Considerations for Designing a Cap-and-Trade Program in Oregon

Feb. 14, 2017

700 NE Multnomah St.
Suite 600
Portland, OR 97232

Phone: 503-229-5696
800-452-4011
Fax: 503-229-5850

www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

State of Oregon
Department of Environmental Quality

This report prepared by:

Oregon Department of Environmental Quality
700 NE Multnomah St, Suite 600
Portland, OR 97232
1-800-452-4011
www.oregon.gov/deq

Contact:
Colin McConnaha
503-229-5094

Acknowledgement: DEQ developed this study in collaboration with Jessica Shipley at the Oregon Department of Energy, who made significant contributions to all elements of this study.

Documents can be provided upon request in an alternate format for individuals with disabilities or in a language other than English for people with limited English skills. To request a document in another format or language, call DEQ in Portland at 503-229-5696, or toll-free in Oregon at 1-800-452-4011, ext. 5696; or email deqinfo@deq.state.or.us.

Table of Contents

1. Executive summary 1

2. Key findings 5

3. Introduction 7

Study focus and structure 7

Stakeholder process 8

Oregon's GHG goals 8

Market based policies for reducing greenhouse gas emissions 9

Existing market-based policies 12

4. Program design 14

Scope 15

Stringency 17

Allowance distribution 20

Revenue 22

Cost containment 24

Offsets 25

Program administration 27

5. Potential economic effects in Oregon 30

Macroeconomic effects 30

Distributional effects 37

6. Effects on disadvantaged populations and rural communities 43

Important definitions 43

Connections to climate change and climate policy 44

Tools to neutralize potential negative effects 46

California's experience 48

Considerations for Oregon 50

7. Interaction with other Oregon policies 52

Introduction 52

Interactions with the RPS and Coal Import Moratorium 55

Interactions with the Federal Clean Power Plan 60

Interactions with the Clean Fuels Program 63

Interactions with other state policies and programs 66

Appendix 1: List of potentially regulated entities 69

Appendix 2: Literature review 74

Appendix 3: Economic modeling 75

1. Executive summary

In Senate Bill 5701 (2016), the Oregon Legislature directed the Department of Environmental Quality (DEQ) to study considerations for implementing a market-based greenhouse gas (GHG) reduction program in Oregon. The legislature specified several areas for DEQ to focus on, including general policy design necessary to achieve Oregon's statewide GHG reduction goals, methods to design a program to minimize negative effects on businesses, disadvantaged communities and rural parts of the state, and how the program would interact with Oregon's existing climate policies.

We focused this study on a "cap-and-trade" program that would establish a firm and declining limit on most of Oregon's GHG emissions and create a marketplace that could be linked to existing cap-and-trade programs in California and Quebec. There are a variety of ways to "price carbon" that establish a market-based approach to reduce GHG emissions. However, cap-and-trade most directly offers the policy characteristics Legislature requested DEQ evaluate, specifically a "greenhouse gas emissions cap" that can "link with other jurisdictions and meet the state's greenhouse gas emissions reduction goals" (language from Oregon Legislature's Budget Report that accompanied SB 5701). Furthermore, cap-and-trade is consistent with policy discussions held during the 2016 legislative session, and is the mechanism currently proposed in the 2017 session.

DEQ held three public meetings to gather stakeholder input on this study. At the outset, we held a meeting to receive input on our planned approach and study outline. We issued a draft of this study in November 2016 for public comment and held a meeting in early December 2016 to receive verbal feedback. Finally, in January 2017 we held a public workshop to discuss the economic modeling conducted to inform this study.

This executive summary provides answers to some of the most common questions that arise when considering the design of a cap-and-trade program. Following this is a list of key findings we developed during the research and outreach conducted for this study that Legislature should understand when considering whether to pursue a cap-and-trade program for Oregon.

How does a cap-and-trade program work?

A cap-and-trade program establishes an overall limit (the *cap*) on GHG emissions from certain sources of pollution, such as electricity providers, industrial facilities, and fossil fuel suppliers. Permits or "allowances" are issued by the state to regulated entities. Each allowance permits a business to emit or supply fuel that emits one ton of emissions. For example, if a program has a cap of 50 million tons of pollution in a given year, the state would issue 50 million allowances in that year. These allowances can be bought and sold on the market (the *trade*). Companies covered by the program must acquire allowances to match their emissions. As the cap declines over time, the entities covered by the program must make collective cuts in emissions. However, because of the formation of a marketplace for allowances, emission reductions won't be uniform across the covered entities but instead will occur where reductions are cheapest. Entities that can most cheaply reduce their emissions will do so, while others will pay to acquire sufficient allowances. This should reduce emissions where it is cheapest to do so, while spurring innovation to develop new methods for greater reductions. As described below, there are different methods for the state to issue allowances.

How does this differ from "cap-and-dividend" or "cap-and-invest"?

It doesn't. These terms describe distinct ways a cap-and-trade program can be designed to use revenue generated by the state's sale of allowances. *Cap-and-dividend* uses program revenue to provide rebates to households or businesses to offset the higher energy costs created by the program. *Cap-and-invest* directs program revenue to fund specific programs; usually those that further reduce GHG emissions to expand the environmental benefit of the program or to lower costs to regulated entities. It's important to note that these different uses of revenue could be combined. For example, some revenue could be provided to natural gas and electric utilities to reimburse their customers for higher energy costs, while other revenue could be invested in programs that reduce GHG emissions or directly benefit households in disadvantaged communities.

How does cap-and-trade differ from a carbon tax?

Both cap-and-trade and a carbon tax establish a price on GHG emissions. Cap-and-trade specifies a certain amount of emissions reduction and allows the price to pollute to adjust based on market demand, while a carbon tax does not prescribe an amount of emissions to be reduced but specifies a price to emit GHGs. Cap-and-trade sets a firm limit on emissions, providing certainty that pollution will be reduced to the level of the cap. This program does not establish a specific price on GHG pollution, letting the marketplace determine this based on the supply of allowances and the demand from regulated entities to pollute. In contrast, a carbon tax does not require specific emission reductions, but does set the price to emit GHGs. The flexibility offered by cap-and-trade provides some benefits compared to a carbon tax. In addition to providing certainty on emission reductions, cap-and-trade offers the state tools to better directly mitigate impacts to specific businesses and should produce emission reductions at a lower overall cost.

Who would be regulated by an Oregon cap-and-trade program?

This would vary depending on the design of the cap-and-trade program. Based on existing conditions, DEQ estimates approximately 100 facilities and businesses would be regulated if the program covered fossil fuel and natural gas suppliers, electricity providers, and industrial emitters responsible for at least 25,000 tons of GHGs per year, which is the emission threshold for being regulated in the existing programs in California and Quebec. See Appendix 1 for a list of these entities.

How much GHG pollution would be reduced?

This would also depend on the design of the cap-and-trade program, including the breadth of emission sources covered and the level of the cap. One of the most important features cap-and-trade offers is the ability for the state to directly set a limit on emissions and the rate that emissions must decline. The amount of pollution reduced is the result of how many sources of emissions are covered by the program and the declining cap on emissions. A program covering the sources listed under the previous question with a cap set at those sources' proportionate share of the cuts for the state's GHG reduction goals would assure the state achieves those goals, so long as sufficient emission reductions are also being achieved by sources not covered by the program.

How would "allowances" to emit GHGs be distributed?

There are two primary methods for the state to distribute allowances: sell them through an auction or provide them to regulated entities for free. Auctioning allowances provides a transparent and fair approach that alleviates the need for the state to determine who receives allowances and in what quantities. It also generates revenue which can be put to furthering state, local, or industry initiatives to cut GHG emissions or mitigating the impact of the program on specific groups, such as utility ratepayers or disadvantaged communities. Freely providing allowances to regulated entities can reduce their costs, but in some situations can profit companies without passing that benefit down to consumers.

A combination of these techniques may offer the advantages of each where they are needed most. Free allocation to certain businesses exposed to trade pressure from competitors outside of the state may be an important tool to avoid pressure on businesses to shift operations and associated jobs outside of the state. This would also simply shift emissions associated with economic activity to another state, and make it so the program fails to reduce global GHG emissions. Providing allowances to natural gas and electric utilities could offset increased costs for their ratepayers. Alternatively, auction revenue could be directed to these utilities and overseen by the Public Utility Commission, or the elected boards of smaller utilities, to assure it benefits utility ratepayers. Auctioning the remainder of allowances is important to clearly establish a market price on GHG emissions and, as noted below, to generate revenue that can benefit disadvantaged and rural communities.

How would revenue be used?

Revenue generated from the sale of allowances to cover emissions from sources other than transportation fuels could be used for a wide variety of purposes, including to offset costs to utility ratepayers, mitigate effects to disadvantaged and rural communities, and further reduce GHG emissions. Oregon's Constitution restricts the use of revenue generated from fees or taxes on transportation fuels. The sale of allowances to cover compliance obligations of transportation fuel suppliers may be subject to this restriction. If that is the case, then revenue from transportation fuels – likely a majority of the revenue generated by the program – would need to be used for the construction, maintenance, and operation of the state's roads and bridges.

What are the economic implications?

Effects on statewide economic output would likely be very small. Modeling conducted for this study suggests that the overall effect on Oregon's economy from a cap-and-trade program could by slightly positive or slightly negative, but either effect would be very small relative to the size of the state economy. However, this modeling did not take into account the health benefits to Oregonians from the reduction of pollutants with local health impacts that comes from reducing GHGs. Thus, the modeling likely understates the economic benefits from a cap-and-trade program in Oregon.

While statewide economic effects are likely small, effects in certain industries are stronger. Sectors more reliant on fossil fuels such as mining and transportation are more negatively impacted, while the transfer of money from emission sources to other parts of the state's economy tends to benefit sectors that would receive the additional spending such as construction,

retail, and media. See Appendix 3 for a full description of the economic modeling conducted for this study.

How can impacts to specific industries be mitigated?

Certain industries, such as food processing and pulp and paper mills, that compete with firms outside Oregon may not be able to pass the cost of purchasing allowances down to their consumers. This could pressure these local businesses to close or move out of state. This would directly impact jobs in Oregon and may merely shift GHG emissions to another location, undermining the goal of the program. Minimizing this outcome is a critical consideration for designing a cap-and-trade program. Fortunately, cap-and-trade provides the state with a tool for mitigating this potential effect: free provision of allowances to certain business exposed to competition from businesses in other jurisdictions. Freely allocating some allowances to industries regulated by the program that are exposed to competition in other jurisdictions should defray additional costs created by cap-and-trade while still creating an economic incentive for these businesses to reduce their emissions.

How would disadvantaged or rural communities be affected?

A cap-and-trade program increases the cost of fossil fuels. This could place a larger burden on low-income households because they generally spend a higher proportion of their income on energy. These households are also less able to make investments to adapt to higher energy prices, such as buying more efficient vehicles and appliances. Rural parts of Oregon tend to be less economically diverse than urban areas, meaning impacts on industries in rural communities could be felt more acutely. For these reasons, a cap-and-trade program could disproportionately impact disadvantaged households and rural areas unless it includes measures designed to neutralize negative effects on these communities.

Targeted revenue spending is the primary mechanism for addressing impacts to these communities from a cap-and-trade program. This could include energy bill assistance or rebates for households in certain income brackets, and targeting investments in projects located in and directly benefiting disadvantaged or rural communities. Additionally, revenue generated by a program could be used for worker training, helping to empower communities to transition to jobs in a low-carbon economy.

How would this program work with Oregon's existing climate policies?

A cap-and-trade program could be designed to complement Oregon's existing climate policies, including the Renewable Portfolio Standard and the Clean Fuels Program. These policies' requirements to transition the electricity and transportation fuel sectors to low-carbon energy helps prepare Oregon's economy to achieve the long-term reductions required by a cap-and-trade program aligned with the state's GHG goals. Similarly, a cap-and-trade program reinforces these sectoral policies by making clean sources of electricity and transportation fuels more cost-competitive with fossil fuels. The cap-and-trade program also provides a back-stop that responds to the performance of these sectoral policies. If the sectoral policies achieve greater reductions, there would be less work for the cap-and-trade program to do. Should these sectoral policies achieve fewer reductions than expected, the cap-and-trade program would compensate by doing more.

2. Key findings

Following are some of the more significant findings supported by this study. These findings are not presented in order of importance.

1. **Cap-and-trade offers a flexible, cost-effective mechanism for assuring GHG reductions**. A carbon market can adapt to changing economic conditions and technology. This flexibility can lower emissions where it is cheapest to do so. Ultimately, a firm cap on emissions can ensure long-term GHG targets are achieved.

2. **Cover as many sources of emissions as possible**: A cap-and-trade program encourages the most cost-effective reductions to occur first, but this incentive only extends to sources of emissions covered by the program. Thus, a program covering more emission sources within the economy produces cheaper cuts in emissions than a program with a narrower scope. A broad program is also needed to achieve Oregon's greenhouse gas reduction goals and to link with other jurisdictions.

3. **Align the cap with Oregon's GHG goals**: A cap-and-trade program designed to achieve Oregon's GHG goals should have a cap set in alignment with those targets. A similarly ambitious cap would likely be required of Oregon's program in order to link with cap-and-trade programs in California and Quebec.

4. **Multiple allowance allocation methods can be used:** Auctioning allowances is likely the best allocation method for sectors that are not regulated closely for consumer protection, such as transportation fuels. Free allocation of some allowances is warranted in sectors where there exists a strong concern about emissions leakage. Free allocation or consignment of allowances to regulated sectors, such as electric and natural gas utilities, could mitigate costs to utility ratepayers.

5. **Use of revenue from transportation fuels is likely to be restricted**: Oregon's constitution likely restricts the use of revenue generated from the sale of allowances to cover compliance obligations of transportation fuel suppliers to "be used exclusively for…public highways, roads, streets and roadside rest areas in the state." This restriction, combined with the allocation findings above, indicate that the majority of revenue from auctioned Oregon allowances would potentially be limited to uses within the Highway Fund.

6. **Employ cost containment mechanisms**: While the emission price in a market program inherently fluctuates in response to market conditions, a variety of mechanisms to avoid price spikes and related impacts to consumers and businesses can be integrated into a cap-and-trade program.

7. **Macroeconomic effects are likely to be small:** Modeling conducted for this study suggests that the overall effect on Oregon's economy from a cap-and-trade program could by slightly positive or slightly negative, but either effect would be very small relative to the size of the state economy. However, this modeling did not take into account the health benefits to Oregonians from the reduction of pollutants with local health impacts that comes from reducing GHGs. Thus, the modeling likely understates the economic benefits from a cap-and-trade program in Oregon.

8. **Economic effects of the program will vary across the state:** Though certain economic effects of a cap-and-trade system may generally be small at the statewide level, some communities and business sectors are likely to be more significantly affected by the carbon price than others.

9. **Freely allocate some allowances to mitigate economic and emissions leakage:** Industries that are in particularly competitive markets might face pressure to relocate some or all of their economic activity due to the carbon price imposed by a cap-and-trade policy. Providing some amount of free allowances to those industries can alleviate this pressure and preserve the integrity of the program.

10. **Revenue generated by the program should be used to benefit disadvantaged and rural communities.** A cap-and-trade program should include methods to mitigate the inherently regressive nature of a price on carbon and address the concerns and needs of the most vulnerable communities in the state. Revenue generated by the program could be used for worker training, helping to empower community transition to jobs in a low-carbon economy, and energy efficiency projects in low-income housing.

11. **A cap-and-trade program can be designed to work with Oregon's existing climate policies.** The emission reductions achieved by policies such as the Renewable Portfolio Standard and the Clean Fuels Program would ease compliance with a carbon market. Allowance distribution can be designed to avoid additional costs for reductions already being achieved by these existing policies.

12. **Combining sectoral policies with a carbon market improves the likelihood that Oregon's GHG goals can be met.** Combining a market mechanism with sectoral regulations like Oregon's Renewable Portfolio Standard and Clean Fuels Program can make low-carbon technology options (e.g. low emission vehicles) available across key sectors of the economy that will be needed to achieve Oregon's long-term GHG goals.

3. Introduction

This study documents key considerations for implementing a market-based greenhouse gas (GHG) reduction program in Oregon. The Oregon Legislature requested[1] Oregon Department of Environmental Quality (DEQ) conduct this study and funded[2] its development in Senate Bill 5701 (2016).

SB 5701 specifically requested that DEQ "study a market-based approach to controlling greenhouse gas emissions by providing economic incentives for achieving emissions reductions". This is elaborated on in the accompanying Budget Report with direction to DEQ to focus the study on four areas related to a greenhouse gas market program:

1. Identify the type, scope, and design of the greenhouse gas emissions cap necessary to link with other jurisdictions and meet the state's greenhouse gas emissions reduction goals.
2. Assess how a market-based program would interact with existing programs, such as the Renewable Portfolio Standard, the Clean Power Plan, and the Clean Fuels Program, and achieve the state's greenhouse gas emissions reduction goals.
3. Study and evaluate how existing market-based programs in other jurisdictions control leakage and how those methods might be adapted to align with Oregon's economy and business sectors.
4. Study and evaluate how existing market-based programs address potential impacts and benefits to disadvantaged populations and rural communities and how those methods might be adopted to Oregon.

Study focus and structure

For the purpose of this study, DEQ focused on a cap-and-trade program that would be compatible with the Western Climate Initiative's multi-jurisdiction carbon market (WCI). WCI currently links cap-and-trade programs in California and Quebec, and Ontario launched a cap-and-trade program this year that it intends to link to WCI next year. While there are other types of market-based approaches to controlling greenhouse gas emissions, such as a carbon tax, this study focused on the WCI program because it is consistent with SB 5701 and the Budget report's reference to a "cap" "to link with other jurisdictions." This is also consistent within the broader context of the 2016 Legislative session in which a bill was introduced that would have directed DEQ to develop and implement a cap-and-trade program that could link to other jurisdictions.[3]

Because of this legislative context, DEQ has conducted this study to focus on issues most likely to have relevance to potential further discussion in Legislature about whether or how to direct DEQ to develop a cap-and-trade program. Consistent with the Budget Report for SB 5701, the focus of this report aligns with the four considerations described above. This study evaluates the

[1] Senate Bill 5701. 2016. https://olis.leg.state.or.us/liz/2016R1/Measures/Overview/SB5701

[2] Senate Bill 5701 included a one-time appropriation of $230,000 to DEQ for this study. Funding was provided to hire staff to research and prepare the study and for a consultant to conduct economic modeling.

[3] Senate Bill 1574. 2016. https://olis.leg.state.or.us/liz/2016R1/Measures/Overview/SB1574

broad policy choices the legislature would need to make, and does not examine some significant details that would need to be explored through subsequent analysis and stakeholder process if DEQ were directed by statute to develop a cap-and-trade program. In short, this study identifies key considerations and program design options to help inform the Legislature, but leaves considerable room for further analysis and outreach that would be necessary for DEQ to fully develop a cap-and-trade program in a subsequent rulemaking process.

The four considerations described above are reflected in the structure of this document:

- Section 4 documents many of the important elements of a cap-and-trade program and the options for designing such a program for Oregon.
- Section 5 identifies potential economic effects in Oregon from the implementation of a cap-and-trade program.
- Section 6 explores how a cap-and-trade program could distinctly affect Oregon's rural areas and disadvantaged communities.
- Section 7 covers how a cap-and-trade program might interact with Oregon's existing policies that affect different sources of the state's greenhouse gas emissions.

Stakeholder process

DEQ sought stakeholder input at the outset of this study. A public meeting was held on June 10th, 2016, at which DEQ provided background information about the request from Legislature for this study, our planned approach to conducting it, the project timeline, and an outline of the study describing the anticipated elements. DEQ received public input through comments at this meeting and in written comments over the following month. DEQ subsequently met with a wide variety of stakeholders to clarify and seek further detail about their comments. DEQ issued a draft of this study in November 2016 for public comment and held a meeting in early December 2016 to receive verbal feedback. Finally, in January 2017 DEQ held a public workshop to discuss the economic modeling conducted to support this study.

Oregon's GHG goals

In 2007, the Oregon legislature passed House Bill (HB) 3543 which established three goals for reducing the state's greenhouse gas emissions:

- by 2010 to begin to reduce greenhouse gas emissions
- by 2020 to achieve greenhouse gas levels 10% less than 1990 levels
- by 2050 to achieve greenhouse gas levels 75% below 1990 levels

The bill also established the Oregon Global Warming Commission (OGWC). Among other responsibilities, the OGWC is tasked with tracking Oregon's progress toward these greenhouse gas reduction goals and reporting on that progress to the Legislature via biennial reports. In its most recent report, the OGWC noted that Oregon appears to have achieved the first goal set out in HB 3543. However, the OGWC also projected that Oregon's current emissions trajectory is not on track to achieve HB 3543's goal for 2020, with emissions projected to exceed that goal by

approximately 11 million metric tons CO_2 equivalent or 22%.[4] Absent additional state or federal policies, OGWC expects this gap to grow in the future and result in Oregon falling well short of its long-term GHG reduction goals.

Market based policies for reducing greenhouse gas emissions

A cap-and-trade program is a type of market-based policy for reducing pollution. Market-based policies encourage behavior changes (e.g. reducing fuel use or switching to cleaner sources of energy) through economic incentives. These types of policies differ from direct regulations that prescribe (or prohibit) certain actions or investments that will reduce (or cause) emissions. Instead, market-based policies encourage individuals and businesses to reduce pollution by establishing financial incentives that make emission reductions in their economic interests and thereby collectively achieving the policy goals.[5] The flexibility of market-based mechanisms can achieve reductions at lower cost than more prescriptive regulatory programs. Section 7 describes how these types of policies interact and can be designed to be complementary.

