Establishing a Regulatory Foundation for Market-Based Greenhouse Gas Programs

Key Steps to Facilitate State Emissions Trading Programs

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Author & Contact Information

Lead Authors: Carrie Jenks, Grace Van Horn, Sophia Hill, M.J. Bradley & Associates LLC

About M.J. Bradley & Associates

M.J. Bradley & Associates, LLC (MJB&A), founded in 1994, is a strategic consulting firm focused on energy and environmental issues. The firm includes a multi-disciplinary team of experts with backgrounds in economics, law, engineering, and policy. The company works with private companies, public agencies, and non-profit organizations to understand and evaluate environmental regulations and policy, facilitate multi-stakeholder initiatives, shape business strategies, and deploy clean energy technologies.

For questions or comments, please contact:

Carrie Jenks
Senior Vice President
M.J. Bradley & Associates, LLC
+1 978 369 5533
cjenks@mjbradley.com

Introduction

Several states in the U.S. have adopted market-based mechanisms to reduce greenhouse gas (GHG) emissions, and others are now considering similar policies, creating the potential for broader GHG trading markets. Motivated by state GHG reduction goals and climate targets, many states have embraced market-based regulatory approaches because they reduce overall compliance costs by encouraging investment in the most cost-effective abatement opportunities. In competitive energy markets, regulators and market participants have been exploring how to design energy markets to appropriately reflect states' environmental objectives and integrate market-based climate policies. As states consider how best to meet their near- and long-term reduction targets, market mechanisms are expected to feature prominently in the policy discussions. To the extent that additional state and regional GHG markets develop, they have the potential to shape a broader North American GHG policy. For example, they could serve as a foundation for federal policymakers as the means to address EPA's legal obligation to regulate GHG emissions consistent with the U.S. Supreme Court decision in *Massachusetts v. EPA*.

Guided by several examples of successful market-based programs, there are a number of actions that states can begin immediately to help improve environmental and climate policy and lay the foundation for potential GHG markets. These existing programs have a proven track record of success, both in helping to reach environmental targets and in integrating a GHG price into other systems and decisions, such as electricity markets. This paper discusses key actions that states might consider to start building a foundation for potential GHG markets. Many of these foundational actions require lower levels of resources and policy commitments and can be started even as states are still exploring their GHG reduction options. In this process, states can build off the experience of operational GHG markets and design programs that leave options open for future collaboration or links between markets.

Linkage Highlight Boxes

Throughout this paper, we have highlighted numerous considerations for policymakers who are developing programs that can link with other GHG markets. As a reference, we have pulled some of the key questions and issues that policymakers will need to address into call-out boxes like these.

Existing North American GHG Markets

Market-based mechanisms have a long track record in the United States—they have been successfully employed in reducing sulfur dioxide (SO_2) and nitrogen oxide (NOx) emissions from power plants, and there are currently two successful cap-and-trade programs in North America that regulate GHG emissions. The Regional Greenhouse Gas Initiative (RGGI), a coalition of linked carbon dioxide (CO_2) trading markets, was formed in 2005 when a group of northeast and mid-Atlantic states signed a memorandum of understanding (MOU) that outlined a cap-and-trade model rule.[1] Each of the nine participating states—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont—has adopted and approved an individual CO_2 Budget Trading Program that applies to all fossil fuel-fired power plants 25 megawatts (MW) or larger. Virginia and New Jersey are also developing regulations to join or trade with RGGI. Each state is responsible for establishing state targets in alignment with the overall RGGI targets, with the majority of emissions allowances (each worth one short ton of CO_2) sold through a regional auction and the proceeds returned to the participating states.

The other successful North American GHG cap-and-trade program spans California and two Canadian Provinces.[2] The program structure is based on the program designed by the Western Climate Initiative (WCI), a coordinating initiative initially established by agreement between California and other western states. Active since 2013, this cap-and-trade program covers not only electricity production and imports but also industrial facilities, transportation fuels, and natural gas distribution. Additionally, it covers seven primary GHGs, measured in metric tons of CO_2 equivalent (CO_2e).[3] In total, the program places an emissions limit on entities responsible for over 85 percent of the state's GHG emissions. Since 2014, the program has been linked with a similar program in Québec, and on September 17, 2017, Ontario signed an agreement with California and Quebec to link programs beginning January 1, 2018.

Both RGGI and California are widely considered to have been successful in achieving their goals of promoting and creating a framework for short- and long-term emissions reductions. Additionally, both programs have directed significant investment into energy efficiency measures and other clean energy programs. California recently extended its program, passing legislation in June 2017, directing the Air Resources Board (ARB) to establish a cap-and-trade regulation that is applicable from January 1, 2021 (the expiration date of the current explicit legislative authority for a cap-and-trade program) through December 31, 2030. The legislation included important programmatic changes.[4] RGGI also recently released a revised Model Rule that extends the program until 2030.[5] In both programs, the electric grid operators in these states (i.e., the California Independent System Operator in California, and PJM, New York Independent System Operator, and ISO-New England in the RGGI region), have all successfully integrated these programs' GHG prices into wholesale electricity markets.[6] This

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1 Note that throughout this paper we discuss "GHG markets," which we use to include all market mechanisms to trade GHG allowances. In RGGI, this is limited to CO_2, the most common GHG, though California and other programs under development include additional gases.

2 For ease and to focus on United States' domestic actions, we will refer to this as the California program throughout this paper.

3 The covered gases under the California and broader WCI program are: CO_2, methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF_3).

4 Key programmatic changes included the extension of the program until the end of 2030, the addition of a hard price ceiling, reduced ability to use offsets to meet compliance obligations, reduced allocation of free allowances for medium- and low-leakage risk industrial industries, and increased transparency and straightforwardness of allowance banking rules. For more details, see http://mjbradley.com/reports/california-cap-and-trade-update-legislation.

5 The Regional Greenhouse Gas Initiative, "Model Rule and MOU Versions" (2017), https://www.rggi.org/program-overview-and-design/design-archive/mou-model-rule.

6 In California, CAISO is currently implementing various market changes that create stronger connections between California's electric market and other regional balancing areas through an energy imbalance market. As part of this process, CAISO has proposed a mechanism to reflect GHG prices in clearing prices that will reflect this greater

means that market rules require bidders to account for GHG costs when setting the market structure and determining prices, which in turn is reflected in various ways in customer rates across the states in these GHG markets (for more details on how this works in energy markets, see the "Incorporating a GHG Price" call out boxes below on page 22).

Linkage: A Brief Overview

A key programmatic component of a GHG market is the ability to "link" markets together in order to form a larger, broader market. The benefits of linkage have been explored extensively by other papers (see box below). In general, the benefits include administrative efficiencies, lower costs as participants have the flexibility to pursue least-cost reduction opportunities across a broader market, and more stable markets. Linkage across programs fosters a number of positive market dynamics, most importantly a single allowance price across all linked jurisdictions.[7]

There are various approaches that regulators can take to link with other markets. Multiple jurisdictions can initiate the market development process together and design a multi-jurisdictional market from the ground up similar to the formation of RGGI. Alternatively, a single jurisdiction can establish a market and lay out a designated linkage process, through which additional jurisdictions could later link to their program if they so choose—often called "trading-ready" programs. California's program, though designed through WCI, which was meant to be a larger market from the beginning, effectively took this path, designing and launching its own market program. Quebec and Ontario subsequently designed programs that met WCI/California's requirements and have linked to that market. Quebec and Ontario's programs were effectively "trading-ready" in the context of the California program because, upon implementation, entities from each jurisdiction could trade allowances with others. States could also develop "trading-ready" programs that are intended to link with each other through the implementation of common program components. As states look to design their own market-based programs, they may want to develop a "trading-ready" program, with an eye toward eventual compatibility across a broader set of states, even if they initially implement it as a stand-alone (i.e., not linked) program, in order to leave options open and minimize the administrative or regulatory barriers for future linkages.

Brief Literature Review

Papers by other researchers have explored the ways in which existing market-based programs could be developed to link with each other or with developing programs. Though this paper is focused on steps to consider in developing a single state GHG market, a key question in that process is whether a state wants to have the option of linking with another state program. The earlier work provides a useful framework for categorizing the individual components of cap-and-trade and other market-based GHG reduction programs. The following summarizes a few of these key works.

Linking Regional Cap-and-Trade Programs: Issues and Recommendations
In 2010, the Georgetown Climate Center (GCC) published results of a collaborative effort among key policymakers across three existing and potential cap-and-trade regions:

- WCI, which at the time involved more than a dozen partner and observer states and Canadian provinces ranging from California to Kansas to Quebec;
- RGGI; and
- the Midwest Greenhouse Gas Reduction Accord (Midwest Accord), a commitment of six Midwestern states and one Canadian province to pursue GHG reductions through joint markets.

The paper analyzed various benefits and challenges of linking. It identified components across the three programs that were "ready for linking," as well as technical issues that could hinder the ability to create linkages across markets.

(continued)

coordination with areas that do not currently participate directly in a GHG market (since California's program is largely limited to generation in or imported to the state).

[7] There are limited exceptions to this rule through the application of allowance "exchange rates," which are used when markets wish to link but have different tolerances/requirements for GHG prices. See Resources for the Future discussion in "Linking by Degrees," cited below.

Brief Literature Review *(cont.)*

The paper concluded that two key steps states could take to begin preparing to link the three regional programs were: (1) harmonizing administrative systems and (2) evaluating the impacts of linking the programs. In addition, the paper noted that "linking is not an all-or-nothing decision—there are different types and degrees of linking, and the regions could take some of these steps now while reserving other decisions for later."

Linking by Degrees: Incremental Alignment of Cap-and-Trade Markets
Resources for the Future (RFF) built on GCC's work and in 2013, published a paper that identified how individual cap-and-trade programs can benefit from aligned program elements, even before or without linking. The paper provides a technical overview of the program elements that would need to be aligned before formal linkage—i.e., the trading of allowances across programs—and identified priorities for aligning elements based on the ease and importance of doing so. However, the paper also emphasized that "the process of aligning programs has its own rewards"—that the incremental alignment of program elements, what they termed "linking by degrees" can capture significant administrative, institutional, and political benefits. The paper applied this two-tier framework to ongoing efforts to connect the RGGI and WCI programs, including evaluating these programs' readiness for trading emissions allowances within a common market and modeling of the resultant potential economic consequences.

Recently, RFF also released a paper evaluating the linking of systems that have different designs, *Linking Carbon Markets with Different Initial Conditions*. The paper focuses on the stringency, offsets, price collars, and legal difference to consider the potential implications for each in linking the California and RGGI programs. The paper recommends that policymakers consider and address potential effects due to linking and discuss potential options. This could include the use of an exchange rate between programs' allowances, though the authors are cautionary about this approach. It also notes that "the path forward for linking would appear significantly easier if programs initially have comparable stringency before linking is pursued," but "incremental alignment of institutions, program design, and stringency represents an important but informal linking by degrees that points toward eventual broad-based GHG policy.

Other existing works have explored how states might develop "trading-ready" programs. As discussed above, a "trading-ready" plan allows states the flexibility to potentially begin trading with other states, when appropriate, without having to enter into a formal partnership or "join" an existing multi-state regulatory program from the beginning. Stakeholders also discussed this concept in the context of planning for the EPA's Clean Power Plan and RGGI's 2016 programmatic review, gaining widespread acceptance.[1] The papers summarized below characterize key considerations for linkage that remain relevant for future GHG market development, even without a federal electric sector GHG reduction requirement.

Implementation Elements for a Trading-Ready Mass-Based Plan
This 2015 brief, jointly written by the Bipartisan Policy Center and the Great Plains Institute, outlines thirteen steps states can take to establish and administer an informal trading-ready program. These steps require minor intrastate coordination and do not require formalized intrastate agreements.

RGGI and CO_2 Emissions Trading Under the Clean Power Plan: Options for Trading Among Generating Units in RGGI and Other States
Published in July 2016, an Analysis Group report explains the various options for states to become trading-ready, as well as considerations while doing so. The report addresses three core issues surrounding "trading-ready" plan preparation:

- Threshold alignment issues
- Key policy/program design considerations
- Emissions caps and other trading considerations

The report explains that clarifying the alignment of the two programs will increase stability, predictability, and efficiency in power sector investments, in government administration, and in minimizing compliance costs passed along to electricity consumers in RGGI states. The report provides guidance for RGGI states to harmonize their program with EPA compliance requirements and highlights options for states to create "open architecture" to expand trading opportunities with states inside and outside the RGGI region.

