in this report began using the SCC in their respective state planning more recently, with 2014-2017 as the range for first incorporation. All the states use the metric to account for environmental externalities when deciding between utility and policy alternatives and renewable resource planning and development. Massachusetts is in the process of instituting a carbon pricing system that uses the SCC federal estimate as a reference to establish a dollar value to attach to incremental increases of carbon emissions.

The following table is illustrative and not a comprehensive depiction of every use of the SCC by these states:

Table 2. State-Level Implementation of SCC Metric

State	Policy	Year	Implementation	Mechanism	SCC
Current Applications:					
California	California Air Resources Board (CARB) Scoping Plan (2008)	2008	The Scoping Plan aims to identify and recommend policies that will accomplish “maximum feasible and cost-effective reductions” of GHG emissions - performs economic analysis of carbon policies to achieve emissions reduction mandates by 2020 and 2030	Resource planning	Uses the federal SCC estimates, range $46.79 - $64.54 per metric ton
Maine	Maine Solar Energy Act	2014	Instructs Maine’s Public Utilities Commission (PUC) to determine the value of distributed solar energy generation and to assess implementation strategies, maximize social welfare	Resource planning	Uses the federal SCC to determine the value of renewable energy resource development, net SCC value of $37.66 per metric ton
Washington	Washington	2014	Directs state agencies to perform	State finance	References the

	Carbon Pollution Reduction and Clean Energy Action (Executive Order 14-04)		cost-benefit tests for energy efficiency improvements, which include a full accounting for the external cost of GHG emissions	decision-making (Investment and Subsidization)	federal SCC estimates at a 2.5% discount rate, specifically using value of $78 per metric ton (SCC estimate for the year 2035)
Illinois	Zero Emissions Credit (ZEC), established through the Future Energy Jobs Act	2016	Places a value on the social benefits of energy produced from zero-emissions facilities	Emissions Credit pricing	References the SCC, uses a ZEC price of $16.50 per metric ton
New York	Reforming the Energy Vision (REV) & Zero Emissions Credit (ZEC)	2016	New York Public Service Commission uses the SCC in the cost-benefit analysis performed on the resource portfolio - including low-carbon nuclear power which also receives the ZEC credit	State finance decision-making (Investment and Subsidization)	Recognizes the federal SCC as the best available estimate, range $13 - $137 per metric ton
Minnesota	Environmental Cost Statute & Public Utilities Commission (PUC) directive	2017	Environmental Cost Statute mandates the Minnesota PUC to quantify and establish a range of environmental costs (externalities) associated with each method of electricity generation - updated environmental costs using the SCC in 2017	PUC decision-making	Recently converted from using the state's own methodology to using the federal SCC estimates, range $9.05 - $43.06 per metric ton
Colorado	Public Utilities Commission (PUC) directive	2017	Colorado PUC ordered the Public Service Company of Colorado (Xcel Energy) to account for the SCC in its Energy Resource Plan	PUC decision-making	Uses the federal SCC estimates, range $13 - $129 per metric ton
Potential Applications:					
Massachusetts	(H. 1726) An Act to Promote Green Infrastructure, Reduce Greenhouse Gas Emissions, and Create Jobs	TBD	The proposed bill would place tax on CO_2 emissions, starting at $20 per ton and rising $5 every year until reaching $40 per ton - the $40 per ton goal is based on the federal estimates of the SCC in the year 2020, currently valued at $42	Carbon pricing system	References the federal SCC estimate to determine the carbon value per ton in a new carbon pricing system
Massachusetts	(S. 1821) An Act Combating Climate	TBD	The proposed bill would tax CO_2 emissions starting at $10 per ton, rising by $5 every year until	Carbon pricing system	References the federal SCC estimate to

	Change		reaching $40 per ton - the $40 per ton goal is based upon the federal SCC estimates for 2020		determine the carbon value per ton in a new carbon pricing system

3.3. Application of Cost-Benefit Analysis in New Jersey

At present, certain cost-benefit analyses utilized within existing state policy processes would likely be the primary application in which the SCC may be employed in New Jersey. Two Executive Orders have been issued that instruct New Jersey state agencies to use cost-benefit analysis to support agency decision-making processes. Executive Order 27 and Executive Order 2 state the following:

1. Executive Order 27 (1994) - Governor Christine Todd Whitman
   "Each administrative agency that adopts, readopts or amends any rule or regulation described in section 2 of this Order shall include as part of the initial publication and all subsequent publications of such rule or regulation, a statement as to whether the rule or regulation in question contains any standards or requirements which exceed the standards or requirements imposed by federal law. Such cost-benefit analysis that supports the agency's decision to impose the standards or requirements and also supports the fact that the State standard or requirement to be imposed is achievable under current technology, notwithstanding the federal government's determination that lesser standards or requirements are appropriate" (The State of New Jersey, 1994, p. 2).

2. Executive Order 2 (20 January 2010) – Governor Chris Christie
   "For immediate relief from regulatory burdens, State agencies shall…employ the use of cost/benefit analyses, as well as scientific and economic research from other jurisdictions, including but not limited to the federal government when conducting an economic impact analysis on a proposed rule" (The State of New Jersey, 2010, p. 3).

3.4. Policy Mechanisms Under Consideration

This report examines three specific mechanisms to assess the applicability of the SCC in the state of New Jersey: cost and net benefit determinations made by state agencies, environmental impact statements, and economic analyses in rulemaking proceedings. The first and third mechanisms have been utilized in New Jersey; however, the second mechanism has not yet been implemented in the state.

First, state agency investment of public monies regarding infrastructure and economic development, in context of including the SCC, primarily involves achieving greater energy efficiency and reducing carbon emissions in state projects and programs. The SCC can be incorporated in state agency CBAs within their decision-making processes when evaluating policy or program alternatives. In this way, state agencies can reduce their carbon emissions by considering the climate impacts of their actions, giving preference to the implementation of low-carbon emitting proposals.

Similarly, public utility commissions are state agencies that function as quasi-judicial regulatory bodies that govern public utilities by regulating essential services, including energy,

telecommunications, natural gas, and water. Public utility commissions have statutory authority to govern through a rulemaking process. This is a legal decision-making process that includes hearings, testimony, and discovery to settle contested issues between various stakeholders. Additionally, utility firms bring project proposals before commissions for approval which is the point in the decision-making process where there is potential to apply the SCC. The metric can be incorporated within cost-benefit analyses for each project to assess the level of environmental impact and its associated costs as compared to other alternatives.

Second, this report examines environmental impact statements. At the federal level, the 1969 National Environmental Policy Act (NEPA) requires all federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. Several US state governments require that an environmental impact statement be submitted as part of a proposal for state funded projects.

Lastly, this report assesses economic analyses that accompany state rulemaking proceedings as required under the New Jersey Administrative Procedures Act and New Jersey Executive Order 27 (1994) and Executive Order 2 (2010). These EOs require state agencies to use cost-benefit analysis to support decision-making processes within rulemaking procedures and when conducting economic impact analyses on proposed rules. At the federal level, agency rulemaking proceedings have used the SCC in cost-benefit analyses since the 2008 decision in *Center for Biological Diversity v. National Highway Traffic Safety Administration*, which are required under a series of executive orders issued in the Reagan (EO 12291, 1981), Clinton (EO 12866, 1993) and Obama (EO 13563, 2011) administrations.

4. Research Methodology

The research team evaluated three policy mechanisms for the incorporation of the SCC in New Jersey. The group examined similar policy mechanisms as they operate in other states and at the federal level. The background knowledge underlying this report was gathered from conducting close readings of SCC literature and discussions with local experts. The team also examined the Interagency Working Group reports and technical support documents to better understand the history and calculation of the SCC.

The primary data collection effort consisted of a series of interviews with experts and public officials across multiple levels of government, both in and out of state. Interviews were solicited via email request with a follow-up request protocol that included up to two emails. Interview subjects were selected first by direct referral from New Jersey Climate Adaptation Alliance clientele representatives and advisor recommendations. This identification process was followed by team members independently soliciting potential interviews when referrals were not available. In total, fifteen requests for interviews were submitted and eleven interviews were conducted. The interviews ranged between approximately 30-90 minutes, and individual respondent confidentiality was offered to assure candid responses. The interview format and foundational questions are found in Appendix 1. All interview questions were based on the foundational questions, but supplementary questions were also added accordingly that matched the expertise of the interviewee.

General expert interviews were primarily conducted via telephone with two or more practicum group members present to ensure accurate response recording. Six general expert interviews were requested, and five were completed. State-specific interviews to gather information about the four case studies were also conducted via telephone with one or two group members present. Nine state-specific interviews were requested, and six were completed. The completed interviews included individuals from three of the four case study states: New York, Minnesota, and Massachusetts. Several attempts were made to contact policy experts and state officials in California. Two individuals were successfully contacted for brief comment but were unavailable to provide the research team with detailed responses in a formal interview format.

5. Policy Mechanisms Under Consideration

Under the direction of the New Jersey Climate Adaptation Alliance, the research team focused its investigation of the SCC in context of specific policy mechanisms and research questions to best inform how the metric could be applied in the state of New Jersey. The three policy mechanisms assessed for this project were first identified the report entitled *An Examination of Policy Options for Achieving Greenhouse Gas Emissions Reductions in New Jersey* (Pacyniak, et al., 2017). The mechanisms are:

1. Cost-benefit determinations
    a. Made by state agencies with regard to investment of public monies in infrastructure and economic development
    b. Incorporated within Public Utility Commission's decision-making processes (such as the net benefit provision in the NJ Offshore Wind Economic Development Act)
2. Environmental Impact Statements/Assessments (including but not limited to Executive Order 215 reviews)
3. Economic analyses that accompany state rulemaking under the Administrative Procedures Act

The three policy mechanisms and their corresponding case studies aim to address the following research questions:

1. What state actors could be relied on to adopt the SCC metric in each of the three mentioned policies?
2. What technical challenges would agencies face in integrating the SCC metric into the policy mechanisms?
3. What is the impact of employing the metric on stakeholders?
4. What is the likelihood that considering the externalities of climate change impacts and incorporating them via the SCC metric into each identified policy mechanism will result in different decision outcomes?