Two types of market-based policies are frequently discussed as mechanisms for reducing GHG emissions:

1. Greenhouse gas tax: This is often referred to as a "carbon tax". This type of policy was studied in Oregon in 2014.[6] Under this type of program, emitters of GHGs, or suppliers of products that emit GHGs (e.g. fossil fuels), are charged a tax or fee for every ton of emissions. This price on greenhouse gases can lead businesses and consumers to find ways for reducing their emissions in ways that are cheaper than paying the tax.
2. Tradeable permits: The most common format for this policy is cap-and-trade, which is the focus of this study. This program establishes an overall limit (the cap) on greenhouse gas emissions from covered sources of pollution, such as electricity providers, industrial facilities, and fossil fuel suppliers. Tradeable permits or "allowances" are issued to these sources up to the cap. The cap declines over time, requiring collective cuts in emissions from the entities covered by the program. Each allowance permits a business to emit or supply fuel that emits one ton of emissions. For example, if a program has a cap of 50 million tons of pollution in a given year, the jurisdiction would issue 50 million allowances in that year.[7] Entities covered by the cap are required to acquire allowances equal to their emissions. Allowances can be acquired via direct allocation from the state, at a state-run auction, or by market purchases. This establishes a market in which these

---

[4] Oregon Global Warming Commission. 2017. Biennial Report to the Legislature 2017. http://www.keeporegoncool.org/sites/default/files/ogwc-standard-documents/OGWC%202017%20Biennial%20Report%20to%20the%20Legislature_final.pdf

[5] Stavins, Robert N. Experience with Market-Based Environmental Policy Instruments. 2001. Resources for the Future. www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-01-58.pdf

[6] https://www.oregonlegislature.gov/lro/Documents/RR%204-14%20SB%20306%20Clean%20Air.pdf

[7] It is important to note that "cap and invest" refers to a particular type of cap-and-trade program in which the revenue generated by the auction of allowances is used to finance initiatives that further the purpose of the program (greenhouse gas emission reductions in the case of the program evaluated in this study).

allowances can be bought and sold. In theory, entities that can most cheaply reduce their emissions will do so, while others will pay to acquire sufficient allowances. This should reduce emissions where it is cheapest to do so, while spurring innovation to develop new methods for greater reductions. The principle underpinning cap-and-trade programs is that this form of policy should minimize the cost of reaching an established environmental outcome (i.e. reducing emissions).[8]

There are several important similarities between a carbon tax and a cap-and-trade program. Perhaps most significantly, both policies establish a clear price on GHG emissions, albeit through different mechanisms. This price signal encourages businesses and households to find ways to emit less because higher-emitting options will cost more. Both policies require government administrative functions to handle reporting, monitoring, verification, and receipt of revenue. In both programs, the carbon price can be placed on a limited number of entities, typically fuel suppliers, electric and natural gas utilities, and large industrial facilities. However, this price is generally passed on to consumers, creating higher energy prices to the extent GHG emissions are associated with the energy. This has the effect of sending a market signal to consumers regarding the pollution associated with the types of goods and services they choose.

The added cost of carbon-intensive energy described above is generally regressive because low-income families typically spend a greater proportion of their income on energy and are less able to invest in methods for avoiding the carbon price (e.g. low-emission vehicles and energy efficiency improvements). Thus, both policies require corrective mechanisms in order to produce an equitable program for generating least cost emission reductions. Section 6 discusses key considerations for designing a cap-and-trade program that minimizes disparate impacts to disadvantaged communities.

Both a carbon tax and a cap-and-trade program introduce the possibility of pushing businesses outside the state to avoid the carbon price, similar to any other tax that is not duplicated in other jurisdictions. This effect is referred to as “leakage”. Leakage can result in a negative economic impact to the jurisdiction and in a lessening of overall emissions reduction as the businesses and their associated emissions locate elsewhere. Therefore, both program types benefit from corrective mechanisms that mitigate the economic pressure for firms to move and thereby limit the leakage caused by the policy. Economic effects generally, and program design considerations to reduce leakage specifically, are explored in Section 5.

While both policies introduce a price on greenhouse gas emissions, there are several distinctions worth noting:[9]

- **Cap-and-trade provides certainty over emission levels.** A fixed amount of pollution, collectively, from the sources of emissions covered by the program is integral to the design of cap-and-trade. In contrast, a carbon tax does not establish any specific amount

[8] Tietenberg, Tom. 2003. “The Tradable-Permits Approach to Protecting the Commons: Lessons for Climate Change”. http://oxrep.oxfordjournals.org/content/19/3/400.full.pdf+html?ijkey=324rjCyD25Jfk&keytype=ref

[9] Stavins, Robert N. 2008. “Addressing Climate Change with a Comprehensive US Cap-and-Trade System.” Article. Oxford Review of Economic Policy 24 (2): 298–321. doi:10.1093/oxrep/grn017.

of emission reduction, although the tax can be adjusted to exert greater influence on emission levels.

- **Carbon taxes provide a more stable price signal.** A carbon tax inherently leads to a stable price because it sets a fixed cost per ton of carbon. There are a variety of design features for a cap-and-trade program that can reduce price fluctuations; several of these program design options are described in Section 4. Nonetheless, a carbon tax allows government to define a specific price that cannot generally be achieved with cap-and-trade.
- **Carbon tax is administratively simpler.** If applied to relatively few businesses, such as fuel suppliers and providers of natural gas and electricity, a carbon tax is relatively simple to administer. Cap-and-trade requires businesses to manage allowances and government systems to track their issuance, trading, and retirement.
- **Cap-and-trade can produce emission reductions at lower cost**. The fixed price imposed by a tax does not offer the flexibility of a cap-and-trade program. The trading element of cap-and-trade spurs the most cost-effective emission reductions within the market and sources of emissions covered by the program. For example, a cap covering both transportation fuels and electricity does not prescribe specific reductions within either individual sector but rather an overall reduction across them. If emission reductions are cheaper within the electric sector, the market should drive down emissions there because it is cheaper to do so, while the transportation fuel suppliers would have greater willingness to pay for allowances.
- **Cap-and-trade produces a carbon price that can adapt to change.** The carbon market created by a cap-and-trade program can react in real time to changes in the underlying economy or energy markets, whereas tax schedules are typically set years in advance and are difficult to quickly adjust. Should energy prices (e.g. crude oil or natural gas) move significantly higher for reasons other than the carbon regulation itself and thus do more to incentivize energy efficiency and reduce emissions, the carbon price in a cap-and-trade system will fall as emissions, and demand for allowances, falls. This will ultimately lower the overall cost of the policy on consumers versus a fixed-price carbon tax.
- **Cap-and-trade can more effectively mitigate impacts to businesses.** Issuance of allowances under cap-and-trade provides an opportunity to mitigate cost impacts to regulated business. For example, free allocation to large industrial emitters can both avoid business and economic impacts, as well as avoid undermining the environmental outcome that would result from pushing businesses and their emissions outside the jurisdiction (i.e., the issue of leakage). The most analogous option under a tax would be to develop tax exemptions, but these either drive down the emission reductions achieved by the tax or require a commensurate increase in the tax rate.
- **Cap-and-trade can provide stronger linkages across jurisdictions**. The marketplace established by cap-and-trade for buying and selling allowances can be expanded across multiple jurisdictions that adopt similar programs. Linking programs across jurisdictions can provide multiple benefits. Perhaps the most significant benefit is that the expanded

market provides businesses with more places to find the most cost effective emission reductions. However, multiple jurisdictions could also adopt carbon taxes with harmonized tax rates.

Existing market-based policies

Market-based programs for reducing greenhouse gases exist in a variety of jurisdictions. Notable programs currently in place are described below:[10]

- **Western Climate Initiative (WCI)**: Many states and provinces across western North America, including Oregon, participated in development of the design framework of a regional cap-and-trade program. Of these jurisdictions, California and Quebec have implemented the WCI program design. Ontario launched a cap-and-trade program in 2017 and plans to link with WCI next year. These jurisdictions' programs include a broad scope encompassing emissions from transportation fuels, natural gas, industrial processes, and electricity generation – including emissions associated with imported electricity. The linked jurisdictions participate in joint auctions of allowances, and allowances issued by one jurisdiction can be used by any compliance entity within the linked programs.
- **Regional Greenhouse Gas Initiative (RGGI)**: RGGI is a cap-and-trade program across nine states in the Northeast and Mid-Atlantic. The program places a regional cap on CO_2 emissions from large electric generating facilities within the nine states. The majority of allowances issued under this cap are auctioned jointly by the nine states at quarterly auctions.
- **European Union Emissions Trading System (EU ETS)**: The EU ETS was formed in 2005 as the world's first large greenhouse gas emissions trading program. It is currently the largest such program, covering all 28 EU member states and three other European states. The program covers emissions from large industrial facilities including electricity generation.
- **Washington Clean Air Rule**: Washington recently finalized rules establishing a cap on emissions from the state's largest sources of emissions, including industrial emitters, natural gas distributors, and fossil fuel suppliers. Facility or company-specific caps are established using historic emissions. These caps then gradually decline. This is not a traditional cap-and-trade program, as allowances are not issued and a marketplace is not established and run by the state. However, there are some flexible mechanisms for compliance, including obtaining emission reduction credits from other entities that have

[10] With the exception of the EU ETS, this is a selection of the most prominent market-based policies in North America. Several Chinese provinces have already enacted carbon markets while the country has more recently committed to a national program. Should this develop it would certainly represent a notable market-based policy for reducing greenhouse gas emissions. Additionally, Alberta has recently developed a carbon tax taking effect January 1, 2017.

exceeded their required reductions, and funding projects that reduce carbon emissions within Washington.

- **British Columbia Carbon Tax**: British Columbia is perhaps the best example of a "revenue neutral" carbon tax. This program taxes fossil fuels at $30 CAD per metric ton. Personal income and corporate taxes in the province are reduced by approximately the amount of revenue generated by the carbon tax, making the policy revenue neutral.

Table 3.1 compares some of the key features of aforementioned cap-and-trade programs.

TABLE 3.1

	Western Climate Initiative	**Regional Greenhouse Gas Initiative**	**European Union Emissions Trading System**
Jurisdictions	California & Quebec (Ontario anticipated in 2018)	Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont	28 EU member states and Iceland, Norway and Liechtenstein
Date program began	2013	2009	2005
Sources covered	Power plants, transportation fuel suppliers, large industrial facilities, electricity imports	Large power plants	Large industrial facilities, including power plants, and operators of flights to and from the EU, Iceland, Norway and Liechtenstein
2015 emissions cap (million metric tons CO_2 equivalent)	459.8	66.8	2,007 for facilities 210 for aviation
2020 Target (million metric tons CO_2 equivalent)	388.94	56.3	1,816 for facilities 210 for aviation
2015-2020 Reduction	15.4%	15.7%	8.6%

4. Program design

This section describes seven key elements to the design of a cap-and-trade program. These elements would directly influence the program's compatibility to link with WCI jurisdictions, efficacy to advance progress toward Oregon's GHG reduction goals, efficiency of doing so cost effectively, and the range and magnitude of effects on regulated and non-regulated entities in Oregon. The seven program design elements described in this section are:

1. **Scope**: The sectors, sources and types of emissions to be covered by the cap
2. **Stringency**: The level and trajectory of the cap in relation to the sources of covered emissions
3. **Allowance distribution**: How allowances are distributed by the government into the marketplace
4. **Revenue**: How money generated from auctioned allowances can be spent
5. **Cost containment**: A variety of market characteristics that collectively reduce volatility in the allowance price
6. **Offsets**: Considerations for including options to provide credit for reducing GHG emissions that are not directly covered by the cap-and-trade program.
7. **Program administration**: The institutional structures and resources needed to implement the program

Within each of these significant program design areas, we highlight options used in other cap-and-trade programs or that are discussed in literature. We also note how considerations under each element affect two factors integral to this study:[11]

- The efficacy of the program to help the state meet its greenhouse gas emission reduction goals, and
- The ability for an Oregon cap-and-trade program to connect with the already linked WCI programs in California and Quebec.

Equity and economic impacts to consumers and businesses are key considerations for designing a program, thus significant differences between program design options in economic outcomes or distribution of costs or benefits are noted. Sections 4 and 5 contain more information on these topics.

[11] Both of these considerations connect with the request from Oregon Legislature for this study. The report accompanying Senate Bill 5701 (2016) directs DEQ to "identify the type, scope and design of the greenhouse gas emissions cap necessary to link with other jurisdictions and meet the state's greenhouse gas emissions reduction goals".

Scope

A broad scope – covering as many sources of emissions as possible – can produce more cost-effective reductions than a program with a narrower scope.[12] A cap-and-trade program encourages the most cost-effective reductions to occur first, but this incentive only extends to sources of emissions covered by the program. Thus, a broad program covering most emission sources within the economy allows for the lower-cost reductions within the jurisdiction to more likely be achieved, thereby lowering the overall cost of the program.

In addition to economic efficiency and a lower cost of emission reductions, a broad scope is needed to enable a program that will be able to achieve the two primary considerations requested by legislature of this study:

1. A program that can achieve Oregon's greenhouse gas reduction goals, and
2. A program that can link with other jurisdictions

A broad scope would align a cap-and-trade program with Oregon's GHG reduction goals. Since its inception in 2007, the Oregon Global Warming Commission has tracked progress toward Oregon's GHG goals using an inventory of all anthropogenic sources of emissions originating in Oregon, with a correction to include emissions from power plants in other states serving Oregonians. Therefore, a cap-and-trade program covering as many of these sources of emissions as feasible could more effectively advance progress toward our state GHG reduction goals.

Covering as many types of greenhouse gases, not just carbon dioxide, would also better align the cap-and-trade program to Oregon's GHG goals. Gases such as methane, nitrous oxide, and various fluorinated gases have potent effect on climate change. DEQ's statewide inventory of Oregon's GHG emissions indicates non-CO_2 gases account for nearly 20% of total state emissions.[13]

However, there are certain emissions sources that are likely not feasible to cover with a cap-and-trade program. Sources of emissions that are difficult to accurately measure and verify are generally excluded from existing cap-and-trade programs. Additionally, emissions that are disbursed across many smaller sources would face high transactional costs to comply with the program and are therefore also excluded from established cap-and-trade programs. Agricultural and forestry emissions meet these criteria. Some non-combustion sources such as small landfills or wastewater treatment facilities that are below an emissions threshold (e.g. 25,000 metric tons CO2 equivalent) may also warrant exclusion because the administrative and cost burden imposed by including them in the program outweighs environmental benefit of including these relatively small sources of emissions. These sources of emissions are not covered by any GHG cap-and-trade programs currently implemented and would likely not be included in an Oregon program.[14]

---

[12] Cope, S. 2006. "Scope of a Greenhouse Gas Cap-and-Trade Program." Article, 1-16. http://www.c2es.org/docUploads/Scope.pdf

[13] DEQ's annual statewide inventories of greenhouse gas emissions are posted here: http://www.oregon.gov/DEQ/AQ/Pages/Greenhouse-Gas-Inventory-Report.aspx

[14] National Research Council of the National Academies. 2010. "Limiting the Magnitude of Future Climate Change. https://www.nap.edu/catalog/12785/limiting-the-magnitude-of-future-climate-change

Policies tailored to the characteristics of these sectors might more effectively achieve reductions from these emission sources.

A broad scope is also likely necessary to link with the WCI market that currently connects cap-and-trade programs in California and Quebec. These two jurisdictions' programs cover approximately 80% of their emissions, including transportation fuels, natural gas, industrial processes, and electricity, including emissions from imported electricity. While there are no precisely established requirements on the necessary scope of another jurisdiction's program needed for linkage, policy documents from California,[15] Quebec,[16] and the WCI[17] indicate that a similar scope to the existing programs is likely necessary.

Table 4.1 identifies the sources of emissions in Oregon's GHG inventory, which could feasibly be covered by a cap-and-trade program, and an approximate number of entities that could be subject to the program.

TABLE 4.1

Emissions sources	Feasibly covered by cap?	Approximate number of OR entities
Fossil fuels	Yes - at the fuel supplier level	38
Natural gas	Yes - supplier level and large emitters[18]	6
Electricity use	Yes - In-state generators and electricity providers[19]	8
Large emitters	above an emissions threshold[20]	49
Agriculture	No	N/A
Minor sources	No[21]	N/A

[15] Air Resources Board. 2016. "Summary of the Cap-and-Trade Program in Ontario, Canada". https://www.arb.ca.gov/regact/2016/capandtrade16/appd.pdf

[16] Quebec Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques. Date unknown. "The Québec cap-and-trade system and the WCI regional carbon market: A Historical Overview". http://www.mddelcc.gouv.qc.ca/changements/carbone/documents-spede/historical-overview.pdf

[17] Western Climate Initiative. 2010. "Design for the WCI Regional Program". http://www.westernclimateinitiative.org/the-wci-cap-and-trade-program/program-design

[18] Natural gas could be covered entirely at the supplier level which could entail just six entities. Ontario's cap-and-trade program uses this approach. Alternatively, large sources could be directly subject to the program, necessitating that suppliers only hold allowances for the amount of gas they supply to Oregon customers less the amount they supply to these large sources. California and Quebec both use this approach. While regulating entirely at the supplier level is simpler, that could inhibit the primary technique for reducing leakage in the industrial sector - free allocation of allowances to large sources of emissions.

[19] The point of regulation for electricity imports could be on utilities directly serving Oregonian electricity users or on the entities that own the power as it is brought into the state. California and Quebec use the latter under a "first jurisdictional deliverer" approach. Determining the best point of regulation for an Oregon cap-and-trade program would require additional analysis into the technical and policy implications of these two approaches.

[20] The data in this chart for large emitters include sources that emitted more than 25,000 metric tons CO_2 equivalent annually from onsite combustion of natural gas and certain industrial processes.

[21] Minor sources noted in this row that are assumed to not feasibly be covered by a cap-and-trade program include small uses of refrigerants and small landfills emitting less than 25,000 metric tons CO_2 equivalent annually.

The sources listed in Table 4.1 as feasibly covered by a cap-and-trade program account for approximately 80% of Oregon's total GHG inventory. These sources could be covered alone or in various combinations. However, as stated above there are important technical and policy reasons for covering as many of these sources as possible. Covering some energy sources but not others can encourage businesses to switch to uncovered energy sources to evade the price signal sent by the program. For example, if electricity or natural gas – but not both – were covered by the program, this would provide an incentive for businesses and households to switch from one source to the other for heating and other energy needs, even though both sources contribute GHG emissions. A similar issue arises within the electricity sector when considering whether to only cover in-state sources of generation or to also include emissions from electricity imports. Only covering in-state generation would send an incentive for utilities to rely more on electricity generated at sources outside the state to evade the carbon price from the cap-and-trade program.

Both of these examples – switching energy source or relying more on imported electricity – result in leakage due to a narrow program scope. Broadening the scope of a cap-and-trade program not only provides the aforementioned economic benefits of lower-cost reductions, but also results in fewer perverse incentives for fuel switching to evade the carbon price without actually reducing emissions.

Thus, a cap-and-trade program designed to assure progress toward Oregon's GHG goals and to link with WCI jurisdictions should have a broad scope covering most or all of the emission sources listed as feasible in Table 4.1.

Stringency

The stringency of a cap-and-trade program is measured both by how quickly and how much it requires sources to cut emissions. This is defined by the relationship between the level of the cap and the sources of emissions subject to the program. The cap is defined by the annual allowance budget, or total number of allowances issued by the jurisdiction within a calendar year. The relation of this allowance budget to the sources and quantities of emissions establishes the overall stringency of the cap-and-trade program.

Stringency has significant implications both to the ability of a cap-and-trade program to advance progress toward Oregon's GHG goals, and to the compatibility for linkage with WCI jurisdictions. The stringency of the cap has direct consequence on the emission reductions ensured by the program and thus the ability for the program to assure progress toward Oregon's GHG goals. Stringency is also one the key areas evaluated by WCI jurisdictions when determining if another program is compatible for linkage.[22]

[22] California Government Codes section 12894(f) and (g) require that the Governor assess any program to which California proposes to link to assess whether the linkage satisfies four requirements. One of these is that the other jurisdiction's cap-and-trade program have equivalent or stricter stringency. The 2013 "Linkage Readiness Report" documents California's review of Quebec's program that supported the approval of the linkage between the

Establishing a stringency aligned with Oregon's GHG reduction goals is likely similar to the stringency compatible with the WCI jurisdictions' cap-and-trade programs. This similarity is not coincidence, but rather the result of those jurisdictions having similar long-term GHG reduction goals as Oregon and those jurisdictions designing their cap-and-trade programs to assure they achieve those goals. Table 4.2 compares Oregon's GHG goals to those of the WCI jurisdictions.

TABLE 4.2

GHG reduction targets of Oregon and WCI jurisdictions	2020	2030	2050
Oregon	10% below 1990	~32% below 1990[23]	75% below 1990
California	1990	40% below 1990	80% below 1990
Quebec	20% below 1990	37.5% below 1990	
Ontario	15% below 1990	37% below 1990	80% below 1990

While Oregon's long-term GHG goals are similar to the WCI jurisdictions, determining the precise level of the cap would still require certain considerations. First, the cap must be aligned to the scope of the program. A broader scope means the program will cover more emitters, and thus more emissions, so a commensurately higher cap (or number of allowances) would be needed for a certain level of stringency. For example, if additional sources of emissions are to be added to the program over time, the cap would likely have to be adjusted accordingly.[24]

A second important consideration is the amount of reduction achieved by capped sectors relative to the total emission reductions necessary to achieve Oregon's GHG goals. The decline of the cap could be set to achieve reductions equal to the proportion of capped sectors to Oregon's total GHG emissions, or to a lesser or greater amount of reduction. Oregon's 2050 goal is approximately 14 million tons (75% below the 1990 level of 56 million tons). If an Oregon cap-and-trade program covers 80% of statewide emissions, then a strictly proportionate approach would be to establish a cap trajectory culminating in a 2050 cap of 11.2 million tons. A cap trajectory ending in less than 11.2 million tons would assure that emission sources subject to the cap-and-trade program achieve more than their proportional "share" of the statewide goal, and a trajectory ending higher than 11.2 million tons would require that they achieve less than their proportional "share" of the goal. However, if it is believed that uncapped sectors will not or

programs those two jurisdictions. This is available here: https://www.arb.ca.gov/cc/capandtrade/linkage/arb_linkage_readiness_report.pdf

[23] Oregon does not have a legislatively adopted GHG reduction goal for 2030. The value shown here is computed simply by a linear decrease between the 2020 goal and the 2050 goal. A similar approach was used by the Oregon Global Warming Commission in their 2015 report to legislature in order to calculate a 2035 target.