The Clean Power Plan and Existing Emissions Trading Programs: Aligning National Goals with the Regional Greenhouse Gas Initiative and California's Cap-and-Trade Program
In May 2016, M.J. Bradley released a paper that identifies RGGI states' and California's general Clean Power Plan compliance options, as well as key issues and questions that these states will need to consider in aligning their existing mass-based GHG trading programs with the Clean Power Plan. The paper highlights both potential benefits and challenges of various aligned compliance plan approaches under the Clean Power Plan.

Notes:
1. Comments in the RGGI docket supporting trading ready programs include: New York ISO (November 17, 2015); Environmental Defense Fund (February 2, 2016); and MJB&A Clean Power Plan Initiative (February 19, 2016). All comments may be found at https://www.rggi.org/design/2016-program-review/stakeholder-comments-2016.

Summary of Key State Foundational Actions

The development of a GHG market can require several layers of regulatory actions. This paper highlights key actions that states can take to start building the foundations for such a program. The actions described in this paper start with the critical administrative processes to inventory and measure GHG emissions. The paper then details how states can begin a process of developing the relationships and partnerships that will help refine program design over time. Finally, it identifies framework components of GHG markets that states can begin exploring depending on the priorities and goals related to GHG emissions reductions. In general, while some states may find that legislative authorization is necessary to establish certain components of a GHG market, most are likely to find that existing regulatory authority provides a framework for taking significant steps forward and even for starting to implement a GHG market. For each section, we highlight key decisions that states will need to make, as well as considerations for regulatory agencies that want to leave open options to forming partnerships or linkages with other GHG markets.

The tables below summarize each of these foundational actions and key considerations discussed in the paper. The tables also note how important each issue might be for linkage with existing programs, taking into account economic/market function considerations as well as policy and political considerations. The following definitions apply to the "importance for linkage" column:

- Low: specific design elements are not necessary to link markets
- Moderate: certain design elements may be necessary to align for linking in order to facilitate well-functioning markets or to make it simpler and more straightforward to meet existing market linkage requirements
- Critical: is highly recommended that states evaluate and design these elements with linkage in mind, including evaluating any formal linkage requirements of existing programs.

Foundational Data Assessment: *accurate data is the backbone for any well-functioning market, and even without determining an exact structure for a future GHG market datasets can be developed that will support modeling and future considerations of market design features*				
	Description	Linkage Considerations	Importance for Linkage	Timeline to Address
GHG Inventory	Estimate of past GHG emissions	• Are the gases and sectors covered consistent with possible partners? • Does the inventory help identify emissions relationships with other states (i.e., leakage, trading opportunities, economic interdependencies)?	**Low** to **moderate** *(consistency with other parties not necessary, but can help identify opportunities and may be necessary for accurate import considerations)*	**Early** *(scoping and pre-program development)*
GHG Monitoring & Reporting	Process for GHG emitters to measure and report their annual emissions	• Are the gases and sectors covered consistent with possible partners? • Are requirements and timeline consistent with other states'? • Are requirements appropriately rigorous?	**Moderate** *to* **Critical** *(some linkage partners may require consistency of covered sectors/gases to ensure stringency; timelines must be enough aligned to allow for joint compliance schedules)*	**Early** *(scoping and pre-program development)*
GHG Modeling	Dynamic economic and/or electricity system modeling that solves for emissions reductions given program design choices and other constraints	• Does modeling show potential impacts on other states? • Does linkage improve program outcomes? • How robust is the system against changes in conditions, such as changing fuel prices or electricity demand? • How close is a business as usual trajectory to emissions reduction goals? • What are business as usual emissions assuming "on the book" policies?	**Low** to **moderate** *(consistency with other parties not necessary, but can help identify emissions outcomes, efficiency opportunities, and possible interactions with partners)*	**Early** *(scoping and pre-program development)*

Stakeholder Engagement: *steps to develop a process to engage with critical stakeholders, including establishing processes for soliciting and incorporating input and developing communications channels*				
	Description	Linkage Considerations	Importance for Linkage	Timeline to Address
Stakeholders within the State				
State and Regional Bodies	Other regulators in the state (e.g., PUC/PSC as well as those of other sectors), energy market operators, or regional conveners	• Early coordination can help identify state-specific issues that could otherwise present barriers to linkage • Regional bodies can share best practices and progress across states	**Moderate**	**Mid-term** *(program design and development phase)*
Regulated Parties	Entities that are likely to have a compliance obligation under the proposed GHG market	• Compliance entities that operate in multiple states can share lessons learned from participation in existing markets and help identify important program consistencies	**Moderate**	**Mid-term** *(program design and development phase)*
Third Parties	Environmental organizations, academic institutions, community and affinity groups, customer advocates, etc.	• Early coordination can help identify state-specific issues that could otherwise present barriers to linkage	**Moderate**	**Mid-term** *(program design and development phase)*
Stakeholders Outside the State				
External Parties	State regulators and stakeholders from other states in the same energy market; that may be affected by a state's GHG market, or that could be interested in linking	• Identify program components important to align with potential partners • Take advantage of existing administrative processes, regulatory texts, and other tools	**Critical**	**Early** *(scoping and pre-program development)*

Market Features: *components of market infrastructure that states can begin developing with stakeholder input, with an eye toward avoiding barriers to collaboration with other programs*				
	Description	Linkage Considerations	Importance for Linkage	Timeline to Address
Allowance Tracking	System that tracks the distribution, ownership, trading, and submission for compliance of allowances.	• What opportunities exist to utilize existing platform(s)? • Does any new system allow for transfers to and from external tracking systems? • Are the system's core requirements consistent with (potential) partner systems?	**Critical**	**Early** *(in developing initial systems requirements and infrastructure)*
Cap Setting & Emissions Reduction Targets	The total amount of emissions that can be released per year	• Is stringency consistent with requirements for linkage with other programs (including factors such as the reduction trajectory and baseline emissions)?	**Moderate** *to* **Critical** (*will need to ensure stringency is consistent with linkage partner requirements; separate caps would lead to revenue flows across linked areas)*	**Mid-** to **Long-term** *(can potentially address through later program updates)*
Offsets	Compliance instruments (in same units as allowances) that represent emissions reductions from projects outside covered sources	• Are offset protocols consistent with potential partners'? • Are offset use limitations in place in line with partner program requirements?	**Critical** (*ensure stringency is consistent with linkage partner requirements)*	**Mid-term** *(program design and development phase)*
Banking & Borrowing	Ability to use allowances for compliance that are from years other than the compliance year	• Is borrowing allowed in potential partner programs? • Are multi-year compliance periods aligned (or able to be aligned) with other programs? • Does the program allow banking (either unlimited or to a certain level?)	**Moderate** *to* **Critical** (*especially concerning borrowing, ensure stringency is consistent with linkage partner requirements)*	**Mid-term** *(program design and development phase)*
Price Control Mechanisms	Market mechanisms that limit allowance prices, either at the low end ("floors") or high end ("ceilings")	• Are any price ceilings consistent with other programs? • Are price floors set at a level that allows for smooth market integration across programs?	**Critical** (*ensure stringency is consistent with linkage partner requirements)*	**Mid-term** *(program design and development phase)*
Allowance Distribution & Revenue Use	Means of introducing allowances into the market, which can include giving allowances to compliance entities for free (allocation) or running auctions.	• Does an allocation methodology create incentives for behavior that differ from other regions'? • Does an allocation methodology address the possibility of leakage across state lines or between linked programs? • If using auctions, is the schedule aligned with possible partners?	**Low**	**Long Term**

Foundational State Action: Data Assessment

A potential starting point for states considering establishing a GHG market is assessing the level of past, current, and projected future GHG emissions in the state. Understanding these data provide the backbone for any well-functioning market and can be developed without a state needing to decide the exact design of the final regulatory policy. In this way, the components highlighted below provide opportunities for states to begin to develop foundational elements of GHG markets without needing to commit to final reduction goals or covered sources, for example. Additionally, as states begin to make decisions about establishing data assessment programs and procedures, they can start to consider which components would be helpful to harmonize with other programs if there is a desire to potentially link the program with other states in the future.

A GHG Inventory, a GHG Monitoring and Reporting System, and GHG Modeling provide the backbone for any well-functioning market and can be developed without a state needing to decide the exact design of the final regulatory policy.

GHG Inventory

The adage "you can't manage what you don't measure" is apt in the creation of well-functioning GHG markets. An inventory of state GHG emissions can help states identify past and current emissions levels, major sources of emissions, and possible avenues for emissions reductions. Inventories are often conducted using economic activity data, energy inputs, and other variables (as opposed to explicitly reported GHG emissions, which are discussed in more detail below). Since many states have or are considering emissions reductions targets based on past year benchmarks (e.g., a certain percentage reduction levels from 1990 levels), emissions inventories can be a critical step in determining appropriate emissions targets.

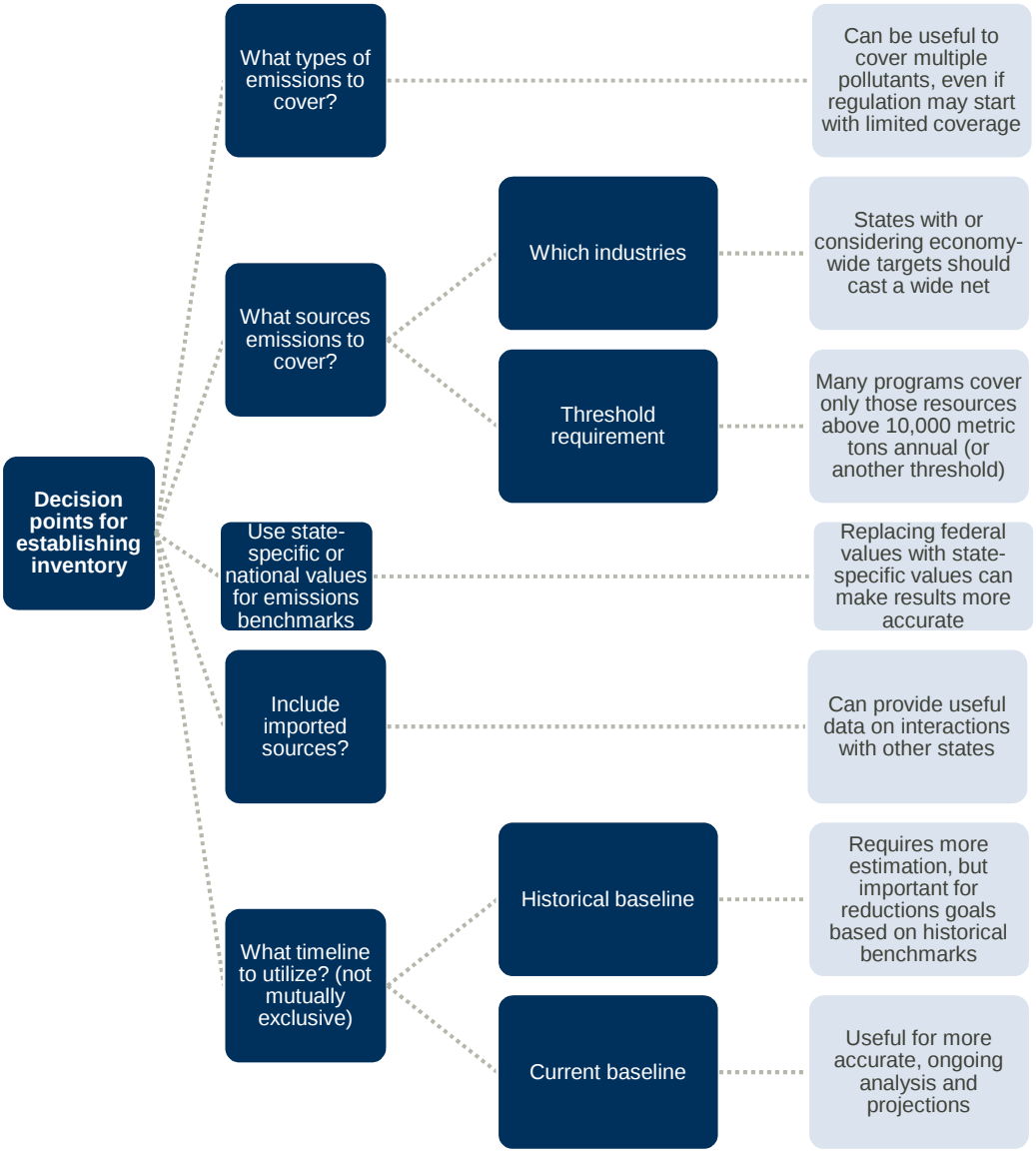
For ideas on how to structure this process, states can start by understanding existing GHG emissions inventories. For example, EPA has conducted annual GHG emissions inventories since the 1990s. This comprehensive report accounts for virtually all gases emitted to the atmosphere including CO_2, methane, and nitrous oxides, but also details emissions of fluorinated gases (HFCs, PFCs, SF_6, and nitrogen trifluoride). The inventory reports emissions by source from both energy and non-energy uses including mobile and stationary fuel combustion, as well as agriculture, metals production, industrial processes and product use, and more. The methodology combines recorded economic output from these sectors (e.g., sales and production data) with emissions benchmarks per unit of production to come up with an estimated emissions level associated with economic activity. In accordance with the United Nations Framework Convention on Climate Change, EPA includes both sources of anthropogenic emissions and sinks. Emissions estimates are made using methodologies consistent with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and with published information for activity data and emissions factors.

