White Paper

Navigating the Path to the Low Carbon Future

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Shareables

- Optimal design for carbon policy requires finding the right mix of market-based and complementary measures
- ICF analysis shows that policies outside cap-and-trade may swing allowance prices by 50%, impacting the cost to utility and other market participants
- Policymakers and stakeholders must account for cross-cutting impacts to make informed design and investment decisions

Executive Summary

Recently, regulators in many states and localities have attempted to decarbonize the economy by using a combination of specific policies (e.g. efficiency mandates) and cross-cutting programs (e.g. cap-and-trade). While they are often familiar with individual programs in isolation, regulators often have faced difficulty designing a balanced portfolio of abatement measures that accounts for possible interactive effects. Well-designed complementary measures can smooth out and moderate carbon prices; poorly calibrated programs can produce price fluctuations and muddy market signals. Stakeholders and regulators must understand these risks to achieve emission reductions within acceptable cost boundaries.

Carbon Tax

A pre-determined tax on every ton of carbon emitted during a certain period.Provides concrete signals to the market, but does not enforce a given emissions outcome.

Cap and Trade

Sets a limit on the total amount of carbon that can be emitted in a certain period. Entities bid for the right to pollute, creating a market signal for necessary levels of abatement. Emissions outcome is more certain, but prices may fluctuate.

Complementary Measures

A range of policies that are designed to generate investment in a particular type of abatement activity based on the judgement of policymakers.

Examples include:

- Reneweable Portfolio Standard
- Electrification
- Vehicle efficiency standards
- Energy efficiency mandates
- Subsidies to particular technology types.

Incentivizing Carbon Reductions

To date, programs that aim to lower carbon have taken three main forms: a carbon tax, cap and trade, and policy actions (also referred to as complementary measures) aimed at increasing low-emitting investment in a specified area. Carbon tax and cap and trade policies set a requirement across an entire region or sector(s) and let the market respond, while complementary measures enhance the design of the market mechanisms and serve a secondary purpose — such as boosting investment in a certain sector of the economy.

Complementary measures can play a vital role in reassuring new investments in lower-emitting technology and signaling intent. However, it can be difficult to calibrate these targets to achieving carbon reduction goals and to changing market dynamics. Without acknowledging this dissonance, complementary measures can pose a detriment to cross-cutting policies like cap-and-trade.

Cap and Trade Price

Potentially volatile price signal that incentivizes cheapest possible abatement based on current market dynamics.

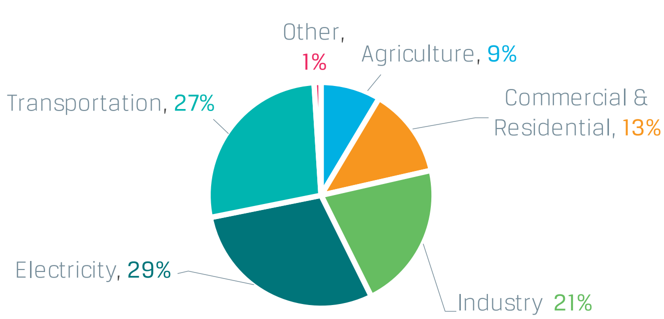
Complementary Measures

Can provide stability and signals for investment that are dictated by policymakers in anticipation of longer-term trends and needs.

Following The Emissions Trail

While most state programs focused on capping carbon emissions are couched in the electric sector, national electric generation only accounts for under a third of total emissions.[1] Therefore, a program aimed at economy-wide reductions should extend beyond electricity generation — and move the needle on transportation, other end use emissions. With a relatively lower emission reduction cost, cap-and-trade alone may put a burden on the generation sector that is disproportionate to its emissions share. Electrification of other sectors to reduce emissions – one complementary option being discussed in the U.S. and and implemented in Canada – would increase that burden, but may open opportunities for new utility investment. Regulators and sources affected by these portfolios must understand and quantify these interactions to prevent costly policy decisions that may ultimately undermine the goal of emission reductions.