[24] California and Quebec both made significant adjustments to their allowance budgets two years after their programs began to accommodate the inclusion of transportation fuels and natural gas. For example, California's allowance budget declined from 162.8 million allowances in 2013 down to 159.7 million allowances in 2014. However, the allowance budget in 2015 grew to 394.5 million allowances in order to accommodate those additional emissions that year.

cannot reduce their emissions, requiring more from the capped sectors may be necessary for the state to hit its goal.

The rate of the decline of the cap is another consideration. The decline of the cap can follow a linear trajectory, or include changing rates of decline over time. A "front loaded" trajectory would achieve a greater rate of annual reduction in the early years with correspondingly reduced rates of decline later. Conversely, a "back loaded" trajectory would have slower initial declines in the cap and greater annual decline in the later years. If the program allows for banking of allowances (described below in the Cost Containment section), a back loaded trajectory could inhibit the program from timely achievement of Oregon's GHG goals because banked allowances during early years under a relatively high cap could be used in later years more closely aligned to the state GHG goals. Furthermore, requiring only modest reductions in the early years could encourage investment in technologies that make later more significant reductions more difficult, such as replacement of coal generated electricity with natural gas instead of non-emitting generation. Conversely, ambitious annual reductions at the outset of the program may be unrealistic as the covered entities learn and adapt to the program and a full suite of lower-emitting alternatives are not yet available. Thus, a linear decline of the cap may be most reasonable absent a compelling reason to adjust it in either direction.

Finally, the cap resulting from these considerations would need to be assessed for compatibility with the WCI system. The caps currently established by WCI jurisdictions generally reflect a proportional trajectory toward their 2020 goals that are noted in Table 4.2. However, an Oregon cap-and-trade program could not likely to be developed and implemented until nearly 2020 at the earliest (given necessary legislative action and subsequent rulemaking). So, an indication of the WCI programs' stringency past 2020 is more informative of the stringency and trajectory that Oregon would likely need for compatibility. The best indication of the stringency of WCI jurisdictions' programs past 2020 is a recent proposal by California for changes to their program design to extend the program for 2021-2031.[25] California has proposed a simple straight-line path to a 2030 target that is a portion of their statewide 2030 goal based on the proportion of capped emissions sources to the statewide total.

Using California's updated proposal as a model, an Oregon cap-and-trade program should likely have to do the following. First, the cap within a given planning period should follow a trajectory no higher than a straight-line path to Oregon's 2050 GHG goal. For example, establishment of a cap over the period of 2021-2030 should culminate at a 2030 cap equal to or less than the 2030 interpolated target listed for Oregon in Table 4.2. Second, this may only need to be based on the proportionate share of capped emissions to Oregon's total emissions. Finally, the trajectory of the cap could be linear.

However, these indicators are not exact, especially in regard to compatibility with WCI jurisdictions. California and Quebec have not established compatibility tests that could be examined as part of this study. Instead, Oregon would need to begin developing of a cap-and-trade program and coordinate closely with the WCI jurisdictions during the development process

[25] California Air Resources Board. 2016. "Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms". https://www.arb.ca.gov/regact/2016/capandtrade16/appc.pdf

to ensure the stringency and certain other program design elements described in this section are done in a compatible manner.

Allowance distribution

Distribution of allowances[26] is a key consideration of a cap-and-trade program, but implications for this element differ significantly from the scope and stringency described previously. Whereas scope and stringency have direct consequences on the ability of the program to assure progress toward Oregon's GHG reduction goals and for compatibility of the program to link with WCI jurisdictions, distribution of allowances has relatively modest effect on these core considerations. Instead, the primary consideration for allowance distribution, often referred to as "allocation", is its ramifications on impacts to directly regulated businesses and ultimately to Oregon consumers through the cost of goods and services.

There are three basic methods for distributing allowances:

1. Free allocation
2. Auction
3. Hybrid (consignment)

Free allocation is just as it sounds – distributing allowances to parties without charging a fee. Perhaps the most obvious and compelling reason for this allocation approach is to directly mitigate potential costs to regulated firms by providing them with at least some of the allowances they require without paying the market price. Allocating allowances freely to regulated firms is administratively simpler than auctioning allowances. However, free allocation requires work in advance to identify the parties receiving free allowances and to develop the methodology for allocating them among the parties. Political considerations are likely to factor in these decisions, as well as technical and economic factors for controlling leakage as discussed in greater detail in Section 5.

Auctioning allowances provides for a relatively transparent approach to distribution, and as discussed later in this section and in other sections of this study, generates revenue that can be reinvested in a number of ways such as to mitigate the effect of the program on low-income households. Rather than the state choosing which entities will receive allowances, the auction uses the market to determine allocation by distributing allowances to the entities that make successful bids. There is also evidence that auctioning allowances can produce a more robust marketplace. That is, while conventional microeconomic theory suggests no difference in efficiency between auctioning and freely allocating permits – both send the same cost signal to emitters and merely transfer wealth within the economy – some have argued that practical

[26] Allowances are essentially permits to emit one ton of carbon dioxide equivalent. Under a cap-and-trade program, each year Oregon would distribute allowances equal to the annual cap. So, if in a given year an Oregon cap-and-trade program has a cap of 40 million tons, the state would need to distribute 40 million allowances using one or more of the methods described in this section.

considerations make auctioning more efficient.[27]. Freely allocating allowances can produce a market with fewer buying and selling entities which in turn makes it difficult for the market to determine the price established by the policy. Lacking a clear carbon price can hinder the program's ability to spur innovation and the resultant emission reductions that are sought by a cap-and-trade program. Conversely, auctioning allowances helps assure market participation, producing a more robust marketplace and a more apparent emissions price. This should in turn yield a stronger response, such as more innovative methods for reducing emissions.[28]

Auctioning allowances also avoids the possibility that regulated parties which receive allowances for free still charge the market price for those allowances to their customers and pocket the resulting windfall profits. While this may not apply to all industries, there is evidence that this occurred in the early stages of the EU ETS.[29] This is primarily a risk in sectors that are not regulated closely for consumer protection, such as transportation fuels. Regulated sectors such as natural gas and electric utilities pose little risk of this and are thus more feasible recipients of free allocation or the consignment approach described below.

In essence, there are compelling reasons for both free allocation and auctioning. The former offers a tool for mitigating leakage and allows the state to reduce costs to certain businesses or their customers,[30] while the latter method is better aligned to the market principles of a cap-and-trade program. A hybrid approach known as "consignment" potentially offers some of the benefits of both allocation methods.

Consignment of allowances entails a two-step process. First, the state freely allocates allowances to entities using a predetermined allocation scheme. Secondly, those entities are required to sell those allowances at the auction. Separate from this consignment process, these entities must purchase any allowances they require for compliance with the program, either on the auction or through a secondary market. Consignment can be used in industries like electricity where the electric distribution utility could be given the value since they are closest to the consumer and are regulated by the Public Utility Commission (PUC) or municipal boards that can assure that the value is used to shield consumers from higher carbon costs.

Consignment provides much of the benefits of free allocation and auctioning. Like free allocation, consignment reduces costs to regulated parties albeit in a different manner. Free allocation allows entities to avoid the cost of purchasing allowances, whereas consignment offsets the cost of allowance purchases by generating revenue for entities from the sale of the consigned allowances. The consignment approach requires greater market participation from entities than free allocation, which offers the aforementioned benefits of an auction.

---

[27] Many of the effects described here reference the literature review compiled by Energy and Environmental Economics (E3) for Oregon DEQ in the context of this cap-and-trade study. That literature review is provided in Appendix 2.

[28] Butraw, Dallas, and Kristen McCormack. 2016. "Consignment Auctions of Free Emissions Allowances under EPA's Clean Power Plan." http://www.rff.org/files/document/file/RFF-DP-16-20.pdf.

[29] Sijm, Neuhoff, and Chen. 2006. "CO_2 Cost Pass Through and Windfall Profits in the Power Sector" http://www.eprg.group.cam.ac.uk/wp-content/uploads/2008/11/eprg0617.pdf

[30] See Section 5

The WCI program design has "largely left allowance distribution decisions open to the discretion of each Partner jurisdiction."[31] However, the WCI program design also notes that jurisdictions must "discuss and seek to address any competitiveness issues or concerns" and that "jurisdictions may standardize the distribution of allowances as necessary to address any competitive impacts." So, while Oregon could have discretion to determine allowance distribution, it is important to consider how this is handled in WCI jurisdictions; California's allocation may be especially important because its proximity yields additional economic interactions with firms in Oregon, including issues of competitive advantage.

Large industrial emitters: Both California and Quebec freely allocate allowances to these facilities based on a variety of factors that take into account historic emissions, industry sector-specific benchmarks, and leakage risk. This makes it so that there is an equitable allocation of allowances across emitters in the same sector and because they are based on the product output of the facility they do not penalize or reward increases or decreases in the amount of production at a facility.

Electricity and natural gas utilities: California consigns allowances to utilities. The California Public Utility Commission prescribes how the revenue from sale of consigned allowances must be used to offset higher electricity or natural gas costs for certain ratepayers. Quebec has very little electricity generated by fossil fuels, and as such does not consign allowances to its utilities.[32]

Fossil fuel suppliers: California and Quebec do not allocate allowances to suppliers of natural gas and liquid petroleum fuels. These companies must purchase allowances at the jurisdictional auction or in secondary markets.

It is important to note that California and Quebec undertook considerable effort to develop formulae to specify precise allocation of free and consigned allowances. As mentioned previously, auctioning allowances is relatively simple aside from the administrative systems necessary to run the auction. Free distribution or consignment necessitate a transparent approach for determining which entities receive allowances and the precise quantity they each receive.

Revenue

Auctioning allowances generates revenue for the state. As such, if auctioning allowances is included in the cap-and-trade program, Oregon would need to determine how to use this revenue. It is also important to note that revenue from auctioning allowances is inherently volatile. While price can be contained to some degree (as discussed in the Cost Containment section below), there will always be uncertainty about the revenue generated by the auction. Use of revenue is not an element of program design that needs to be aligned with WCI jurisdictions to maintain compatibility for linking. Using revenue for further GHG emission reductions, particularly from sources not covered by the cap, could further progress toward Oregon's GHG goals. However,

[31] Western Climate Initiative. 2008. "Design Recommendations for the WCI Regional Cap-and-Trade Program". http://www.westernclimateinitiative.org/the-wci-cap-and-trade-program/design-recommendations

[32] More detail is provided in the literature review compiled by Energy and Environmental Economics (E3), available in Appendix 2.

other program design elements such as stringency and scope may be more significant to the program ensuring progress to the state GHG goals. Therefore, this section describes general purposes for which revenue generated by a cap-and-trade program could be used.

In general, revenue can be used for five broad purposes:

1. Improving the efficiency of the program: Spending revenue on projects that reduce emissions from sources covered by the cap will lower demand for allowances and thereby reduce their cost. This can include programs that provide businesses and consumers with low-carbon alternatives (e.g. transportation options).
2. Broadening the scope of the program: Alternatively, funding projects that reduce emissions from sources not covered by the cap will extend the reach of the program to these uncapped sources.
3. Mitigating distributional impacts: Revenue can be spent on programs benefiting businesses and their workers that are disproportionately impacted by the price signal of the cap-and-trade program. Similarly, revenue could fund projects benefiting disadvantaged populations and rural communities that may be disproportionately affected by the price of the program. Section 5 discusses economic sectors that could experience this price signal more acutely, while Section 6 examines how a cap-and-trade program would affect disadvantaged populations and rural communities.
4. General spending: Revenue from a cap-and-trade program could be used to finance the wide variety of government activities traditionally funded by other taxes. Several countries in the European Union Emission Trading System (EU ETS) have opted for this approach by directing their revenue from this program into their national treasuries.[33]
5. Reducing other taxes: Existing state taxes or fees could be lowered by using revenue from the cap-and-trade program. British Columbia's (B.C.) carbon tax uses this approach. Taxes on B.C. households and businesses are reduced by approximately the amount of revenue generated by the carbon tax, thereby creating a "revenue neutral" program.[34]

California and Quebec have predominantly used revenue from their programs to fund programs in the first three categories. Quebec has allocated all revenue to fund initiatives in their Climate Change Action Plan.[35] California similarly dedicates all revenue from their program to funding projects that reduce greenhouse gas emissions. Additionally, 25% of the revenue must also go to projects that provide a benefit to disadvantaged communities and at least 10% of the funds must be for projects located within those communities.

---

[33] Carbon Pricing Leadership Coalition. 2016. "What Are the Options for Using Carbon Pricing Revenues?". http://pubdocs.worldbank.org/en/668851474296920877/CPLC-Use-of-Revenues-Executive-Brief-09-2016.pdf

[34] British Columbia Ministry of Finance. "What is a Carbon Tax?". http://www.fin.gov.bc.ca/tbs/tp/climate/A1.htm

[35] Quebec Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques. 2012. "2013-2020 Climate Change Action Plan". http://www.mddelcc.gouv.qc.ca/changements/plan_action/pacc2020-en.pdf

It is important to note that Oregon's Constitution restricts the use of revenue generated from fees or taxes on transportation fuels. Sale of allowances to cover compliance obligations of transportation fuel suppliers may be subject to this restriction. If that is the case, and an Oregon cap-and-trade program distributes allowances similarly to California, then a majority of the revenue generated by the program would need to "be used exclusively for the construction, reconstruction, improvement, repair, maintenance, operation and use of public highways, roads, streets and roadside rest areas in the state."[36]

Oregon's Constitutional restriction may not entirely preclude using the revenue generated from transportation fuel suppliers for the aforementioned five broad purposes. For example, revenue from allowances sold to transportation fuel suppliers could fund roadway projects that improve transportation efficiency and reduce GHG emissions. Similarly, this revenue could fund roadway projects directly within and/or that benefit disadvantaged populations and rural communities. Alternatively, this funding could offset other fees or taxes that are currently relied upon for funding state transportation projects. Despite these possibilities, Oregon's Constitution likely imposes a significant restriction on how revenue from a cap-and-trade program could be used and is an important consideration for designing a cap-and-trade program.

Cost containment

Rather than prescribing a cost per ton of emissions as a carbon tax does, a cap-and-trade program relies on a market to establish the allowance price. This can produce fluctuations in the emission price established by the program. Some degree of price movement is expected from a cap-and-trade program and is key to the program achieving its environmental goals at the lowest possible cost. Short-term volatility in allowance prices can come in response to external economic factors; this volatility generally helps the program achieves the required reductions at least cost. However, excessive volatility and price spikes can dampen the incentive for innovation and make it challenging for regulated entities to make long-term plans in response to the changing signals produced by the policy. Most cap-and-trade programs are designed to avoid these problems by including mechanisms to prevent price spikes.

Following are brief descriptions of several mechanisms for moderating price volatility. These descriptions note how the programs in WCI jurisdictions implement (or not) these cost containment mechanisms. Because linked cap-and-trade programs require fungibility of allowances across jurisdictions, cost containment measures must generally be common among the linked programs to prevent competitive differences. Thus, in order for Oregon to develop a program to link with WCI jurisdictions, the state program would likely need to match how WCI jurisdictions have implemented these cost containment mechanisms.

Banking: Allowing entities to retain allowances across multiple compliance periods provides flexibility and encourages early emission reductions. California and Quebec permit allowances to be held indefinitely, but also impose holding limits that prescribe a maximum amount of allowances that can be held by entities.

[36] Oregon Constitution. Section 3(a), Article IX

Borrowing: Permitting entities to borrow against future releases of allowances can cushion price increases at the cost of allowing greater emissions within a compliance period than is otherwise prescribed by the cap. Borrowing is not allowed in the California and Quebec programs. The European Union Emissions Trading System provides a very limited form of borrowing.

Linkage: Connecting cap-and-trade markets across multiple jurisdictions provides for broader and more diverse marketplace that is less volatile. Ontario recently evaluated multiple cap-and-trade options and concluded that linking with California and Quebec would result in a lower and more stable price.[37]

Price floor: A price floor establishes a minimum price that the state would auction allowances. This can ensure a meaningful incentive is established by the program, and provide more certainty about the revenue generated by the program.[38] California and Quebec have price floors. The California floor price started at $10 per allowance (metric ton CO_2 equivalent), rising by 5% plus the Consumer Price Index rate of inflation.

Price ceiling: Various mechanisms can provide a price ceiling to either ensure the allowance price does not exceed a certain price or provide a brake on prices past a prescribed threshold. Some mechanisms, such as alternative compliance pathways provide a "hard" ceiling by guaranteeing entities will not have to pay above a certain price. Both California and Quebec employ a "soft" ceiling by using a set aside referred to as an Allowance Price Containment Reserve (APCR). The APCR provides additional allowances into the market at three prescribed price tiers: $40, $45, and $50. Similar to the aforementioned price floor, these price tiers increase by 5% plus inflation.

Offsets: While offsets can provide cost containment, there are broader considerations on this program design element that are discussed separately below.

Offsets

Offsets can provide lower cost compliance options and thereby dampen potential increases in the market price. Offset credits represent emission reductions from sources not covered by the cap. These credits can be incorporated into a cap-and-trade program and used like allowances. An offset is generally equivalent to an allowance; both permit the emission of one ton of carbon dioxide equivalent from an emission source covered by the cap. Offset credits also offer an opportunity to spread the incentive for emission reductions to sources not directly covered by the cap-and-trade program. For example, methane from agricultural sources may not be feasibly covered by the cap, yet offset credits awarded to dairy digesters could nonetheless allow the program to encourage reductions from these sources. However, offsets can raise concerns that require consideration and mechanisms for ensuring the credits provide the reductions they represent.

---

[37] Province of Ontario. "Ontario's 5 Year Climate Change Action Plan." http://www.applications.ene.gov.on.ca/ccap/products/CCAP_ENGLISH.pdf

[38] Purdon, Mark, David Houle, and Erick Lachapelle. 2014. "The Political Economy of California and Quebec's Cap-and-Trade Systems." http://www.sustainableprosperity.ca/sites/default/files/publications/files/QuebecCalifornia%20FINAL.pdf

As noted above in the Scope section, certain sources of emissions may not be feasibly covered by a cap-and-trade program. Offsets can reduce the cost of emission reductions in a cap-and-trade program by increasing the emission reduction opportunities to these sources not feasibly covered by the cap. Offsets can also be used to help commercialize technology to capture and reduce GHG emissions and develop protocols to quantify emissions from sources that are otherwise not required to reduce their emissions. California has protocols for generating offset credits from the following six types of projects:

- Forest management and preservation projects that sequester CO_2 or avoid the loss of forest carbon;
- Biogas control systems for manure management on dairy cattle and wine farms;
- Capture and destruction of methane from mining operations;
- Destruction of high global warming potential ozone depleting substances which are used as refrigerants;
- Reduced methane emissions from rice cultivation;
- Urban tree planting and maintenance projects to permanently increase carbon storage in trees.

Quebec has adopted four offset protocols, opting not to include the two forestry project types or rice cultivation and including a protocol for landfill gas capture and destruction. Generally, linked WCI jurisdictions must agree on offset protocols to allow the offset credits to be fungible across the linked systems. An Oregon program could link to WCI if it allowed credits from some or all of these six credit types. However, including additional project types would likely require coordination with WCI jurisdictions to address concerns about relative competitiveness and the integrity of any new protocol.

While offset credits can lower compliance costs and broaden the reach of the cap-and-trade program, they have also sparked concern about the environmental integrity of the policy. One such concern is that insufficient verification and enforcement of offsets can yield credits to projects that do not actually generate the emission reductions for which they are awarded. Verification can be challenging because of many site-specific factors to a project's actual emission reductions. This challenge can be compounded by project types that require ongoing monitoring for years or decades. "Additionality" raises another concern about offset credits. This refers to the incremental emission reduction from a project that can be shown to have occurred as a result of the purchase of the offset credit rather than for some other reason (e.g., existing regulations). Proving this additionality can be challenging, and requires examination of the financial motivations and regulatory context specific to an individual project.[39]

California and Quebec address these concerns with protocols defining the types of projects (listed above) that can generate offsets credits, and strict requirements on verification and monitoring of each project. These protocols prescribe the data quantity and quality that must be

[39] National Research Council of the National Academies. 2010. "Limiting the Magnitude of Future Climate Change. https://www.nap.edu/catalog/12785/limiting-the-magnitude-of-future-climate-change

available to ensure emission reductions can be verified by an independent third party. Enforcement is another important assurance that offset credits provide real, additional, and permanent emission reductions. California and Quebec rely on different enforcement mechanisms, but in both cases these provide assurance that erroneous offset credits will be replaced with allowances in order to ensure that the emissions cap is not exceeded.

To date, California has issued over 50 million offset credits, of which none have been found to double count or overstate emission reductions.[40] One project awarded 88,955 credits for destruction of ozone depleting substances was later invalidated due to failure to comply with applicable environmental, health and safety regulations.[41] As this is the only instance of invalidation resulting from California's verification processes, less than 1% of the offset credits issued thus far have been invalidated.

Another concern about offsets is that entities covered by the cap can avoid investing in changes to reduce their emissions by purchase of these credits. Offset projects essentially offer an alternative source of emission reduction into the program, thereby relieving some pressure on covered entities to reduce their own emissions. Large industrial sources of GHG emissions covered by the cap-and-trade program are often emitters of other pollutants that pose localized health considerations. In California and elsewhere this has led to environmental justice concerns as these large sources of emissions have traditionally been located in closer proximity to disadvantaged communities (see Section 6). California and Quebec address this concern, at least to some degree, by limiting the use of offset credits to 8% of any single entity's compliance obligation. Oregon may need to adopt a similarly stringent limitation on the use of offset credits to link with WCI jurisdictions.