Additionally, states currently conduct annual and triennial emissions inventories for primarily non-GHG criteria pollutants as part of EPA's National Emissions Inventory.[8] This has been incorporated into state regulatory processes differently in each state. For example, in Virginia, the Air Pollution Control Board directs the agency to "develop a comprehensive program for the study, abatement, and control of all

[8] U.S. Environmental Protection Agency, National Emissions Inventory (NEI), https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei.

sources of air pollution in the Commonwealth."[9] In addition, individual states have established GHG emissions inventory processes. For example, the California Energy Commission released its first GHG emissions inventory in 1990 (using 1988 data); the Air Resources Board since 2006 has been responsible for an annual inventory.[10] These inventories cover electricity, industry, transportation, waste management, agriculture, and lands management, primarily using bottom-up analyses based on fuel deliveries and usage data.

Figure 1. Key Decision Points in Establishing a GHG Inventory Process



As shown in **Figure 1**, in establishing a process for developing a GHG inventory, states will need to make a number of key decisions. First, they must determine which emissions will be included in the inventory,

[10] California Energy Commission, California Energy Commission's Climate Change Activities, http://www.energy.ca.gov/climatechange/.

Example: New York State Greenhouse Gas Inventory of Emissions in 1990-2014

States' ability to conduct inventories of their historical emissions is crucial to developing, implementing, and tracking emissions reductions goals. EPA's readily- and publicly-available tools and methodologies, such as the EPA State Greenhouse Gas Inventory (SIT) software and the methods provided in the Emission Inventory Improvement Program (EIIP) guidance document, provide useful tools for states in creating these historical emissions inventories.

New York is one of many states that has relied on EPA data and methodologies to prepare its emissions inventory. New York's Greenhouse Gas Inventory report, which estimated in-state emissions from 1990 to 2014, uses SIT and EIIP tools, default emissions, and methodology as a baseline to do so. However, New York made modifications to the inventory to make it more applicable and accurate for the state.

One modification that New York made was to replace default national coefficients, calculated by the EPA, with state-specific coefficients. For example, in calculating fuel consumption from residential, commercial/institutional, and industrial sectors, the state replaced SIT-provided default data with state-specific fuel consumption data, found in the 2016 Patterns and Trends report from the New York State Energy Research and Development Authority (NYSERDA).

Additionally, in calculating natural gas consumption, if state-specific historical data was lacking, New York relied on national consumption estimates released by the U.S. Energy Information Administration until the year at which state-specific numbers became available, beginning in 2014 in this instance. The calculation of transportation emissions inventories also relied heavily on New York's state-specific data to calculate metrics such as Vehicle Miles Traveled (VMT). New York also used Federal Highway Administration (FHWA) marine vehicle gasoline sales to estimate historical off-road motor gasoline consumption.

New York also improved its emissions inventory by excluding emissions sources when not applicable. For example, when calculating industrial non-fuel emissions, the State excluded default EPA data for taconite, lime, and ammonia, as these industrial processes are either not found in New York or do not have reliable or complete data.

Notes:

1. New York State Greenhouse Gas Inventory: 1990 – 2014, Final Report (December 2016). https://www.nyserda.ny.gov/-/media/Files/EDPPP/Energy-Prices/Energy-Statistics/greenhouse-gas-inventory.pdf

including both the sources of emissions as well as the specific gases. Here, states may see a benefit in casting a wide net to ensure the collection of comprehensive statewide data. This can be useful even if a state is currently considering only regulating certain gases (e.g., CO_2) or certain industries (e.g., electricity). For example, New Jersey's 2012 GHG emission inventory (covering 2009 data) covered all sectors of the economy and a broad range of GHGs, including methane and SF_6 in addition to CO_2.[11]

Another important consideration for states could be whether to include emissions from imported sources, particularly electricity. For many states, a significant portion of the state's electricity, and thus emissions from that sector, is produced out of state. For these states, an accurate picture of the state's GHG profile may include these "imported" emissions. In addition, understanding the portion of emissions associated with out-of-state producers of electricity can help inform future program design choices, such as whether to impose compliance obligations on imported electricity (this may be important to avoid the incentives that would otherwise arise to increase reliance on non-regulated imported electricity to the detriment of in-state generators). In particular, states will need to be deliberate about whether to include an estimated inventory of emissions imports from other states with existing or potential GHG markets that could be future linking partners. This information can help lay the groundwork for future conversations about how to account for electricity that crosses between linked programs, which can be critical to address for smooth and efficient market operations.

[11] New Jersey Department of Environmental Protection, "Statewide Greenhouse Gas Emission Inventory for 2009" (November 2012), http://www.nj.gov/dep/sage/docs/ghg-inventory2009.pdf. Note, however, that, at the time of the 2012 inventory, New Jersey's GHG market was in conjunction with RGGI, which only covered CO_2 emissions from the electricity sector.

GHG Monitoring and Reporting

GHG emissions inventories are a critical tool for determining broad, industry-wide estimates of emissions, but greater data precision is necessary to support a market-based trading system. To improve emissions measurement, states could establish a framework for GHG monitoring and reporting. GHG monitoring and reporting can also help identify opportunities for emissions reductions and other investments, provide more detail to local policymakers and stakeholders, and track year-over-year performance. These processes can feed into GHG inventories, making them more accurate.

Similar to the process for developing a GHG inventory, states exploring GHG monitoring and reporting can learn from existing programs. Since 2010, EPA has required a range of entities to report GHG emissions under its GHG Reporting Program (GHGRP) (see box for more detail.) [12] RGGI states and California also have existing GHG reporting regulations. These regulations incorporate numerous sections of EPA's GHGRP, but make additions or changes to reflect specific state goals, regulations, or industries. For example, California requires that all flow meters and other measurement devices that provide data used to calculate GHG emissions or product data comply with the relevant requirements of the EPA regulations.[13] Massachusetts adopts the federal language in the Code of Federal Regulations (CFR) establishing the Mandatory Greenhouse Gas Reporting Program (40 CFR 98) as well as large parts of the federal Continuous Emissions Monitoring (CEM) requirements for SO_2, NOx, and CO_2 (40 CFR 75).[14] Connecticut

Example: EPA GHG Reporting Program

EPA developed its reporting program regulation as the Obama Administration was developing and considering possible GHG reduction programs and more than four years before the Agency released the draft Clean Power Plan. The reporting rule now covers 41 categories of emitting facilities, ranging from electricity production to food processing to soda ash manufacturing. Approximately 8,000 facilities nationwide report their GHG emissions each year by March 31, and EPA releases annual data each October. While the GHGRP does not require reporting from all sources, it accounts for 85 to 90 percent of emissions in the U.S. and is mostly facility-level. Gases that must be reported include CO_2, methane, and N_2O.

EPA's GHGRP requires reporting from, among others, all sources of emissions located in the U.S. that emit at least 25,000 metric tons of CO_2e per year. Some of the entities subject to reporting include direct GHG emitters, fossil fuel suppliers, industrial gas suppliers, and facilities that inject CO_2 underground for any reason. The GHGRP also requires facility-level reporting for direct emitters from either fuel combustion or processing such as iron and steel production, cement production, and more. The program includes some provisions that are specific to certain industries, such as requirements that underground CO_2 injection sites must report by facility using standard industry calculations for mass and volumetric flow. Alternatively, the basic facility-level reporting excludes fuel and gas suppliers, which are instead required to report GHG quantities that would be emitted from combustion or use of the products that have been supplied, imported, and exported during the year. Reporters use business transaction documentation for quantities of product supplied and mass balance methods to determine emissions based on reporter-specific emissions factors.

Notes:
1. EPA Mandatory GHG Reporting. https://www.epa.gov/ghgreporting/resources-subpart-ghg-reporting
2. Greenhouse Gas Protocol. http://www.ghgprotocol.org/.
3. Greenhouse Gas Reporting Program and the U.S. Inventory of Greenhouse Gas Emissions and Sinks. https://www.epa.gov/ghgreporting/ greenhouse-gas-reporting-program-and-us-inventory-greenhouse-gas-emissions-and-sinks

12 *See* 74 FR 56260 (October 30, 2009).

13 Cal. Code of Regulations §95103(k)(2)

14 310 CMR 7.71 (5)(c)(6) "In cases where emissions from a particular emission source are being reported to the United States Environmental Protection Agency pursuant to 40 CFR Part 98, the same methodology shall be utilized to quantify the emissions from that source for the purpose of reporting the emissions pursuant to 310

adopts emissions monitoring requirements and certification tests from the federal CEM rules, with a few exceptions.[15]

Given that many facilities and companies throughout the U.S. already are familiar with these existing federal and regional reporting processes, states considering new reporting regulations and statutes could harmonize their state programs to existing ones. This coordination would make it simpler for compliance entities that must report to both federal and state bodies and for those entities that own and operate facilities in multiple states. Existing tools such as the World Resources Institute's Greenhouse Gas Protocol also provide a suite of standards, guidance, tools, and training opportunities for business and government leaders to quantify and manage GHG emissions.[16]

CMR 7.71. *See* 310 CMR 7.00: Air Pollution Control *at* p. 952, http://www.mass.gov/eea/docs/dep/service/regulations/310cmr07.pdf.

[15] Regulations of Connecticut State Agencies Sec. 22a-174-31. Control of carbon dioxides emissions. Section (i) Monitoring and Reporting: "Requirements for installation, certification, and data accounting. The owner or operator of each CO_2 budget source shall:

(i) Install all monitoring systems necessary to monitor CO_2 mass emissions in accordance with 40 CFR 75, except for equation G-1. Equation G-1 in Appendix G of 40 CFR 75 shall not be used to determine CO_2 emissions under this section. This may require systems to monitor CO_2 concentration, stack gas flow rate, O_2 concentration, heat input and fuel flow rate;

(ii) Successfully complete all certification tests required under this subsection and meet all other requirements of this subsection and 40 CFR 75 applicable to the monitoring systems installed under subparagraph (A)(i) of this subdivision"

[16] Greenhouse Gas Protocol website, http://www.ghgprotocol.org/.

Creating Monitoring and Reporting Systems

States that wish to establish monitoring and reporting regulations that can easily link or trade with another state will need to consider the following key questions:

- Which entities will be required to submit reports under the regulation? Should there be an emissions threshold to trigger reporting requirements?

  This threshold does not necessarily have to align with future market compliance requirements. For example, California requires electric generation facilities with emissions greater than 10,000 metric tons CO_2e to report their emissions, but only those facilities with emissions over 25,000 metric tons CO_2e must comply with cap-and-trade requirements.

- Should the covered reporting sectors and gases align with inventory processes, including the same range for reporting requirements?

  Consider whether coverage aligns with potential linkage partners, as well.

- Is it appropriate to phase in reporting requirements across industries over time?

  Phased requirements can help industries and regulators adjust to new obligations, but it is important to ensure that enough requirements are in place to provide data for conversations with linkage partners.

- What is the appropriate schedule for entities to report emissions?

  Policymakers should consider that reporting timelines can be a primary determinant of eventual market compliance timelines and consistent compliance timelines may be critical to future links between programs. In addition, ensuring consistent reporting timelines at the beginning of program development can help states avoid barriers to future linkages. If states identify reasons for establishing differing reporting schedules (perhaps based on existing state administrative procedures), these states may also want to consider how to phase in changes to reporting schedules to move toward alignment in the long run.

- What design elements should be included to ensure rigor and verification?

  Both RFF and GCC highlight these categories of elements as key requirements for linking. For example, it is important for states' monitoring and verification processes to provide policymakers with confidence that reported emissions are accurate and provide opportunities for amendments to misreported data. Utilizing experience and standards from existing programs can not only reduce a state's administrative burden to develop a new program but also help assure potential future trading partners that entities across states are held to similar emissions reporting requirements. Imposing consistent or similar requirements can also help lower regulatory burdens for compliance entities that operate facilities in multiple states.

