WHAT IS THE VALUE OF BEING **FIRST?**

Perspectives from the California and Sweden Experiences

Dallas Burtraw, Daniel F. Morris, and Lars Zetterberg

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Instrument Design for Global Climate Mitigation

RESOURCES FOR THE FUTURE

This document reports the proceedings from a workshop convened in San Francisco on May 7, 2013 by the ClimateWorks Foundation, Mistra Indigo, and Resources for the Future.

Resources for the Future
1616 P St. NW
Washington, DC 20036

www.rff.org

Resources for the Future (RFF) is an independent, nonpartisan organization that conducts economic research and analysis to help leaders make better decisions and craft smarter policies about natural resources and the environment. Located in Washington, DC, RFF's research scope comprises programs in nations around the world.

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WORKSHOP AGENDA

Panel 1. Policy Leadership

Jon Krosnick, Stanford University
Lars-Erik Liljelund, Swedish Foundation for Strategic Environmental Research (Mistra)
Alan Lloyd, International Council on Clean Transportation
Michael Peevey, California Public Utilities Commission
Phil Sharp, Resources for the Future

Panel 2. Transportation and Air Pollution

Anthony Eggert, UC Davis Policy Institute for Energy, Environment, and the Economy
Peringe Grennfelt, Mistra Indigo; (formerly) IVL Swedish Environmental Research Institute
Josh Linn, Resources for the Future
Dan Sperling, UC Davis Institute of Transportation Studies and California Air Resources Board
Thomas Sterner, University of Gothenburg and Environmental Defense Fund

Featured Speaker

Mary Nichols, California Air Resources Board

Panel 3. Competitiveness

Dallas Burtraw, Resources for the Future *(moderator)*
Severin Borenstein, UC Berkeley Energy Institute and UC Berkeley Haas School of Business
Aaron Cosbey, International Institute for Sustainable Development
Carolyn Fischer, Resources for the Future
Åsa Löfgren, University of Gothenburg
Richard Morgenstern, Resources for the Future
Birgitta Resvik, Fortum
Renae Steichen, Collaborative Economics, Inc.

Introduction and Workshop Summary

In the first week of May 2013, the concentration of carbon dioxide in the Earth's atmosphere broke through the 400 parts per million level. This milestone pushes the stated goal of the international community to keep worldwide temperatures below a 2˚C increase even further from reach and illustrates the relentless challenge of climate change. A comprehensive international agreement to rein in emissions of greenhouse gases has proven elusive, and the world's largest emitters have had decidedly mixed progress in terms of crafting effective national climate policies. At the same time, there are notable examples both at the national and subnational levels of pioneering climate policy initiatives.

Against this backdrop, a delegation of 12 academics and regulators from Sweden joined nearly 100 counterparts in San Francisco for a May 7 workshop: "What is the Value of Being First? Perspectives from the California and Sweden Experiences."

Within their respective communities, the country of Sweden and the state of California are recognized as leaders in environmental policy. Sweden is recognized especially for its leadership within Europe with respect to water pollution and acidification in the environment. California is recognized within the United States for its leadership with respect to air pollution. Today, in the context of global climate change, the two share a leading role in the development of policy within their jurisdictions and outreach to their communities. But as leaders, they do not want to stand alone, and seek collaboration. The workshop demonstrated that these jurisdictions, in acting as leaders, have strong connections to their counterparts abroad.

The following three themes emerged in the workshop:

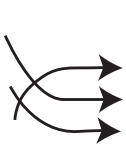
1 Multiple approaches and policy instruments have played essential roles in the environmental successes of California and Sweden.

Successful environmental improvements have required persistent regulatory efforts, but policymakers have employed flexible regulations infused with incentives when possible, including the use of prices to improve efficiency and reduce costs. Regulation has thus far played a larger role than environmental pricing (such as a cap-and-trade program or emissions taxes) and continues to do so in California.

Workshop participants noted a concern about the use of environmental prices, in that they may exacerbate emissions leakage and undermine competitiveness when there is incomplete participation among major economies. Combining regulatory policies with pricing allows prices to be set at a relatively lower level, which may help preserve competitiveness.

Combining regulatory policies with pricing allows prices to be set at a relatively lower level, which may help preserve competitiveness.