The first two questions will be considered along with each policy mechanism in section 5, while questions 3 and 4 will be discussed jointly in section 6 as they relate to all mechanisms.

5.1. Mechanism 1A: Investment of Public Monies in Infrastructure and Economic Development

Mechanism: Cost-benefit determinations made by state agencies with regard to investment of public monies in infrastructure and economic development

5.1.1. University and Private Sector Investments of Monies for Infrastructure and Economic Development

The SCC has been successfully implemented in cost-benefit analyses performed by certain state agencies, institutions, and private businesses. These entities consider the impacts of climate change when deciding how to investment their funds in infrastructure and economic development projects.

Universities

In July 2017, Yale instituted a university-wide carbon charge program. This program was implemented to account for the costs of building-related carbon emissions. The university's carbon charge applies to over 250 buildings and accounts for nearly 70% of campus CO_2 emissions. The program specifically targets the university's current infrastructure and future infrastructure development. In September 2017, as part of the program's implementation, Yale began requiring its buildings to send monthly reports detailing the metering of electricity, chilled water, natural gas, and steam consumption, and the resulting greenhouse gas emissions. The cost of the university's carbon charge is based on the 2013 SCC estimates by the IWG.

Additionally, Vassar adopted a Climate Action Plan in 2016 that outlines a path of action for achieving carbon neutrality by the year 2030. Carbon neutrality is defined as having a net zero carbon footprint. The Climate Action Plan specifically dictates that as Vassar's buildings and grounds continue to evolve, energy efficiency and renewable energy generation practices must become integral to campus development. This directly involves designing all campus building construction and renovation projects, with specific consideration toward low or no emissions generation. Campus-wide green building standards help achieve desired emissions reductions for capital projects and building renovations (Vassar College, 2016, p. 6). Thus, Vassar will seek alternative energy sources, energy reduction strategies, and efficiency improvements to reduce operating costs to achieve the overarching goal of zero net carbon emissions. The cumulative college-wide carbon charges were calculated using the IWG estimates of the SCC discounted at the 2.5%, 3% and 5% rates.

Private Sector

According to the Carbon Disclosure Project (CDP), 29 companies based in or doing business in the US cited that they employ an internal price on carbon pollution in their planning processes. This is done to properly weigh both the risks and opportunities related to climate change. Based on CDP data from 2013, some of these companies include Microsoft, General Electric, Walt Disney, ConAgra Foods, Wells Fargo, DuPont, Duke Energy, Google, Delta Air Lines, Walmart, and PG&E (CostofCarbon.org, 2014, pp. 1-5). Notably, the Exxon Mobil Corporation uses a SCC price of $80 per metric ton of CO_2 emissions for the year 2040. This measurement exceeds the central federal SCC estimate for 2040, which based on 2016 IWG estimates is valued at $60 per metric ton of CO_2 emissions.

These examples demonstrate the way in which universities and private entities are currently including climate change externalities in their planning processes, specifically regarding investments for infrastructure and economic development.

5.1.2. Applications in Other States

New York

This case study illustrates and provides insight into the potential of Mechanism 1A in New Jersey. The case study focuses on New York's Reforming the Energy Vision (REV) policy, specifically regarding REV's Clean Energy Fund, which serves as the economic development arm of the strategy. REV uses a CBA framework that includes the SCC to account for the costs of climate externalities in the state's development projects. REV has been successful in achieving its goals to make New York's energy system more affordable, support the growth of clean energy, and reduce greenhouse gas emissions. See Appendix 5 for more details on New York's clean energy system initiative.

Similar applications of cost-benefit determinations made by state agencies regarding investment of public monies in infrastructure and economic development have also been instituted in Maine and Washington, in varied contexts.

5.1.3. Details on Potential Application in New Jersey

Although Executive Orders are in place in New Jersey (EO 27, 1994 and EO 2, 2010), state agencies have not consistently implemented these requirements. While agencies do consider the implications of their proposed actions, they do not regularly perform full cost-benefit analyses. This challenge is not unique to New Jersey. The Pew Charitable Trust study's review of cost-benefit analysis in the 50 states shows that state officials routinely reported political and practical obstacles in conducting cost-benefit analysis and applying the results of the analysis to policy-making (The Pew-MacArthur Results First Initiative, 2013, p. 8). Despite such difficulty, the regular application of cost-benefit analysis has the potential to heighten transparency and maximize efficiency in state agency and utility decision-making. Therefore, New Jersey could consider instituting more routine applications of CBA in the state. Moreover, CBA is the primary method by which the SCC can be included in regulatory evaluations. Since the SCC assigns a dollar value to the costs of damages attributable to climate change — or inversely, monetizes the benefits of avoiding climate change damages — it requires an economic assessment method that quantifies costs and benefits, not one that simply evaluates impacts. For this reason, CBA is a necessary economic tool for regulatory oversight that New Jersey state agencies may want to utilize for the incorporation of the SCC to consider the impacts of climate change when weighing policy alternatives during the planning process for the investment of public monies.

5.1.4. Implementation Challenges in New Jersey

What state actors could be relied on to adopt the SCC metric in this case?

Carbon emissions in New Jersey primarily result from the transportation sector, power sector, and fossil fuel use in residential, industrial, and commercial heating (Pacyniak, et al., 2017, p. 3). Some examples of state agencies that could incorporate the SCC in CBA and potentially have the greatest impact when considering infrastructure and economic development projects are: (1) the New Jersey Department of Environmental Protection (NJDEP); (2) New Jersey Department of

Transportation (NJDOT); (3) New Jersey Department of Community Affairs (NJDCA); and (4) NJ Economic Development Authority (NJEDA). This is not an exhaustive list as carbon reduction strategies could be employed widely throughout the state.

While NJDEP, NJDOT, NJDCA, and NJEDA do consider the impacts of their proposed regulations and projects involving the investment of public monies, specifically regarding infrastructure and economic development, these agencies have not systematically conducted full cost-benefit analyses for all their potential actions. To this end, a number of state-expert interviewees expressed concern about the ability of New Jersey state agencies to perform full CBAs. To this end, the Pew Charitable Trust study explained, “Comprehensive cost-benefit analyses require technical skill, solid data, time, money, and staff. A lack of some or all of the needed expertise and resources can prevent a state from under- taking an analysis, lower a study’s quality, or reduce the effect on policy” (The Pew-MacArthur Results First Initiative, 2013, p. 8). Therefore, more research is needed on the subject.

In New Jersey, the DEP Office of Economic Analysis does perform CBA, which could incorporate the SCC metric if it has the institutional and resource capacity to do so. An interviewee confirmed that the office also conducts cost-effectiveness analysis, which is particularly of use when the necessary data for a full CBA is unavailable. In the past, NJDOT employed Rutgers University, specifically the Rutgers Intelligent Transportation Systems Laboratory (RITS) and the Center for Energy, Economic & Environmental Policy (CEEEP), to conduct cost-benefit analyses for its evaluation processes. NJDCA has an Office of Policy and Regulatory Affairs that is tasked with evaluating existing department programs and providing guidance to department staff. Lastly, NJEDA performs net benefit analysis. In this way, NJEDA estimates both direct and indirect impacts on a one-time and ongoing basis for the projects they undertake. Specifically, “NJEDA has built an economic impact model to help measure the likely impact of a given development to the state and municipality” (NJEDA, 2010, p. 1). NJEDA quantifies impacts when possible, however this is not regularly the case.

If NJDEP, NJDOT, NJDCA, and NJEDA do not have the capacity to take on full economic analyses, they could consider outsourcing the responsibility to an impartial third party. A resource currently available to state agencies is the New Jersey Department of the Treasury, Office of Revenue and Economic Analysis (OREA). The OREA supports the State Treasurer’s Office and retains a staff of economists and research professionals. The OREA provides data, projections, and analyses that are used in preparing the Governor’s Budget Message, the Budget in Brief, the Citizen’s Tax Guide, the Comprehensive Annual Financial Report, the Appropriations Act, the Annual Tax Expenditure Report, the Statistics of Income Report, the Official Financial Statement, and fiscal notes for the State Legislature. This Office additionally delivers research reports and technical memoranda for the Department of the Treasury, the Governor’s Office, and other state agencies as needed (OREA, 2018). The OREA could serve as a potential resource for cost-benefit analyses that incorporate the SCC in regard to the investment of public monies in infrastructure and economic development, which could impact state decision-making outside the scope of energy and environmental regulation.

Therefore, if cost-benefit analysis is not systematically performed by the NJDEP, NJDOT, NJDCA, or NJEDA, the OREA could be called upon to provide the necessary analysis. The OREA’s data collection, projections, and analyses have been performed for the following state departments: Office of Management and Budget, Division of Taxation, State Legislature, Labor and Workforce Development, Department of Community Affairs, Division of Gaming and Enforcement, the NJ

Lottery, and Port Authority of NY & NJ (OREA, 2018). Although OREA has not yet worked with NJDEP, NJDOT, or NJEDA, it has experience with other state agencies.

At the federal level, the Office of Information and Regulatory Affairs (OIRA), within the Executive Branch, is the central authority for: (1) the review of Executive Branch regulations; (2) approval of government information collections; (3) establishment of government statistical practices; and (4) coordination of federal privacy policy (OIRA, 2016, p. 1). The presence of OIRA helps to ensure the completion and review of cost-benefit analysis by federal agencies. In New Jersey, there is currently no governmental body that serves as the OIRA equivalent to monitor state agencies and review their CBAs for proposed regulations and projects. While all regulations in New Jersey are reviewed outside of their state agency by the Office of Administrative Law to make sure they are consistent with the Administrative Procedures Act, there is presently no institution in place to examine the underlying analyses, as OIRA does at the federal level. To this end, a report by the Mercatus Center suggests that most states currently lack the capacity and necessary institutions to incorporate technical analysis and evidence into regulatory decision-making (Broughel & McLaughlin, 2018, p. 1). However, the paper recommends that regulatory agencies at the state level find a way to integrate quality economic analysis into their evaluation processes, thereby utilizing as much information as possible to anticipate the potential effects of all proposed regulation.