Program administration

Implementing a cap-and-trade program requires several administrative functions. Following is a brief description of the key functions and how these could be fulfilled if Oregon were to adopt a program that could link with WCI jurisdictions.

- GHG emission reporting and verification: A fundamental element of a cap-and-trade system is the reporting of emissions by sources covered by the program. Oregon currently requires most emission sources listed in Table 4.1 as "feasible" to report annually on their GHG emissions. However, because a cap-and-trade program places the monetary cost on the emissions reported to the state, the reporting program necessitates a more robust monitoring and verification process than we currently have in place. The WCI program design outlines an emission reporting structure that includes reporting protocols similar to those currently used in Oregon's program. However, California and Quebec both require the GHG reports from entities covered by the cap-and-trade program to submit reports by accredited third-party verifiers. These verification reports provide assurance that the emissions covered by the cap-and-trade program, and for which allowances must be retired, are accurately reported. Quebec uses international standards established for GHG

[40] https://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm

[41] https://www.arb.ca.gov/cc/capandtrade/offsets/ods_final_determination.pdf

validation and verification for third-party verifiers, while California developed their own accreditation program for verifiers. Oregon would likely need to expand the existing GHG reporting program to align with the sources of emissions covered by the cap-and-trade program and to increase monitoring and verification.

- Allowance tracking system: Tracking the issuance, trading, and retirement of allowances is an important component of a cap-and-trade program. WCI, Inc. administers the Compliance Instrument Tracking System Service (CITSS) to provide this functionality. WCI, Inc. is a non-profit organization funded and controlled by the WCI jurisdictions. CITSS is a software platform that provides accounts for compliance entities and other market participants to track the receipt and transfer of allowances issued through participating WCI jurisdictions. This common platform is an important linkage between the programs as it facilitates the movement of allowances across jurisdictions which is a necessary component of a joint marketplace. Oregon would need to use CITSS for allowance tracking if our cap-and-trade program were linked to WCI jurisdictions.
- Compliance verification and enforcement: Each jurisdiction must rely on its own authority to enforce compliance with their respective cap-and-trade program requirements. However, some degree of harmonization of verification rigor and enforcement penalties is needed to ensure a level playing field across the linked jurisdictions. The WCI standardized penalty for non-compliance is a requirement for compliance entities to submit allowances in a 4:1 ratio (i.e. one allowance covering the original compliance requirement plus three additional allowances) for each ton of emissions that a regulated entity does not submit allowances for within the compliance period. Oregon would need to develop an enforcement process aligned with that element of the programs in California and Quebec. Additional administrative, civil and criminal penalties for non-compliance can be developed at the discretion of individual jurisdictions.[42]
- Auction platform: California and Quebec conduct joint auctions via the GHG Allowance Auction and Reserve Sale Platform available at www.wci-auction.org. This provides a centralized platform for auctioning allowances issued by both jurisdictions. The platform allows participants to apply for, post bids to, and review results for the auctions. Participants must be registered in CITSS to participate in an auction. Oregon could use this auction platform to participate in joint auctions with WCI jurisdictions.
- Market monitor: In addition to market monitoring performed by the regulators in California and Quebec, WCI, Inc. contracts for third-party services to audit and monitor sales of allowances at the auction platform and to monitor related market activity including secondary markets that subsequently trade allowances. These market monitoring services identify potential issues such as exceedance of holding limits, anti-competitive trading behavior and any other potentially fraudulent activity affecting the

[42] Western Climate Initiative. 2010. "Design Summary". http://www.westernclimateinitiative.org/component/remosotory/general/program-design/Design-Summary/

allowance market. Oregon could use these market monitoring services if we were to develop a cap-and-trade program linked with WCI jurisdictions.

- WCI administration: Several of the aforementioned functions are at least partially performed by WCI, Inc. WCI, Inc. is a non-profit corporation formed to facilitate multi-jurisdictional trading of greenhouse gas allowances. WCI Inc. is governed by a Board of Directors comprised of officials from the member provinces and states. Currently this is California, Quebec, Ontario and British Columbia. Oregon would likely join this Board if we were to develop a program linked to these other jurisdictions. In addition to the Board of Directors, WCI Inc. has formed several technical committees that meet regularly to evaluate how the linked programs are functioning and to consider harmonized amendments.

DEQ has not identified specific staffing or funding required to administer a cap-and-trade program, as this was outside the scope of this study and would depending upon program design. However, it is clear that several new staff would be required to develop and implement such a program. These staff would need expertise in rule writing, stakeholder engagement, and the many elements of the program, including knowledge of the GHG sources in sectors covered by the program, the economic and market aspects of the program, and monitoring and enforcement. Additionally, new resources for information technology would be needed to support the program. Finally, funding for procurement of professional services could be necessary to provide economic analysis or other expertise not feasibly provided through staff.

5. Potential economic effects in Oregon

This section summarizes the anticipated economic effects of a cap-and-trade program in Oregon. It draws upon a number of sources in literature, the economic effects observed from similar climate policies in other jurisdictions, and macroeconomic modeling conducted as part of this study of a hypothetical cap-and-trade program in Oregon. Also included in this section is a discussion of the expected impacts of cap-and-trade on certain Oregon industries and distinct considerations for mitigating effects on energy-intensive, trade-exposed businesses.

Macroeconomic effects

Review of existing modeling

Most modeling and analyses done to-date have focused on climate policies generally, rather than specifically of the effects of cap-and-trade. In general, economic modeling and studies of the effects of climate policy find that overall effects are very small (<1% of gross state/national product) in magnitude (whether positive or negative) relative to the size of the economy. The results of macroeconomic analyses depend on the type of model used – there is often a tradeoff between having greater functionality within the model and more complexity and cost to operate it. All studies of climate policy attempt to evaluate and quantify certain economic effects, including those that are positive, negative, or neutral. The primary economic effects of climate policies, including market-based approaches, are described below.[43]

- Correcting market failures: climate policies can correct for various market failures, including the tendency of consumers to underinvest in energy efficient technologies and the negative externality of freely emitted greenhouse gases. Correcting these failures is largely seen as a positive economic effect of climate policies, and this correction may cause businesses and households to spend less on energy, freeing up resources for other economic activities.
- Stimulus effect: the positive effects from investments in new energy sources and consumer technologies can increase jobs and economic activity within the associated sectors and upstream industries. Increases in jobs in these industries leads to higher total spending on goods and services and more total employment.
- Displacement: this negative effect occurs when other goods and services are displaced by new energy sources and consumer technologies. The reduced economic activity in fossil fuel and connected industries creates a negative stimulus effect.
- Price effect: the increased prices of carbon-intensive goods and services will send a market signal to consumers to begin to shift reliance toward lower carbon alternatives. Production costs of products in the economy that continue to depend on high carbon inputs will increase. Depending on consumers' ability to substitute other lower-carbon

[43] Many of the effects described here reference the literature review compiled by Energy and Environmental Economics (E3) for Oregon DEQ in the context of this cap-and-trade study. That literature review is available in Appendix 2.

goods and services, this can potentially lead to decreased household income and total employment. Price effects can be mitigated, though not completely eliminated, through cap-and-trade policy design, such as through rebates to utility consumers. Price effects can also be mitigated by robust complementary measures that drive down emissions and thereby reduce the cost of allowances traded within the cap-and-trade program.[44]

- Distributional effects: some industries and demographic groups will end up better off than others as spending shifts from higher to lower carbon-intensive goods and services. While the overall macroeconomic effect of this is neutral, there are equity and other implications which are discussed below and in greater detail in Section 6.
- Local spending: some studies suggest that a positive effect results from shifting spending from fossil energy to renewable energy because it causes more money to be spent in the local economy rather than being sent to external fuel producers. This may be particularly true in states like Oregon that import nearly all of our fossil fuels.

A comprehensive review of macroeconomic modeling literature primarily investigating the effects of complementary policies like a Renewable Portfolio Standard (RPS) and energy efficiency standards found that the effects (positive or negative) are likely to be small relative to the size of the overall jurisdictional economy.[45] However, this is partially because of the countervailing effects described above whereby gains in some parts of the economy are offset by losses elsewhere. So while the overall net economic effects are generally found to be quite small, there are localized positive and negative effects that can produce important distributional considerations.

One study estimated that a national-level revenue-neutral carbon tax (analogous to a cap-and-trade program where auction revenues are returned to households on a per-capita basis) would have small positive impacts on the US in 2025, including in the Pacific Region (Oregon, Washington, and California).[46] The 2014 Portland State University study of a carbon tax in Oregon came to a similar conclusion as mentioned above: a tax that repatriated revenue back to the economy (similar to a cap-and-trade program that uses auction revenue for public expenditures or targeted investments) would have a relatively small impact on employment and state economic output, although the benefits and costs would vary across regions, income levels, and industries.[47] Even in the most negative scenarios analyzed by the Portland State team,

---

[44] International Energy Agency Insights Series: Managing interactions between carbon pricing and existing energy policies, 2013

[45] Price, S., G. Kwok, E. Hart, and F. Kahrl, 2013. *Macroeconomic Impacts of Renewable Energy Policy*

[46] Scott Nystrom, and Patrick Luckow. 2014. "The Economic, Climate, Fiscal, Power, and Demographic Impact of a National Fee-and-Dividend Carbon Tax." http://www.energyindependentvt.org/wp-content/uploads/2015/04/REMI_Final.pdf

[47] Liu, Jenny H.; Renfro, Jeff; Butenhoff, Christopher; Paruszkiewicz, Mike; Rice, Andrew. 2014. "Economic and Emissions Impacts of a Clean Air Tax or Fee in Oregon (SB306)". Northwest Economic Research Center (NERC). Portland State University, College of Urban and Public Affairs. http://www.pdx.edu/nerc/sites/www.pdx.edu.nerc/files/carbontax2014.pdf

overall employment and output growth remained positive – the carbon tax acted as a small drag on that growth.

Economic effects in other jurisdictions

California conducted economic modeling in 2008 and 2010 to estimate the effects of their climate policies as a whole. The original analysis from 2008 found slight increases in gross state product when savings from energy efficiency are considered. Other analyses have found both slightly positive and slightly negative costs to the economy from California's various complementary policies.[48] California estimates that energy efficiency and clean vehicle policies more than pay back their costs and found that net benefits of $400 per year accrue to low-income households due to their reduced spending on gasoline and electricity.[49] While no retroactive analysis has been done yet to isolate the effect of the cap-and-trade program on California's economy, economic data from the last few years indicate robust growth while the cap-and-trade program was in its early years. For example, California's employment grew at a rate of 3.1% in 2014, faster than the national rate of 2.3%.[50] California has the highest total manufacturing output of any state[51] and they generate 1.7 times as much economic activity with the same amount of energy as the rest of the U.S.[52]

The potential economic effects of Ontario's forthcoming cap-and-trade program are perhaps the most relevant for Oregon because it is the newest addition to WCI and is an example of adding a cap-and-trade program to an existing suite of complementary policies. The province's cap-and-trade program is intended to cover 82% of the province's emissions and is projected to cost 0.03% of the province's economy in 2020.[53] In particular, the effects the cap has on energy prices are projected to reduce household consumption by 0.04%. Ontario plans to direct auction proceeds to households to reduce this negative impact. The use of auction revenue to mitigate negative impacts is discussed further in this section, Section 4 and Section 6.

In a 2015 report analyzing the economic impacts of the Regional Greenhouse Gas Initiative's (RGGI) most recent three years (2012-2014), the Analysis Group found that the cap-and-trade program in the Northeast led to positive economic impacts across all states, totaling

---

[48] *Exploring the Interaction Between California's Greenhouse Gas Cap-and-Trade Program and Complementary Emissions Reduction Policies.* EPRI, Palo Alto, CA: 2013. 3002000298

[49] CARB. 2008. "Climate Change Scoping Plan," no. December: 108. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[50] "Job growth in California soars", Chris Kirkham and Tiffany Hsu, March 6, 2015, LA Times, http://www.latimes.com/business/la-ficalifornia-jobs-20150307-story.html

[51] 2014 State Manufacturing Data Table, National Association of Manufacturers. http://www.nam.org/Data-and-Reports/StateManufacturing-Data/2014-State-Manufacturing-Data/2014-State-Manufacturing-Data-Table/

[52] California Green Innovation Index, 6th Edition, May 2014 http://next10.org/2014-california-green-innovation-index, p 13

[53] Sawyer, Dave, Jotham Peters, and Seton Stiebert. 2016. "Overview of Macroeconomic and Household Impacts of Ontario's Cap and Trade Program." Vol. 2016. http://www.enviroeconomics.org/#!Impact-Modelling-and-Analysis-of-Ontario?s-Proposed-Cap-and-Trade-Program/c1uze/573a64620cf23f57cc66dd05

approximately $1.3 billion in net economic value added (2015 dollars).[54] The report found that the positive economic outcome from the RGGI program results in large part from states' decision to sell allowances at auction and use the proceeds primarily by returning funds to electric ratepayers and funding local investments in energy efficiency and renewable energy. The local investment keeps more of the energy dollars inside their region, reducing the amounts that leave the region to pay for fossil fuel production.

Implications for Oregon

Literature, modeling of similar programs, and the experiences from other jurisdictions provides a strong indication of the likely effects a cap-and-trade program might have on Oregon's economy. The research to-date on the macroeconomic impacts of climate policies and the modeling done of the effects of other cap-and-trade programs all point to a similar conclusion: the overall economic impacts are small, relative to the size of the economy. Whether the economic effect is projected to be positive or negative often depends on whether the modeled program takes into account co-benefits of reducing pollution and whether it calculates benefits of local re-investment of revenue. Some studies return positive economic effects, particularly when programs provide for investment in local jobs and energy-saving measures. Others return negative effects, particularly when models don't account for co-benefits (such as improvements in air quality) or don't use revenue generated by the program to mitigate increased energy prices.

While research continues on the macroeconomic impacts of these policies, the existing literature points to a conclusion on the potential effects in Oregon: whether positive or negative, it is very likely that the total economic impact of a cap-and-trade program in Oregon would be small relative to the size of the state economy; that is, on the order of 1% of gross state product.[55] That said, the precise effect on Oregon's economy can't be known prior to implementation of a program.

In addition to what we can glean from literature and existing modeling, for this study we have contracted for new modeling conducted by Energy and Environmental Economics (E3), a California firm with experience analyzing the cap-and-trade program in that state. E3 analyzed how a cap-and-trade program could affect Oregon's economy. The results of this modeling effort are summarized below, while more detail is provided in Appendix 3.

---

[54] Hibbard, Paul; Okie, Andrea; Tierney, Susan; Darling, Pavel; 2015. "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States". Analysis Group. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf

[55] Stern, N. 2006. "The Economics of Climate Change." *Stern Review*. doi:10.1257/aer.98.2.1

Hübler, Michael, Sebastian Voigt, and Andreas Löschel. 2014. "Designing an Emissions Trading Scheme for China—An up-to-Date Climate Policy Assessment." *Energy Policy* 75: 57–72. doi:10.1016/j.enpol.2014.02.019

Rolland-Holst, David, Fredrich Kahrl, Madu Khanna, and Jennifer Bakka. 2009. "Clean Energy and Climate Policy for U. S. Growth and Job Creation." https://are.berkeley.edu/~dwrh/CERES_Web/Docs/ES_DRHFK091024.pdf

Stavins, Robert N. 2008. "Addressing Climate Change with a Comprehensive US Cap-and-Trade System." Article. *Oxford Review of Economic Policy* 24 (2): 298–321. doi:10.1093/oxrep/grn017

Economic modeling of cap-and-trade in Oregon

E3 used a two-step modeling process to evaluate the potential macroeconomic and distributional impacts to Oregon's economy from implementation of cap-and-trade. The first step required estimating and projecting the likely effects from Oregon's currently existing suite of policies, as well as projected economic and energy demand growth, would have on the level of statewide GHG emissions. This allowed E3 to determine the quantity of emissions that would need to be reduced by the cap-and-trade program in order for Oregon's GHG emission reduction goals to be met. This amount of emission reductions, as well as assumptions about the cost of allowances and certain program design features, is an input to the second step of the modeling process which estimates the magnitude of the economic effects from the cap-and-trade program itself. This section discusses the second step of the modeling process. Additional detail on both steps of the modeling methodology and the results is included in Appendix 3.

Model used: IMPLAN Pro

E3 used the Oregon-specific version of the macroeconomic model IMPLAN Pro 2015.[56] This is an "input-output" model which calculates changes in macroeconomic variables, such as economic value added and employment, that result from changes in spending from all sectors within the economy. Input-output models do not capture price effects (i.e. changes in consumers' demand for certain goods, or willingness to switch to other goods as a result of price changes) or structural changes within the economy in the future (i.e. the creation of new industries in response to policy changes).[57] At the core of the model is a matrix of multipliers that describe how changes "multiply" through the economy, increasing or reducing output from different sectors based on their supply chain linkages. The Oregon model contains 526 economic business sectors in total.

Estimating the potential impact of cap-and-trade on the Oregon economy using IMPLAN requires modifying the sector-level income and expenditure data in the IMPLAN matrix. In doing so, there are two basic economic effects that are modeled: the increased cost of energy due to the carbon price, and the stimulation of investment, both in low-carbon technologies due to the carbon price and elsewhere in the economy due to revenue recycling. The former is modeled as a reduction in sector-specific income due to the need to purchase allowance permits. The latter is modeled as an increase in sector-specific income due to the revenue from cap-and-trade auctions being spent in various sectors and recycled through the Oregon economy. Both of these effects are dependent on the assumptions made in the various scenarios, which is discussed in more detail below.

Economic effects not modeled

The outputs from the IMPLAN model can illustrate multiple expected effects of cap-and-trade in Oregon, but the limitations of the model mean that some effects – primarily positive ones –

---

[56] IMPLAN Pro 2015 is equipped with 2014 data. More information about IMPLAN is available here: http://implan.com/product/state-totals/

[57] In contrast, a computable general equilibrium model (CGE) would allow for prices to adjust so that goods, services, labor and capital can reach an equilibrium. They are much more complex and expensive to operate.

cannot be captured numerically. The version of the model available for this study is also not capable of breaking down the economic effects geographically which means that it is difficult to draw any conclusions by county or census tract, or by other important delineations such as income bracket. While some of these effects can be inferred from the projected impacts to various industries, a more sophisticated model would be needed in order to conduct an analysis of many of these other potential effects.

Of the potential positive effects of cap-and-trade not modeled in this study, the health co-benefits of decreased pollution and the associated increased productivity could be some of the most significant. Reductions in greenhouse gases from covered sources are also likely to lead to reduced asthma attacks, heart attacks, hospital admissions, and premature deaths, among other potentially significant co-benefits.[58] For example, a National Academy of Sciences 2009 study estimated that air pollution from burning fossil fuels in the U.S. is responsible for approximately 20,000 premature deaths per year.[59] A recent analysis of the RGGI cap-and-trade program found that since 2009 the program has reduced premature deaths, asthma attacks, and work days lost in the implementing states, totaling around $5.7 billion in health savings and other benefits.[60]

In addition, the distribution of economic costs and benefits across income levels or other socioeconomic strata is not modeled within IMPLAN. While the modeling does evaluate the overall economic effect of some scenarios in which auction revenue is repatriated back to households, the model is not capable of looking at the trickle-down effects to specific groups of households.

Key inputs and assumptions in IMPLAN

Table 5.1 details the primary inputs and assumptions that define the contours of the scenarios modeled within IMPLAN. These inputs and assumptions are the key factors that determine the differences in economic outcomes discussed below and in Appendix 3. All IMPLAN analysis was conducted for a snapshot year of 2035. The goal for the modeling exercise was to show the range of potential impacts rather than to precisely model a particular policy design or particular implementation approach. A desire to model the range of impacts is reflected in each of the inputs and assumptions: the variations on the inputs attempt to capture the "bookends" of possible effects on the economy. Thus, none of scenarios modeled necessarily represent the most likely ways that cap-and-trade would be designed for Oregon, but instead illustrate the range and magnitude of potential economic effects that this type of policy could produce.

---

[58] Boyce, James and Pastor, Manuel; 2012. "Cooling the Planet, Clearing the Air: Climate Policy, Carbon Pricing, and Co-Benefits." Economics for Equity and the Environment Network. https://dornsife.usc.edu/assets/sites/242/docs/Cooling_the_Planet_Sept2012.pdf

[59] National Academy of Sciences; 2009. "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use." Washington, DC: National Academies Press.

[60] "Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative, 2009-2014." January 2017. Prepared by Abt Associates, available here: http://www.abtassociates.com/AbtAssociates/files/7e/7e38e795-aba2-4756-ab72-ba7ae7f53f16.pdf

TABLE 5.1

Input / Scenario assumption	Explanation of inputs	Variations	Explanation of variations
Carbon price	The price paid per allowance purchased and the cost to achieve emission reductions	$32/ton	Forecast of the WCI auction floor price in 2035
		$89/ton	Forecast of the WCI reserve trigger price in 2035
Emissions forecast	The quantity of emissions that would need to be reduced by the cap-and-trade program, after the effects of other policies have been taken into account	"Reference" case: cap-and-trade covers 16.4 million tons CO2e	Other policies are reducing statewide emissions by 7.8 million tons in 2035
		"Aggressive" case: cap-and-trade covers 8.8 million tons CO2e	Other policies are reducing statewide emissions by 15.4 million tons in 2035
Loss factor	An estimation of the economic inefficiency in the system, due to companies or consumers shifting spending outside of the state, administrative costs of running the program, and other inefficiencies	15% loss	Lower inefficiencies = more value from the program staying in Oregon's economy
		30% loss	Higher inefficiencies = less value from the program recirculating in Oregon's economy
Permit distribution	The method allowances are distributed in the economy, thus determining the distribution of allowance value within the economy	Auction	100% of allowances are auctioned, and revenue is returned to households which increase spending according to existing expenditure patterns
		Free allocation	100% of allowances are given for free to industry, which reinvests the value of the allowances within the economy according to existing spending patterns

Summary of key results

IMPLAN produced results for 526 economic sectors in Oregon with data on how costs and expenditures move between those sectors.[61] For purposes of summarizing the results of the analysis, E3 aggregated those sectors into 19 high-level categories, in addition to showing the economic results for the statewide economy as a whole. Data tables detailing the full results for all 16 scenarios analyzed are provided in Appendix 3.