The data presented at the event suggest only weak evidence that environmental prices have driven innovation or technology diffusion. Nonetheless, where prices have been introduced—in the form of higher fuel taxes in Sweden and elsewhere around the globe—they are associated with greater fuel efficiency. Evidence at the workshop also suggests that economies continue to grow after environmental prices



1 Multiple approaches and policy instruments have played essential roles in the environmental successes of California and Sweden.

2 There exists a crucial interaction between air pollution policy and climate policy that requires coordinated policies in the future.

are introduced. Experience with regulation, which has been more common, shows abundant evidence of innovation. Engineers and other innovators respond when they are given incentives to do so. Local governments also respond to incentives in planning infrastructure. California hopes to exploit this behavior in its new and innovative climate-related land use law (SB 375).

The historic experience invites a mix of policies looking forward. However, even with a dominant role for regulation, there is the hope that the greater use of prices over time can introduce more efficiency and reduce costs.

2 There exists a crucial interaction between air pollution policy and climate policy that requires coordinated policies in the future.

At the global level, short-lived climate pollution (pollution that has a short residence time in the atmosphere, including black carbon from the combustion of coal and biomass) is recognized as the second most important source of climate pollution behind carbon dioxide emissions.

Short-lived pollution is especially damaging in the Arctic region, where it contributes to the melting of snowpack and local warming. Such pollutants have been a traditional focus of conventional air pollution policy; black carbon, for example, also leads to substantial negative health outcomes, especially in the developing world. In California, achieving goals to reduce conventional air pollution in order to achieve associated health outcomes may be harder than achieving goals to meet greenhouse gas (GHG) emissions targets, and doing so will require coordinated regulations. Workshop participants also noted that, going forward, nitrogen oxides may become the binding constraint for both air pollution and climate change, with growing relevance also in water pollution.

3 Success in both Sweden and California has been built on research and development. This element of success includes natural science, technology, and social science research.

In both jurisdictions, the orientation toward research and development to investigate problems and find solutions as well as the reliance on science as a basis for regulation have contributed to the success of industry and a culture of innovation.

Achieving goals to reduce conventional air pollution…may be harder than achieving goals to meet greenhouse gas emissions targets and doing so will require coordinated regulations.

R&D

3 Success in both Sweden and California has been built on research and development. This element of success includes natural science, technology, and social science research.

Nineteen Distinguished Viewpoints from Two Leading Jurisdictions

Nineteen distinguished policymakers, academics, and thought leaders shared their views on the progress made by California and Sweden and the challenges that lie ahead. We summarize their comments below.

Jon Krosnick

Frederic O. Glover Professor in Humanities and Social Sciences, Stanford University

Panel 1. Policy Leadership

Not only do most Americans accept the current understanding of climate change, they also think the federal government should take action to address the problem.

The message from the latest polling about public attitudes toward climate change is a hopeful one for those looking for political support for more aggressive emissions reductions. The majority of Americans continue to believe that climate change is happening, that it is caused by humans, and that the federal government should act accordingly. In fact, 75 percent of respondents to a recent Stanford poll believe climate change is the result of human activity, including large majorities in states such as Texas and West Virginia, where fossil fuel extraction and refinement are major aspects of their economies. This percentage has remained fairly stable over several years. Only a small portion of US citizens do not trust climate science or scientists.

Not only do most Americans accept the current understanding of climate change, they also think the federal government should take action to address the problem. Of the respondents, 61 percent would like to see the federal government do more to address global warming and 76 percent think the federal government should regulate emissions from businesses specifically. What's more, the survey results show that Americans are willing to shoulder some of the economic burden to ensure emissions are regulated. According to participants in recent surveys, they would collectively be willing to spend $17.7 billion per year of taxpayer dollars to address climate change, a figure that matches up with estimates by the US Environmental Protection Agency (EPA) of the costs of potential GHG regulations.

Lars-Erik Liljelund

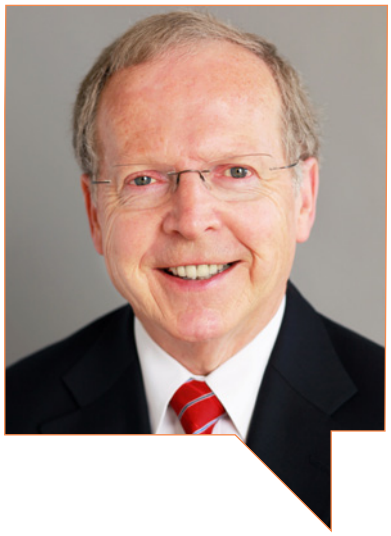
Executive Director, Swedish Foundation for Strategic Environmental Research (Mistra)

Panel 1. Policy Leadership

Sweden has increased its GDP by 50 percent with no increase in GHG emissions.