What technical challenges would agencies face in integrating the SCC metric?

CBAs in the state of New Jersey could generally be improved in terms of production, scope, and application. New Jersey is not considered to be a leader in the use of CBA, distinctly falling behind in terms of the number of studies produced per year and the breath of analysis in examining multiple alternatives to effectively compare policy solutions (The Pew-MacArthur Results First Initiative, 2013, p. 3). These general improvements to CBA in the state would need to be addressed for the incorporation of the SCC to affect policy decisions.

Another challenge of integrating the SCC into cost-benefit analysis involves properly understanding and considering the factors that go into the analysis. A Brookings Institute study identifies a key issue that could be explored in implementing a cost-benefit analysis that incorporates the SCC, namely addressing the possibility that emissions may not decrease by the full amount assumed (Hahn & Ritz, 2014, p. 16). This issue speaks to the problems associated with carbon leakage. The Brookings study suggests that leakage may need to be factored into the price set for carbon emissions. One way to potentially address this issue is to set the SCC at a rate that is less than the global SCC. Another possible solution is to apply the SCC to the net reduction in emissions after accounting for leakage, as opposed to applying the measurement to gross emissions, which is the current practice. New Jersey could consider this issue when establishing a SCC value for the state. The value New Jersey chooses for the SCC would be applicable across all state agencies for the consistent evaluation of climate impact costs in their infrastructure and economic development projects.

5.2. Mechanism 1B: Public Utilities Decision-Making Process

Mechanism: Cost-Benefit and Net Benefit Determinations Made by NJ Board of Public Utilities

5.2.1. Application of SCC within CBA in Public Utility Commission Decision-Making and Rates Counsel recommendations

Public Utility Commissions

In state-level policies, Public Utility Commissions (PUCs) have been integral to applying the SCC within CBA, especially regarding the assessment of environmental impacts of electricity generating utility projects within project applications brought before them. Several state PUCs — including Minnesota and Colorado — have ordered the integration of the SCC in such a way. For example, the Minnesota Public Utilities Commission (MPUC) released a final order in 2017 with an updated environmental cost range calculated from the federal SCC values that utilities are required to use. Reference Appendix 6 for more details on the Minnesota case study.

5.2.2. Details on Application in New Jersey

New Jersey BPU Decision-Making Process

Similar to MPUC, New Jersey's Board of Public Utilities (BPU) is the state agency authorized to oversee regulated utilities such as natural gas, electricity, water, and telecommunications through monitoring rates, charges, rules and regulations of these utilities that operate in New Jersey. The Board is statutorily mandated to ensure safe, adequate, and proper utility services and responding to consumer complaints. As a quasi-judicial body, the BPU makes decisions on various rulemaking matters. For example, when a petition is filed to the Board, it will first decide if the petition will become a case or if it will be sent over to the Office of Administrative Law (OAL). The OAL is where an Administrative Law Judge (ALJ) gives a decision on the matter which the board can then decide to accept, reject, or change (NJBPU, 2018).

A case retained by the Board or sent to the OAL goes through a legal process which may involve public hearings, briefs, discovery, and testimony. Evidence, arguments, and comments are provided at public hearings and the Board makes its final decision at a public agenda meeting. The decision made by the Board can be appealed in the Appellate Division of the New Jersey Superior Court (NJBPU, 2018).

NJBPU oversees several key programs in which CBA is utilized: the New Jersey Clean Energy Program (NJCEP) statewide energy efficiency and renewable energy incentive programs and projects under the 2010 Offshore Wind Economic Development Act. This law requires any entity seeking to construct an offshore wind project to submit an application with a completed cost-benefit analysis to the BPU for its approval.

Since 2003, Rutgers University's Center for Energy, Economic & Environmental Policy (CEEEP) has conducted CBAs of energy efficiency and renewable energy programs and has employed the federal SCC since 2013 using a 3% discount rate, according to an interviewee. The 2015 NJ Energy Master Plan Update included recommendations for applying cost-benefit tests to energy efficiency programs to promote cost effective conservation and energy efficiency (NJBPU; NJDEP, 2015). In 2018, TRC Energy Services and CEEEP conducted a CBA for NJCEP residential,

commercial, and industrial energy efficiency programs. According to the BPU, CBAs have been conducted for 11 NJCEP energy efficiency programs available to New Jersey's residential, commercial, and industrial customers and the Distributed Energy Resources program (NJBPU, 2017).

The purpose of the CEEEP cost-benefit model is to determine the overall effectiveness of particular energy efficiency projects that are proposed to the Clean Energy Council. The model was designed to accommodate a large number of sensitivity analyses. The purpose of the sensitivity analyses is to ascertain how the overall costs and benefits will change when various inputs in the model are altered (discount rate, electricity prices, rebate levels, etc.). The model automatically generates the cost-benefit tests that can be used for analysis as a tool to compare various programs against each other.

The SCC metric has been incorporated in other instances within cost-benefit analysis in New Jersey. In the 2014 evaluation of PSE&G's energy efficiency programs, the SCC was utilized to calculate Emissions Permit Prices using IWG 2007 numbers converted to nominal dollars with an 8% discount rate. Discount rates are used to convert future economic values into present day dollars (CEEEP, 2017). However, the 8% discount rate is not the recommended IWG rate as discussed in Appendix 3. These discrepancies indicate a need to standardize the metric within New Jersey policy-making processes.

From expert interviews, important differences between Minnesota and New Jersey came to light in the policy formation landscape, and in regard to institutional capacity of BPU. First, in the state policy landscape, it is important to note the prior existence of a statute which mandates the MPUC to quantify environmental costs which utilities are then required to use in any electricity generation project brought before the commission. However, in New Jersey no such statute exists mandating the BPU to quantify the environmental costs of any greenhouse gases. There is limited precedent in the New Jersey Administrative Code requiring BPU to mandate quantification of environment costs; however, there are instances of cost-benefit analyses that have incorporated the SCC within societal cost test analyses, (one of the five cost-benefit tests for Clean Energy Programs energy efficiency programs). Such analyses have been performed at the initiative of the analyst conducting the CBA rather than by statutory authority.

Outsourcing CBA to consultancies is feasible for the BPU, considering it is routinely done, for example, in rate cases to fund proposed energy efficiency programs. BPU also requires utilities to submit their own CBAs, which include the consideration of economic benefits for the state. The biggest hurdle the BPU faces in terms of institutional capacity is to be able to evaluate the data and key assumptions made in CBAs that are brought before the Board.

Furthermore, incorporating the SCC in New Jersey is not as direct of a process as done by the MPUC. In Minnesota, the MPUC conducts capacity model planning, but this is not the case in New Jersey. Resource and capacity planning is not feasible in New Jersey because the energy generation market is deregulated. Resource and capacity planning for energy generation is conducted through PJM, the regional transmission organization (RTO) for New Jersey. Therefore, in order to fully incorporate the SCC within New Jersey's energy policy landscape the BPU must first establish what the environmental cost values are that utilities will use in CBAs. Second, BPU's rulemaking must take into account the process by which a state policy directive will be incorporated by the utilities if it orders all utility resource planning and capacity planning for energy generation to take into account the environmental cost of energy generation through CBA.

5.2.3. Implementation through New Jersey Division of Rate Counsel

The New Jersey Division of Rate Counsel is an independent entity that serves to advocate for and represent the interests of utility consumers. In matters of utility rate cases brought before the BPU, the Rate Counsel is a party to every case and consults with experts to examine the evidence presented to the Board by a utility. If the Rate Counsel's findings differ from the Board's decision, the Counsel may appeal to a higher court (New Jersey Division of Rate Counsel, 2009).

The Rate Counsel reviews CBAs submitted by utilities to the Board and makes recommendations to the Board based on independent assessments (New Jersey Division of Rate Counsel, 2009). In particular, for the instances of utilities proposing rate changes, the Rate Counsel has statutory authority to "conduct investigations, initiate studies, conduct research, present comments and testimony before governmental bodies" under N.J.S.A 52:27EE-48 (The State of New Jersey, 2010). With this authority, the Rate Counsel conducts cost-benefit and net benefit assessments of any proposed rate changes and has the potential to include the SCC metric within the broad range of CBA tests it conducts.

5.2.4. Offshore Wind Economic Development Act (2010)

The 2010 Offshore Wind Economic Development Act (OWEDA) amends P.L.1999, c.23 to include regulations, oversight, and to incentivize wind energy development in New Jersey (C.48:3-87). OWEDA mandates the BPU to oversee the development of 1100 MW of wind energy generation from qualified wind energy projects. To comply with the statute requirements, the BPU updated its rules to require any company applying for project approval to submit a full CBA which includes "an analysis of the anticipated environmental benefits and environmental impacts of the project," and that the CBA must demonstrate "positive economic and environmental net benefits to the State" (The State of New Jersey, 2010). However, this CBA requirement does not mandate the use of the SCC.

5.2.4. Implementation Challenges in New Jersey

What state actor could be relied on to adopt the SCC metric in this case?

For this specific mechanism, the BPU can be relied upon to adopt the SCC in cost-benefit analyses of energy and resource planning and use. N.J.S.A 48:1 grants the BPU authority to set rules regarding oversight of utilities, including utility energy efficiency programs (NJBPU, 2018). This gives the agency the authority to introduce, solicit public comment, and set the SCC range of values for utilities to use in any assessments, including requiring CBA and net benefit analyses that incorporate the SCC.

The BPU could potentially update the environmental information disclosure regulation, N.J.A.C. 14:8-3.1, which requires an electric power supplier or basic generation service provider to disclose on a customer's bill about the source of energy purchased. Similarly, N.J.A.C. can be updated with new or changed rules to include the SCC under the NJCEP. The BPU also added that the Interior Department's Bureau of Ocean Energy Management (BOEM) in November 2015 held a competitive lease sale for renewable energy in federal waters, which offered nearly 344,000 acres offshore New Jersey for potential wind energy development (Linares, 2018). Any application for a new energy project would require a net benefit assessment of environmental benefits and impacts. This net benefit assessment could include the SCC.