- What units of emissions should be used for reporting and potential future market program compliance?

  Currently, RGGI and EPA require reporting in short tons, while the U.N. and WCI gather data in metric tons. Though differing units would not inherently restrict trading among states, it can create market complications and would require additional administrative processes. States establishing new programs with potential trading partners in mind can establish reporting units consistent with those of potential partner states.

GHG Modeling

Another useful early step for developing a GHG market framework is conducting modeling of how a GHG limit could affect various covered sectors. This exercise can be a useful way to engage a broad range of stakeholders, as discussed in the following section, and begin building a network of experts and advisors. These stakeholders can provide input on modeling assumptions that serve to make the model results more reflective of real world conditions and begin a discussion about GHG emissions reductions activities already underway. Stakeholders can also help identify preferred design elements (see box). Working with external stakeholders can also help add transparency into the modeling platform, including inputs, assumptions, and policy cases, which can improve understanding and agreement around the modeling results.

For any modeling, it will also be important to use modeling to determine a "business as usual" projection of emissions that takes into account state-specific factors. This can then become the starting point for cap-setting and evaluating an annual reduction trajectory.

In addition, the results of modeling can help identify key areas of focus for regulators. This could include specific design elements that are shown to have large impacts on market operations and GHG price results and/or total costs passed on to customers (note that the market GHG price and customer cost are not necessarily the same). These elements can then be given specific attention in the regulatory process. Modeling can also help identify opportunities and effects within particular sectors (e.g., larger

Modeling: Key Inputs, Outputs, and Insights

A GHG modeling exercise can provide numerous benefits and insights to the development of a robust GHG market program. In order to be most effective, this will generally require strong stakeholder engagement and analysis of multiple sensitivity cases to understand how results can vary under different assumptions. This may include alternative forecasts of fuel prices, economic conditions, and technology costs. Since modelers cannot know exact future conditions; the differences between the results of these cases can help states design programs that are most likely to work under a variety of conditions, and provide directional if not fully predictive results. Cases may also vary market design options (such as trading, cost containment mechanisms, and use of allowance value). Certain design elements can be more difficult to model than others, especially if they have dynamic impacts on other inputs or outputs (e.g., modeling the impact of investment of revenue requires assumptions about numerous economic factors); however, developing different cases can help test a program design across multiple assumption sets. In designing cases, it is important that modelers note the uncertainties and limitations resulting from the model design. The modeling should also include a "business as usual" case, providing a baseline from which to compare the policy case forecasts.

Below we highlight key elements for a successful GHG model and insights that policymakers may pursue.

Key Inputs

- Existing sources of emissions and activity levels
- Emissions caps and reductions trajectories: as discussed in more detail below, a state could model multiple emissions caps in different policy cases
- Existing emissions reductions policies: modeling should incorporate companion policies in place in a state, such as building efficiency codes or renewables procurement standards
- Key sectoral economic projections: this includes costs of operations as well as demand for products; in the electricity sector, for example, this would include projections of electricity demand as well as prices of inputs such as natural gas and coal
- Emissions reductions technology costs: states could utilize a range of cost projections and will likely want to use projections that change over the modeling horizon (i.e., as technologies develop, costs come down)
- Scope of market: ideally, modeling can be conducted across a multi-state area that allows states to gauge the impact of linkages across states
- Key market policy decisions: emissions reductions could be affected by certain policy decisions. These could include allowance distribution methodologies, provisions to allow entities to bank allowances, provisions for trading with other parties within and outside, and price floors or ceilings.

(continued)

reductions are shown to occur in one industry compared to another, or specific concerns for trade exposed industries) and can help decide whether program design should include provisions to address or mitigate those effects.

Finally, modeling results can provide states with important information on how a new GHG market could lead to leakage or affect other states under various scenarios. These results can serve as starting points to begin conversations with other states and possibly to help prioritize potential linkage partners. Modeling can also help states learn about and quantify the impacts of policies in place already (which is necessary to develop a business as usual emissions trajectory) across a potential linkage region, and can orient stakeholders as they pursue additional emissions reductions and policies.

Modeling: Key Inputs, Outputs, and Insights *(cont.)*

Key Outputs

- Total emissions reductions trajectories: the pace of emissions reductions (note that in some cases, the cap may not be binding, if companion policies or economic factors drive additional reductions; cases with hard price ceilings may also see emissions rise above cap levels)
- Emissions reduction costs: in most cases, this would be reflected as an allowance price
- Economic cost impacts: in most models, this would be limited to assessing impact on production costs; in some sectors or models, broader impacts could be considered, such as bill impacts in the electric sector (this is important to assess separately from emissions reductions costs, because allowance prices do not necessarily reflect the consumer cost of the program)
- Changes in economic output: this can be especially important to assess when considering linkage across multiple states, as economic output can shift among states (both to/from states that are modeled to have a GHG price and those that are not)

Key Insights

There are many reasons states may wish to conduct GHG modeling. Some key insights that policymakers may seek identify:

- How do policy design choices affect emissions reductions trajectories?
- How will the program affect economic activity in my state?
- Does the program result in emissions or economic leakage and if so, are there programmatic elements that can help minimize or avoid this leakage?
- Are there policy design choices that can minimize total cost paid by customers?
- Is the program proposed stable over multiple possible economic scenarios?
- What is the impact of companion policies on the GHG market program? Should modifications be considered in those programs to ensure program goals are met and better align with the GHG market?

Foundational State Action: Stakeholder Engagement

A successful GHG market will require action from a wide range of entities across a state. States already have significant experience in bringing key stakeholders together to identify areas of alignment and develop consensus positions. Many states and regions have developed an extensive stakeholder network through work surrounding federal regulatory efforts for power sector CO_2 limits and can build from these discussions to transition to state-driven GHG markets work. For example, in considering compliance options in anticipation of the Clean Power Plan, numerous states initiated stakeholder processes within their state as well as with other states to consider compliance options, design features of particular market-based trading programs, implications of various design choices, and opportunities to develop solutions addressing various stakeholders' positions. Building from these experiences, many states are well-positioned to engage with stakeholders to evaluate similar policy design and analytical questions.

As states begin to consider these market-based trading systems, they can find significant benefit to defining a process to engage with critical stakeholders, including establishing processes for soliciting and incorporating input and developing communications channels. To avoid creating barriers to linked or regional markets, states should pursue relationships with parties external to the state as well as those located and active in the state. In addition, numerous regional formal and informal organizations, such as the Northeast States for Coordinated Air Use Management (NESCAUM) or the National Association of Clean Air Agencies (NACAA) can help create forums for sharing information.

A key to relationship building is to start early in the program development process. Starting a stakeholder process early can help a state avoid redirection late in the rule development process due to stakeholder input that could have been received earlier, and helps to shape near-term directions and decisions. Stakeholders are most likely to engage constructively when there is a clear understanding of the objectives of and process for an upcoming regulatory effort.

Stakeholders Within the State

GHG markets are by nature interdisciplinary and multi-sectoral. Air and environmental regulators are likely to be the chief administrators of the program but will need to work with numerous other stakeholders to successfully implement a GHG market.

Example: RGGI Stakeholder Process

From early in the program development process, RGGI states expressed a commitment to developing a regional CO_2 emissions reduction program through "a process that integrates public participation and stakeholder input."[1] In January 2004, RGGI released a draft outline of a possible stakeholder process, with the following four goals:

1. Provide a mechanism for informing the public and stakeholders of the RGGI Staff Working Group's deliberations, and draft and final work products;
2. Provide a forum for early input from stakeholders on key design elements of a regional cap-and-trade initiative;
3. Maintain an ongoing dialogue between the RGGI Staff Working Group and stakeholders; and
4. Establish opportunities for the public and stakeholders to submit formal comments to the RGGI Staff Working Group at key decision points in the RGGI process.[2]

Since that time, RGGI states have consistently held stakeholder meetings when considering elements of the program, beginning with those on the program format, the RGGI memorandum of understanding (MOU) between states, the RGGI Model Rule and each State's RGGI program.[3]

In addition, RGGI has conducted two rounds of program review, initiated in 2012 and 2016, to consider program successes, impacts, and design elements. Key to this process are public meetings to gather stakeholder input. In addition, this process includes an opportunity for written comment. States are encouraged to hold state-specific stakeholder meetings. Upon conclusion of the 2012 review, RGGI stated that it was "a rigorous and comprehensive evaluation, supported by an extensive regional stakeholder process that engaged the regulated community, environmental nonprofits, consumer and industry advocates, and other interested stakeholders."[4]

Notes:
1. RGGI Stakeholder Process. https://www.rggi.org/docs/stakeholderprocess.pdf
2. Id.
3. RGGI Stakeholder Meetings. http://rggi.org/news/45-program-design/program-design-archive/154-stakeholder-meetings
4. RGGI Program Review. http://rggi.org/design/program-review

Additional State and Regional Regulatory Bodies

Many of the industries likely to be included in a GHG market are already highly regulated. Including those industry-specific regulators in regular planning discussions can help build a GHG market that is reflective of existing industry regulation and processes as well as help refine those regulations to plan for and incorporate GHG goals and market operations. This can help reduce regulatory burden for compliance entities, make markets more efficient, and take advantage of the deep knowledge base and long experience of industry regulators. These relationships are also critical as the regulatory framework is implemented and as a market mechanism is operationalized. Individual industry regulators can provide important insight into how a GHG market affects a specific industry and help to refine the market structure, if necessary, to ensure continued smooth operations.

For example, electricity providers are typically under the jurisdiction of a state public utilities commission or public service commission (PUC/PSC) or equivalent regulatory body. In vertically integrated states (i.e., those states where electric utilities own and operate a majority of generation assets), a PUC/PSC typically oversees the utility's long-term planning process. Early coordination and relationship building with this planning process can help the state ensure that utilities consider GHG targets in identifying long-term investments and other corporate decisions. In these states, the PUC/PSC would likely be required to approve the electricity procurement decisions that a utility would need to make to achieve required emissions reductions and any utility expenditures on allowances or offsets for compliance. In states with a competitive wholesale electric market (i.e., those states where third party power producers, and some utilities, own generation and sell it into a centralized market, from which utilities purchase for delivery to their customers), a PUC/PSC may be required to approve cost recovery and rate authority for utility market purchases that now reflect GHG costs. However, assuming generators have the compliance obligation for any GHG emission standards, a PUC/PSC would not need to approve compliance decisions as any additional costs incurred by generators would likely be reflected in wholesale power prices.[17]

In both types of states, a PUC/PSC would also need to approve any rate changes necessary to incorporate a GHG price, as well as approve (and possibly help determine) the use of any revenues utilities earned from sale of allowances. A PUC/PSC could also be involved in GHG market development if the state wishes to incorporate changes into existing, or establish new, companion (also called complementary) GHG reduction measures (such as energy efficiency standards or renewables procurement targets) to aid in reaching the cap's reduction target or to create requirements for specific compliance strategies.

Additionally, many electricity producers and utilities operate in competitively organized markets run by regional transmission operators (RTOs) or independent system operators (ISOs).[18] These entities are responsible for ensuring reliable operation of the electric grid in states with competitive wholesale electric markets. The RTOs/ISOs are also responsible for ensuring that the energy markets match producers of electricity with its consumers, a delicate balancing act that requires complex, sometimes second-by-second, management. States located in RTO/ISO regions should coordinate with these entities to help plan for how the imposition of a GHG price could affect dispatch of resources across these markets. In some cases, RTO/ISOs may be able to, in conjunction with utilities, PUC/PSCs, and other stakeholders, conduct modeling that examines how various options for GHG market components would affect

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[17] A possible exception to this would be if a competitive market state decided to place the compliance obligation on the utility (the deliverer of electricity and emissions), rather than the generator (the producer of the electricity and emissions). While this has been considered in the development phases of some GHG markets, it has not yet been applied. However, there is rough precedent for this model in other sectors, such as in California, where *deliverers* of fuels (such as gasoline or natural gas for use in homes) have the compliance obligation, rather than the actual producer of the emissions (the driver of the car or the burner of natural gas in a heating system). In this case, the utility regulator in a competitive market state would potentially play a role similar to that of a vertically-integrated state utility regulator.

[18] The term used varies by region, but in today's electricity markets RTOs and ISOs perform the same functions.