The results show that the cumulative statewide impact from a cap-and-trade policy designed to reduce emissions in line with Oregon's GHG reduction goals is expected to be small, ranging from a decline in statewide GDP of 0.08% in the most negative scenario to an increase in statewide GDP of 0.19% in the most positive scenario. Historical GDP growth in Oregon from 2005 – 2015 averaged 4.0% annually; assuming all else was held constant, the effects of a cap-and-trade policy as analyzed here would mean new annual growth rates between 3.92% and 4.19%.[62]

The results for employment show that, on a statewide level, employment is expected to increase for the majority of scenarios modeled. Employment impacts are expected to range from a 0.07% loss of jobs (roughly 1,540 jobs) in the most negative scenario to a 0.32% increase in jobs (roughly 6,580 jobs) in the most positive scenario.

Though small impacts can be expected at a statewide level, certain sectors are likely to experience greater costs, while others are projected to incur greater benefits due to the policy. For example, the construction sector sees a positive economic effect from the policy under all scenarios modeled, while the transportation and mining sectors see the largest declines relative to their industry size. Precise prediction of the economic effects by sector is not a strength of the IMPLAN analysis, especially because there is no assumed changed to the underlying economic structure. Rather, the results should be interpreted to indicate that impacts will vary by sector and that the distributional effects of a cap-and-trade policy should be carefully considered when determining how the policy would be implemented. This is discussed in greater detail below, and all sector-level results are provided in Appendix 3.

Distributional effects

Though certain economic effects of a cap-and-trade system may generally be minimal at the macroeconomic level, there are distributional impacts across geographies, income levels, and industries that need to be considered. For example, cap-and-trade (and carbon pricing, more generally) is likely to be regressive unless implemented along with other measures designed to

[61] As previously mentioned, IMPLAN tracks flows between sectors but does not estimate effects beyond the first-order costs and benefits of imposing a cap-and-trade policy, as dictated by the key inputs and assumptions outlined in Table 5.1.

[62] For additional context, these results mean that in terms of overall impact on economic growth, it would take between 8 days more and 18 days less per year to achieve the same GDP growth as it would without the simulated cap-and-trade program.

alleviate these effects.[63] The impacts to disadvantaged communities and possible remedies are discussed in greater detail in Section 6. This section focuses on the predicted impacts to energy-intensive industries and the communities that may be reliant on those industries for their local economies.

Emissions Leakage

Introducing an environmental regulation in one state can cause business costs and consumer prices to rise in that jurisdiction relative to costs in other jurisdictions that do not introduce comparable regulations. In industries where businesses are not able to pass on increased costs to consumers – also known as trade exposed industries – businesses may shift production outside of the jurisdiction to avoid the increased costs. This not only means that the emission reductions in the implementing jurisdiction are offset by increased emissions elsewhere ("emissions leakage") but also that the economic benefit of that production is lost to another jurisdiction. In addition to leakage risk, California also identified a risk that some manufacturers will face a loss of profitability at the start of the program, and that this loss of profitability would inhibit those entities from investing in cost-effective emission reductions. Design features of a cap-and-trade program can be tailored to counteract the economic pressure that could induce emissions leakage and transition risks to energy-intensive industries.

In California, staff developed a methodology for identifying industries at risk of emissions leakage and a mechanism for minimizing that risk. Free allowances are credited according to formulae which take into account historical annual emissions by facility, an emissions benchmark for a facility's industry, and an annual adjustment factor to reflect a steadily tightening emissions cap. The calculations also take into account the leakage risk (high, medium, or low) for each industry, as determined by two metrics: trade exposure and emission intensity.[64] Free allowances are then ratcheted down over time, more quickly for low and medium risk sectors as compared to high leakage risk sectors. Three studies of potential emissions leakage in California were completed in 2016 and staff are now considering changes to the metrics used to determine leakage risk for the program post-2020.[65] Having a program that allows for continual

---

[63] Stavins, Robert N. 2008. "Addressing Climate Change with a Comprehensive US Cap-and-Trade System." Article. *Oxford Review of Economic Policy* 24 (2): 298–321. doi:10.1093/oxrep/grn017

[64] Trade exposure can come from international competition or from domestic competition in other states. Domestic competition may be a greater concern for some Oregon industries than international. Much greater detail on how California defines these two metrics, the data sources for analyzing the metrics, and how they apply to various industries can be found in appendices J and K to the Staff Report: Initial Statement of Reasons, published by California staff on October 28, 2010 and available at https://www.arb.ca.gov/regact/2010/capandtrade10/capandtrade10.htm.

[65] See page 34 of California's staff report for a discussion of potential changes to the leakage metrics. https://www.arb.ca.gov/regact/2016/capandtrade16/isor.pdf

The three studies can be found at the following links:

International Leakage (UC Berkeley): (http://www.arb.ca.gov/cc/capandtrade/meetings/20160518/ucb-intl-leakage.pdf).
Domestic Leakage (Resources for the Future): (http://www.arb.ca.gov/cc/capandtrade/meetings/20160518/rff-domestic-leakage.pdf)
Food Processing Leakage: (http://www.arb.ca.gov/cc/capandtrade/meetings/20160518/calpoly-food-process-leakage.pdf)

assessment of leakage risk enables California to review the evolving research and evidence of emissions leakage and modify industrial assistance as needed.

Energy-intensive, trade-exposed industries

Communities will be affected by the treatment of energy-intensive, trade-exposed industries in a cap-and-trade program. The way different communities are affected depends on their proximity to industries and their reliance on these industries for economic growth and stability. Some rural communities may be more dependent on a smaller number of businesses as the primary sources of employment. If those businesses are also energy-intensive and trade-exposed, a cap-and-trade program could be a larger strain on these rural economies than in areas with more diverse industrial composition. Where the local economy is more varied, the overall impact of a cap-and-trade program would be smaller even if it posed a challenge for certain industries. Allocating allowances freely to entities in industrial sectors that face trade pressures can help alleviate some of the impact to these industries and the local economies that rely on them.

It is also important to note that some industries that may qualify for free allowances to prevent economic and emissions leakage may also be located in close proximity to disadvantaged communities. To the extent that those industries are responsible for localized pollutants in addition to greenhouse gas emissions, giving those industries free allowances could exacerbate the disproportionate pollution burden that affected communities have historically borne. In addition, free allocation to industry adds to the regressive nature of the cap-and-trade policy; that is, the costs of compliance are then borne even more disproportionately by lower-income households. This is because providing allowances to certain companies and their shareholders shifts the cost of the program to the rest of the market, including low-income households for whom there is already a disproportionate impact resulting from the increased cost of carbon-intensive energy.[66]

Freely allocating allowances to certain industries and businesses is important for mitigating potential emissions leakage and its negative effects on the efficacy of a cap-and-trade program and on communities that rely on those industries. However, the cap-and-trade program and other policies also need to address the potential effects on disadvantaged communities. This is discussed in more detail in Section 6.

Oregon business sectors susceptible to leakage

As described above, California employed a detailed regulatory process for determining which industries and entities to classify as energy-intensive and trade-exposed for purposes of free allocation of allowances. This process included analyzing metrics and processes used in other jurisdictions, sensitivity analyses, and discussions with stakeholders. Such a process for Oregon was not within the scope of this current study. Although Oregon's economy is structurally

[66] Chamberlain, Andrew, Who Benefits from Free Emission Allowances? An Economic Analysis of the Waxman-Markey Cap-and-Trade Program (September 28, 2009). Available at SSRN: https://ssrn.com/abstract=1479857 or http://dx.doi.org/10.2139/ssrn.1479857

different than California's, we can gather some useful conclusions about the industries in Oregon that may be susceptible to emissions leakage from the outcomes of California's process.

There are currently about 50 entities in Oregon with on-site CO_2 emissions above 25,000 metric tons which is the threshold used in California to determine the entities covered by the cap-and-trade system.[67] See Figure 1 for a map showing the locations of these entities. These are the entities that, for the purpose of this discussion, we assume would be "regulated entities" within an Oregon cap-and-trade system. Of those 50 entities, 29 are in industry sectors that could be theoretically susceptible to leakage pressure under a carbon pricing regime.[68] Of those 29 entities, 19 are in industries that California analyzed in the process of determining leakage risk designations in their cap-and-trade program. These entities fall into industries such as food processing, pulp and paper mills, cement manufacturing and iron and steel mills, and all 19 entities fall within the high or medium leakage risk categories in California. The other 10 Oregon entities are in industries such as electronics manufacturing, semiconductor manufacturing and ethyl alcohol manufacturing. A detailed regulatory analysis similar to California's would be needed to determine the appropriate leakage risk category for these industries (and for all Oregon industries), however it is probably safe to assume that the leakage risk for these entities would be either medium or high.[69]

Given that Oregon's industrial sectors are likely to be similarly at risk for emissions leakage as California's, a cap-and-trade program in Oregon would probably also need to freely allocate some allowances to these industries. The exact methodology for doing so, including quantity of free allowances and the duration over which those allowances would continue to be given for free, would need to be determined in a thorough regulatory process that included further analysis and stakeholder engagement to take into account the unique pressures that Oregon's businesses face. In addition, as more jurisdictions enact policies to price carbon, the leakage risk for all jurisdictions may decrease. As policymakers' understanding of the problem of emissions leakage evolves, the cap-and-trade program should allow modifications to leakage assistance where appropriate.

---

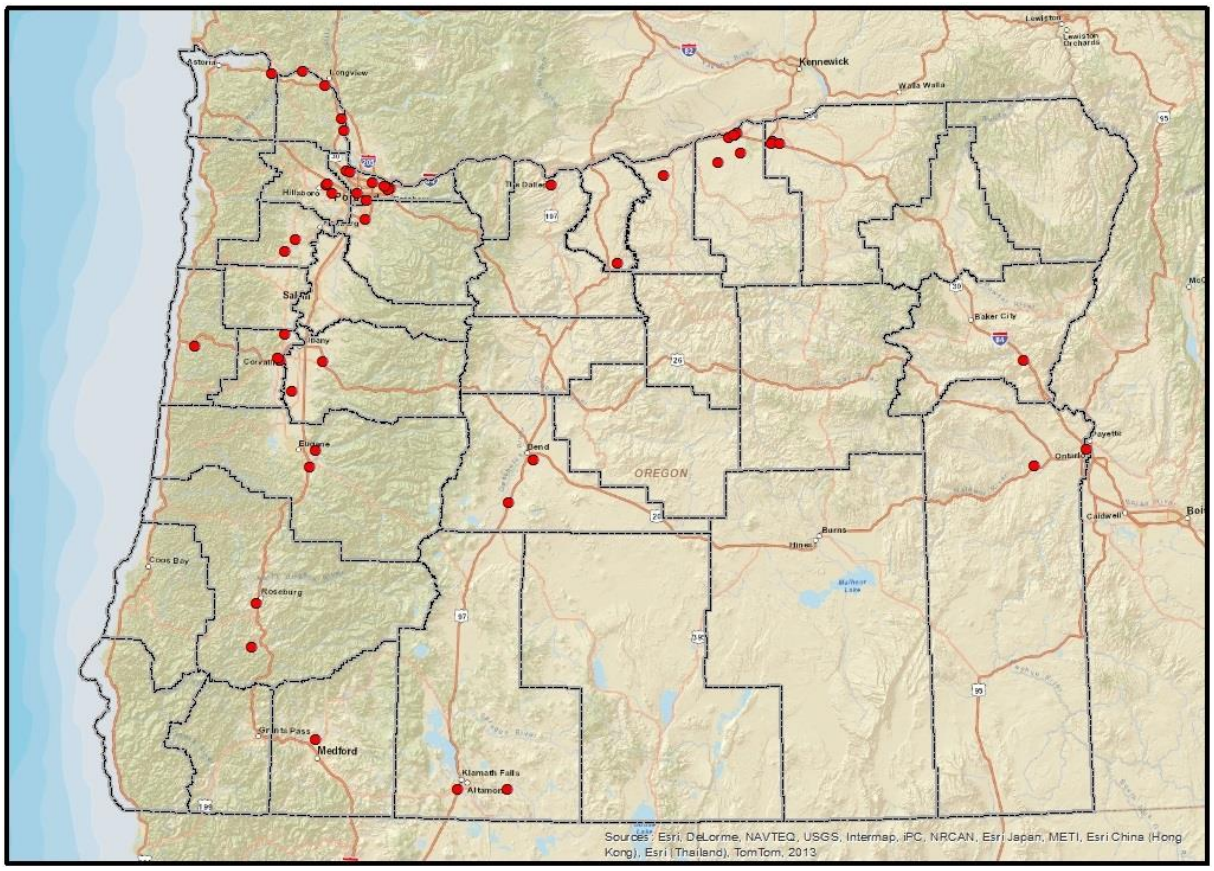
[67] See Appendix 1 for a complete list of these entities, including their leakage classification in California (if applicable.)

[68] For our purposes, as in California, we assume that on-site electricity generation at Universities, solid waste landfills, and other existing power plants in the state would not be facing trade pressures that would cause them to leave the state.

[69] Appendix 1 contains further description of the 29 entities mentioned here, the industries they represent, their locations, and aggregated employment information.

FIGURE 1

Locations of facilities currently emitting over possible threshold for regulation



Emissions leakage and rural Oregon

To estimate the possible connection between Oregon's more rural counties and the businesses that may be considered susceptible to leakage, we looked at the locations of the 29 entities described above. 18 out of the 29 businesses identified above are in counties other than the greater Portland metro area (Multnomah, Washington, and Clackamas counties). This simple look at the number of entities shows that rural Oregon counties host a significant portion of those facilities that are likely to be deemed at risk for emissions leakage.[70] As previously discussed, these industries may be essential engines of economic growth and stability in rural economies, which could make the impact of a cap-and-trade program significant. Free allocation of allowances to susceptible industries is one way to mitigate the impacts to these communities.[71]

---

[70] A better measure of the dependency of rural counties on the trade-exposed businesses would probably be the ratio of number of jobs supported by those businesses compared with overall employment in the county. That analysis was not within the scope of this project, but could be a useful exercise to undertake in the context of setting up a cap-and-trade allowance allocation scheme during rulemaking.

[71] Other approaches could be taken to support communities that are dependent on these industries, although many of them – such as new job training programs or targeted energy efficiency deployment – would likely involve investment of cap-and-trade auction revenue. California uses a substantial portion of the auction revenue to fund

Emissions leakage from electricity-intensive industries

Businesses that rely heavily on electricity as an input to their processes ("electricity-intensive") could face higher costs as a result of increased electricity prices due to the cap-and-trade program and may warrant consideration as susceptible to emissions leakage. To the extent that utilities' have new costs to comply with cap-and-trade, those costs are likely to be passed on to end consumers. If those end consumers are also businesses that are trade-exposed, and therefore unable to pass their increased costs on to consumers, those businesses may face leakage pressure. To the extent that cap-and-trade were to increase compliance costs for some utilities more than others within Oregon there could be pressure for large electricity consumers to relocate within the state, creating a separate but related transfer of economic output from one part of the state to another. Concerns about out-of-state emissions leakage due to indirect costs of a cap-and-trade program can be mitigated by ensuring that the value of allowances is used to help keep electricity rates down, either through direct allocation to utilities or through the repatriation of auction revenue to certain customer groups.

---

greenhouse gas reduction projects throughout the state. The availability of auction revenue may be limited in Oregon due to a provision of the state constitution that requires revenue collected from the transportation sector to be deposited into the Highway Trust Fund and spent on roads. This is discussed further in Section 6.

6. Effects on disadvantaged populations and rural communities

This section consists of five subsections: 1) a discussion of definitions of "disadvantaged populations" and "rural communities"; 2) description of the connections these communities have to climate change and climate policy; 3) tools to mitigate negative effects and maximize benefits of climate policy; 4) a discussion of California's experience approaching these issues; and 5) considerations for Oregon.

Important definitions

The legislature directed DEQ to examine the effects of a cap-and-trade system on "disadvantaged populations" and "rural communities" but did not provide any further direction on the definitions of these communities. In the process of conducting the study, it became clear that precisely defining these terms is not necessary for identifying key considerations for potential legislation establishing a cap-and-trade program in Oregon. These considerations are not necessarily dependent on the exact parameters used to define these communities.

This study does not attempt to determine the precise definitions of these terms for purposes of policymaking because a wide range of legitimate opinions and views exist among key stakeholder groups in Oregon. However, the precise definition of these terms may be of great importance in subsequent regulatory processes and determine how effective measures in the program would be at addressing the concerns and needs of these communities. Those decisions would likely be made in a legislative or regulatory discussion that would involve more stakeholder outreach than was possible within the scope of this study. The discussion below highlights some common language and definitions previously or currently being used in Oregon or elsewhere in order to provide context for the rest of this section and the report as a whole.

Healthy Climate Act Definitions

The 2016 Healthy Climate Act defined "disadvantaged communities" as follows:

> "Disadvantaged communities" includes, but is not limited to:
>
> (a) Communities with a high percentage of people of color, low-income households, immigrants or refugees relative to other communities;
>
> (b) Linguistically isolated communities; and
>
> (c) Communities with high exposures to pollution or toxics relative to other communities.

The bill did not contain a definition of "rural communities," but it did contain the following definition of an "economically distressed area":

> "Economically distressed area" means an area designated as distressed by the Oregon Business Development Department under ORS 285A.020 and 285A.075.

Oregon Environmental Justice Task Force (EJTF) Definitions

The Oregon EJTF was formed by the Legislature to help protect Oregonians from disproportionate environmental impacts on minority and low-income populations. The EJTF's Best Practices Handbook defines Environmental Justice (EJ) in the following way:

> "Environmental justice goes beyond traditional civil rights laws by including low-income communities along with communities of color as populations needing additional consideration due to disparate impacts. EJ communities include:
>
> - Minority communities
> - Low-income communities
> - Tribal communities
> - Underrepresented communities, such as youth, elderly, or those with physical or mental disabilities"

Definitions of "Rural"

There are fewer readily obvious definitions of "rural communities" for purposes of a cap-and-trade system. The U.S. Census Bureau defines "rural" areas as being all territory, population, and housing units located outside urbanized areas and clusters. This means that rural areas are those with populations less than 2500 people in a territory or area. One comment received by DEQ in the context of this study suggested that the definition of rural could be "communities located entirely outside of the acknowledged Portland Metropolitan Area Regional Urban Growth Boundary and the acknowledged urban growth boundaries of cities with populations of 30,000 or more."

Connections to climate change and climate policy

The following section summarizes some of the key interests raised by stakeholders and community leaders, as well as in various studies on connections between disadvantaged populations and rural communities and the effects of climate change and the policies like cap-and-trade that are being used to address it.

Impacts of climate change

Climate impacts themselves are likely to burden communities of color, low-income communities, and rural communities in unique ways.[72] For example, low-income households, particularly those of color, are more likely to be without air conditioning to aid in withstanding the heat waves that Oregon is likely to continue to experience more frequently.[73] People of color

---

[72] Rachel Morello-Frosch, et al. 2009. "The Climate Gap: Inequalities in How Climate Change Hurts Americans and How to Close the Gap." *available at* http://dornsife.usc.edu/assets/sites/242/docs/The_Climate_Gap_Full_Report_FINAL.pdf, *archived at* http://perma.cc/7JJ-LAAV.

[73] Dalton, M.M., P.W. Mote, and A.K. Snover [Eds.]. 2013. Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities. Washington, DC: Island Press. http://occri.weebly.com/uploads/8/7/9/4/87945130/climate_change_in_the_northwest.pdf

and low-income people are less likely to have access to modes of transportation necessary to reach safe ground in the event of an emergency. They are more likely to be exposed to the health risks posed by climate change[74] and less likely to have health insurance to deal with the consequences.[75] In rural Oregon communities, homes and jobs are at risk from increasing numbers and intensities of wildfire and forest diseases.

Effects of a cap-and-trade policy

A cap-and-trade program (or any other policy that prices carbon) is inherently regressive due to the fact that lower income households spend a higher proportion of their income on energy costs.[76] Without mechanisms (such as targeted use of revenue generated by the program) to address the regressivity, the rise in fossil energy costs due to the cap-and-trade program will disproportionately impact lower income households. In addition, these households are less likely to have the ability to make investments needed to adapt to higher energy prices (such as buying new, more efficient appliances) than wealthier households.

Rural households may not necessarily need to drive more miles than other Oregonians on average,[77] but Eastern Oregonians do rely more on vehicle travel than Western Oregonians. Rural households may rely more heavily on technology that must be operated using fossil fuels (e.g. large equipment or trucks) than urban households in the core Portland-metro area with access to public transportation. Rural households and industries may have few lower-carbon alternatives available to them for certain tasks, making it difficult to avoid paying increased energy costs resulting from a carbon price. However, many rural Oregonians are served by public utilities that have access to nearly carbon-free electricity, which should alleviate the effects of a carbon price on the cost of electricity to those consumers.

Carbon-intensive industries may be more impacted by a cap-and-trade program, and, without the inclusion of measures to prevent it, may respond to cost increases in ways that reduce employment. Some of these industries are located in rural parts of Oregon where the local economy is less diverse than urban areas, which could mean that any negative impacts on these industries from a cap-and-trade program would be felt more strongly in rural communities.