What technical challenges would agencies face in integrating the SCC metric?

Requiring the implementation of the SCC for project proposals calls for the BPU to set what value of the SCC will be accepted and used. This is a complex question and as demonstrated in other states and in interviews with experts, it remains a contested issue. The BPU is likely to hold hearings, including having an Administrative Law Judge weigh in on the process to determine which SCC value could be applied in New Jersey. Another challenge would be incorporating the SCC into energy planning and procurement decisions made by the BPU to consider the cost of externalities of carbon emissions. From expert interviews, it is likely that the BPU will face the challenge of evaluating CBAs presented by utilities due to internal capacity issues, namely an ongoing need for economic expertise to review and assess cost-benefit analyses presented to them.

5.3. Mechanism 2: Environmental Impact Statements/Assessments

Mechanism: Environmental impact statements/assessments (including but not limited to Executive Order 215 reviews)

5.3.1. Environmental Impact Statements/Assessments at the State and Federal Level

At the federal level, an environmental impact statement (EIS) is a document required by the National Environmental Policy Act (NEPA) for certain actions significantly affecting the quality of human environment (US EPA, 2017). NEPA was signed into law on January 1st, 1970 and requires federal agencies to assess the environmental effects of their proposed actions prior to decision-making. Section 102 in Title I of the Act requires federal agencies to incorporate environmental considerations into their planning and decision-making processes through a systematic interdisciplinary approach. Specifically, all federal agencies are required to prepare detailed statements assessing the environmental impacts of alternatives to all major federal actions significantly affecting the environment (US EPA, 2017). The case study corresponding to this mechanism is the Boston Harbor Feasibility study and Environmental Impact Statement, which includes an economic cost-benefit assessment, screening of alternatives, environmental assessment, and recommendation plans. See Appendix 7 for details on the Boston Harbor environmental impact statement study.

An EIS can be used as a tool to inform decision-making. It describes the positive and negative environmental effects of proposed actions, and it typically lists one or more alternative action that may be chosen instead of the action described in the EIS. Several US state governments require that a document similar to an EIS be submitted as part of a proposal for certain actions. The State of New Jersey's Executive Order 215 requires state agencies and authorities to prepare an EIS and submit it to the New Jersey Department of Environmental Protection. The environmental impact assessment process can include economic benefit-cost analysis, but it is not a requirement (The State of New Jersey, 1989).

NEPA does not require that agencies monetize costs and benefits in the process of decision-making. However, the *Center for Biological Diversity v. National Highway Traffic Safety Administration* case set the precedence for all the federal agencies to employ the SCC in cost-benefit analyses for EAs and EISs in all future rulemaking covered under NEPA. When an agency chooses to monetize emissions or finds that it is appropriate to apply cost-benefit analysis to choose between alternatives, such analysis may be appended to the NEPA document as an aid in the evaluation of environmental impacts (Council of Environmental Quality, 2007). Determining the appropriate method for conducting

cost-benefit analysis is a decision left to the agencies, taking into account established practices for cost-benefit analysis with a strong theoretical underpinning. The federal SCC estimates developed through an interagency process ensures that the SCC reflects the best available science and methodologies and is used to assess the social benefits of reducing CO_2 emissions across alternatives in rulemaking. The SCC provides a harmonized interagency metric that can give decision-makers and the public useful information for their NEPA review.

5.3.2. Details on Application in New Jersey

An environmental impact statement/assessment would provide all the information and details needed to evaluate the effects of a proposed project on the environment. The scope of an environmental impact statement (EIS) or environmental assessment (EA) must be jointly agreed upon by the proposing department, agency, and the NJDEP.

Executive Order 215 (EO 215) was signed by Governor Thomas H. Kean on September 11, 1989. EO 215 requires that all state agencies and authorities prepare and submit an environmental assessment (EA) or environmental impact statement (EIS) to the NJDEP for all major construction projects. The objective of this EO is to reduce or eliminate any potential adverse environmental impacts of projects initiated or funded by the state. Projects initiated by state departments and agencies, as well as projects in which state departments and agencies are granting at least 20% of financial assistance, shall comply to this order. It is advised that EISs be submitted and reviewed at an early stage of the project, specifically prior to site preparation and construction.

As confirmed via interview with state experts, the SCC is currently not being used in the EIS review process. However, incorporation of the SCC can increase the efficiency of selecting project alternatives and can give decision makers detailed information for their review. The SCC can be used as a tool to evaluate the positive and negative impacts of the project to improve the decision-making process. The potential application of the SCC through this mechanism is limited because while the SCC is a specific dollar amount, the costs in EIS/EA are not necessarily monetized. The dollar amount cannot be used directly in this mechanism because an EIS evaluates actions which significantly affect environmental quality.

5.3.3. Implementation Challenges in New Jersey

What state actor could be relied on to adopt the SCC metric in this case?

NJDEP could be relied on to adopt the SCC in environmental impact statements/assessments. NJDEP is the lead agency responsible for preparing EIS for all major construction projects in the state. EIS prepares analyses of the potential impacts of a project and the possible alternatives in accordance with EO 215 for state funded projects and in accordance with NEPA for federally funded projects.

NJDEP's Office of Permit Coordination and Environmental Review arranges all Federal NEPA and state EO 215 reviews through the Environmental Review Unit. This unit can act as an authoritative body under DEP, which could adopt the SCC as a tool for measuring the environmental impacts of the projects. Currently, the SCC is not being used for EIS, but the use of the SCC to access the positive and negative impacts across project alternatives can provide useful information to the decision makers in the review process.

What technical challenges would agencies face in integrating the SCC metric?

The most significant challenge associated with this mechanism is to efficiently incorporate the SCC in the cost-benefit analysis that is used to evaluate alternative options within an EIS. To accomplish this integration, analysts and economists will need to have the expertise to perform such calculations. Within state agencies, institutional and resource capacity building also poses the greatest challenge, specifically in regard to making the agencies proficient with the cost-benefit analysis process.

5.4. Mechanism 3: Economic Analyses

Mechanism: Economic analyses that accompany state rulemaking under the Administrative Procedures Act

5.4.1. Economic Analysis in New Jersey Rulemaking Proceedings

As discussed in Section 3.3 and 5.1, New Jersey state agencies are required by executive order to use cost-benefit analysis to support decision-making processes in their rulemaking procedures. Executive Order 27, issued in 1994 by Governor Christine Todd Whitman, requires the use of cost-benefit analysis as part of state agencies' formal rulemaking process, in which administrative agencies "should analyze whether analogous federal standards sufficiently protect the health, safety and welfare of New Jersey citizens" and that the public be advised of the agencies' conclusions in this process. Under this executive order, cost-benefit analysis should support an agency's decision to impose standards or requirements that exceed those mandated by federal law and support its conclusion as to whether the standards are achievable under current technology (The State of New Jersey, 1994, p. 2). Executive Order 2, issued in 2010 by Governor Chris Christie, establishes "Common Sense Principles" for state rules and regulations, which requires all state agencies to "employ the use of cost/benefit analyses, as well as scientific and economic research from other jurisdictions, including but not limited to the federal government when conducting an economic impact analysis on a proposed rule" (The State of New Jersey, 2010, p. 3).

Distinct from the legal structures of Mechanism 1A, New Jersey Statutes (Section 52:13F-3) mandate that economic impact statements be prepared when a majority of the legislative committee asks for the analysis during the consideration of a specific bill. The Commissioner of the Commerce and Economic Development Department is responsible for preparing these economic impact statements, which must include must include cost-benefit analyses regarding the number of jobs created and/or lost, the total cost of the initiative, development of new markets, and the overall impact of the proposed legislation (The State of New Jersey, 2013).

For further information regarding how the SCC has been applied in practice within state rulemaking processes, please see Appendix 8, which discusses the employment of the SCC within the 2016 regulatory impact analysis for California's 2018-2030 appliance energy efficiency standards.

5.4.2. Implementing the SCC in New Jersey Rulemaking Proceedings

What state actor could be relied on to adopt the SCC metric in each of the three mentioned policies?

Existing legal structures in New Jersey mandate that state agencies conduct economic analyses within their decision-making processes, which include economic impact statements and

cost-benefit analyses that accompany rulemaking proceedings. Thus, these agencies could be relied upon to employ the SCC within their existing cost-benefit models. However, state agencies are not statutorily required to quantify the nonmonetary, social costs or benefits of their impacts (e.g. on the environment) within cost-benefit analyses, which presents a challenge to fully integrate the SCC into their rulemaking processes. However, two key authorities -- the Governor and state legislators -- can be relied upon to mandate economic analyses to employ the SCC for proposed rules with significant environmental impacts. The Governor may unilaterally enact an executive order, or the state legislature may pass new legislation to amend the New Jersey Statutes to broadly incorporate the SCC into future rulemaking proceedings. Given the recent change in governorship with the newly inaugurated, environmentally-ambitious Murphy Administration, and relatively broad consensus with the state legislature, the support for either approach is likely high. Given these circumstances and a favorable political climate, the integration of the SCC into future rulemaking processes via executive order or legislative mandate is currently a feasible goal for state policy makers.

What technical challenges would agencies face in integrating the SCC metric into the policy mechanisms?

Implementing the SCC poses key technical challenges to policy makers, e.g. choosing the correct discount rate under each regulatory alternative, given that such impacts will differ on a case-by-case basis. The requirement for state agencies to conduct cost-benefit analyses within their rulemaking proceedings suggests that there is institutional and resource capacity to employ the SCC within existing regulatory processes. However, without a standardized, well-designed, and universally-mandated process to incorporate the SCC within economic analyses for proposed state regulation, its consistent implementation within and across such analyses is threatened.

6. Case Study Findings

From the individual case studies, this report found that there is a variety of state actors that could be relied upon for the incorporation of the SCC in New Jersey, as well as an array of technical challenges that these actors may face during implementation. The primary state actors that could be utilized in the implementation of the SCC are the New Jersey Department of the Treasury, Office of Revenue and Economic Analysis (OREA), New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation (NJDOT), New Jersey Department of Community Affairs (NJDCA), New Jersey Economic Development Authority (NJEDA), and New Jersey Board of Public Utilities (NJBPU).