Incorporating a GHG Price: California and RGGI

The California Independent System Operator (CAISO) is responsible for running the state's electricity market. Under the cap-and-trade program, the price for energy now reflects GHG compliance costs, as owners of power plants with compliance obligations reflect those costs in their market bids. In addition, those entities that schedule imports of electricity with emissions into the state also are required cover the emissions of this imported electricity, and thus embed compliance costs in their bids. The CAISO's market optimization then uses these bids to determine the "least cost dispatch" – i.e., the lowest cost resources (now including the costs of GHG emissions) to serve all electricity demand in the system.

The RGGI region spans the jurisdiction of three different grid and market operators: PJM, the New York Independent System Operator (NYISO) and the New England Independent System Operator (ISO-NE). All of the states included in NYISO and ISO-NE participate in RGGI, and therefore, their inclusion of the price of CO_2 looks very similar to the process in California. In PJM, which covers much of the Mid-Atlantic and parts of the Midwest, only Delaware and Maryland are RGGI participants (though Virginia and New Jersey will soon join). In these states, power plants act similarly to those in other RGGI states, including the cost of RGGI compliance in their bids in the energy market. However, because not all power plants are acting in this way, PJM assumes that there likely has been some "leakage" across state lines. PJM defines two different types of leakage:[1]

- Price leakage occurs when the increased cost to emitting resources in RGGI states is passed through to consumers in non-RGGI via electricity exports from RGGI states.
- Emissions leakage occurs when fossil fuel-based electricity from non-RGGI resources, not subject to the carbon cap, is imported to the RGGI region.[2]

PJM has considered a framework for a way to apply a CO_2 price to imported electricity. However, at this time, it has focused efforts on more indirect ways of incorporating clean energy procurement policies and resources into markets, submitting two proposals to FERC outlining approaches to reform its capacity market.[3]

Notes:
1. It is likely that leakage amounts to date have been small due to the low RGGI price.
2. PJM, "Advancing Zero Emission Objectives Through PJM's Energy Markets." http://pjm.com/~/media/library/reports-notices/special-reports/20170502-advancing-zero-emission-objectives-through-pjms-energy-markets.ashx
3. FERC Docket ER18-1314

electricity market pricing, efficiency, and power flows. Early coordination can help take advantage of any opportunities for RTOs/ISOs to conduct assessments of options in help inform key decisions.

In some of the RTOs and ISOs, grid operators and market participants are actively engaged in public processes to explore ways of adjusting market designs to reflect emerging state policies or to achieve state or regional public policy outcomes, including state GHG goals. For example, New York is considering a method to incorporate a carbon price into its markets to align with public policy objectives.[19] Proposals in this vein are intended to help achieve even deeper reduction in GHGs than are being driven by the environmental regulatory programs in those states, or to help increase dispatch of cleaner generation that is aligned with participating states' goals. Other methods, such as that adopted in ISO New England, have focused on potential reforms to the capacity markets in order to accommodate state clean energy goals.[20] This discussion and similar processes are underway in PJM, where the ISO has submitted two proposals to FERC to reform its capacity market to incorporate clean energy mandates and incentives,[21] and State policymakers should be aware of and involved in these discussions.

States may also benefit from soliciting and incorporating feedback from other state regulators that oversee additional sectors or related programs. This could include Departments of Transportation, Departments of Agriculture, economic development agencies, local air quality management districts, municipal

[19] New York Independent System Operator, "Expert Topic: Carbon Pricing," https://home.nyiso.com/expert-topic/carbon-pricing/.
[20] Adopted by FERC Order (162 FERC ¶ 61,205) on March 9, 2018. For more information see https://www.iso-ne.com/committees/key-projects/caspr/.
[21] FERC Docket ER18-1314.

administrators, and others. These agencies, like those for the electricity and energy industry more broadly, can be critical sources of industry data, provide insight into efficient GHG emissions reductions levers and challenges and opportunities to market-design considerations, and highlight existing regulations that should be aligned with any GHG market.

In developing these relationships, states can consider both initial outreach and relationship building as well as establishing a framework for continued two-way communication. A regular schedule for information sharing and feedback can complement ongoing GHG market development activities and serve as the foundation for subject matter input when the state begins to define specific program components.

Key Questions for Utility Regulators and Grid Market Operators

The electricity generation and delivery industry is highly regulated and coordinated, falling under the jurisdiction of environmental regulators as well as utility commissions, market operators and monitors, and others. In developing GHG markets, states will want to work with these regulators and coordinators to create a program that is well integrated with existing regulatory and operational structures. Those states that are considering linkage may find this coordination especially critical in order to align market processes and regulations across multiple jurisdictions.

There are two main structures for utility company organization and regulation in the U.S.: vertically integrated areas and competitive market areas. In some states, there is a hybrid of these two models: a vertically integrated utility owns generation and is subject to regulated long-term planning processes, but it participates in markets by selling this generation into the market (in which third-party independent power producers also participate) and then purchasing sufficient generation to meet their customers' demand. In all areas, a key role of utility regulators is to approve rates set by utilities to recover their costs (either of running generation or purchasing from markets). In the context of GHG markets, utility regulators may also have a role in determining how revenue from allowances is used, such as investment in certain technologies or directly offsetting costs for customers.

These regulators and grid market operators can be an important resource for environmental regulators developing GHG markets. Especially for those states considering linked GHG markets, regional market operators can help provide important insight on potential regional impacts of a GHG market. Key questions states may want to explore include:

All States

- How will this market affect utility operations and the delivery of electricity to customers, and how can the program be designed to mitigate or prepare for those impacts? For example, is the program design sufficiently flexible to accommodate necessary generation shifting and allow time for modifications to ensure frequency and voltage are adequately supported?
- How should any revenue from the sale of allowances in the program be used?
- If utilities are allocated allowances, how will their value be used (e.g., for customer benefit)?
- Are there any companion GHG reduction programs in place for utilities (e.g., renewable procurement or energy efficiency programs) that should be taken into account in program design or aligned with the GHG market?

Vertically Integrated Areas

- What utility planning requirements can help facilitate or must be coordinated with GHG emissions targets and GHG markets? For example, do state Integrated Resource Planning processes ensure that utilities are making investments in lower emitting resources or energy efficiency?
- What authority will utilities need to purchase GHG compliance instruments (i.e., allowances or offsets)? What authority will utilities need to reflect the cost of purchased allowances and/or value of allocated allowances in customer rates?

Competitive Market Areas

- Will any electricity market tariffs need to be adjusted to allow participants to embed GHG prices in their bids?
- Are there are any procedures currently in place (or in consideration) in the market that incorporate a GHG price? Are there processes in place to ensure that power producers do not pay twice for GHG emissions?

Regulated Parties

States should also start building a framework for regulated party communication early in the GHG market development process. In many cases, the regulated entities may be the best source of data on their operations and information on how a GHG market, or one of its specific components, will affect their operations. Additionally, many regulated entities will operate across state lines. This can provide regulators with a useful perspective into what has worked from an industry perspective in other states and help highlight potential areas that a state may wish to coordinate with other states in order to streamline compliance.

The methods for soliciting input, responding to questions, and otherwise interacting with industry are numerous and may work best in conjunction with each other. These approaches include workshops, requests for data, requests for comment, regulator presentations and roundtables, and listening sessions. In addition, states should consider identifying opportunities to engage industries individually (e.g., sector-specific workshops) and others that allow for collaboration and communication across sectors (e.g., statewide industry roundtables). These processes could start informally as information gathering and over time potentially advance into formal feedback and working sessions that are incorporated into the regulatory record.

Third-Party Stakeholder Groups

States should also engage with third-party stakeholder groups that represent specific interests and constituents in the state. These can include environmental and environmental justice organizations, academic institutions, community and special interest groups, consumer advocates, labor organizations, and others. Developing working relationships with these organizations and communities early in the regulatory

Example: Stakeholder Engagement in Virginia

Virginia's path toward a carbon market for the electric sector officially began with Executive Order 57, issued by Governor McAuliffe in June of 2016, which required the Secretary of Natural Resources to convene a Work Group to develop recommendations to reduce Virginia's carbon emissions under existing state authority.[1] This Work Group consisted of senior delegates from five agencies (the Secretaries of Natural Resources and Commerce and Trade, the Directors of the Departments of Environmental Quality and Mines, Minerals, and Energy, and the Deputy Attorney General for Commerce, Environment, and Technology). It also formed the foundation for a broad stakeholder process, holding six meetings between August 2016 and February 2017 and hearing 40 presentations from stakeholders. These stakeholders included energy producers and electric utilities, consumer groups and advocates, clean energy and environmental advocates, electricity market operators, and many others. The Work Group also facilitated a comment period from February to April 2017, though which it received more than 8,000 written comments. The Work Group then used the highly informed feedback gathered through this process to release a "Report and Final Recommendations to the Governor" on May 12, 2017, which called for a market-based mechanism to reduce emissions from the electric power sector.[2]

Shortly thereafter, Governor McAuliffe issued Executive Directive 11, which directed the Virginia Department of Environmental Quality to develop a proposed regulation for a market-based CO_2 emissions control program for the electric sector that was consistent with existing multi-state trading programs.[3] The DEQ initiated its regulatory process drawing on the detailed record of stakeholder input and engagement to form a foundation for its program design proposal. It established a Regulatory Advisory Panel of members of key stakeholders, largely focused on environmental advocates and electric utilities and generators. This group received input from others through three Regulatory Advisory Panel Meetings; the DEQ also held two Public Webinars on specific program design issues and solicited written input, receiving over 2,000 comments. The Regulatory Advisory Panel published its final report documenting meetings and findings in late September 2017.[4] On November 8, 2017, the DEQ released a draft proposed regulation that could link with existing multi-state trading programs. Comments on the draft regulation were accepted until April 9, 2018. Final regulations could be issued this summer for Virginia to start its program in 2020.

Notes:

1. Executive Order 57 (2016). https://naturalresources.virginia.gov/media/6396/eo-57-development-of-carbon-reduction-strategies-for-electric-power-generation-facilities.pdf.
2. Governor Terence R. McAuliffe's Executive Order 57 Work Group, "Report and Final Recommendations to the Governor." May 12, 2017. https://naturalresources.virginia.gov/media/9156/eo57-report-final-5-12-17.pdf.
3. Executive Directive 11 (2017). https://governor.virginia.gov/media/9155/ed-11-reducing-carbon-dioxide-emissions-from-electric-power-facilities-and-growing-virginias-clean-energy-economy.pdf
4. Final Activity Report - Regulatory Advisory Panel Concerning Carbon Trading Rule (Rev. C17). http://www.deq.virginia.gov/Portals/0/DEQ/Air/GHG/C17-RP00-fin.pdf?ver=2017-10-06-084815-330

process can ensure that impacts on a broad range of communities and interests are considered throughout the policy development process. In addition, early interaction with these parties, especially those representing business and consumer groups, can provide states with an opportunity to educate communities on the ways a GHG market can provide value to state companies and customers.

Stakeholders Outside the State

In addition to developing relationships with key stakeholders within the state and those outside of the state in regional regulatory bodies as discussed above, a state considering a new GHG market may also want to consider engaging with similar entities in other states or with government experts with existing GHG market experience. Coordinating with neighboring states can also be important for identifying interstate impacts of GHG markets, such as potential changes to electricity flows or effects to other interstate markets. This might include states within the same market region.

Additionally, developing relationships with outside stakeholders early in the process will be critical for those states that are targeting linkages with other GHG markets. This outreach would allow the new state market to be developed with an eye toward aligning administrative processes, regulations, and other key design features that are important for linking.

Summary of Key Stakeholders in GHG Market Program Development Activities

The following list includes many key stakeholders important for engagement, but is not meant to be comprehensive.

- State and Regional Regulatory Bodies
  - Industry regulators (e.g., Public Utilities Commission)
  - Electricity market operators
  - Air regulator and management agencies
  - Economic development, municipal administrators, and other related departments (commerce, transportation, etc.)
- Regulated Parties
- Third-Party Stakeholder Groups
  - Environmental and environmental justice organizations
  - Community and special interest groups
  - Consumer advocates
  - Labor organizations

Foundational State Action: Develop Market Framework

A GHG market, while in many cases the most efficient way to reduce GHG emissions with limited administrative burden, requires up-front activities to design and set up the market infrastructure. This section highlights core elements that are useful to evaluate early in the process of program development. These elements can be viewed as "foundational" program design choices that states can begin to discuss with stakeholders and include key decision points for the development of any GHG market design process. These elements include: allowance tracking systems and market design features such as emissions reduction targets; allowance distribution and revenue use; banking and borrowing; and price control mechanisms.