Impacts of co-pollutants

---

[74] Oregon Climate and Health Profile Report, Oregon Health Authority, Public Health Division, 2014. https://public.health.oregon.gov/HealthyEnvironments/climatechange/Documents/oregon-climate-and-health-profile-report.pdf

[75] Cathy Schoen, et al. 2013. "Health Care in the Two Americas: Findings from the Scorecard on State Health System Performance for Low-Income Populations." *available at* http://www.commonwealthfund.org/Publications/Fund-Reports/2013/Sep/Low-Income-Scorecard.aspx?page=all, *archived at* http://perma.cc/JMS8-DVCK

[76] Stavins, Robert N. 2008. "Addressing Climate Change with a Comprehensive US Cap-and-Trade System." Article. *Oxford Review of Economic Policy* 24 (2): 298–321. doi:10.1093/oxrep/grn017.

[77] Oregon Department of Transportation, 2013. "Final Report on Impacts of Road Usage Charges in Rural, Urban and Mixed Counties." http://www.oregon.gov/ODOT/HWY/RUFPP/Road%20Usage%20Charge%20Program%20Documents/08-Impacts%20of%20Road%20Usage%20Charging%20in%20Rural,%20Urban,%20Mixed%20Counties%202013.pdf

Industrial facilities and other sources (e.g. motor vehicles) that emit greenhouse gases often also emit a combination of other pollutants that are associated with health impacts. These include particulate matter (PM) 2.5, ozone precursors, and toxic air pollutants. In some cases these pollutants may be reduced as a co-benefit of measures implemented to reduce greenhouse gases. For example, mobile sources of greenhouse gases are the largest contributor to exposure to air toxics in Oregon; policies such as the Clean Fuels Program that require swapping traditional petroleum fuels for alternatives such as electricity should have the added benefit of reducing the impact of co-pollutants such as toxics. In Oregon, communities with high concentrations of people of color are disproportionately located in close proximity to the major point and mobile sources of emissions, although this is not a perfect correlation.[78] One concern with cap-and-trade is that by allowing facilities to purchase permits to emit carbon, and carbon offsets for a portion of their compliance obligation, the program may not lead to reductions in GHG emissions, or the associated co-pollutants, at a specific facility. The "trading" features of the program, which help keep costs of compliance lower, also result in uncertain decline in GHGs and co-pollutants from individual facilities.[79]

In short, while a cap-and-trade program assures collective reductions in greenhouse gas emissions across the covered sources of emissions and some corresponding amount of reduction from co-pollutants, the inherent flexibility of emissions trading means that the outcome of the program on any given facility is uncertain. However, as the reductions required by the program become more stringent, and as regulated industries adapt their processes to carbon constraints, in-state reductions can be expected from all facilities. Because achieving reductions in co-pollutants is likely to remain a concern for communities in close proximity to large emitters for the short- and medium-term, policymakers may want to consider other mechanisms to reduce these impacts, some of which are discussed below.

Tools to neutralize potential negative effects

This section discusses various policy tools often cited in literature that can help address impacts of climate change policies to disadvantaged and rural communities. We also include ideas raised by stakeholders in direct conversations and position papers.

Provisions within a cap-and-trade policy

There are several commonly cited ways to structure a cap-and-trade policy to help ensure that the cost burden does not fall disproportionately on low-income or disadvantaged communities. The

---

[78] A 2016 analysis by the Sightline Institute found that people of color are spread across the state but that in certain cases, these communities are close to stationary sources of pollution: parts of Portland, Medford, Klamath Falls, and in the Boardman/Hermiston area have census tracts with more than 41 percent people of color in close proximity to a stationary source. There are also high concentrations of people of color but no major stationary pollution source in East Clackamas, Hood River, Jefferson County, and Salem. See:

Eberhard, Kristin, "What is the Best Way to Ensure Climate Justice in Oregon?", Sightline Institute (2016), pp 16. Available at http://www.sightline.org/download/54654/

[79] One preliminary study of the effect of cap-and-trade in California on direct GHG and co-pollutant reduction at facilities located in close proximity to low-income and minority communities found that many industry sectors increased their in-state GHG emissions since the beginning of the program, despite the fact that overall statewide GHG emissions have continued to decline. See http://dornsife.usc.edu/PERE/enviro-equity-CA-cap-trade.

first is through the provision of energy bill assistance or rebates for households which can be targeted at certain income groups. California provides a rebate to all households on their electric bill (called the "climate credit"). A recent study by the Luskin Center for Innovation found that an average low-income household electric utility customer could receive a positive financial impact between 2016 and 2020 associated with the cap-and-trade program.[80] One way that electricity bill rebates could be implemented within cap-and-trade would be to consign allowances to electric utilities on behalf of their ratepayers, require those allowances to be sold at auction, and direct the PUC to determine how to rebate those proceeds back to customers in an equitable manner. This is the approach currently being used in California.

A household rebate or dividend (on a per capita, lump-sum basis) can make a cap-and-trade policy progressive rather than regressive, while evidence suggests that reducing the payroll tax would be neutral and reducing income taxes would amplify the regressivity of the carbon price.[81] Revenues from the sale of cap-and-trade allowances at auction can be used for other purposes that may also benefit disadvantaged communities, including investment in efficiency, fuel switching, and reducing personal and work-related travel and policies that can help households lower their reliance on carbon-intensive energy uses. In California, some examples of these programs include the Affordable Housing and Sustainable Communities program, the Low Carbon Transit Operations program, and the Transit and Intercity Rail Capital program.

There are a number of ways to use cap-and-trade auction revenues to assist communities that need it the most. Other valuable expenditures could include building resilience in disadvantaged and rural communities to the effects of climate change, increasing access to health care in those communities, and funding job training programs to ensure disadvantaged and rural workers have the skills necessary to take advantage of opportunities in low-carbon sectors. Other uses of revenue could be building capacity and technical know-how in those communities to be able to apply for funding under any new programs the state might create and funding weatherization for non-owner occupied housing in low-income communities.

Programs outside of cap-and-trade

The state can implement policies and programs to benefit disadvantaged and rural communities separately from a cap-and-trade program. For example, expenditures mentioned above do not have to originate from the revenue generated by a cap-and-trade auction in order to be effective at mitigating any negative effects of the program or creating positive benefits. Aside from new spending measures, policies that set standards for increasing levels of energy efficiency in buildings, appliances and vehicles can help ameliorate increased energy costs. Energy efficiency standards and incentives are likely to be progressive, exerting a larger proportional positive impact on lower-income households because those households spend a greater proportion of their income on energy use. These types of policies are also likely to disproportionately benefit rural

---

[80] Gattaciecca, Julien; Callahan, Colleen; DeShazo, J.R. "Protecting the Most Vulnerable: A Financial Analysis of Cap-and-Trade's Impact on Households in Disadvantaged Communities Across California". Luskin School of Public Affairs, UCLA (2016). Available at: http://innovation.luskin.ucla.edu/sites/default/files/FINAL%20CAP%20AND%20TRADE%20REPORT.pdf

[81] Burtraw, Dallas; Sweeney, Richard; Walls, Margaret. 2009. The Incidence of U.S. Climate Policy: Alternative Uses of Revenues from a Cap-and-Trade Auction. *National Tax Journal* 62:3, 497-518. https://www.ntanet.org/NTJ/62/3/ntj-v62n03p497-518-incidence-climate-policy-alternative.html

communities as long as households have access to financing for the increased up-front capital costs required to invest in achieving those long-term fuel savings.[82] Programs outside of the cap-and-trade program could subsidize purchasing for more expensive but efficient technologies and could target disadvantaged communities or rural areas.

State environmental quality programs directly regulate pollution to ensure specific health quality standards are met. DEQ already has several long-standing programs that enforce federal air quality standards on Oregon's largest sources of pollution. Additionally, DEQ is working with the Oregon Health Authority to reform industrial air toxics regulations to better align them with public health considerations.[83] Programs like these that are focused on non-GHG pollution may be better suited to address sources of localized health concern.

California's experience

Approaches to mitigating potential harms

California's climate change law contained provisions aimed at ameliorating harms faced by disadvantaged communities. It encouraged the state to direct revenues to disproportionately impacted communities, and mandated the creation of an Environmental Justice Advisory Committee (EJAC). However, the environmental justice community in California was opposed to the state's approach of using cap-and-trade as one of the policy mechanisms for achieving the goals of the climate law.[84] They were concerned that a cap-and-trade program could lead to areas with heavy localized emissions of various pollutants because major polluters would be allowed to avoid reducing their emissions by purchasing additional allowances or offsets. They were also concerned that the policies put in place by the Air Resources Board (ARB) didn't provide enough direct benefit to underserved communities, and that a future change in administration could reverse policies that were designed to benefit those communities. A coalition of environmental justice, health, labor and other advocates sponsored the introduction of SB 535, which was signed into law in 2012, to address these concerns.

SB 535 requires that at least 25% of California's cap-and-trade auction revenues be invested in programs that benefit disadvantaged communities, and that at least 10% of the funds be invested within those geographic areas. The law directed CalEPA to identify the State's most disadvantaged communities for investment opportunities. The agency created a screening methodology to help identify the areas disproportionately harmed by environmental and socioeconomic burdens. The screening tool, called "CalEnviroScreen," maps the environmental,

---

82 Rolland-Holst, David, Fredrich Kahrl, Madu Khanna, and Jennifer Bakka. 2009. "Clean Energy and Climate Policy for U. S. Growth and Job Creation." https://are.berkeley.edu/~dwrh/CERES_Web/Docs/ES_DRHFK091024.pdf.

83 See DEQ's webpage on our Cleaner Air Oregon Regulatory Overhaul: https://www.oregon.gov/deq/RulesandRegulations/Pages/2017/Rcleanerair2017.aspx

84 Truong, Vien; "Addressing Poverty and Pollution: California's SB 535 Greenhouse Gas Reduction Fund," *Harvard Civil Rights-Civil Liberties Law Review,* Vol 49, 2014.

health, demographic, and socioeconomic data of census tracts in the state to create a score for communities which then guides investments under SB 535.[85]

In 2016, California's legislature passed Assembly Bill (AB) 197 which contained some additional direction for ARB regarding the implementation of strategies to reduce GHG emissions. The bill directed ARB to prioritize rules and regulations that result in direct emission reductions inside California at large stationary sources of GHG emissions and from mobile sources. AB 197 also requires annual posting of GHG, criteria, and toxic air contaminants data at the sub-county level for stationary sources and to at least a county level for mobile sources.[86] It is not clear yet exactly if or how this will change ARB's approach to implementation of the cap-and-trade program, but it is another indication of the environmental justice community's preference for policies that realize co-benefits of GHG reductions within disadvantaged communities.

Approach to inclusion in the policy process

As mentioned, California's climate law created an advisory committee (the EJAC) tasked with representing the communities most exposed to air pollution and affected by climate change in discussions with ARB on policies to reduce greenhouse gas emissions. Environmental justice advocates believed that the EJAC would have influence in the implementation of AB32, and were encouraged by the fact that the Committee did not have a termination date. However, as implementation got underway, EJAC members and advocates began to feel frustrated with the process at ARB and the fact that AB32 did not contain any requirements for ARB to incorporate EJAC input into the final Scoping Plan. As a result of this frustration, members of the EJAC and other advocates sued ARB in an attempt to force a more detailed analysis of the alternatives to a cap-and-trade system.[87]

SB 535 was partly a response to the early experiences with AB32 of many in the advocacy community. In addition to directing funding to disadvantaged communities, the process of developing CalEnviroScreen was a multi-year effort that included consultation with stakeholders across a range of interest groups, including low-income and minority populations. Investment priorities for cap-and-trade auction revenue were also developed this way. This process increased the access and inclusion in the process for these communities. In 2016, AB 197 added two Members of the Legislature as nonvoting members of the Air Resources Board in an effort to increase public access and transparency for ARB decisions.

---

[85] For a detailed description and history of environmental justice issues and concerns in AB 32 and SB 535, see: Truong, Vien; "Addressing Poverty and Pollution: California's SB 535 Greenhouse Gas Reduction Fund," *Harvard Civil Rights-Civil Liberties Law Review,* Vol 49, 2014.

[86] California Air Resources Board, "Discussion Draft: 2030 Target Scoping Plan Update." 2016. Available at: https://www.arb.ca.gov/cc/scopingplan/2030target_sp_dd120216.pdf

[87] Truong, Vien; "Addressing Poverty and Pollution: California's SB 535 Greenhouse Gas Reduction Fund," *Harvard Civil Rights-Civil Liberties Law Review,* Vol 49, 2014.

Considerations for Oregon

It seems clear both from literature on the theoretical effects of a cap-and-trade program, as well as the best practices from implementation of cap-and-trade in California, that a fair, equitable and successful program in Oregon would carefully address the concerns and needs of the most vulnerable communities in the state. This subsection summarizes some of the key considerations that have arisen from examining other programs, existing Oregon policies and processes, and from discussions with stakeholders.

Lessons from other programs

California has grappled with many difficult issues with regard to the distributional effects of their cap-and-trade program on vulnerable communities. Their experience points to the importance of early involvement by these communities in the policy design process, and the need for decision-making bodies to be accountable to those communities, such as through an advisory committee. It also suggests the need for programs dedicated to improving quality of life for disadvantaged and rural communities, either through direct spending of auction revenues, the creation of complementary policies, or both. These programs and policies should address the regressive nature of a carbon price, the disproportionate impacts of climate change on these communities, and the potential unintended consequences of the cap-and-trade program itself.

One of the key elements of California's strategy for addressing impacts to vulnerable communities has been the development of CalEnviroScreen, which is used to determine the priority areas for investment for the portions of the auction revenue that must go to disadvantaged communities. A similar tool could be developed for Oregon, taking into account the fact that indicators for an Oregon tool may need to be different than California's.[88] Such a tool could be useful for determining priority investments of cap-and-trade revenue, but it could also be used to identify where other state policies could focus efforts to alleviate disparate impacts to these communities.[89]

The Province of Ontario is in the process of developing its cap-and-trade program, as well as complementary measures called for in their Climate Action Plan. The Plan features a number of policies designed to enhance the distributional impacts of the policy, mitigating any negative impacts or bringing net benefits to "low-income households and vulnerable communities."[90] For

---

[88] The previously sited 2016 report by the Sightline Institute described how the geographic pattern of disadvantaged communities in Oregon is less clear than in California. The report examined three factors – particulate matter pollution, poverty, and people of color – and mapped the areas of the state where these factors are most prevalent. Census tracts in Oregon often score high on one or two indicators, but few score high on all three. Most pollution and some populations of color are along the highway corridors, whereas rural areas don't have major highways or much pollution but do have high levels of poverty.

[89] The Oregon Health Authority has developed a Climate and Health Vulnerability Assessment focusing on social vulnerability as a way to integrate the concepts of social determinants of health and environmental justice into climate change planning. The indicators in this Assessment could be a good starting point for any tools developed in Oregon around spending of cap-and-trade revenue. https://public.health.oregon.gov/HealthyEnvironments/climatechange/Documents/Social-Vulnerability-Assessment.pdf

[90] Province of Ontario. 2016. "Ontario's 5 Year Climate Change Action Plan." http://www.applications.ene.gov.on.ca/ccap/products/CCAP_ENGLISH.pdf

instance, they include electricity bill assistance, incentives for weatherization and efficient vehicles, and a "green bank" to provide low-interest financing for capital investments in efficient technologies. As implementation moves forward in Ontario, there may be more specific lessons learned for Oregon.

Existing Oregon policies and processes

Oregon's Environmental Justice Task Force has already provided some guidance for how to craft environmental policies in the state in a fair and equal way. The key tenants of their guidance are: 1) "fair treatment and equal protection, meaning a just distribution of the benefits and burdens of decisions," and 2) "meaningful involvement, meaning all stakeholders must have an opportunity for meaningful involvement in all decisions that may affect their immediate lives." These principles could guide the creation of a cap-and-trade program in Oregon, including regulatory processes that would need to take place. These principles support the considerations from other jurisdictions discussed above and could be further defined for the context of a cap-and-trade policy, for example through a robust stakeholder process following any legislative action.

It is important to note that Oregon's constitution most likely requires that revenue collected from transportation fuel suppliers by a cap-and-trade auction be deposited in the Highway Trust Fund and spent on roads.[91] If this interpretation of the constitution were upheld in the context of cap-and-trade auctions, it would have significant implications for the ability of the state to establish some of the programs discussed above designed to address the needs of vulnerable communities. Like in California, well over half of the revenue generated from a potential auction would come from the transportation sector. However, unlike California, Oregon would likely not have the freedom to spend that revenue on a range of programs, some percentage of which could benefit disadvantaged communities. This restriction might require the creation of other programs in order to achieve the objectives of protecting and benefiting disadvantaged and rural communities. It might also suggest that money from the cap-and-trade auction that is deposited into the Highway Fund should be earmarked for projects within or that benefit disadvantaged and rural communities. The Healthy Climate Act of 2016 contained a provision that would have required revenue subject to this restriction to be used for GHG reduction – this could be another (not mutually exclusive) way to focus the use of the revenue for specific objectives.

[91] A 1992 Oregon Supreme Court decision held that "money raised from burdens imposed on motor vehicle fuel[s]" must go to the Highway Trust Fund, even if the money was raised from an air pollution emissions fee.

7. Interaction with other Oregon policies

Understanding how Oregon's existing policies and programs would interact with a market-based emissions trading system is a key question for program design. This section will review common arguments regarding the role of a cap-and-trade system in combination with other policies, discuss the general experiences in other jurisdictions, explore how several Oregon policies might interact with a cap-and-trade system, and make observations about how a market-based system could be designed to be complementary to Oregon's existing suite of policies.

Introduction

The majority of discussion in the academic and practitioner literature about the interaction of climate policies is focused on whether and how to add regulatory (also referred to as "complementary") policies to a climate policy strategy that has a cap-and-trade system as its basis. In contrast, the question under consideration in this study is the reverse: how to add a market-based system to an existing climate policy strategy that includes a handful of primarily regulatory measures. Thus, we focus this discussion on the usefulness (or lack thereof) of a cap-and-trade system for achieving Oregon's stated policy goals and how such a system would interact with Oregon's existing policies.

Roles of cap-and-trade and regulatory measures

Cap provides certainty about emission reductions: Among the reasons for implementing a cap-and-trade mechanism in addition to other regulatory policies is the notion that the absolute cap on emissions provides certainty about the environmental outcome of the overall climate policy strategy.[92] With a cap that covers most of the major emitters, policymakers can be more confident in the achievement of their emission reduction targets. Whereas regulatory measures might require certain incremental technological change, such as reducing the carbon intensity of transportation fuels, they generally do not require any specific quantity of emission reductions to occur. The overarching emissions cap provides environmental certainty and is frequently referred to as a "backstop" to the regulatory measures.[93] This feature of cap-and-trade is particularly relevant for Oregon where recent analyses demonstrate that the state is not likely to meet its GHG reduction goals with the existing suite of regulatory measures.[94]

Carbon price addresses key market failure: The adoption of a cap-and-trade system will put a price on carbon emissions, addressing the market failure inherent in the free release of carbon emissions to the atmosphere. Imposing a cost on carbon forces emitters to internalize this negative externality, which makes consumers and businesses more likely to make decisions that reduce emissions (e.g. makes the cost of renewable-generated power less expensive relative to fossil-fuel-generated power, makes the net cost of a higher efficiency vehicle relatively less

---

[92] "Limiting the Magnitude of Future Climate Change," National Academies Paper Press, 2010, page 101. https://www.nap.edu/catalog/12785/limiting-the-magnitude-of-future-climate-change

[93] ARB's initial strategy for using a cap-and-trade program in combination with regulatory measures is outlined in the original Scoping Plan: https://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

[94] Oregon Global Warming Commission, February 2017. "2017 Biennial Report to the Legislature." Available at: http://www.keeporegoncool.org/view/ogwc-reports

expensive). The price signal spurs innovation in all sectors of the economy covered by the cap which is necessary to achieve the emission reduction requirements. If the market is properly functioning, those requirements are met in the most cost-effective manner.

Regulatory measures put downward pressure on carbon prices, but also make them less certain: There is general agreement in the literature that regulatory measures that reduce emissions from sectors covered by the cap-and-trade regime will lower the price of emission allowances within the market-based system.[95] This is because the regulatory measures reduce the abatement that is needed to achieve the cap, reducing allowance prices. However, disagreement remains as to whether this ultimately lowers the overall cost of achieving climate goals. Initial economic analysis conducted by California concluded that overall climate program costs were reduced by pursuing the combined approach,[96] while competing analysis conducted by independent consultants at the same time came to a different conclusion.[97] This latter analysis found that by limiting the flexibility inherent in a market-based system, regulatory measures increase the overall costs of the climate policy program. Uncertainty in how effective regulatory measures will be at reducing emissions also creates uncertain demand for allowances in the capped system and leads to a related lack of certainty in the prices for allowances. If regulatory measures under- or over-deliver on their expected level of emission reductions, the abatement required from the cap mechanism can be higher or lower, leading to fluctuating carbon prices.

Combined approach can address multiple market failures: When used together, a comprehensive cap-and-trade mechanism and sector-specific regulatory measures can address multiple market failures that otherwise hinder the development and deployment of low carbon technologies.[98] In addition to the free release of carbon discussed above, other market failures include imperfect information,[99] the principal-agent problem,[100] and the "split incentives" that exist in the building sector.[101] While the carbon price helps to internalize the costs of carbon pollution, it will not fully address these other market failures. In addition, many policymakers

---

[95] International Energy Agency Insights Series: Managing interactions between carbon pricing and existing energy policies, 2013. http://www.iea.org/publications/insights/insightpublications/managinginteractionscarbonpricing_final.pdf

[96] California Air Resources Board, Updated Economic Analysis of California's Climate Change Scoping Plan, March 24, 2010. https://www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf

[97] Charles River Associates, "Analysis of the California ARB's Scoping Plan and Related Policy Insights," March 2010, https://assets.enviance.com/repository/pdf/analysis-of-ab32-scoping-plan.pdf

[98] In addition to the negative externality of free emissions, there are the difficulties of step-change technology deployment, fragmented supply chains, imperfect information, principal-agent problems, and irrational consumer behavior.