The technical challenges identified in these policy mechanisms address the institutional and resource capacity and expertise of state agencies in using the SCC in their analyses. A key difference among the policy mechanisms is their degree of feasibility. The mechanisms differ in applicability, practicality, and the degree of effort required for implementation. In this way, the technical challenges for the implementation of the SCC in New Jersey are relatively varied. Cost-benefit and net-benefit determinations made by state agencies and the BPU (Mechanisms 1A and 1B) and economic analyses accompanying rulemaking proceedings (Mechanism 3) present less technical challenges for the SCC's immediate implementation. Environmental impact statements (Mechanisms 2) constitute greater challenges for implementation due to the lack of precedent or the absence of the necessary laws and/or policy mechanisms to facilitate the use of the SCC in the state of New Jersey.

Moreover, from the three policy mechanisms detailed above, the research team has drawn the following conclusions regarding the potential impacts on stakeholders that would result from the incorporation of the SCC in New Jersey and the likelihood that the metric will result in different decision outcomes. These findings are summarized across all mechanisms due to their similarities.

6.1. What is the Impact of Employing the Metric on Stakeholders?

In the short-term, implementation of the SCC in state planning and rulemaking, will likely have an impact on the state actors directly responsible for conducting, reviewing, and applying the results of CBAs with the SCC. Using the SCC necessitates that full cost-benefit analyses and other economic analyses be performed, therefore imposing costs on the entities responsible for their implementation. For this reason, state agencies may have to consider evaluating their institutional and resource capacity, specifically educating their employees on how to properly account for climate externalities using the SCC. The inclusion of the SCC also impacts the public as a whole, since society may benefit from more informed and transparent decision-making and improved economic efficiency of state regulatory actions.

Moreover, carbon-intensive industries may be subject to greater regulatory scrutiny in both the short- and long-terms, with ratepayers potentially bearing some of the costs of these stricter energy regulations through higher energy prices in the short-term. However, in the long-term these costs may be mitigated over time with adaption and advancements in science and technology. Overall, the inclusion of the SCC may impact non-renewable energy projects, public utilities, transmission organizations and disproportionately-high energy users.

6.2. Does Incorporating the SCC Result in Different Decision Outcomes?

In regard to the application of the SCC to these specific policy mechanisms, it is unclear whether the inclusion of the metric in CBA or EISs/EIAs has served as a distinguishing factor or resulted in different decision outcomes in other states or at the federal level. This research was not able to singularly parcel out the effect of the SCC in the policy analysis or decision-making processes. More research may be needed on this subject. However, from the research compiled assessing the SCC's application in other states, this report does find that the SCC has been effectively used to support and advance legislation that has a positive impact on the environment and supports reducing GHGs. Moreover, the SCC also has the potential to be impactful in future applications that examine policy alternatives that negatively impact the environment, because the implementation of the metric institutes consideration of climate externalities.

Research also suggests that accounting for additional factors, like carbon leakages, in CBAs can help improve the accuracy and quality of the results garnered from these analyses that incorporate the SCC (Hahn & Ritz, 2014, p. 16). Moreover, the likelihood that state agencies (e.g. NJBPU, NJDEP) consider the externalities of climate change impacts and incorporate them via the SCC into cost-benefit and net benefit determinations is dependent on several factors: (1) the discretion of BPU commissioners who through an investigatory, hearing, and public comment process make the final decision of how to incorporate the SCC into CBA requirements for utilities and utility planning; (2) the guiding principles of delivering adequate service, competitive pricing, and energy conservation in state energy and utility policy; and (3) the political willingness of the New Jersey Governor's Office to mandate that state agencies consider the externalities of CO_2 emissions when evaluating policy alternatives.

According to a 2014 Brookings Institute report entitled *Does the Social Cost of Carbon Matter? Evidence from US Policy*, which evaluated 53 regulatory policies between 2008 and 2013, the SCC does not appear to have a "substantial impact" on US policy outcomes. Some evidence, however, does suggest that in some cases the SCC may change the ranking of considered policy alternatives based on their respective expected net benefits in approximately one out of every eight cases (Hahn & Ritz, 2014, p. 20). These findings were supported by our policy expert interviewees in various states, suggesting that the SCC is best utilized as a tool to inform policy decisions and to provide a more transparent analytical process. The SCC metric also functions as a useful instrument to embed the notion that there is a quantifiable social value associated with carbon reduction efforts in policy discussions. As such, the SCC serves as a non-threatening, politically palatable advocacy and policy tool to help support proposed infrastructure development, legislation, and regulatory actions.

7. Recommendations

Based on the research, this paper proposes two sets of recommendations. The short-term recommendations reflect best practices for the incorporation of the SCC in CBA in the state of New Jersey. The short-term recommendations also constitute the paper's suggested next steps, highlighting the mechanisms with existing structures in the state that have been identified for the immediate inclusion of the SCC. Conversely, the long-term recommendations consist of the mechanisms that would require greater effort to incorporate the SCC in the state. The long-term recommendations also offer a suggestion regarding the creation of an institution to ensure optimal standard practice regarding the use of CBA with the SCC in New Jersey.

7.1. Short-Term Recommendations

Overall Recommendation: To help achieve New Jersey's emissions reduction target by the year 2050, New Jersey could incorporate the SCC in cost-benefit and net benefit determinations made by state agencies and the BPU to account for climate impacts in state planning.

Discussion: Including the SCC in the analyses conducted by state agencies and the BPU is a feasible task, which can be instituted immediately. Currently, cost-benefit analyses are performed by state agencies and the BPU, albeit not systematically. Although state agencies routinely examine the impacts of their proposed actions, full cost-benefit analysis is needed to include the SCC into decision-making processes. The SCC can be seamlessly incorporated in cost-benefit analysis, provided analysts have the expertise and agencies have the institutional and resource capacity to perform the necessary calculations. This is a challenge for New Jersey and many other states, according to the Pew Charitable Trust report. The main challenge for New Jersey regarding these mechanisms is legislatively requiring that CBA be performed for proposed regulations, and specifically calling for the SCC to also be included in such analyses. Overall, this report finds that the SCC is a well-developed metric that is ready for incorporation.

> **Supporting Recommendation 1:** State agencies may have to review institutional and resource capacity building to be able to conduct cost-benefit analysis that incorporates the SCC.
>
> **Discussion:** Currently, cost-benefit analysis is not systematically conducted by state agencies or the BPU. As indicated in the Pew Charitable Trusts study, state officials across the 50 states have cited political and practical obstacles to conducting cost-benefit analysis. Moreover, it is reported that conducting a cost-benefit analysis requires technical skill, meaningful data, time, money, and staff (The Pew-MacArthur Results First Initiative, 2013, p. 8). Therefore, if state agencies are not able to perform the analysis, they may have to consider relying on third party contractors.
>
> **Supporting Recommendation 2:** State agencies may want to consider expanding and improving the production, scope, and application of cost-benefit analysis to further develop the state's regulatory oversight capabilities.
>
> **Discussion:** New Jersey may want to consider increasing and refining its usage of CBA to inform policy and decision-making in the state. CBA is a critical tool for evaluating the impacts of proposed policy alternatives. Thus, its application in state agencies could be significantly increased to support improved, informed, and transparent rulemaking. CBA serves as a

measure for social welfare, examining if the benefits of a proposed regulation outweigh the costs imposed on society. Such analyses could be incorporated systematically in New Jersey to equip policy-makers with the most comprehensive information available to advise benevolent decision-making processes.

Supporting Recommendation 3: The state could institute the use of a standardized global SCC value to ensure consistent application across state agencies.

Discussion: It is recommended that New Jersey use the Interagency Working Group (IWG) federal estimate from 2016, which is a global estimate. It is important that the state adopt an estimate that reflects global emissions due to the trans-border nature of climate change and climate impacts. Regarding discount rates, most often the states have used the SCC at the central value 3% discount rate, with Washington state as the exception employing the 2.5% rate. However, the IWG recommends the SCC be calculated using the three discount rates and 95th percentile offered in their reports. In 2017 the IWG was disbanded by the Trump Administration, which means that the most up-to-date federal estimate of the SCC is from 2016. Additionally, to ensure progress continues, the National Academies of Sciences, Engineering, and Medicine (NAS) released a comprehensive review of the methodology for estimating the SCC and subsequently issued their recommended updates in January 2017. The economic think tank Resources For The Future plans to pioneer “a multi-year, multidisciplinary research initiative to advance the NAS recommendations and lead to a comprehensive update of the SCC estimates,” (Nelson, 2017, p. 2). Meanwhile, the Climate Impact Lab, a consortium of Rutgers University, Berkeley, the University of Chicago and the Rhodium Group, is working to leverage big data-approaches to improve some of the fundamental underpinnings of the approaches used to estimate the SCC (Climate Impact Lab, 2018). Upon release of this estimate, New Jersey may want to consider the products of these groups for possible adoption. More generally, best practices suggest that the numbers used for the SCC be reevaluated and updated periodically.

Supporting Recommendation 4: To facilitate the process of deciding upon the SCC value range that can be applied consistently within New Jersey, the Board of Public Utilities could convene a stakeholder group for that purpose.

Discussion: In state-level applications of the SCC there are many stakeholders that may need to be brought into the conversation for how to apply the SCC metric within cost-benefit analysis. These stakeholders include utilities, ratepayers, state agencies, regional transmission organizations, and subject matter experts. A stakeholder group or taskforce could be assembled for the purpose of considering all stakeholders testimony and assessing scientific evidence that could help determine what SCC value range could be applied in New Jersey’s regulatory policies. The BPU could take on this task because it has the authority to implement what is decided or defer to an Administrative Law Judge to review.

Supporting Recommendation 5: More research is needed to evaluate the distributional effects of incorporating the SCC in cost-benefit analysis at the state level.