EXHIBIT 1. 2015 EMISSIONS BY SECTOR



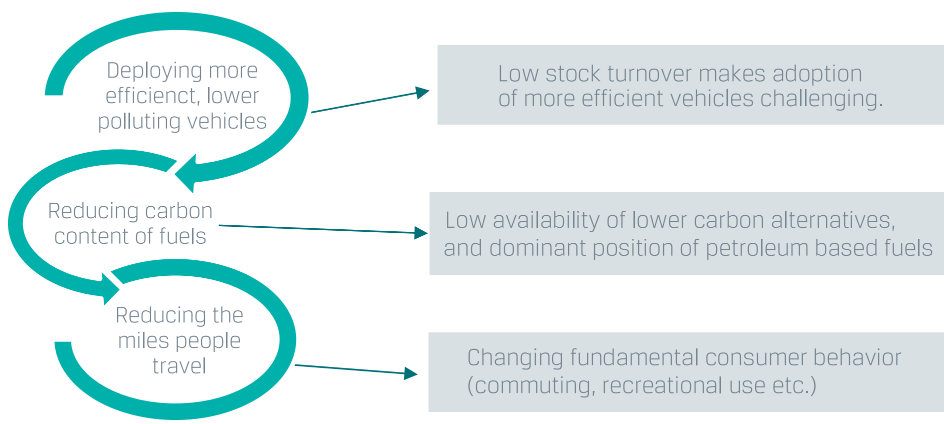
[1] US EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2015 https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015

Focusing on a Sustainable Long-Term Plan

The high cost of reductions in the transportation sector limits the ability to drive abatement, particularly in the near-term. For instance, the imposition of a hypothetical carbon tax of $10/Tonne would cause gasoline prices to rise only $0.10/gallon[2] — which is well within the range of price changes over the past 6 months (and therefore less likely to affect customer behavior). Thus, incentivizing meaningful changes in consumer behavior within the transportation sector requires more tailored policy tools.

Most transportation entities are price takers, which means fuel providers pass costs on to customers. With little incentive save the price of carbon penalties, the transportation sector may buy up a larger share of available allowances in a particular market. This, in turn, could drive up the carbon price and cause deeper reductions in other sectors to meet economy goals. In this scenario, the industrial or energy sectors would compete at a relatively much higher price to purchase carbon allowances and potentially implement more aggressive measures to cut emissions.

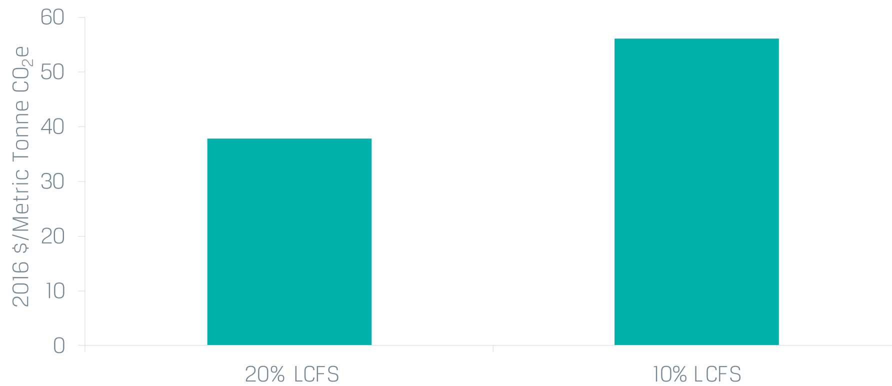
EXHIBIT 2. TRANSPORTATION CARBON REDUCTION EFFORTS AND CHALLENGES



Properly calibrated complementary measures can reduce emissions in the short-term, create a long-term signal to continue to invest in infrastructure and research that would support greater future adoption of infrastructure that supports emissions reductions, and help maintain a price for carbon in the cap and trade market that allows other actors more time to adjust to tightening budgets.