[99] This is the basic problem that consumers might not know how much a particular appliance or household activity is affecting their overall energy use. There are barriers to obtaining this information, or information about how to reduce energy use, which often prevent consumers from acting to conserve energy.

[100] The landlord-tenant relationship is a classic example: if a landlord buys the energy-using appliance while the tenants pay the energy bills, the landlord is not motivated to invest in efficient appliances.

[101] This is the situation in which a builder, who does not pay the utility bills at the property they're constructing, has a limited incentive to install energy efficiency measures even with a carbon price in place. The builder does not reap the rewards of the efficiency measures so has little incentive to incur greater costs to themselves to install the measures.

and academics believe a combined approach is necessary to spur step-change technology deployment and ensure that low carbon technology options – such as affordable non-emitting personal vehicles – are available and deployable at scale when much greater emission reductions are required (e.g. in the 2050 timeframe).[102] Complementary measures can make it easier and less costly for consumers to substitute their current energy consumption patterns for lower-carbon alternatives. Capital investments often have long lifespans (upwards of 50 years in the electricity sector); in the absence of policies to accelerate the adoption of lower-emitting options, over-deployment of high-carbon technologies may hinder the ability to cost effectively meet long-term climate goals.[103]

In sum, an approach that combines a market-based mechanism with targeted regulatory measures – as compared to using either approach on their own – is more likely to ensure that low-carbon technology options are deployable across all sectors of the economy in the long-term and that the total reductions achieved add up to what is necessary to meet overall environmental goals.[104] However, it must be acknowledged that this type of approach can create uncertainty for covered entities, potentially leading to higher overall costs of carbon reduction than implementing cap-and-trade on its own.

Experience and approach in other jurisdictions

A number of jurisdictions have either committed to non-legally-binding GHG reduction goals and/or are employing regulatory measures such as renewable energy mandates or energy efficiency incentives to reduce emissions. For example, 20 states plus the District of Columbia (DC) have GHG reduction goals and 27 states plus DC are implementing renewable portfolio standards.[105] Around the world, other jurisdictions are implementing sector-specific reduction targets or policies to incentivize low carbon technology. These examples make it clear that many jurisdictions are pursuing emission reductions without a carbon pricing mechanism like a cap-and-trade system.

However, the most comprehensive programs for reducing emissions and those that include legally-binding emission reduction targets involve a combination of either a cap-and-trade mechanism or other carbon pricing system alongside regulatory measures. Most prominent among these examples include the WCI jurisdictions, the countries participating in the European Union Emissions Trading Scheme, the Regional Greenhouse Gas Initiative (RGGI) states, and the Canadian province of British Columbia. In particular, it is clear that jurisdictions with firm economy-wide GHG emission reduction targets have adopted policies to put a price on carbon as

---

[102] International Energy Agency, "Summing up the Parts: Combining Policy Instruments for Least-Cost Climate Mitigation Strategies," September 2011 and Busch, Chris and Hal Harvey, "Climate Policy for the Real World," Energy Innovation, May 2016

[103] "Limiting the Magnitude of Future Climate Change," National Academies Paper Press, 2010, page 101. https://www.nap.edu/catalog/12785/limiting-the-magnitude-of-future-climate-change

[104] Hood, Christina, International Energy Agency Insights Series: Managing interactions between carbon pricing and existing energy policies, 2013. http://www.iea.org/publications/insights/insightpublications/managinginteractionscarbonpricing_final.pdf

[105] Center for Climate and Energy Solutions; policy maps available at: http://www.c2es.org/us-states-regions/policy-maps/renewable-energy-standards

an important part of their strategy for attaining that target. All of these jurisdictions are also implementing regulatory measures that have the effect of reducing greenhouse gas emissions from particular sectors.

California grappled with many of the tradeoffs discussed above in the process of setting up the suite of policies under their climate law, AB32. The ARB AB32 Scoping Plan set out a broad range of measures, including a cap-and-trade program, which ARB planned to rely on to achieve the required reductions.[106] Although the regulatory measures (including an RPS, a low carbon fuel standard, and others) are projected to achieve roughly 80% of the reductions required by 2020, ARB considers the cap-and-trade program to be providing assurance that overall reductions will be sufficient to meet the requirements of AB32. The regulatory measures are seen as stimulating greater levels of energy efficiency, development of renewable energy, and higher levels of transportation fuel economy to achieve long-term climate goals and other objectives such as a reduction in other air pollutants.

Interactions with the RPS and Coal Import Moratorium

For Oregon's two largest electric investor-owned utilities (IOUs), the Renewable Portfolio Standard (RPS) increases in a stair-step fashion until it reaches 50% in the year 2040. The original Oregon RPS was passed in 2007 and required large utilities to meet a standard of 25% renewable energy by 2025. In 2016, the Oregon legislature passed SB 1547 which created the more aggressive 50% target and requires the IOUs to eliminate coal-fired power from Oregon utility rates by 2030 or 2035.[107] These two resource procurement policies (hereafter referred to as "SB 1547 policies") for the state's largest utilities will increase the proportion of renewable energy consumed in Oregon and decrease the carbon intensity of the electricity resource mix serving Oregonians.

General Interactions

The likely interaction between the SB 1547 policies and a cap-and-trade system in Oregon will depend on how the market-based system covers the electricity sector. Both the SB 1547 policies and a cap-and-trade system will encourage more low carbon electricity generation. Because the SB 1547 policies will reduce greenhouse gas emissions attributed to Oregon's electricity sector, they will reduce the quantity of overall emission reductions that are required by all covered entities in a cap-and-trade program.

DEQ's GHG Reporting Program accounts for emissions from utilities based on the mix of generating resources allocated to Oregon ratepayers. Under this accounting approach, the prohibition on coal from Oregon's utility rates will reduce utilities' compliance obligation under a cap-and-trade program. While it is difficult for any state to assure changes in operation at coal plants in other states, the coal prohibition in SB 1547 is likely to reduce exposure of Oregon ratepayers to the cost of a cap-and-trade program.

---

[106] California Air Resources Board, Initial AB 32 Climate Change Scoping Plan Document, 2009. https://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

[107] https://olis.leg.state.or.us/liz/2016R1/Downloads/MeasureDocument/SB1547

Comparison of Policy Requirements

Although the SB 1547 policies will reduce greenhouse gas emissions from Oregon's electric utilities, the exact quantity of those reductions is not certain. These policies will ensure a decline in the carbon *intensity* of the electricity resource mix of the IOUs, but do not require a specific *quantity* of emission reductions. Conversely, a cap-and-trade system would ensure a certain quantity of emission reductions from the covered entities, but it would not necessarily ensure that reductions occur within the electricity sector itself (at least in the short- to medium-term while the cap is less stringent). Rather, a cap-and-trade system would incentivize the least-cost emission reductions from entities within covered sectors, which may or may not occur in the electricity sector. While the RPS ensures a certain share of utilities' electricity come from renewable energy by a certain date, a cap-and-trade system with the requisite stringency would ensure achievement of the emission reductions necessary to meet Oregon's climate goals. Neither policy can independently guarantee both of those outcomes.

Potential advantages of an Oregon cap-and-trade system

The combination of a cap-and-trade system, which places a price on carbon, alongside the SB 1547 policies, could be beneficial for achieving Oregon's policy goals. This sub-section focuses on the interaction of a cap-and-trade system with the RPS, specifically. Cap-and-trade and an RPS address different structural failures in the energy market that cause an under-investment in renewable energy generation compared to what is needed to achieve long-term policy goals. The two approaches apply distinct and complementary downward pressure on emissions from the electricity sector. A market mechanism that puts a price on carbon would help send the correct signal to fossil-generated power, while a renewable procurement mandate creates a more robust and competitive renewable energy market that pushes down he cost of renewable technologies and helps provide certainty to renewable developers that they will reap the benefits of investing in innovative technology. This section discusses these complementary effects in more detail.

Addressing market failures

By putting a price on carbon, a cap-and-trade system addresses the existing market failure of the free release of carbon from fossil generated electricity. Without a carbon price, the environmental damages from greenhouse gas emissions are not paid by purchasers of fossil generated electricity. A cap-and-trade system would rearrange the cost competitiveness of various electricity resources, where natural gas would have an advantage over coal creating near-term emission reduction opportunities. Similarly, a carbon price both increases the cost competitiveness of renewable energy in comparison to fossil fuels and appropriately discourages the use of fossil-fuel power.

The RPS addresses a different kind of barrier to renewable energy deployment. Innovation and technology improvements are needed to bring down costs of deploying low carbon technology, a process that is often referred to as "learning-by-doing" and is well-documented for multiple technologies. These cost reductions result from development and deployment of technology that the free market may under-incentivize because the benefits of doing so cannot be fully commercially captured by the entity undertaking the investment. This is due to the fact that improvements to technology or reductions in cost due to innovation can spill over to other

developers,[108] reducing the incentive that any one entity has to invest in innovation. The RPS can help overcome this barrier by providing the certainty necessary for investors and innovators to support needed investment in renewable technology and innovation.[109]

In addition, a procurement requirement like an RPS ensures that utilities not only have an incentive to switch from high emitting sources like coal to lower emitting sources like gas, but that they also have an incentive to increase quantities of zero-emitting generation.

Increasing the likelihood of achieving the goals of Oregon's RPS

By introducing an economic reason for the electricity sector to shift to less carbon-intensive sources, a cap-and-trade program is likely to increase the chances that Oregon will achieve the goals of its RPS policy. The introduction of a price on carbon will increase the per megawatt hour price of power coming from carbon-producing sources (e.g. coal and natural gas) relative to renewable energy sources (e.g. wind and solar).

The difference in cost that a utility must pay for a renewable energy resource as compared to the resource they would otherwise choose (primarily natural gas) is called the "incremental" cost for renewable energy. Under Oregon's RPS policy, a utility is not required to purchase additional renewable energy resources to the extent that the incremental cost of complying with the policy exceeds 4% of their total annual revenue requirement. Assuming that the cost of complying with a cap-and-trade program were integrated into utility planning processes at the PUC, as has been historically done for environmental regulations, introducing a carbon price would raise the price of fossil-generated power relative to renewable power and thus reduce the incremental cost of renewable energy as calculated for purposes of Oregon's RPS.[110] This will mean that the utilities will be more likely to comply with the necessary quantity of renewable energy to meet the targets in Oregon's RPS within the statute's 4% cost limitation.

Increasing the likelihood of achieving Oregon's GHG goals

Absent a policy like the RPS, a cap-and-trade program may encourage investments in new natural gas generation that lower emissions compared to coal yet may not do enough to achieve long-term GHG targets. Because natural gas power plants are long-term investments, further investing in these facilities might hinder progress toward Oregon's 2050 GHG target, the achievement of which likely requires considerable generation from non-emitting resources. A regulatory policy like an RPS can help bring costs of renewable energy down and encourage

---

[108] International Energy Agency, "Summing up the Parts: Combining Policy Instruments for Least-Cost Climate Mitigation Strategies," September 2011

[109] Taylor, Rubin and Nemet, 2006. "The Role of Technological Innovation in Meeting California's Greenhouse Gas Emission Targets." http://www.cmu.edu/epp/iecm/rubin/PDF%20files/2006/2006ra%20Taylor%20&%20Rubin,%20CA%20Climate%20Change.pdf

[110] An increase in the price of natural gas or a decrease in the cost of renewables would have the same effect.

development of new technologies.[111] This can result in long-term cost reduction, unlocking the ability to achieve long-term climate change mitigation targets.[112]

Achieving deep decarbonization in the electricity sector is widely viewed as one of the most important elements of a successful societal strategy to reduce greenhouse gas emissions.[113] Fully decarbonizing other end-use fuels (e.g. natural gas, gasoline) is likely to be technologically difficult, requiring a significant shift to decarbonized electricity in a wide range of end uses (e.g. transportation and home heating). Implementing a cap-and-trade program that covers the electricity sector would help ensure that the sector achieves carbon reductions necessary for other sectors to cost-effectively decarbonize as well. It would ensure that all sectors including electricity have the long-term market certainty about an intent to deeply decarbonize the economy.

Potential drawbacks of adding cap-and-trade to the existing policy landscape

Layering a cap-and-trade mechanism onto the existing regulatory landscape has the potential to add complexity to the requirements already faced by the electric utilities. One concern about adding a cap-and-trade program is that utility customers could effectively pay for the same greenhouse gas reductions more than once because policies already exist that have the effect of reducing emissions from the electricity sector. Designing the cap-and-trade mechanism such that the costs and emission reduction benefits of other policies are accounted for can help mitigate these concerns, as discussed below.

Designing cap-and-trade to be complementary

The electricity sector cap

Utility customers generally bear the cost of compliance with a carbon reduction policy or program. A cap-and-trade program that adds compliance cost in addition to those of complying with the SB 1547 policies would add additional costs for electricity customers. However, as described in Section 4, certain allowance allocation techniques can protect customers from those cost increases. There are several options for allocation of allowances that can help protect utility customers from the additional costs of a carbon market and help align the cap-and-trade program with other policies like the SB 1547 policies.

One option is to allocate allowances on behalf of customers for free to the utilities and require that the utilities sell those allowances at auction. This is also known as “consigning” the

---

[111] See for example:

International Energy Agency, “Summing up the Parts: Combining Policy Instruments for Least-Cost Climate Mitigation Strategies,” September 2011 and

Busch, Chris and Hal Harvey, “Climate Policy for the Real World,” *Energy Innovation*, May 2016 and

Fischer, C., and R. G. Newell. 2008. Environmental and technology policies for climate mitigation. *Journal of Environmental Economics and Management* 55(2):142-162.

[112] Philibert, C. (2011), “Renewable Energy Policy and Climate Policy Interactions”, *Climate and Electricity Annual 2011*, IEA/OECD, Paris, pp. 35-42.

[113] Deep Decarbonization Pathways Project (2015). Pathways to deep decarbonization 2015 report, SDSN – IDDRI. http://deepdecarbonization.org/wp-content/uploads/2016/03/DDPP_2015_REPORT.pdf

allowances to the utilities, and is the approach that has been used in California. The quantity of allowances consigned to the utilities could be determined a number of different ways, and would likely need to be determined after further analysis and stakeholder review. One possible methodology that would closely link the electricity sector's cap with the state's greenhouse gas emission reduction goals would be to consign an amount in any given year that is determined to be the electricity sector's "share" of Oregon's emission reduction trajectory for that year. That proportional share represents the level of emissions that the utilities themselves predict they will achieve due to the SB 1547 policies. The sale of the allowances at auction would generate a revenue stream that could be used to mitigate any increased costs that ratepayers will experience due to the costs to their utility of complying with the program. The Public Utility Commission would determine how the generated revenue could be used to mitigate any increased costs to ratepayers.

Another allocation option would be to distribute allowances for free to the electric utilities in a similar fashion as described above, but not require the utilities to sell those allowances at auction. As with the approach described above, the quantity of freely allocated allowances could be determined using a number of different methodologies,[114] including the one discussed above.[115] Under this approach, utilities would have no additional compliance burden from the cap-and-trade program beyond what they are already planning to accomplish with the SB 1547 policies. Taking this approach would effectively transfer the value of the allowances to the utilities, rather than leaving them with the state to auction. The utilities would presumably be required by the PUC to use the value of those allowances to the benefit of their ratepayers, thus working to keep costs as low as possible. To the extent that utilities were able to use those allowances to cover their emissions, there would be no additional cost of compliance for the cap-and-trade program beyond the cost of complying with the SB 1547 policies. If the utilities were able to reduce emissions to a greater degree than anticipated by the declining cap, the additional allowances could be sold and the value returned to utility ratepayers.

Conversely, if the utilities needed additional allowances beyond what they were allocated to cover their emissions, there would be an additional cost to complying with the program that would ultimately be passed through to customers. In this situation, there would be no revenue stream (as there would be under the consignment approach discussed above) to help mitigate those costs to ratepayers.

Streamlining use of compliance instruments

Another consideration for designing a cap-and-trade program to be complementary to the RPS will be determining whether compliance with either program will be influenced or affected by the compliance requirements of the other policy. California has taken an approach that keeps the two programs entirely separate for purposes of compliance, namely that Renewable Energy

---

[114] Historical emissions or updating based on output are two commonly discussed and analyzed options.

[115] If policymakers wanted to ensure that the sector has an incentive to reduce their emissions more than their proportional share, the allocation amount could be decreased by a certain percentage in a predictable fashion every year. For example, California applies a percentage reduction to the allocation given to its utilities – once the quantity of allowances to be distributed was determined, those levels were multiplied by 90% to determine the actual amount to be freely allocated.

Certificates (RECs) are not used to demonstrate anything of relevance to the cap-and-trade program, and cannot be used to avoid a compliance obligation with the cap-and-trade program. In the process of establishing a cap-and-trade program, Oregon agencies and stakeholders would need to analyze this issue and work with other jurisdictions in a linked system to ensure that the programs fit together in a way that doesn't undermine their effectiveness or their flexibility to work together successfully.

Interactions with the Federal Clean Power Plan

The Clean Power Plan (CPP) is a federal Clean Air Act regulation finalized by the US EPA in August 2015, directing the states to reduce greenhouse gas emissions from existing power plants located within their borders. If implemented, the CPP is projected to reduce emissions from regulated units nationwide by one-third from 2005 levels by 2030. Pursuant to the Clean Air Act, EPA directed the states to develop and submit State Implementation Plans (SIPs) to demonstrate their chosen approach to complying with their assigned reduction target. States have broad flexibility in determining their preferred approach. The implementation of the CPP by EPA and the states is currently on hold while legal review of the rule unfolds in the federal courts.[116] In addition, the likelihood of the CPP being implemented as finalized decreased significantly with the new administration in the White House. This section briefly examines interactions between a cap-and-trade program in Oregon and the CPP as finalized in August 2015.

General Interactions

States have two main options for the structure of their compliance plan: a mass-based or a rate-based approach. If a state chooses to comply using the "mass-based" approach (an overall emissions cap on sources), covered entities within the state could be eligible for inter-state trading of emission permits with entities in other states that also choose the mass-based approach. In this scenario, a separate multi-sector cap-and-trade program would likely regulate the same sources as the CPP using a similar mechanism, but with different reduction targets and rules surrounding compliance.

If a state chooses to comply with the CPP using a "rate-based" approach (an overall intensity standard), covered entities within the state would be required to demonstrate compliance with an emissions intensity (pounds CO_2 per MWh of electricity output) level, rather than a fixed cap, using a different kind of compliance instrument (called emission rate credits or ERCs). Covered entities within the state would be eligible for inter-state trading of ERCs with entities in other states that also choose the rate-based method of compliance. In this scenario, a separate multi-sector cap-and-trade program would likely regulate the same sources but the basic compliance requirement on regulated entities would be quite different.

With either a mass-based or a rate-based CPP compliance approach, the overlap and interaction between the CPP and a cap-and-trade program would depend on a number of policy choices in both programs, some of which we discuss in this section.

[116] It is possible that some or all of the requirements set forth in the final CPP released in 2015 will change or be struck down as a result of the legal process.

Comparison of Policy Requirements

The table 7.1 below describes three areas of comparison between the likely requirements of the CPP in Oregon and a cap-and-trade program implemented in Oregon: the covered emissions, level of stringency, and treatment of imported power.

TABLE 7.1

	CPP	Cap-and-trade
Covered emissions	• CO_2 from Oregon power plants that were in operation by 2012	Emissions covered could include: • CO_2 from Oregon power plants that were in operation by 2012 • emissions from sectors other than electricity • emissions from new power plants built after 2012[117] • emissions associated with imported power[118] • emissions of greenhouse gases other than carbon dioxide
Level of stringency	**Business-as-usual**: Oregon as a whole will achieve compliance due to existing and planned investments in renewable energy, energy efficiency, and closure of the Boardman coal plant.	**Beyond business-as-usual**: if designed to achieve Oregon's GHG reduction goals, cap-and-trade would result in greater emission reductions than the CPP.
Treatment of imported power	**Oregon's imported power is not covered by Oregon's CPP plan**: Oregon's CPP compliance plan would have no direct control on the power imported into Oregon. Emission reductions at out-of-state plants will be dictated by those states' strategies for CPP compliance.[119]	**Could cover imported power**: program design could include imported power, which would provide more certainty of meeting the state's GHG reduction goals.

[117] States have the option to include new sources in their regulations if they are opting for a mass-based approach. States that include new sources receive a less-stringent emissions cap to accommodate the new sources.

[118] CO_2 associated with some of Oregon's imported power would also be regulated separately by other states' CPP compliance plans.

[119] At this stage of implementation, it is difficult to determine the reductions that will occur in other states as a result of the CPP.

Potential advantages of an Oregon cap-and-trade system

The primary advantage of a cap-and-trade program – even if the CPP exists beyond its legal and political challenges – is that cap-and-trade would make the achievement of Oregon's greenhouse gas reduction goals more feasible. The CPP is limited in scope, reduction timeline, and stringency. Specifically for Oregon, the CPP target can be met with existing and planned actions and thus will not be a mechanism for achievement of the state's more ambitious GHG reduction goals.

The timing and significant uncertainty surrounding implementation of the CPP is important to this consideration. Whether the CPP as finalized by EPA will be upheld by the courts is the first major uncertainty with the rule. The final requirements and options for states could be changed in response to court opinion or, more likely, the program may not be pursued by the Trump administration. In addition, the timing of finalization of the rule and the dates by which states must begin to comply are uncertain. If the court challenges or regulatory changes delay implementation of the rule significantly, EPA may delay or shorten the compliance period. An Oregon cap-and-trade program would give the state substantially more certainty than the CPP currently gives about how and when emission reductions will occur in the electricity sector.