Discussion: At the federal level, it is statutorily required that agencies consider the distributional impacts of any proposed regulation when performing a cost-benefit analysis. This requirement is not common at the state-level and is absent in New Jersey regulatory policy. At present, it is unclear how the inclusion of the SCC metric in cost-benefit analysis would have

equity impacts on policy decisions. More research is needed to understand the socioeconomic impacts of environmental policy that uses the social cost of carbon.

7.2. Long-Term Recommendations

Recommendation 1: New Jersey can consider working towards incorporating the SCC in environmental impact statements.

Discussion: The inclusion of the SCC in environmental impact statements (Mechanism 2) is a more arduous task and would be considered a longer-term goal for the state. Specifically, the challenge with employing this mechanism is that the SCC has never been used in environmental impact statements (EIS) before. No state has been able to successfully campaign for the inclusion of the SCC in this measure. Including the SCC increases transparency and facilitates the decision-making process by informing on the positive and negative impacts associated with a proposed project or regulation. The administrators of EIS could consider taking steps to account for externalities and the impacts of climate change in their review process. Statutorily requiring SCC be considered in EIS would highlight for policymakers the effects of climate change in their analysis, which has beneficial implications for the types of projects that ultimately pass EIS and are implemented. This is an opportunity for New Jersey to pioneer this process since the SCC has never before been used in this context. If the New Jersey Department of Environmental Protection (NJDEP) has the capacity and expertise to include the SCC in EIS, the calculation would be rather simple, but the result has the potential to be very impactful on decision-making.

Recommendation 2: The creation of a regulatory agency or entity at the state-level could oversee the implementation and review of cost-benefit analyses done by state agencies.

Discussion: State agencies could consider finding a way to incorporate quality economic analysis into their decision-making processes. Using as much information as possible is a best practice to emulate when trying to estimate and evaluate the possible effects of any proposed regulation. The existence of a regulatory agency or overseeing entity would ensure that state agencies performed the required analysis as well as examine its quality and accuracy. OIRA is the example to emulate at the federal level.

Recommendation 3: The Governor or the New Jersey Legislature may want to examine the merits of mandating the application of the SCC in economic analysis via state rulemaking proceedings.

Discussion: New Jersey state agencies are not required to specifically quantify the nonmonetary benefits (e.g. environmental protection) of their regulations. This presents a challenge in implementing the SCC for proposed rules that have a significant environmental impact, but also represents an opportunity for state policy makers to implement best practices of regulatory analyses using the key principles noted above. Two potential approaches to mandate the use of the SCC within such analyses exist: (1) an executive order by the Governor or (2) the passage of legislation. Each of these approaches has tradeoffs -- namely with respect to feasibility and consistency. An executive order can be unilaterally enacted by the Governor himself without approval from the state legislature but may be easily reversed by a change in administration. Alternatively, new legislation is less feasible, requiring majority approval by the state legislature and the Governor, but is more difficult to reverse. Overall, a key advantage to employing this specific mechanism is the opportunity for New Jersey policy makers to learn and build from existing federal and state practices that employ the SCC within their rulemaking proceedings.

8. Conclusion

This report examines the potential for incorporating the SCC metric in state-level policy and planning in New Jersey. Specifically, three policy mechanisms are assessed: cost-benefit analysis done by state agencies, environmental impact statements/assessments, and economic analysis that accompany state rulemaking. Overall, the report finds that the metric can be useful for state policy-makers to ensure that they consider the effects of climate change, which has social costs that are not internalized, particularly when making infrastructure or energy policy decisions. Further, the metric is most effectively utilized in cost-benefit analyses for evaluating policy alternatives.

The research team determined that the feasibility of the three mechanisms greatly differ:

- Cost-benefit and net benefit determinations made by state agencies and the BPU (Mechanism 1A and 1B) are the most suitable mechanisms for the immediate inclusion of the SCC because cost-benefit analysis is already conducted by these agencies in some instances.

- Alternatively, in the state the structures for economic rulemaking analyses (Mechanism 3) do currently exist; however, there is no mandate to consider climate externalities within these analyses. The broad and consistent application of the SCC within this mechanism would require an executive order or statute.

- Lastly, environmental impact statements (Mechanism 2) constitutes a more significant challenge for the state since this mechanism has not been previously implemented within New Jersey, nor has it used the SCC.

Overall, this report finds that incorporating the SCC within New Jersey state-level policies is a helpful step towards understanding the economic and social benefits of policies intended to address greenhouse gas emissions mitigation.

Although the SCC is a well-developed metric that could be considered ready for incorporation in state planning and policy-making processes, incorporating the SCC in these mechanisms will require significant political will and state action. For this metric to have a significant impact on decision-making, it will require a longer-term process to embed the metric comprehensively in all state-level environmental regulation. Moreover, while the metric could be used in New Jersey within existing cost-benefit practices, it is recommended that the exact values for the SCC be updated periodically in accordance with developments in technology and science.

In sum, the SCC has immense value as a policy tool, and research suggests that it can also serve as a critical tool in raising awareness about the impacts of climate change. The SCC is a non-threatening and politically palatable metric that supports progress toward mitigating climate change, allows a smooth integration into policy analyses and decision-making processes, and facilitates more informed, transparent analyses and decision outcomes. The research team believes the SCC could easily be implemented today and could make a significant difference in the state of New Jersey in the future.

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Appendix 1: Interview Protocol

Interview Request

Dear (interviewee name),

My name is ___, and I am a graduate student at Rutgers University's Bloustein School of Planning and Public Policy. I am part of a graduate student group working with the New Jersey Climate Adaptation Alliance on a research project. Our faculty advisor is Dr. Andrea Hetling, Associate Professor at the Bloustein School of Planning and Public Policy, and she is copied on this email.

The primary goal of the project is to identify specific policies and practices that can incorporate a social cost of carbon metric into state planning and regulation.

Given your experience with similar policies in _____ (state), we believe your input would be invaluable. Would you be willing to talk to us about ___, and agree to allow us to use your responses in our project? Your responses will be confidential.

We expect that the call will take no more than a half hour and can be scheduled at your convenience.

Thank you, and I look forward to your response. You may email me at _____ and/or call me at _____.

Sincerely,
Student name

Interview Structure

Title of Study: At What Cost? Opportunities to Incorporate the Social Cost of Carbon into State-Level Policies in New Jersey

Study Investigator: Andrea Hetling, Bloustein School, Rutgers University – New Brunswick

Research Team Members: Zachary Froio, Pratyusha Kiran, Hera Mir, and Liana Volpe

Thank you for agreeing to speak with us.

We would like to interview you to learn more about SCC policies in your state. The primary goal of our project is to identify specific policies and practices that can incorporate a social cost of carbon metric into state planning and regulation.

The interview will last about 30 minutes. The interview is anonymous, and no one will be able to link your answers back to you. We will be taking notes during the interview, and we are not recording our conversation. Our notes will be stored on a secure server and only the research team will have access to them.

Being in this study is voluntary. You can choose not to answer any of the questions you are asked and can stop the interview at any time.

Do you have any questions? May I begin the interview?

Questions:

1. What policy initiatives regarding the social cost of carbon (SCC) have been enacted in your state? What aspects of the policy have been successful and what has not? Why?
2. What are the impacts of these initiatives? How do you measure these outcomes?
3. What were the initial challenges faced in incorporating the SCC measurement? What are the ongoing challenges?
4. For states looking to implement the SCC, which state policies are they using as reference? What lessons have been learned from other states?
5. Who are the stakeholders affected by these policy decisions? Who are the winners and losers?

Appendix 2: Quantifying the SCC

Beginning with the work of economist William Nordhaus in the early 1980s, academic research continued into the 21st Century to inform initial estimates of climate change damages attributable to greenhouse gas emissions. Such estimates were first incorporated in federal impact analyses under the Bush Administration in 2008. The Obama Administration established the Interagency Working Group on Social Cost of Carbon (IWG) to develop a more consistent and standardized cross-agency approach to estimating the SCC (National Academies of Sciences, Engineering, and Medicine, 2017, p. 26). The IWG uses three climate economic models, known as *integrated assessment models*, to value damages resulting from climate change that include, for example, property damages from increased flood risk, changes in net agricultural productivity and energy system costs, the value of ecosystem services, and costs from impacts to human health (IWG, 2010, p. 5). These models project future economic growth and an associated baseline level of emissions to translate into projections of future global warming and economic damages attributable to climate change. These projected baseline emissions are perturbed with an incremental addition of emissions to estimate the difference between the baseline and perturbed damage trajectories. Using various discount rates, the dollar value of these damages is then discounted back to the time of emissions to determine the *present discounted value* of the SCC (IWG, 2010, p. 15).

Given the global nature of climate change, the IWG argued that the SCC should reflect climate damages worldwide. Arguments that the SCC account for global damages include the global nature of the climate system and the exceedingly complex task of disaggregating domestic, regional, or local damages from SCC models as a result. Additionally, the use of a global SCC encourages international cooperation to mitigate and adapt to climate change, while a localized value would underestimate the true, full-extent of damages attributable to its effects (Institute for Policy Integrity, 2017). The choice between using a global SCC and a domestic SCC parallels the question of whether Pennsylvania should only consider the damages its emissions cause in-state in determining how strictly to regulate pollutants, or whether it should also consider the damages caused in New Jersey (and elsewhere).

Appendix 3: Discount Rates

The Interagency Working Group (IWG) reports values of the SCC for emissions occurring in each year from 2010 through 2050. The SCC estimates increase into the future because future emissions result in greater incremental damage as the magnitude of climate change increases over time. For each year of emissions, the resulting stream of damages are estimated through to the year 2300, and then discounted back to the year of emission. The IWG uses three discount rates to reflect various uncertainties regarding how interest rates may change in the future. The central 3% rate is based on standard Office of Management and Budget (OMB) guidance for the consumption rate of interest. At the time this value was set by OMB in 2003, it reflected the long-term, pre-tax rate of return on risk-free government debt.