Design and Adopt an Allowance Tracking System

First, developing an allowance tracking system is a no-regrets first step that states can undertake early in the process of GHG market development. There are few to no contentious policy design choices to make concerning an allowance tracking system, and given that this system underlies the entire rest of the market, it can be a good first step for states to undertake.

Developing an allowance tracking system is a no-regrets first step that states can undertake early in the process of GHG market development

An allowance tracking system is used to trace the distribution, ownership, trading, and submission for compliance of allowances (and offsets). This system will include one or more accounts per entity (e.g., an account for trading allowances and a separate account for compliance), a platform for transferring allowances between parties, and the protocols for parties to create accounts and make transactions in the system. Under some programs, the tracking system will also include restrictions, such as limits on number of allowances and offsets that can be held by certain parties or over certain timeframes. Accurate tracking is critical for ensuring that parties have obtained enough allowances to cover their emissions and that total allowances submitted are in compliance with state emissions caps. Tracking systems will also have to include or incorporate verification protocols to ensure legitimacy of allowances moving through the system.

Because a tracking system is required for the creation and trading of allowances, states can begin developing this system as a foundation for other program elements. Existing frameworks in RGGI and WCI can provide states exploring new markets with already-developed protocols, regulatory text, and requirements for participating entities. Even partial adoption of this existing infrastructure and drawing from state experience with these systems can significantly reduce regulatory burden to establish new systems. Additionally, states should consider what future administrative efficiencies could be gained by aligning with existing programs, such that new tracking systems are built to be compatible with existing systems. RFF has identified the format of the serial number for cataloging allowances within the tracking system as an "essential [feature] that need[s] to be aligned before a functional market can be developed and trading can occur."[22] Additionally, tackling this administrative issue provides a straightforward opportunity for regulators to work toward alignment with other programs, laying a foundation and starting a productive dialogue in advance of more complex coordination later.

[22] Dallas Burtraw et al., "Linking by Degrees: Incremental Alignment of Cap-and-Trade Measures," Resources for the Future (April 2013) *at* p. 16., http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-13-04.pdf (RFF 2013).

Evaluate Key Market Design Features

States will need to make numerous decisions regarding GHG market design. Below are key elements that states can begin considering with both internal and external stakeholders when building a framework for their program. Each state must adapt the design of these components to its political and economic conditions.

Throughout this process, the existence of already-operational markets provides opportunities for states to utilize existing experience to help identify the appropriate design of a market for their state. These existing markets also provide useful guideposts and can help states avoid adopting program components that would create barriers to interstate coordination. Virginia, for example, early in the regulatory process identified a goal to create a "trading ready" program that allows for multi-state exchange of allowances.[23]

Based in part on previous work in this space,[24] this section identifies and explores in more detail five key GHG market elements that states can begin considering with both internal and external stakeholders and have potential implications for future market linkage (see box for summary). This approach could facilitate a process similar to Virginia's—identifying the goal of linkage at the start of program development and evaluating design elements through a lens of compatibility with future trading partners.[25]

1. Setting Caps and Emissions Reduction Targets

Fundamental to establishing a market-based trading program is the choice of *which* sources will be regulated and *how much* their GHG emissions will be limited. Setting an annual emissions cap, which determines how much pollution is allowed from affected sources (in other words, the stringency or ambition of the program) is a critical decision. Closely related will be the choice of which sources will be regulated, and therefore, included under the overall pollution limit or "cap." States that are considering possible linkages with other states may aim to include the industries covered by the existing program. For example, a state that is targeting eventual linkage with WCI might want to include the electricity, natural gas, transportation, and industrial sectors. However, states that are looking to create more narrow programs may wish to pursue an electricity-only program to link with RGGI or other sector-specific programs. While such alignment may be useful

Programmatic Design: Linkage Step Highlights

The market components identified in this section are important to consider for any state beginning development of a state GHG market. However, those states planning for linking with additional programs should take special care with the following elements to avoid creating barriers to partnerships with other states:

- **Allowance tracking**: linked programs must be able to share allowances across programs, requiring at a minimum compatible and transparent tracking systems.
- **Setting and adjusting caps**: states do not need identical emissions limits, but must align certain elements. Importantly, linked programs should have the same covered sectors (these could differ, but not without creating significant linkage complications) and stringency of caps and future adjustments.
- **Allowance distribution:** states should consider whether distribution methods would create conflicting price signals or misalign incentives with partner programs.
- Price control mechanisms and offsets: linked programs will often aim to have similar **price ceiling** and **offset provisions** in order to ensure comparable program integrity and stringency. In addition, different **price floors**, while not creating inherent barriers to linkage, can create a de facto lower floor across the linked region. States will want to consider those implications.

[24] RFF 2013.
[25] *Id.*

Aligning Stringency Requirements with Existing Programs

Both California and RGGI states have established requirements for linkage with potential partner programs that are directly related to the environmental integrity and stringency of their programs.

In California, while the "[Air Resources] Board may approve a linkage with an external GHG [trading system] after public notice and opportunity for public comment" per the cap-and-trade program, additional legislative requirements were added in 2012.[1] Among others, these require that California's program only by linked to those programs that have "adopted program requirements for greenhouse gas reductions, including, but not limited to, requirements for offsets, that are equivalent to or stricter than those required by [California's program]."[2]

In RGGI, a new state may become a "Signatory State" "by agreement of the Signatory States as reflected in an amendment to [the RGGI] MOU."[3] Additional requirements apply, however, including that the new state sign the amended MOU (see appendix for linkage details) and put in place regulations that comport with RGGI requirements, including those related to program stringency.

With these requirements in mind, key considerations for states considering linkage with either of these programs may include:

- Has the state established overall emissions targets, including possible companion state policies, that are sufficient to achieve emissions reductions in line with California or RGGI targets?
- Does the proposed new program include any compliance measures that allow for emissions above the cap, such as borrowing or hard price ceilings, and are these consistent with potential linkage partner programs?
- In the case of California, does the program include enough sectors and emissions to be consistent California's economy-wide targets?

Notes:

1. *Cal. Code of Regulations § 95941*
2. *Cal. Gov. Code §12894. (f)(1)*
3. *MOU Section 5(A)*

for program administration, it is not necessarily required for linkage (though it may be important for establishing a program with appropriate emissions reductions stringency).

As discussed above, an important step for establishing emissions caps is an emissions inventory. In states with targets tied to historic emissions levels, a starting point for setting ultimate emissions goals will likely be a historical inventory of emissions (for example, a state that has a legislative requirement to reduce emissions 80 percent below 1990 levels will need a state-accepted inventory of 1990 emissions). In states without already-identified targets, an inventory or more recent reporting can help the state determine possible starting points for emissions goals. States can also start developing a process for ongoing reassessments of program stringency. This could be based on a timeline of regular program reviews (such as is in place in RGGI) or could be triggered by certain allowance prices or other market indicators. Additionally, states may find it useful to identify business-as-usual emissions, accounting for all otherwise "on the books" policies (e.g., energy efficiency or renewable energy policies, vehicle emission standards, or building standards) which can be projected based on inventory data and GHG modeling.

In conjunction with setting a starting cap level, states will also need to determine the rate of annual decrease in the cap. States should consider the appropriate trajectory to achieve a final target (e.g., 2050 emissions goals). The modeling undertaken can be helpful to determine how a certain emissions reduction trajectory will affect GHG prices, emissions outcomes, and key sector-specific economic outputs such as electric generation mix. This modeling can help states assess a reasonable reduction trajectory to reach long-term targets. Because many cost-effective emissions reduction technologies require multi-year implementation horizons (such as adding additional renewable resources or implementing efficiency improvements at industrial facilities), states may also want to consider how a program's cap and trajectory create the economic and regulatory certainty to support such investments.

States may also want to consider how a program's cap and trajectory create the economic and regulatory certainty to support emissions reduction investments.

Stringency of the emissions caps, both at the start of the program and subsequent program adjustments, is likely to be a key consideration in determining whether it is possible to link with other state programs. For example, California requires that linked programs have emissions targets (and other programmatic measures) that are "equivalent to or stricter" than the WCI program.[26] As part of this process, states should also evaluate how companion climate and environmental programs, such as vehicle emissions standards, renewable procurement requirements, or energy efficiency incentives, will contribute to emissions reductions. States with strong existing programs that have already set the groundwork for emissions reductions may be able to set more stringent caps that take into account these companion programs. The existence of such companion programs could also be one of the factors considered in determining whether a state is able to link with other existing programs.

2. *Allowance Distribution & Revenue Use*

States will need to determine how to distribute allowances to market participants. To do this, a state could hold a series of auctions or directly allocate the allowances. States may also decide to use a hybrid approach. This could include allocating a portion of allowances and auctioning the remainder, or allocating and requiring a "consignment auction," in which entities that receive allocations must consign those allowances to an auction, from which they can buy the quantity they need for compliance.[27] Both WCI and RGGI states use a combination of allocation and auction, though RGGI auctions a much higher percentage of allowances than the WCI region. While RGGI's model rule stated at least 25 percent of the allocated allowances/allowance value should "go to a consumer benefit or strategic energy purpose," the RGGI states have historically auctioned more than 90 percent of all allowances, using the revenues for these stated purposes.[28]

While the method of allowance distribution does not necessarily impact the market price of allowances, it

Key Impacts of Allowance Allocation Decisions

Utilizing different methods for distributing allowances through the market is not a barrier to linkage. However, allowance allocation can affect market fundamentals and program performance. Modeling can be an important tool to explore some of these impacts. While this paper does not explore these impacts in detail, some key areas that may be affected by allowance allocation include:

- *Revenue availability*: some methods, such as auctions or consignment auctions, allow the regulator to utilize or set standards for the utilization of the value of allowances. This can help to support certain companion programs (including energy assistance for customers) or fund other state initiatives or provide customer benefit. Direct allocation with no consignment auction does not provide the opportunity for state officials to directly distribute new revenues.
- *Emissions leakage*: allocation can be used to mitigate the impact of emissions leakage by muting an incentive to decrease regulated emissions and instead increase emissions in an unregulated area (either in a different jurisdiction or at a facility that is not covered by the rule). Output-based updating allocations can provide a production incentive that can help counteract incentives for emissions leakage.
- *Economic leakage/shifts*: in linked programs, differing allocation methodologies across jurisdictions can create differing incentives. For example, entities in a state with a fixed allowance allocation may be incentivized to run less than entities in a state with an updating, output-based allocation. This could lead to flows of economic activity and/or revenues across jurisdictional boundaries.
- *Customer incentives*: allocation decisions can also affect the way that GHG prices are reflected in consumer goods prices, which can change incentives for customers. If allowance revenue is used to directly offset a price signal (e.g., by limiting electricity rate increases), it could create less of a reason for customers to switch to products and services that have lower GHG emissions, which can slow expected transitions to those products and services. However, revenues could be returned in lump sum payments so as to avoid hiding this price signal while still offering direct customer cost protection. Revenues could also be used to fund incentive programs to reduce emissions, such as energy efficiency rebates, which can lower customer costs indirectly.

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[26] Cal. Gov. Code §12894 (f)(1) and (f)(3).

[27] For more discussion of this topic, *see, e.g.*, RFF, "Consignment of Free Emissions Allowances Under EPA's Clean Power Plan, June 2016. Available at http://www.rff.org/files/document/file/RFF-DP-16-20.pdf

[28] The Regional Greenhouse Gas Initiative, "The Investment of RGGI Proceeds in 2015" (October 2017), https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2015.pdf.

does determine the distributional impacts of the program; specific auction or allocation design choices can also have significant impacts (see box to right).

If a state utilizes an auction to distribute all or some of its allowances, those auction revenues can support companion policies and incentives. For example, over the nine years that RGGI has been in effect, allowance auctions have generated nearly $2.9 billion in proceeds.[29] These proceeds have then been distributed to the RGGI states, who have invested auction revenues in energy efficiency measures, community-based renewable power projects, GHG reduction measures, and education and job training programs. The investment of auction proceeds in energy efficiency delivers particularly high economic returns, as increased energy efficiency leads to lower electrical demand, lower wholesale power prices, and lower consumer electricity bills. In addition, consumer savings on energy bills lead to increased contributions to the local economy, creating positive local macroeconomic impacts. The RGGI program led in the most recent program period (2015-2017) to $1.4 billion (net present value) of net positive economic activity in the nine-state region,[30] with total benefits across the nine year program life exceeding $4 billion.[31] All in all, RGGI, Inc. projects that auction proceeds from 2009-2015 alone will result in a lifetime savings of 76.1 million MMbtu of fossil fuel energy and 20.6 million MWh of electricity, resulting in a total avoidance of 15.4 million short tons of carbon pollution.[32]

Under free (or "direct") allocation, compliance entities receiving allowances own the value of those allowances, though the regulations may require that the value be used for specific purposes. States could ensure that the value of allocated allowances are used for public benefit by establishing a regulated consignment auction and regulatory requirements for the use of revenues earned through sales of consigned allowances. In California, the Air Resources Board established a requirement that allowances allocated to utilities be used to benefit customers and required that the Public Utilities Commission implement a specific oversight process for the utilities they regulate. This resulted in bill relief for residential customers, in the form of rate relief and biannual Climate Dividends to all households, as well as a carve out for up to 15 percent of revenues that can be used for clean energy investment.[33] States can engage stakeholders in determining the best uses for any revenues.