Potential drawbacks of adding cap-and-trade to the existing policy landscape

If the CPP is upheld by the courts in its current form and pursued by the EPA, states will begin finalizing decisions regarding whether to use a rate-based or a mass-based plan structure. If a sufficiently large number of states were to adopt a trading-ready plan structure compatible with Oregon's plan, a market for CPP compliance instruments could become a reality.[120] Because Oregon's compliance entities collectively are likely to be in a position to sell compliance instruments under either a rate-based or mass-based approach, there could be an opportunity to generate revenue for the state by participating in a regional or national CPP market. However, implementing cap-and-trade in Oregon might require that we forgo connecting with a CPP market. This is primarily due to the fact that if Oregon adopts a cap-and-trade program, we may need or want to use this program as our state compliance strategy rather than adopting a trading-ready program that could link to a CPP-specific market.[121]

However, if Oregon chooses to move forward with a multi-sector cap-and-trade program prior to the resolution of the uncertainty around the CPP, the state would have the ability to design its CPP compliance plan to be complementary to the cap-and-trade program, or, alternatively, revisit the cap-and-trade regulations to accommodate a CPP strategy.

Designing the plans to be complementary

Because the requirements, timeline and basic existence of CPP is uncertain, it is not possible to predict precisely how a cap-and-trade program would interact with a hypothetical CPP

---

[120] At this stage, it is impossible to say what would be a "sufficiently large" number of states. It is also impossible to say what the price for ERCs or allowances might be, which would ultimately determine how useful the CPP market would be for effectuating emission reductions or generating revenue for Oregon entities.

[121] This CPP plan type is known as "state measures", and is the approach being pursued by California. It is unknown whether Oregon would need to also adopt this structure in order to be compatible to link with other WCI jurisdictions. Oregon may want to adopt this structure for other reasons, as well.

compliance approach. However, the rule published by EPA provides at least a couple options for structuring both programs to work well with the other. Some of the possible options are briefly described here:[122]

- Use the "state measures" plan structure for CPP compliance while implementing cap-and-trade. Under this option, Oregon would adopt a similar approach to the one California is proposing,[123] namely that the state would demonstrate to EPA that the existing suite of policies and programs in the state will achieve the same (or greater) emission reductions at covered units as required by the CPP targets for Oregon. This option has the benefit of preventing Oregon policies from becoming subject to federal enforceability under the Clean Air Act. It has the drawback of preventing Oregon entities from participating in a linked CPP market, should one materialize.
- Remove CPP covered units from cap-and-trade if joining a CPP market becomes a higher state priority. Another option would be to no longer include the generating units that would be covered by Oregon's CPP plan in the cap-and-trade program if the state determines that joining a regional or national market for CPP compliance is a better option. The benefits of this option would be to join a robust regional or national market covering the electricity sector, simplifying compliance for regulated parties and potentially lowering costs. The drawbacks include the likelihood that the emission reductions achieved by a regional or national CPP system would be insufficiently stringent or long-term to meet Oregon's GHG reduction goals. This option would also require coordination with other cap-and-trade linked jurisdictions as a change of this magnitude to the scope of the program may raise questions about market functionality and maintaining the necessary stringency for linking.
- Design a mechanism to link CPP mass-based allowances with the cap-and-trade program. This option is the least certain of the three discussed here given that it is unclear whether either the CPP or cap-and-trade programs would allow it, but worth noting given the potential benefits. It may be possible to link a multi-sector cap-and-trade program with an electricity-only CPP mass-based trading system through a discount factor applied to allowances being traded into one program from the other to account for different stringencies. Other options for linking programs could be possible; any discussion of this strategy would need involvement of the other jurisdictions that are part of the linked cap-and-trade system at the time.

Interactions with the Clean Fuels Program

Oregon's Clean Fuels Program (CFP) will reduce the carbon intensity of transportation fuels sold in the state by 10% by 2025. The program is modeled after California's Low Carbon Fuel Standard, and is also quite similar to the Low Carbon Fuel Requirement in British Columbia.

---

[122] Other options for program structure may arise in the future as the CPP is finalized and if/when a cap-and-trade market expands to other states.

[123] https://www.arb.ca.gov/cc/powerplants/meetings/09222016/proposedplan.pdf

The CFP requires a reduction in the total carbon intensity of fuels, which accounts for the emissions from combusting the fuel in a vehicle, as well as the "upstream" emissions. These upstream emissions include various sources associated with the delivery of fuels to vehicles, including the extraction, refinement, and transport of the fuels.

The CFP places a requirement on companies importing large volumes (more than 500,000 gallons/year) of fossil fuels into Oregon to gradually reduce the carbon intensity of the fuels they import. These fuel importers can also purchase credits generated by companies producing fuels with a lower carbon intensity than the standard, such as biogas, electricity, and renewable diesel.

General Interactions

Interactions between the CFP and a cap-and-trade system in Oregon would generally occur in four ways:

1. Fuel importers subject to the CFP would likely also be subject to the cap-and-trade program and thus be responsible for the cost of compliance with both policies.
2. The reduction in carbon intensity of fuels required by the CFP would lower the exposure of Oregon's transportation fuels to the carbon price established by the cap-and-trade program.
3. Similarly, the establishment of a carbon price by the cap-and-trade program would make lower carbon fuels more cost competitive with fossil fuels in the state, thereby easing cost-of-compliance with the CFP.
4. The market transformation sought by the CFP could enable lower cost compliance with the long-term decline in emissions required under a cap-and-trade program.

Comparison of Policy Requirements

The CFP and a cap-and-trade program have different objectives but employ similar mechanisms. While the requirement of the CFP is expected to reduce greenhouse gas emissions by approximately 7 million tons of CO_2 equivalent, direct emission reduction is not the primary purpose of the program. Rather, the main objective of Oregon's CFP and similar policies in other jurisdictions is to transform the transportation fuel market away from its current reliance on fossil fuels toward a more diverse and cleaner fuels market.[124] In contrast, a cap-and-trade program is designed to more directly reduce greenhouse gas emissions by establishing an overall limit on emissions over covered sources.

While the direct objectives of these policies differ, they both set broad performance targets and leverage markets to allow least-cost compliance with these targets. The CFP mandates a reduction in carbon intensity of the fuels companies import into Oregon, but does not stipulate the types and combinations of lower carbon fuels companies import to achieve compliance. The CFP also provides a marketplace in which companies producing low carbon fuels can sell credits to companies importing fossil fuels, thereby offering an alternative or supplemental compliance

[124] Letter from Governor Kitzhaber directing DEQ to adopt rules to implement the CFP. April 17, 2012. http://www.deq.state.or.us/aq/cleanFuel/docs/LowCarbonStandards041712.pdf

pathway. The purpose of the CFP marketplace is similar to the market established by a cap-and-trade program: allow regulated companies to comply most cost-effectively.

The emissions covered by the CFP differ from those in a cap-and-trade program. The cap-and-trade program being assessed in this study would require fuel importers to hold allowances only for the emissions associated with the combustion of the fuel. The CFP accounts for all emissions associated with the production and use of fuels imported into Oregon, including emissions associated with extraction, refinement and transport of the fuels.

Potential advantages of an Oregon cap-and-trade system

As noted above, the objectives and requirements of the CFP and a cap-and-trade program are complementary. First, the CFP encourages greater use of lower carbon fuels which will reduce the exposure of Oregon's transportation fuels to the cap-and-trade allowance price. Secondly, the cap-and-trade program would make the lower carbon fuels required by the CFP more cost effective relative to traditional fossil fuels. Essentially, complying with one program reduces the cost of complying with the other.

However, the market transformation sought by the CFP is potentially a more significant complement to a cap-and-trade program. A cap-and-trade program aligned with Oregon's statewide GHG reduction goals will, in the long-term, require significant reductions that will likely necessitate major shifts in the energy sources fueling the state's economy. The CFP is designed to stimulate this shift in the transportation sector, and thus could facilitate more cost-effective emission reductions that will be necessary to meet a cap that declines in alignment with Oregon's statewide GHG reduction goals.

Potential drawbacks of adding cap-and-trade to the existing policy landscape

A cap-and-trade program would likely regulate most or all of the companies subject to the requirements of the CFP. Thus, the regulatory and administrative costs of the cap-and-trade program would be added to those of the CFP. The costs of both programs are expected to be passed on to consumers via higher prices for fossil fuels. However, as noted above, complying with the CFP should lower the exposure of fuel importers, and ultimately purchasers of fuels, to the price imposed by the cap-and-trade policy. Thus, the costs of each program individually are not entirely duplicative when the policies are implemented together.

Essentially, the drawback for combining a cap-and-trade program and the CFP is much like the potential negative interaction with the RPS: the combination of policies adds to the regulatory and administrative complexity for the entities that are subject to both regulations.

Designing cap-and-trade to be complementary

Assuming that a cap-and-trade program covers fuel suppliers, there is relatively little in the design of the program that has significant influence on the interaction with the CFP. The cap-and-trade program would likely be designed to place the point of regulation (i.e. the entities that need to acquire allowances for the fuel) as far upstream as possible in order to put the administrative requirements of compliance on the fewest number of businesses.

Interactions with other state policies and programs

Given its potentially broad scope, a cap-and-trade program in Oregon would interact with a number of other state policies and programs. It was not possible to include an analysis of all the possible interactions a cap-and-trade program might have in Oregon in this study. Thus, we focused on a short list of policies and programs that overlap, support, or are duplicative of the goals or effects of a cap-and-trade program. This section briefly explains those interactions and some of the considerations related to the implementation of cap-and-trade.

Zero Emission Vehicle (ZEV) Mandate

Oregon has adopted California's program for increasing the proportion of zero emission vehicles on the road. The regulations require auto manufacturers to sell an increasing proportion of ZEVs as a share of their total sales of new cars and light-duty trucks. Oregon is also a signatory to the Multi-State ZEV Action Plan, which is a coordinated approach to increasing the use of ZEVs.

A cap-and-trade program would be a mutually reinforcing policy with Oregon's ZEV policies and goals. The ZEV programs will help accelerate emission reductions in Oregon to the extent that they encourage greater use and utilization of a lower carbon transportation option. These programs are important for helping to make low carbon transportation options available for consumers in a carbon-constrained future. The carbon price due to a cap-and-trade program would help shift market preferences to lower emitting technology, such as electric vehicles. This will help manufacturers achieve the sales goals at the heart of the ZEV program. Multiple studies have concluded that shifting from traditional petroleum-fueled vehicles to ZEVs is one of the most important technological shifts that must occur in order for long-term GHG reduction goals to be achieved.[125]

An important consideration for a cap-and-trade program would be how this shift affects the proportion of emissions attributable to the electric power sector. An increase in the deployment of electric vehicles could increase demand on generating resources in the electricity sector. The shift from traditional transportation modes to electricity may necessitate a review of allowance allocation methodology to accommodate it.

Energy Facility Siting Council's Carbon Dioxide Standard

In 1997, the Oregon Legislature enacted a CO_2 emissions standard for natural gas powered base load electric generating plants (HB 3283). In addition, the legislation authorized the Oregon Energy Facility Siting Council (EFSC) to adopt CO_2 emission standards for other fossil-fueled power plants. Since 1997, EFSC has adopted CO_2 emissions standards for most large, carbon dioxide emitting power plants. Applicants for site certificates must demonstrate compliance with the emissions standard. To date, all applicants have complied with the standard using the "monetary path." This compliance option allows the site certificate applicant to pay a standard dollar amount per ton of CO_2 for all emissions over the lifetime of the plant that are expected to be in excess of the standard. The total amount paid is used by The Climate Trust to purchase carbon offsets on behalf of the applicant.

---

[125] Deep Decarbonization Pathways Project (2015). Pathways to deep decarbonization 2015 report, SDSN – IDDRI. http://deepdecarbonization.org/wp-content/uploads/2016/03/DDPP_2015_REPORT.pdf

Facility operators who used the "monetary path" during the siting certificate process would also likely be covered entities in a potential cap-and-trade program. Those facilities may have paid a lump sum to The Climate Trust for the purpose of purchasing carbon offsets for a portion of their future emissions. Thus, some consideration of such early action may be warranted when constructing the cap-and-trade program. If a cap-and-trade program were in place, policymakers may want to consider whether it is necessary to continue the CO_2 emissions standard for newly sited power plants.

Voluntary Renewable Energy Programs

All Oregon utilities are required to provide customers with a voluntary, green power rate.[126] One of the key features of these programs is that voluntary renewable energy purchases can be claimed by the households and companies that make them. That is, those purchases are associated with renewable energy generation that is additional to generation that is required of the utility by state and federal regulations. Customers are thus able to claim that their electricity purchases reduce emissions, and their electricity supply is renewable and carbon-free. The incremental difference that these purchases make is often referred to as "regulatory surplus." The demand for purchases in these programs has been a major driver of new clean energy development nationwide.[127] In Oregon, the programs have been popular with customers: Portland General Electric is currently ranked #1 in the country for voluntary renewable program participants, and PGE and PacifiCorp rank #1 and #4, respectively, for the percent of customers participating in these programs.[128]

Adding a cap-and-trade program to the policy landscape can eliminate the surplus nature of these programs unless measures are taken to preserve it. Once a cap-and-trade program is in place, emission reductions from covered units that are due to voluntary renewable energy purchases may no longer be surplus to regulation. Rather, those purchases would support the electricity sector's overall compliance with the carbon cap, rather than going beyond that regulatory requirement. An allowance set-aside is a mechanism that can be used in the cap-and-trade program to preserve the surplus nature of voluntary renewable programs. With this approach, allowances under the cap would be set-aside and retired in an amount equivalent to the CO_2 emissions avoided due to the voluntary renewable purchases. This is the approach currently being utilized in California and RGGI.[129]

Voluntary GHG Reductions by Natural Gas Utilities

In 2013 the Oregon Legislature enacted a bill (SB 844) which allows local natural gas distribution companies to recover from ratepayers the cost of voluntary GHG emission reduction

---

[126] ORS 469A.205

[127] http://resource-solutions.org/site/wp-content/uploads/2016/09/CRSPolicyBrief_VRESet-asidesformass-basedCPP_8-26-2016.pdf

[128] http://apps3.eere.energy.gov/greenpower/resources/tables/topten.shtml

[129] RGGI State Set-Aside Provisions for Voluntary Renewable Energy (VRE), Draft August 21, 2009, http://www3.epa.gov/greenpower/documents/ev ents/rggi_status_table.pdf.

Support Voluntary Purchases of Clean, Safe, 21st Century Energy With an Off-the-Top Rule Under Cap-and-trade, May 18, 2009, http://resource-solutions.org/site/wpcontent/uploads/2015/08/CT-Policy-Brief.pdf.

programs that are approved by the Oregon Public Utility Commission. The utility is allowed to receive a payment per ton of GHG emissions reduced, in addition to having the ability to recover the costs of the investments made to implement the approved program.

To date, no projects have been approved by the Oregon PUC under this program. However, if a cap-and-trade program were implemented in Oregon, careful consideration of the overlap with possible projects under the auspices of SB 844 would be warranted. A cap-and-trade program that covered emissions from the natural gas sector could be regulating the same emissions as would be reduced by a voluntary SB 844 program. It may be necessary for policymakers and regulators to examine the interactions between the two programs to determine if any adjustments are needed.

Energy Efficiency Policies and Programs

Policies and programs to advance energy efficiency have been implemented in Oregon for since the 1970s. There are a variety of approaches to funding energy efficiency, but one of the most important in Oregon is the use of public purpose charge (PPC) dollars to fund energy efficiency measures in the investor-owned utilities' service territories. The PPC is a three percent surcharge added to customers' utility bills which is used by the Energy Trust of Oregon (Energy Trust) in coordination with the investor own utilities to implement measures that save energy, invest in renewable energy technology, and implement low-income programs. Energy Trust estimates that since 2002 their projects have saved participants $5.6 billion on their energy bills.

Energy Trust is required to evaluate the cost-effectiveness of potential projects in order to determine what energy efficiency activities to invest in. The cost-effectiveness tests are determined by the PUC and take into account the benefit of the energy savings to ratepayers over the life of the energy efficiency measure against the cost of implementing the energy efficiency measure. A cap-and-trade program would influence the cost-effectiveness of energy efficiency by increasing the benefits of saving energy. A price on carbon would raise the wholesale cost of electricity in the market, which would mean that more efficiency measures would be cost-effective to implement. The inclusion of a cap-and-trade program would increase the financial justification for both utilities and customers to invest in energy saving measures.

Appendix 1: List of potentially regulated entities

Following are companies and facilities that reported at least 25,000 metric tons CO2 equivalent to DEQ for 2014. These companies and facilities could be regulated entities under a cap-and-trade program in Oregon. However, ***this could change based on program design.***

Fossil Fuel Suppliers

Company Name	Metric Tons CO2
A & B Enterprises, Inc.	25,989
Albina Fuel Company	28,480
American Energy	61,969
Amerigas	310,036
Apex Oil Company, Inc.	63,402
Associated Petroleum Products	89,919
BP West Coast Products LLC	3,176,167
Byrnes Oil Company, Inc.	119,243
Campo & Poole Distributing, LLC	72,790
Carson Oil Company, Inc.	152,671
Chevron USA Inc.	2,954,874
CHS Inc	37,060
Devin Oil Co., Inc.	60,339
Ed Staub & Sons Petroleum, Inc.	50,687
Hattenhauer Distributing Company	69,765
Heller & Sons Dist Inc	40,252
Jacksons Food Stores, Inc.	67,925
Jubitz Corporation	27,994
McCall Oil & Chemical Corp	317,073
MIECO Inc.	78,982
Musket Corporation	39,930

PC Energy, LLC	100,838
Phillips 66 Company	2,745,120
Pilot Travel Centers, LLC	278,520
Plains Midstream Canada	136,713
Pounder Oil Service, Inc.	45,494
SEI Fuel Services, Inc.	53,577
Shell Oil Products US	3,089,825
Space Age Fuel Inc.	883,573
Suburban Propane	130,682
Tesoro Refining and Marketing Company LLC	3,322,216
The Jerry Brown Company, Inc	86,901
Tyree Oil, Inc.	238,029
Universal Propane	257,299
UPS	26358
Valero Marketing and Supply Co.	58,979
Vitol Inc	2,792,614
Wilson Oil	28,264

Natural Gas Suppliers

Company Name	Metric Tons CO2
Avista	616,211
Cascade Natural Gas	1,647,068
NW Natural	5,328,249
NW Pipeline - Williams	181,774
Gas Transmission Northwest	4,258,152
Kelso-Beaver Pipeline	823,452

Electricity Use

Company Name	Metric Tons CO2e
Clatskanie	72,219
Constellation New Energy	38,477*
Eugene Water & Electric Board	34,136
Idaho Power	303,269
Nobel Americas	885,076
PacifiCorp	9,556,549
PGE	6,868,097
Umatilla Electric Cooperative	128,884

* These are emissions reported in 2015

Large Emitters

Company Name	mtCO2e	County
Ash Grove Cement Company	694,409	Baker
Cascade Pacific Pulp, LLC	59,173	Linn
Cascade Steel Rolling Mills, Inc.	79,867	Yamhill
Cascades Tissue Group-Oregon	41,747	Columbia
ConAgra Foods Lamb Weston, Inc.	35,809	Umatilla
ConAgra Foods Lamb Weston, Inc.	46,578	Morrow
Dry Creek Landfill, Inc.	65,244	Jackson
Dyno Nobel Incorporated	197,124	Columbia
Entek International LLC	26,707	Linn
EP Minerals, LLC	51,585	Malheur
EVRAZ North America	119,453	Multnomah
Finley Buttes Landfill Company	63,893	Morrow
Gas Transmission Northwest LLC	50,734	Sherman

Gas Transmission Northwest LLC	52,838	Klamath
Gas Transmission Northwest LLC	54,009	Deschutes
Georgia-Pacific Consumer Products LP - Wauna Mill	244,319	Clatskanie
Georgia-Pacific Toledo LLC	331,948	Lincoln
H.J. Heinz Company, L.P.	49,675	Malheur
Hermiston Generating Company, L.P.	937,035	Umatilla
Hermiston Power LLC	1,176,764	Umatilla
Hollingsworth & Vose Fiber Company	42,927	Benton
Intel Corporation	374,927	Washington
International Paper	100,779	Lane
Jireh Semiconductor, Inc.	68,514	Washington
Klamath Energy LLC	909,444	Klamath
Knott Pitt Landfill	67,266	Deschutes
Microchip Technology, Inc.	87,187	Multnomah
Oregon Health Sciences University	30,203	Multnomah
Oregon Potato Company	48,038	Morrow
Oregon State University	42,109	Benton
Owens Corning Foam Insulation, LLC	106,496	Multnomah
Owens-Brockway Glass Container Inc.	41,849	Multnomah
Pacific Ethanol Columbia, LLC	38,514	Morrow
PCC Structurals, Inc.	25,615	Multnomah
Portland General Electric - Beaver/Port Westward	822,512	Columbia
Portland General Electric - Boardman	3,072,634	Morrow
Portland General Electric - Coyote Springs	1,057,340	Morrow
Riverbend Landfill Co.	65,711	Yamhill
Roseburg Forest Products Co.	30,395	Douglas
Roseburg Landfill	52,466	Douglas
SemiConductor Components Industries, LLC	98,404	Multnomah

Short Mountain Landfill	163,777	Lane
St Johns	84,751	Multnomah
TriQuint Semiconductor, Inc.	55,383	Washington
United States Gypsum Company	51,183	Columbia
Valley Landfills, Inc. - Coffin Butte	32,109	Benton
Wasco County Landfill, Inc.	67,682	Wasco
Waste Management Disposal Services of Oregon, Inc.	243,778	Gilliam
West Linn Paper Company	92,054	Clackamas

Appendix 2: Literature review

Available separately

Appendix 3: Economic modeling

Available separately