The two other rates are modifications of this central rate. The lower rate, 2.5%, accounts for uncertainty in interest rates are highly uncertain over time. The higher rate, 5%, accounts for the possibility that climate change damages will be largest in a world where economic growth is largest rate is used to account for the possibility that climate change damages are positively correlated with the market rate of return, as well as the justification that consumers accept high interest rates to smooth consumption over time (IWG, 2010, p. 17). Under the Trump Administration, the EPA introduced interim values of the SCC using the existing 3 percent discount rate (societal discount rate) and a 7 percent discount rate in its regulatory impact analysis of the Clean Power Plan. The 7 percent discount rate, consistent with the Office of Management and Budget Circular A-4, represents the average before-tax rate of return to private capital in the US economy (US EPA, 2017, p. 43). The National Academies conclude, however, that the 7 percent discount rate should be used only under restrictive assumptions and is thus not theoretically justifiable to estimate the SCC in practice.

Appendix 4: Background on Environmental Regulations

Regulations are formal rules promulgated by government agencies to implement and enforce policy goals. State-level environmental regulations are the entire set of policy instruments used by state governments to meet policy goals, e.g. emissions targets. Regulation can include legislative statutes, executive orders, state agency rulemaking and administrative policy tools (Ribeiro & Kruglianskas, 2015, p. 58).

In an environmental context, regulations often intend to correct *market failure*, to restore an efficient allocation of resource use within the market (Raimondo, 1992, p. 49). Market failure arises, for example, when economic activity generates pollution (e.g. GHG emissions) which is often not internalized by market prices. Government intervention through regulations, however, can achieve the social goals of protecting public health and the environment by restricting polluting activities (Anderson, 1998, p. 482).

Command and control regulation is a top down approach to regulation which prescribes how entities and institutions can behave. For environmental requirements, this type of regulation is exemplified as emission standards, which are enforced through licenses or permits issued by environmental agencies. These policy instruments are based on legal determinations that dictate how much pollution a certain entity can emit (Ribeiro & Kruglianskas, 2015). Complementary to command and control regulation is *incentive-based* regulation which provides inducements to firms, often in the form of subsidies, to encourage pollution reduction. For example, instituting a tax system will incentivize a firm to reduce cost, and in turn reduce its level of pollution.

Another form of emissions regulation is an emissions credit trading system. In such a program, firms that are able to decrease their emissions below the specified amount of emissions they are permitted to emit, can then sell any outstanding emissions credits to another firm that needs it. In this way, firms can profit from decreasing their carbon emissions (Taylor, Pollard, Rocks, & Angus, 2012, p. 268).

Information based approaches to environmental regulation help governments and policymakers make decisions based on evidence based knowledge. For example, policymakers can use these tools to identify which firm and technologies are meeting the state's emissions targets. These instruments complement direct regulations by providing evidence of program and policy effectiveness and providing transparency in private and public decision-making. Studies show these approaches are generally "unintrusive, non-coercive and generally cost effective, but [exhibit] low reliability" (Taylor, Pollard, Rocks, & Angus, 2012, p. 280). Similarly as a policy instrument for economic analysis, the SCC metric has been applied within economic analysis of environmental regulations that are concerned with curbing pollutant emissions by assessing the estimated cost of damages from CO_2 emissions. The metric provides information on how policy alternatives measure the damages done by emissions in monetary terms. Generally, it is implementation of a mix of policy instruments which makes any regulation effective in accomplishing a state's policy goals.

Appendix 5: Case Study – New York

New York: Reforming the Energy Vision Initiative (REV)

REV is a strategy that aims to establish a clean, more resilient, and affordable energy system for the state of New York. REV is changing New York's energy policy as well as altering the way government and utilities operate in order to maximize energy efficiency and create a complete clean energy system. REV is transforming the state's electric distribution utilities, specifically working to move away from serving unmanaged loads and utilizing traditional infrastructure, to running a dynamic platform that offers ratepayers the highest benefits at the lowest cost and maximizes consumers choice. In this way, one of REV's primary goals is to create new infrastructure that supports and helps manage a reliable energy system, which accurately reflects cost reductions and net benefit gains (New York State Department of Public Service, 2015, p. 2).

In the process of establishing REV, the Public Service Commission (the Commission) demonstrated that New York's energy system efficiency and consumer benefits could be improved, while costs could similarly be reduced. The Commission showed that by valuing and providing proper compensation for behind-the-meter generation, active load management, and conservation, the entire system could be upgraded (New York State Department of Public Service, 2015, p. 2). The Commission also acknowledged the need for a consistent methodology to examine and compare opportunities for improvement to the energy system. For this reason, the Department of Public Service (DPS) determined that cost-benefit analysis (CBA) was the best methodology to employ. The use of CBA would ensure that proposed opportunities and technologies were subject to uniform consideration and that ratepayer funds were efficiently utilized.

Overall, REV aims to transform utility decision-making and the consistent application of CBA facilitates efforts to improve ratemaking, energy efficiency, and transparency. In its Order Adopting Regulatory Policy Framework and Implementation Plan, the Commission instructed DPS to develop a detailed CBA framework for considering utility proposals within the REV proceeding. The CBA framework was designed to primarily consider the marginal costs and benefits of Distributed Energy Resources (DER) against traditional utility investments and expenditures in Distributed System Implementation Plans (DSIP) and tariff development (New York State Department of Public Service, 2015, p. 2). Specifically, the framework focuses on four categories of utility expenditures: (I) utility investments to build Distributed System Platform capabilities; (2) procurements of DER via selective processes; (3) procurement of DER via tariffs; and (4) energy efficiency programs (p. 4). Therefore, by considering these four categories of expenditures in utility planning, the framework uses the method of valuing alternative resources in terms of highlighting the traditional costs that can be averted.

The CBA framework created by DPS incorporates the costs of climate externalities in its analysis, specifically using the SCC to monetize the marginal climate damage costs in the state's utility proposals and resource portfolio. It is stated that, "these analyses must include consideration of social values (sometimes called external costs and benefits), quantifiably when possible and qualitatively when not," (New York State Department of Public Service, 2015, p. 6). The external costs DPS accounts for are: (1) net avoided greenhouse gases; (2) net avoided criteria air pollutants; (3) avoided water impacts; (4) avoided land impacts; and (5) net non-energy benefits (p. 12). See Table 3 for further details.

Table 3. Outline of Benefits and Costs Considered in NY REV CBA Framework

	BCA TEST PERSPECTIVE		
BENEFITS	**Rate Impact Measure (RIM)**	**Utility Cost (UCT)**	**Societal (SCT)**
Bulk System			
Avoided Generation Capacity (ICAP), including Reserve Margin	√	√	√
Avoided Energy (LBMP)	√	√	√
Avoided Transmission Capacity Infrastructure and related O&M	√	√	√
Avoided Transmission Losses	√	√	√
Avoided Ancillary Services (e.g. operating reserves, regulation, etc.)	√	√	√
Wholesale Market Price Impacts*	√	√	--
Distribution System			
Avoided Distribution Capacity Infrastructure	√	√	√
Avoided O&M	√	√	√
Avoided Distribution Losses	√	√	√
Reliability / Resiliency			
Net Avoided Restoration Costs	√	√	√
Net Avoided Outage Costs	--	--	√
External			
Net Avoided Green House Gases	--	--	√
Net Avoided Criteria Air Pollutants	--	--	√
Avoided Water Impacts**	--	--	√
Avoided Land Impacts**	--	--	√
Net Non-Energy Benefits (e.g. avoided service terminations, avoided uncollectible bills, health impacts, employee productivity, property values, to the extent not already included above)**	√**	√**	√**
COSTS			
Program Administration Costs (including rebates, costs of market interventions, and measurement & verification Costs)	√	√	√
Added Ancillary Service Costs	√	√	√
Incremental Transmission & Distribution and DSP Costs (including incremental metering and communications)	√	√	√
Participant DER Cost (reduced by rebates, if included above)	--	--	√
Lost Utility Revenue	√	--	--
Shareholder Incentives	√	√	--
Net Non-Energy Costs (e.g. indoor emissions, noise disturbance)**	--	--	√

* See discussion on pp. 14-15.
** These are very item- and project-specific; see discussion in the text at p. 39.

(New York Department of Public Service, 2015: 12)

In terms of implementation, the DPS *Staff White Paper on Benefit-Cost Analysis in the Reforming Energy Vision Proceeding* (14-M-0101) issued on July 1st, 2015 states, "The Clean Energy Fund and Utility Energy Efficiency proceedings will address the process by which utilities, and the New York State Energy Research and Development Authority (NYSERDA), transition from the status quo for Energy Efficiency and other clean energy initiatives. This CBA framework will provide the proposed components of value of DERs, and, where relevant, a consistent set of quantification methods to be used in each of the above related REV processes," (New York State Department of Public Service, 2015, p. 8). Furthermore, in order to ensure analyses are transparent, the DPS calls for each utility to compile, produce, and make readily available a CBA Handbook. A CBA Handbook would describe the utility's benefit and cost components and how the analysis was applied in the evaluation of DER projects.

As part of the CBA Framework, the analysis originally used the SCC. However, according to a state-expert interviewee, New York utilities have recently begun to employ the value of Tier 1 Renewable Energy Credits (RECs) to account for externalities, instead of using the SCC. RECs are market-trade credits for the production of renewable energy. Specifically, NYSERDA defines Tier 1 RECs as, "derived from the energy production of megawatt-hour (MWh) by RES-eligible electric generation sources which first entered commercial operation on or after January 1, 2015. One Tier 1 REC represents the energy production of one MWh," (NYSERDA, 2018). For the Renewable Energy Standard Compliance in 2017, the Tier 1 REC sale price was $21.16/MWh renewable electricity. For

2018, the Tier 1 REC Sale Price is $17.01/MWh renewable electricity. Since the SCC and Tier 1 RECs constitute different values, a state-expert interviewee explained that New York may consider instituting a pricing floor for valuing climate externalities, which would be equal to the most up-to-date SCC value. Moreover, according to the interviewee, New York may work towards utilizing the SCC measurement in this context. This would guarantee that a minimum cost of climate externalities would be accounted for in the REV CBA. As such, if the SCC was utilized in this way, it would serve as a measuring stick, by which to evaluate pricing for externalities and to ensure a minimum threshold is accounted for in utility planning. Utilizing the Tier 1 REC value is only applicable to electricity planning, since natural gas planning still employs the SCC to account for externalities in the state of New York.