Allowance distribution methods do not inherently create barriers to linkage; markets can function smoothly with some states using auctions and others using direct allocation methods. States may nevertheless wish to consider allowance distribution in light of potential linkages as allocations can affect market dynamics. For example, different distribution methods across linked states can cause allowances to flow more between states than they otherwise might, which could affect emissions in certain states or create incentives to move emitting activity across state lines. GHG modeling and past program experiences can help to reveal these possible dynamics and provide states with information when making this program design decision. States in the early stages of program development may find it important to begin stakeholder discussions on the appropriate way to distribute allowances, whether by auction or

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29 The Analysis Group, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States: Review of RGGI's Third Three-Year Compliance Period (2015-2017)" (April 17, 2018), http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_april_2018.pdf.

30 *Id.*

31 Natural Resources Defense Council, "RGGI Shows Tackling Climate Change Pays Major Dividends," (April 17, 2018), https://www.nrdc.org/experts/bruce-ho/rggi-shows-tackling-climate-change-pays-major-dividends

32 M.J. Bradley & Associates, "A Pioneering Approach to Carbon Markets: How the Northeast States Redefined Cap and Trade for the Benefit of Consumers" (February 2017), http://mjbradley.com/sites/default/files/rggimarkets02-15-2017_0.pdf.

33 California Public Utilities Commission, Decision Adopting Greenhouse Gas Allowance Revenue Allocation Formulas and Distribution Methodologies for Emissions-Intensive and Trade-Exposed Customers, Decision 14-12-037 (Filed March 24, 2011), http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M144/K130/144130487.pdf.

direct allocation, that reflect the key economic and policy priorities in that state. Modeling can be a helpful tool to evaluate possible outcomes of different allowance distribution methodologies. New legislative authority may also be required in some states to collect and distribute revenue if a state decides to adopt an auction approach.

3. *Offsets*

States could decide to allow compliance entities to use offsets to cover GHG emissions obligations as well as allowances. These compliance instruments are measured in the same units as allowances—one ton or metric ton per offset. However, instead of representing a ton that can be emitted under the program's cap (as an allowance would), an offset represents an *avoided* ton (or metric ton) of emissions that took place outside the cap, either in an uncapped sector or outside the geographical boundaries of the GHG market program. Offsets are created under "protocols" that are managed by the program regulator and identify specific emission avoidances and verification processes. Offsets are typically viewed as cost mitigation mechanism that can provide downward pressure on allowance prices. They can also be used to create a framework or incentives for emissions reductions in critical sectors that are not directly included in the GHG market. However, usage has been low in U.S. programs to date.

To leave options open to future coordination with other programs, states will need to consider establishing offset protocols that parallel existing programs.[34] Both RGGI and WCI currently have imposed limits on the percent of any given compliance entity's emissions that can be covered by offsets (6 percent in WCI and 3.3 percent under RGGI). In order to meet stringency requirements for linking, a state that wishes to join WCI or RGGI should not allow offsets beyond this level.

4. *Borrowing and Banking*

States can begin stakeholder discussions on whether and to what extent to allow banking and borrowing of compliance instruments. Unlimited or nearly unlimited banking is generally standard across existing market-based GHG programs.[35] However, states that wish to allow borrowing should consider that this would likely present a significant barrier to linking with other states' programs, as unlimited borrowing can present environmental integrity concerns. A possible alternative to borrowing is establishing multi-year compliance periods, which delay the need to surrender allowances, providing added compliance flexibility without sacrificing the environmental integrity of the program. Both WCI and RGGI have adopted three-year compliance periods that provide flexibility for compliance entities.

Key Definitions: Banking & Borrowing

Allowances and offsets are typically issued with vintages, which identify the year in which they were issued. Banking is the ability of a compliance entity to use an allowance (or offset) in a year after it was issued—using a 2015 vintage allowance to meet a 2018 compliance obligation, for example. Borrowing allows a compliance entity to use a future year allowance for current compliance obligations—submitting a (not yet issued) 2020 vintage allowance for a 2017 compliance obligation. Both banking and borrowing require tracking systems that can track allowance vintages; borrowing may also require additional functionality to ensure that already-retired allowances are appropriately treated once they are eventually issued.

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[34] The California ARB currently allows entities to generate offset credits using the following Compliance Offset Protocols: U.S. Forests Projects, Urban Forests Projects, Livestock Projects, Ozone Depleting Substances Projects, Mine Methane Capture, and Rice Cultivation Projects. As of the 2017 Program Review, RGGI will award CO_2 offset allowances for projects in two categories: 1) landfill methane capture and destruction and 2) avoided methane emissions from agricultural manure management operations. More information can be found at http://www.rggi.org/market/offsets/categories and https://arb.ca.gov/cc/capandtrade/offsets/offsets.htm.

[35] While there are no limits on length of time that allowances can be held, California has limits on the total allowances that can be held in certain accounts. Additionally, RGGI is likely to adjust (lower) future emissions levels to account for high existing banks.

5. *Price Control Mechanisms*

Many market-based GHG reduction programs include price control measures that maintain allowance prices within certain, pre-determined levels. These can include price floors, which RGGI and WCI both employ, though at different levels.[36] These price floors can help create critical market stability and investment certainty for entities that are considering emissions reductions investments. Many programs also include price ceilings, which can take multiple forms. This can include a hard ceiling, above which allowance prices may never rise. In this case, a state would offer an unlimited number of additional allowances (beyond the level of the cap) at the ceiling price. As an alternative, RGGI and WCI both use a limited reserve of allowances that are sold if allowances reach certain trigger levels. This creates a "softer" price ceiling, for while it serves to limit prices in the short term, if all allowances in the reserve are sold, prices can continue to rise above the ceiling price. Under the RGGI program, allowances in the cost containment reserve are additional to cap levels, meaning that purchases increase total number of emissions that can be released in participating states up to the limited amount of allowances available in the reserve. In WCI, the reserve is populated with allowances from the program's allowance budget (i.e., full utilization of the allowance price containment reserve would result in total emissions still remaining under cap levels). As part of the adoption of the updated 2017 RGGI Model Rule, most of the RGGI states intend to implement an "emissions containment reserve" that would act as an alternative type of price floor by removing allowances from circulation if prices fall below agreed levels. Offsets and compliance flexibility such as banking and multi-year compliance periods are also approaches to moderating prices. Other mechanisms, such as the use of allowance revenue, can help limit customer *costs*, which are distinct from the allowance price.

Allowance Prices vs. Customer Cost

A fundamental function of a cap-and-trade program is to establish, by limiting GHG levels, a price on GHG emissions that producers of those emissions will then internalize and incorporate into business decisions. This price of GHG emissions will be reflected in the price of allowances.

An allowance price, however is distinct from customer costs for several reasons, including how the allowances are distributed to compliance entities. The revenue associated with selling allowances, or the value of allocated allowances, can be returned to customers or otherwise invested in programs that lower customer costs. Allocated allowances could, for example, be used by compliance companies to limit product price increases. Alternatively, allowance revenue from auction sales could be used to invest in energy efficiency programs that could lower customer electricity usage, therefore lowering bills (even as electricity rates may rise slightly due to higher electricity costs).

States developing new market-based programs will need to evaluate whether to include any price control mechanisms and which are most important to evaluate based on the dynamics in a state. Those wishing to consider linking, however, should pay close attention to the floor prices of potential partner programs. To date, most GHG market programs have seen allowance trading at or very near the floor, making this the *de facto* allowance price. When programs link, one result is that a single allowance price forms across both linked markets as the linked market adjusts to new supply and demand dynamics. A new market without a floor linking with a RGGI or WCI program that does have a floor could result in the effective allowance price falling below the stated RGGI or WCI floor, as compliance entities in RGGI/WCI purchase lower-priced allowances from the uncontrolled market. This could be a strong barrier to linkage with existing programs that wish to be sure to maintain their existing price floor. However, as RFF notes, having different floor prices (and thus often, different market clearing prices) is not an absolute barrier to linkage.[37]

[36] A price floor is most easily established in a market that utilizes auctions, where regulators can establish a floor through a minimum auction bid price. In a market with allocated allowances, states could utilize a consignment auction for some or all allowances, again with a minimum bid price, to create a price floor. This method has been used in California, where some allowances are directly auctioned (those associated with the transportation sector), some are part of a consignment auction (those allocated to investor-owned utilities), and some are allocated with no consignment requirement (those for municipal utilities, natural gas utilities, and industrial facilities).

[37] RFF 2013.

Conclusion

A successful GHG market program must have a strong foundation. The steps in this paper—data assessment, stakeholder engagement, and the development of market frameworks—are critical for a strong program. These steps also draw on the example and proven track record of existing GHG markets in the United States, utilizing their experience to highlight key considerations as well as providing a framework for how an emerging GHG market can be designed to align and link with those existing programs.

As states take the first steps toward starting new programs, this paper helps to break key program development into manageable, discrete actions. To that end, Appendix A summarizes some of the key decisions and considerations for each of the foundational state actions discussed in more detail in this paper, including key considerations for linking programs.

Appendix A: Key Decisions and Linkage Considerations of GHG Market Foundational Activities

Foundational Data Assessment: *the backbone for any well-functioning market, that can be developed without determining an exact structure for a future GHG market that can help support modeling and considerations of market design features*				
	Description	Use(s)	Key Decisions	Linkage Considerations
GHG Inventory	Estimate of past GHG emissions	• Baseline for emissions targets • Identifying key sectors, industries, or emissions reductions opportunities	• Which industries and gases to include • Whether to include imported electricity	• Are the gases and sectors covered consistent with possible partners? • Does the inventory help identify emissions relationships with other states?
GHG Monitoring & Reporting	Process for GHG emitters to measure and report their annual emissions	• Additional detail for setting emissions targets • Establishing compliance obligations under future programs	• Which industries and gases to include • Threshold level of emissions that trigger reporting requirements • Schedule and format of requirements	• Are the gases and sectors covered consistent with possible partners? • Are requirements and timeline consistent with other states'? • Are requirements appropriately rigorous?
GHG Modeling	Economic and/or electricity system modeling that solves for emissions reductions given program design choices and other constraints	• Identify impacts of specific program design choices • Identify key impacts across sectors or compliance entities • Engage stakeholder group early in process	• Model type • Input assumptions (economic, environmental, and other variables) and scenarios • Which stakeholders to involve	• Does modeling show potential impacts on other states? • Does linkage improve program outcomes?