[2] Calculation based on EIA data on CO2 emission intensity of a gallon of E10 https://www.eia.gov/tools/faqs/faq.php?id=307&t=11

EXHIBIT 3. PROJECTED 2030 ALLOWANCE PRICES



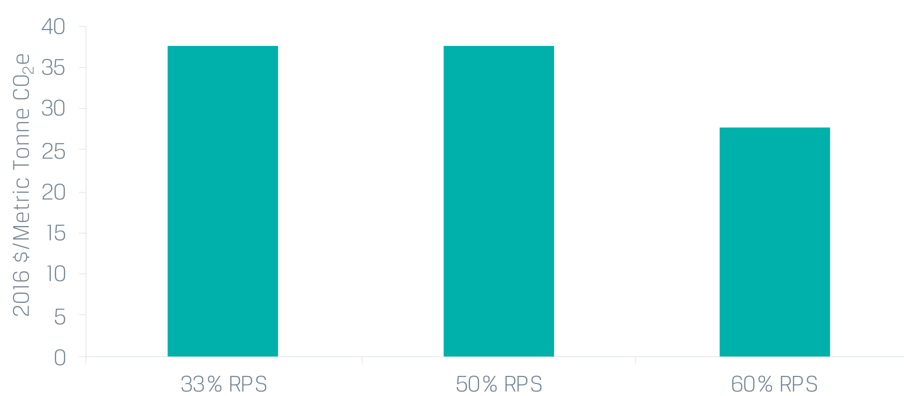
Using California's programs as an example, ICF projections in Exhibit 3 show that the imposition of a 20% Low Carbon Fuel Standard reduces transportation sector emissions significantly — which in turn reduces the pressure and cost of abatement from other sectors. This reduces the demand for allowances, lowering the projected market clearing allowance price in California by 19 $/Metric Tonne CO_2e, relative to a 10% LCFS mandate.

Strike A Balance With Dynamic Programs

Complementary measures have also played a major role in the power sector in the form of policies like energy efficiency mandates and Renewable Portfolio Standards (RPS). Failing to make these targets dynamic may leave stakeholders blind to the evolving linkages between sectors. Ultimately, poorly handled complementary measures lead to a fragmented policy framework that results in disproportional reliance on one measure.

The California case study in Exhibit 4 displays the need to walk the line between doing too much and too little. California's 2030 decarbonization target requires deep cuts in the power sector, achieved through greater penetration of renewable resources.

EXHIBIT 4. PROJECTED 2030 ALLOWANCE PRICES



The RPS is therefore a complementary measure that works in addition to cap and trade to achieve these reductions. Setting too low a target (e.g. a 33% RPS level) results in no change in market clearing carbon allowance prices, since the carbon price is sufficient to incent renewable penetration equivalent to a 50% RPS level. On the other hand, the imposition of a 60% RPS level in 2030 would drop allowance prices by $10/Metric Tonne. A 60% RPS forces the market to reduce power sector emissions further and faster than economics would dictate. The increased abatement reduces the burden on reductions from other sectors and lowers the carbon price. The cost of incremental renewable commitments is ultimately still passed on to customers, potentially increasing the total cost of the program. A balanced program that takes advantage of changing dynamics is crucial to cost-effectively meet carbon reduction goals.

Heat Pump vs. Gas Furnace

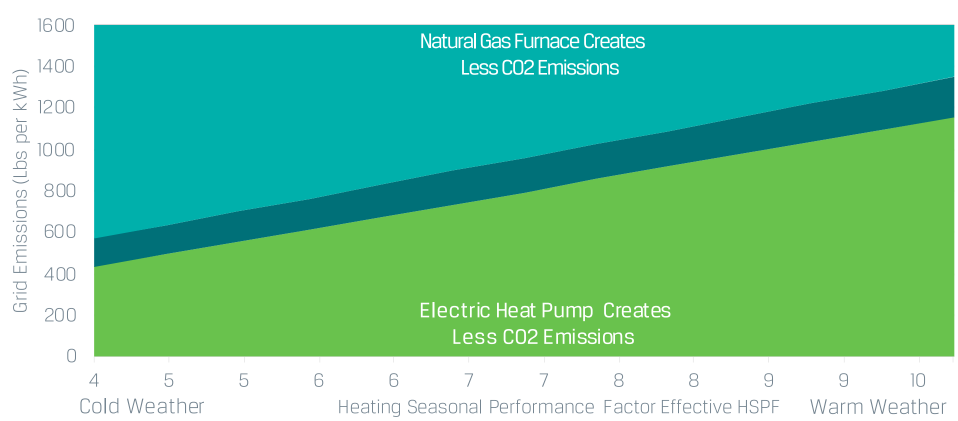
In addition, in colder climates, heat pump efficiency declines substantially on the coldest days, leading to increases in peak period electricity demand, and potentially to costly increases in the electricity capacity and transmission grid.