REV Clean Energy Fund (CEF)

As one of REV's three core pillars, the CEF is the REV mechanism to follow through on New York's commitment to reduce ratepayer collections, drive economic development, and accelerate the use of clean energy and energy innovation to modernize New York's electric grid (NYSERDA, 2016, p. 1). The CEF's stated goals include: (1) to reduce greenhouse gas emissions through increased efficiency and use of renewable energy; (2) to make customer energy bills more affordable; (3) to deliver $39 billion in customer bill savings over the life of the program; (4) to accelerate growth of the State's clean energy economy; (5) to mobilize private investment; (6) to leverage $29 billion over CEF's timeline; and (7) to provide more value to the customer while reducing ratepayer collections by $1.5 billion by 2025 (p. 1). The CEF utilizes the CBA framework developed by DPS to evaluate where CEF funds would be best used in advancing new clean energy programs, maximizing ratepayers savings, developing infrastructure, and employing capital in an efficient manner. In this way, the DPS CBA, which incorporates the SCC, influences how New York invests public monies in infrastructure and economic development, specifically in regards to utility planning. Incorporating the SCC into CBA supports the development of projects that are low carbon emitting, and therefore an important economic tool in encouraging the production of clean energy, energy innovation, and energy efficiency.

Appendix 6: Case Study – Minnesota

Minnesota's Public Utilities Commission (PUC) is a quasi-judicial regulatory body with authority to regulate electricity, natural gas, and telephone service industries. The Minnesota PUC is given statutory authority to oversee utility services to ensure safe and fair distribution of energy at reasonable rates consistent with Minnesota's energy policies (MPUC, 2018). The commission consists of five commissioners appointed by the governor.

Beginning in 1993, Minnesota began to quantify environmental costs associated with electricity generation in the state with the "Environmental Cost Statute". This statute mandates the Public Utilities Commission to establish a range of environmental costs and required utilities to use these costs "when evaluating and selecting resource options in all proceedings before the commission, including resource plan and certificate of need proceedings." In 1997, the MPUC adopted final values of several electricity generation byproducts including CO_2 after contested case proceedings (MPUC, 2018). However, this did not utilize the federal SCC as determined by the IWG, which was later standardized in 2010.

More than a decade after the final environmental costs were adopted by the MPUC, in 2013, a group of environmental advocacy organizations brought a motion before the commission requesting to update the cost value of CO_2 emissions and recommended the adoption of the federal SCC value. This led the commission through a five-year decision-making process.

The commission first determined that based on scientific evidence the existing values of environmental costs required updating. Then, it opened an investigation into the correct range of values for the environmental cost of pollutants including CO_2. The commission asked the Minnesota Department of Commerce and the Minnesota Pollution Control Agency ("the Agencies") to convene stakeholders to provide recommendations. However, with little consensus among stakeholders, the Agencies recommended to the commission the adoption of the federal SCC at midpoint values (MPUC, 2018). Then, the MPUC referred the investigation to the Office of Administrative Hearing (OAH) with a *Notice and Order for Hearing.* The Commission ordered the parties to determine whether the federal SCC "is reasonable and the best available measure to determine the environmental costs of CO_2 emissions under Minn. Stat. 216B.2422…" (MPUC, 2018, p. 2). In 2015, the Administrative Law Judge (ALJ) filed her finding, which concluded that the federal SCC can be used to quantify the range of environmental costs associated with CO_2 emissions but with two important changes: (1) calculating costs beyond 2200 was not necessary, and (2) calculating the cost of low-probability/high-cost outcomes, the 95th percentile was not necessary.

Following the ALJ's findings, the Commission held proceedings in which the various parties involved filed exceptions to these findings. These parties included MLIG, the Clean Energy Organizations, Xcel, the Agencies, and the Utilities. After hearing oral arguments in 2017, the Commission examined the case, made findings to concur with the ALJ's report, and released a final order to adjust economic assumptions which resulted in a range of $9.05 - $42.36 per ton in 2020 (MPUC, 2018).

In 2013, Minnesota also passed the "Solar Energy" legislation that allows Investor-Owned Utilities (IOUs) to apply to the PUC for a Value of Solar (VOS) tariff as an alternative to net metering and as a rate identified for community solar gardens (Eleff, 2013). Minnesota's VOS includes the avoided environmental costs of solar power relative to other power sources.

To quantify the costs associated with electricity generation, the MPUC uses the *Damage-Cost Valuation Method* and requires parties to continue using this method, which "attempts to place an economic value on the net damage to the environment caused by power-plant emissions" (MPUC, 2018, p. 6). This method is chosen over other methods because it focuses on damages from emissions rather than other variables. The other methods include:

- The ***willingness-to-pay* method**, which measures the amount that society would be willing to pay for reduced emissions;
- The ***cost-of-control* method,** which uses the costs of avoiding or reducing an environmental effect at the source to estimate the value of the externality;
- The ***mitigation-cost* method**, which uses the costs of eliminating the harm or impact of an externality; and
- The ***risk-of-regulation* method**, which estimates future taxes or costs that a utility might incur due to increased regulation of emissions. (MPUC, 2018, p. 6)

In Minnesota, utilities are mandated to integrate environmental costs within the 15-year resource planning, which also requires them to minimize costs. As confirmed by an expert interviewee, when considering the impact of incorporating the SCC within economic analyses, environmental costs are just one component of several factors considered by MPUC. Other factors, including reliability of service, cost to ratepayers, and safety are also valued to assess utility projects and planning brought before the Commission.

Additionally, MPUC runs capacity expansion models which examine adding capacity to Minnesota's electricity generation systems over time and tests for many alternatives to add capacity and to retire units of generation. Within these models, environmental costs of the pollutant are set at a range quantified by MPUC. In this manner, the cost of damage done by pollutants including CO_2 is internalized. Thereby, the model is able to output higher emission energy generation projects as more costly than lower emission projects, i.e. all else being equal, natural gas will be more costly than wind energy.

However, it is important to note that the primary goal of MPUC is to not to minimize social costs but rather to minimize rates. In its decision-making process, the MPUC considers all factors including environmental costs by how the capacity model ranks alternative models. Alternative models that cost the least overall take higher precedence than models that cost more. This is done through resource planning in which MPUC incorporates the SCC metric under "least cost planning" using a social test framework. By incorporating the social cost of pollutant emissions, electrical rates are minimized with the internalization of previously external cost of greenhouse gases including carbon.

Appendix 7: Case Study – Massachusetts

The Boston Harbor Deep Draft Navigation Improvement Project is sponsored by the Massachusetts Port Authority (Massport), a legislatively chartered state authority. This project encompasses the deepening of three tributary channels (Reserved Channel, Mystic River Channel and Chelsea Creek Channel) and two areas in the Main Ship Channel (Inner Confluence and the mouth of Reserved Channel) to provide sufficient ship maneuvering areas for the deepened channels. The scope of the Boston Harbor Feasibility Study and Supplemental Environmental Impact Statement (SEIS) includes problem identification, alternatives formulation, analysis and screening of alternatives, engineering design, cost estimates, environmental assessment, economic cost-benefit assessment, cultural resources assessment, identification of a recommendation plan of improvement, and determination of federal interest. The review process includes the evaluation of technical aspects of the documents as well as NEPA documents. Boston Harbor is located on the western shore of Massachusetts Bay and is New England's largest port handling 25 million tons of cargo annually (US Army Corps of Engineers, 2007). The principal focus of the improvement plan was to examine the feasibility of deepening access from the Conley terminal by at least 45 feet. The improvement plan and cost-benefit assessment are focused on the reduced transportation costs of container shipping. The major environmental benefit from this plan is the reduction of regional air pollution from a decline in truck traffic due to the modal shift from land transportation to waterways. The review also predicts a permanent reduction in the regional air emission after the construction due to the diversion away from trucks to ship (US Army Corps of Engineers, 2013, pp. 2-22). In this study, the SCC metric could have been used in this study for evaluating the alternatives more efficiently.

Appendix 8: Case Study – California

Recent legislation in California requires state agencies to consider the social costs of GHG emissions. For example, California's Administrative Procedures Act, as amended by Senate Bill No. 617 in 2011, requires agency rulemakings for major regulations to account for the benefits associated with regulatory actions, including "nonmonetary benefits such as the protection of public health and safety, worker safety, or the environment." According to California's amended Government Code, Section 11346.36, standardized regulatory impact analyses (SRIAs) should assess and determine the benefits and costs of proposed regulations "in monetary terms to the extent feasible and appropriate" (State of California, 2011).

An example of the use of the SCC in a SRIA comes from an analysis of proposed appliance efficiency standards. The California Energy Commission (CEC), the state's primary energy policy and planning agency, is mandated by law to reduce the wasteful and inefficient consumption of energy and water in California through regulations that prescribe minimum levels of efficiency for appliances sold in the state that consume a significant amount of energy or water. In compliance with California's rulemaking requirements for major regulations set forth by Senate Bill 617, CEC's SRIA -- prepared by the University of California, Berkeley's Department of Agricultural and Resource Economics -- analyzes the economic impacts of its proposed 2018 Appliance Efficiency Standards, designed to reduce electricity usage in desktops, notebooks, small-scale servers, workstations, monitors, and electric signage displays (Roland-Holst, Evans, Springer, & Emmer, 2016, p. 7).

Using the Berkeley Energy and Resources (BEAR) model -- a dynamic economic and policy simulation tool -- the SRIA forecasted the demand, supply, and resource allocation across the statewide economy to estimate the impacts of the proposed efficiency standards. According to the analysis, the standards are expected to save the state approximately 2.3 terawatt hours of energy per year, an estimated $350 million per year in direct net energy savings. The BEAR model also predicts the levels of GHG emission reductions attributable to the standards and employs the SCC to monetize the corresponding avoided global climate change damages as a result. Using a SCC range of $13 to $47 per ton, the proposed 2018 standards would avoid an estimated $11.4 to $41.1 million of climate change damages from 2018-2030 (Roland-Holst, Evans, Springer, & Emmer, 2016, p. 27).