Stakeholder Engagement: *steps to develop a process to engage with critical stakeholders, including establishing processes for soliciting and incorporating input and developing communications channels*				
	Description	Use(s)	Key Decisions	Linkage Considerations
Stakeholders within the State				
State and Regional Bodies	Other regulators in the state (e.g., PUC/PSC as well as those of other sectors), energy market operators, or regional conveners	• Coordination for utility planning and operational approvals • Modeling and other projections of impacts on both covered and non-covered sectors	*NA*	• Early coordination can help identify state-specific issues that could otherwise present barriers to linkage • Regional bodies can share best practices and progress across states
Regulated Parties	Entities that are likely to have a compliance obligation under the proposed GHG market	• Soliciting input on operational requirements and possible market impacts • Coordination with requirements in other existing markets (for those regulated entities operating across state lines)	*NA*	• Compliance entities that operate in multiple states can share lessons learned from participation in existing markets and help identify important program consistencies
Third Parties	Environmental organizations, academic institutions, community and affinity groups, customer advocates, etc.	• Help include a broad range of communities and interests • Opportunity to educate communities on the ways a GHG market can provide value to state companies and customers	*NA*	• Early coordination can help identify state-specific issues that could otherwise present barriers to linkage
Stakeholders Outside the State				
External Parties	State regulators and stakeholders from other states in the same energy market that may be affected by a state's GHG market, or that could be interested in linking	• Anticipate regulatory complications • Take advantage of existing administrative processes, regulatory texts, and other tools • Align with existing programs • Identify impacts on external parties	*NA*	• Identify program components important to align with potential partners • Take advantage of existing administrative processes, regulatory texts, and other tools

Market Features: *components of market infrastructure that states can begin developing with stakeholder input, with an eye toward avoiding barriers to collaboration with other programs*				
	Description	Use(s)	Key Decisions	Linkage Considerations
Foundations				
Allowance Tracking	System that tracks the distribution, ownership, trading, and submission for compliance of allowances.	• Log trades and transfers of allowances • Measure compliance	• Participation requirements • Limits on transfers and trading • Trading platform and interoperability with other platforms	• What opportunities exist to utilize existing platform(s)? • Does any new system allow for transfers to and from external tracking systems? • Are the system's core requirements consistent with (potential) partner systems?
Key Design Elements				
Cap Setting & Emissions Reduction Targets	The total amount of emissions that can be released per year	• Required to determine total compliance levels across market • Identifying process for future program updates (for market performance, stringency, or other reasons)	• Stringency of initial caps • Process and/or schedule for ongoing adjustments	• Is stringency consistent with requirements for linkage with other programs (including factors such as the reduction trajectory and baseline emissions)?
Allowance Distribution & Revenue Use	Means of introducing allowances into the market, which can include giving allowances to compliance entities for free based on a particular methodology (direct allocation) or running auctions.	• Ability to shape incentives for activity and emissions reductions • Can provide support for specific industries or initiatives • Allocation can be used to control compliance and customer costs • Auction revenue could support companion policies that help lower compliance costs.	• Free allocation methodology, if any, including which parties, calculation of allowances allocation per party, and timeline for distribution • Auction structure, if any, including participation requirements and schedule and use of any auction revenue	• Does an allocation methodology create incentives for behavior that differ from other regions'? • Does an allocation methodology address the possibility of leakage across state lines or between linked programs? • If using auctions, is the schedule aligned with possible partners? • Is it possible to use the same auction platform as possible trading partners?
Offsets	Compliance instruments (same units as allowances) that represent emissions reductions from projects outside covered sources	• Can increase compliance flexibility and lower costs • Can provide opportunity for reductions outside of covered sectors	• Types of projects that can create offsets • Number of offsets that can be used for compliance	• Are offset protocols consistent with potential partners'? • Are offset use limitations in place in line with partner program requirements?
Banking & Borrowing	Ability to use allowances for compliance that are from years other than the compliance year	• Compliance flexibility • Decreased market volatility	• Ability to bank allowances for future use, and any limitations on such banking • Ability to borrow allowances from the future to use for compliance (or multi-year compliance periods)	• Is borrowing allowed in potential partner programs? • Are multi-year compliance periods aligned (or able to be aligned) with other programs? • Does the program allow banking (either unlimited or to a certain level?)
Price Control Mechanisms	Market mechanisms that limit allowance prices, either at the low end ("floors") or high end ("ceilings")	• More compliance cost certainty for covered entities • Decreased market volatility	• Price ceiling, if any, including how to introduce allowances above a "hard" cap and any escalation of price level • Price floor, if any, including escalation of price level	• Are any price ceilings consistent with other programs? • Are price floors set at a level that allows for smooth market integration across programs?

Appendix B: Specific Text of Linkage Process and Requirements for RGGI and CA

California

California's Cap-and-Trade Program is contained in Title 17, Division 3, Chapter 1, Subchapter 10, Article 5 of the California Code of Regulations (also commonly referenced as California Code of Regulation §§ 95801-96022; for ease of reference in this paper, we will use this reference convention). The details of the general process of linkage and sector-based crediting program linkage is contained in Subarticles 12 and 14, respectively (i.e., CCR §§94940-45 and §§95990-95995). Additionally, in 2012, the California Legislature added additional requirements that must be met prior to the California Air Resources Board approving any linkage. These requirements are detailed in Title 2, Division 3, Part 2.5, Chapter 5 of the California Government Code (also commonly referenced as California Government Code §12894(e)-(g)).

Key legislative and regulatory requirements for linkage as laid out by these sections include:

1. The California Air Resources Board must comply with relevant provisions of the California Administrative Procedure Act, including opportunity for public notice and comment (details of this Act can be found in the California Government Code §§ 11340 - 11342.4)[38]
2. Linkages with other states and countries by the State Air Resources Board should be done transparently and should be independently reviewed by the Attorney General for consistency with all applicable laws.[39]
3. The Governor must make the following findings:
    a. The jurisdiction with which the state agency proposes to link has adopted program requirements for greenhouse gas reductions, including, but not limited to, requirements for offsets, that are equivalent to or stricter than those required by the California Cap-and-Trade Program
    b. Under the proposed linkage, the State of California is able to enforce the California Cap-and-Trade Program, and related statutes, against any entity subject to regulation under those statutes, and against any entity located within the linking jurisdiction to the maximum extent permitted under the United States and California Constitutions.
    c. The proposed linkage provides for enforcement of applicable laws by the state agency or by the linking jurisdiction of program requirements that are equivalent to or stricter than those required by California Cap-and-Trade Program.
    d. The proposed linkage and any related participation of the State of California in Western Climate Initiative, Incorporated, shall not impose any significant liability on the state or any state agency for any failure associated with the linkage."[40]

California has successfully linked its program with that of Quebec, Canada in keeping with the requirements enumerated above. In December 2012, Québec finalized its cap-and-trade program regulations, and on February 22, 2013 the ARB notified the Governor of the proposed link with the Québec program and requested that he make the findings required under Cal. Gov. Code § 12894(f).

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38 CCR §95941.

39 Cal. Gov. Code § 12894(a)(1).

40 Cal. Gov. Code § 12894(f).

On April 8, 2013, Governor Brown issued a letter finding that the Québec program met all the requirements for linking with the California program.[41] In these findings, the Governor directed that ARB continue to work with Québec to prepare for linking, and to report on progress by November 1, 2013. Additionally, Air Resources Board Resolution 13-7 (April 19, 2013) directed ARB's Executive Officer to complete pre-linkage activities prior to January 1, 2014, including a review of processes, procedures and systems of California's and Québec's programs to ensure consistency and compatibility.[42]

The Governor's findings requested that the report include an assessment of the following specific areas (emphasis added):[43]

- Testing and evaluating the **auction platform and trading systems** to ensure that they are compatible and ready to be implemented and that linkage can be accomplished without disruption to California's program.
- Specifying a process for review and public input of changes in a linked jurisdiction's program to ensure that the programs remain of **comparable stringency and integrity**.

Therefore, the ARB focused its pre-linkage assessment on the following three categories:

- Are the procedures and systems being used to implement the program in each jurisdiction compatible with each other and do they ensure the integrity of the program?
- Are the procedures and systems that need to be conducted jointly by the linked jurisdictions well defined and in place to support linking?
- Do the two jurisdictions have in place procedures to work collaboratively and constructively to maintain the harmonization of the linked programs and to resolve differences that may arise? [44]

The following criteria were used to assess the procedures used in each of the program elements:

- Completeness: Do the procedures and processes cover the full set of activities needed to implement that element of the program? Are all regulatory requirements met?
- Management Control: Do the procedures provide effective management control? Are roles, responsibilities, and approvals clearly defined? Is the responsibility for key activities (such as the transfer of allowances from jurisdiction accounts) properly divided among staff to ensure that no single individual can execute the activities?
- Accuracy: Do the procedures ensure data accuracy through validation and multiple levels of review? Do assigned staff have the necessary background to perform the data reviews?
- Security: Do the procedures protect confidential and market sensitive information? Is access to confidential and market sensitive information restricted to staff that require access?
- Auditability: Do the procedures include an audit trail for all decisions and actions? Are those records retained securely?[45]

Upon concluding this review, ARB concluded that the two jurisdictions had in place procedures for ongoing coordination and regulatory development, and that, after completing identified outstanding tasks, the programs were prepared to by the target date of January 1, 2014.

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41 State of California, SB 1018 Request for Cap-and-Trade Program Equivalency Findings (February 26, 2018), https://www.gov.ca.gov/news.php?id=17933.

42 California Air Resources Board, Amendments to California Cap-and-Trade Program – Linkage (April 19, 2013), https://www.arb.ca.gov/cc/capandtrade/linkage/resolution13-7.pdf.

43 State of California, SB 1018 Request for Cap-and-Trade Program Equivalency Findings (February 26, 2018), https://www.gov.ca.gov/news.php?id=17933.

44 California Air Resources Board, "Linkage Readiness Report" (November 1, 2013), https://www.arb.ca.gov/cc/capandtrade/linkage/arb_linkage_readiness_report.pdf.

45 *Id.*

Regional Greenhouse Gas Initiative

RGGI allows for linkage through the addition of a Signatory States to its governing Memorandum of Understanding (MOU). Section 5(A) of the MOU details this process:

1) A Non-Signatory State may become a Signatory State by agreement of RGGI's current members.
2) If the current members agree to accept a Signatory State, an amendment is published to the program's Memorandum of Understanding (MOU). The amendment will establish:
    a. The state's initial base CO_2 emissions budget in short tons, as well as the increasing of the regional emissions budget detailed in the MOU to include the allowance budgets of the new Signatory State.
    b. The state's joining of the program and its required adherence to the understandings and commitments contained in the MOU and the First Amendment. More broadly, the state commits to adhere to RGGI's program design, particularly in agreeing to:
        i. Recognize allowances from all other participating states' program
        ii. Commit to propose the model cap-and-trade program outlined in the MOU for state regulatory or legislative approval
3) Expansion. The MOU expresses RGGI's desire to expand the geographic reach of the program. To achieve this goal, Signatory States "shall welcome expressions of interest from Non-Signatory States."[46]

The Maryland Healthy Air Act, passed on April 6, 2006 by Maryland Governor Robert Ehrlich, mandated reductions in nitrogen oxides, sulfur dioxide, and mercury, three major pollutants from coal-fired power plants. The legislation also required the state to become a full participant in RGGI by no later than June 30, 2007.[47] To assess the potential positive and negative impacts of joining the program, the Maryland Department of the Environment (MDE) contracted with the University of Maryland's Center for Integrative Environmental Research (CIER), to conduct a study of the economic and energy impacts related to Maryland's potential participation in RGGI.

The University of Maryland study examined the potential effects of RGGI on:

- Preservation and enhancement of the economic welfare of the residents of the State
- Maintenance of a safe and reliable electric power supply in the State
- Adequacy of the energy supply in the State, including the potential for power plant shutdowns,
- Ability of persons who own, lease, operate, or control an affected facility to compete in neighboring states, and
- Electric rates for residents of the State.

The study concluded that overall, joining RGGI would only have a "limited impact on the economy and electric power markets in Maryland."[48] After formally releasing the report, the University of Maryland requested comments from stakeholders. Throughout the research and modeling process, over 60

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[46] The Regional Greenhouse Gas Initiative, "Memorandum of Understanding" (December 2005), https://www.rggi.org/sites/default/files/Uploads/Design-Archive/MOU/MOU_12_20_05.pdf.

[47] University of Maryland Center for Integrative Environmental Research, Maryland Regional Greenhouse Gas Initiative, http://cier.umd.edu/RGGI/MDJoinsRGGI.html.

[48] University of Maryland Center for Integrative Environmental Research, "Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative" (January 2007), http://cier.umd.edu/RGGI/documents/UMD_RGGI_STUDY_FINAL.pdf.

stakeholders, representing more than 30 institutions, responded to open invitations to comment on the analysis.[49] Comments were compiled and published on the Center's website, as well as made available to the state legislature.[50]

After the conclusion of the research and modeling process, Maryland successfully joined RGGI on July 20, 2007 by means of an amendment to the program's MOU.[51]

[49] Matthias Ruth et al., "Economic and Energy Impacts from Participation in the Regional Greenhouse Gas Initiative: A Case Study of the State of Maryland," 36 Energy Policy 2279-2289 (April 2008), http://hobbsgroup.johnshopkins.edu/docs/papers/JEPO2775_Ruth_RGGI.pdf.

[50] University of Maryland Center for Integrative Environmental Research, "Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative" (January 2007), http://cier.umd.edu/RGGI/documents/UMD_RGGI_STUDY_FINAL.pdf.

[51] Regional Greenhouse Gas Initiative, "Second Amendment to Memorandum of Understanding" (April 20, 2007) http://www.rggi.org/docs/mou_second_amend.pdf.