The Need for a Holistic View

Programs that encourage de-carbonization are not a panacea for the entire country. The benefits of any proposals or policies targeting deep decarbonization of large swaths of the economy must be balanced with the individual attributes and goals of the region or sector implementing the policies. Electrification of residential heating loads is one example of a policy with potential for significant unintended consequences if all factors are not considered. While electrification of residential heating loads would displace direct-use natural gas by consumers, any changes to net emissions would need to account for factors such as the local electric grid emission levels and the relative performance and efficiency of the replacement electric heating unit.

The chart below highlights this interplay between electric grid emissions and the performance of an electric heat pump in a given climate region. The colder the climate, the lower the grid emissions are required to be to result in a net reduction in the CO2 emissions. Additionally, while reductions in natural gas use could present savings opportunities on future gas distribution infrastructure requirements, any incremental demands placed on the electric system must also be considered. If the system is unable to accommodate significant increases in winter demand, there may be a need to develop new generating capacity, thus increasing the cost of the emissions savings. Developing policies catered to the needs and goals of a particular actor ensure the most cost efficient program is pursued.

EXHIBIT 5. GRID EMISSIONS CROSSOVER VALUE NATURAL GAS FURNACE VS. ELECTRIC HEAT PUMPS



Designing an Optimal Decarbonization Strategy

Components of carbon policy portfolios (some already underway in some states and provinces and as envisioned by others) affect other components, as well as the success of the overall program. Meeting targets in one particular sector can influence market clearing allowance prices that affect all sectors — resulting in significant risk to all market participants, regardless of their own abatement potential. Thus, stakeholders must understand compliance not only in relation to their respective sectors and others in their sphere, but how compliance in other sectors may affect their own as well. Regulators, meanwhile, must deliberately balance these measures to meet emission reduction requirements.

Designing a harmonized set of carbon reducing policies and programs depends on the quality of cooperation among stakeholders and regulators. To strike the right balance, they must commit to incorporating perspectives across the energy landscape with integrated analysis at the company-level of potential outcomes. New policies and programs shouldn't "shake things up", but should instead balance costs and benefits flow seamlessly with existing efforts – and those efforts should be updated to welcome new efforts, technologies and changes to the market and to consider the cost implications of the different elements of the emissions reductions strategy

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About the Authors

Imran Lalani is a Manager at ICF International, where he has seven years of consulting experience providing project and modeling leadership and support for the Commercial Energy Division. Mr. Lalani's work at ICF focuses on emissions markets, with a particular emphasis on federal and state GHG regulations. He has led and supported studies for a variety of clients including Electric Utilities, Independent Power Producers (IPPs), industry associations, and nonprofit policy organizations aimed at understanding the impact of environmental policy on power and fuel markets, analyzing emissions outcomes and program stringency as well as implications on long term planning and asset valuation.

Mr. Lalani has a B.A. in Economics from Oberlin College and an M.A. in Economics from Johns Hopkins University.

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Philip Sheehy is a Technical Director at ICF. He and his team provide market advisory services to fuel providers, utilities, project developers, investors, and public agencies on issues related to low carbon fuels and technologies. Dr. Sheehy has helped public and private entities understand the value of renewable gas, focusing on supply and cost constraints, environmental commodities, and policy risk assessments.

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