In short, Sweden is a first mover on climate policy because it had the opportunity to act and its policies have been driven by hard science. The country's neutrality during World War II has proved to be one advantage for Sweden that allowed it to think about environmental issues before most countries. Sweden did not have to focus major efforts on rebuilding from that particular catastrophe; it could instead focus on internal improvements. Additionally, there have not been large political fights about environmental issues in general in Sweden. Politicians and the public at large generally have agreed that they want a clean environment.

The same opportunities have not always been the case with respect to climate policy, however. Sweden has moved forward in pursuing a clean energy portfolio despite the challenges of needing energy imports and possessing limited energy resources within the country's borders. Sweden is more hesitant to be a first mover today than it was in the past, in part because of its open borders within the European Union. The country worries that if it continues to be first on climate policy and if this raises the cost of production in Sweden, it may not be able to compete with the rest of the European Union. Despite those concerns, Sweden has increased its GDP by 50 percent with no increase in GHG emissions since 1990—so there can be success as a front runner.



Alan Lloyd

President, International Council on Clean Transportation

Panel 1. Policy Leadership

Research and development remains the linchpin for success.

California possesses a different perspective on climate than other states and nations, in part because of its unique nexus of problems and opportunities for regulation related to transportation. The geographic size of the state and the corresponding automobile market, in combination with its photochemical smog and the associated damage to crops and human health, spurred California's leadership on air pollution before action was taken in Washington. That leadership position led to a special provision that essentially allows the state to write its own rules under the Clean Air Act. In turn, other states have the option to adopt California rules in lieu of federal rules when they are more stringent. Another factor that has contributed to the state's success is the strong technical staff at the state's Air Resources Board. Still another factor is strong legislative leadership including bipartisan gubernatorial support. Finally, research and development is essential. California overall, including its environmental policy, has benefited from the presence in the state of 7 of the top 50 research universities in the world.

As a result, California has made dramatic progress over the years in reducing pollutants associated with transportation, despite massive growth in population and vehicle miles traveled. Businesses in the state have worked to keep up with regulations, and some have been more successful than others. High-tech industries generally perform well; emissions-intensive industries, such as steel, and those that rely on solvents, such as furniture manufacturing, struggle to meet environmental standards; and agriculture is a bit of a mixed bag. The result is an environment where people want to live and work.

Regional air quality problems, including smog, do generate different concerns and solutions than greenhouse gases. The leadership shown by state elected officials and the opportunity to act as a proving ground for innovative policies and new technologies is helping to facilitate the transition from addressing local air pollution to global pollutants. The frontier for decarbonizing the transportation sector is in developing countries, but there are still many ways to move forward in California. Important future developments include transitioning car and truck fleets away from fossil fuels toward electrification from "green" energy sources, self-driving automobiles, increased vehicle-to-vehicle communication, and even high speed rail. Research and development remains the linchpin for success, though. High-tech industries have done very well in California and they will need to continue to do so to facilitate further progress.

Michael Peevey

President, California Public Utilities Commission

Panel 1. Policy Leadership

Efficiency programs have increased with the goal of maximizing returns from fuel resources, not reducing the comfort of consumers. Efficiency programs now total $1 billion per year in California.

The Public Utility Commission (PUC) is the economic regulator of the state's utilities, but it also has focused on making the state "greener." During his administration (1999–2003), Governor Gray Davis instructed the PUC specifically to focus more on environmental sustainability, although leadership on environmental issues in California dates back to the first governorship of Jerry Brown in the 1970s. He spent time on forward-thinking issues and eventually created the California Energy Commission (CEC) to deal with growth and concerns about nuclear power. The CEC instituted appliance standards, building standards, energy efficiency programs, and emissions performance standards. In 1982, the state adopted the decoupling of revenues from sales for electric utilities, which removed the disincentive for them to invest in energy efficiency programs. In 2003 the state introduced rules that dictate the order in which different types of generators begin producing electricity (known as the loading order), with energy efficiency as the number one priority. Efficiency programs have increased with the goal of maximizing returns from fuel resources, not reducing the comfort of consumers. Efficiency programs now total $1 billion per year in California.

On the climate policy front, the state has implemented a cap-and-trade system that covers all sectors and that will soon link with the Canadian province of Quebec. Starting in the fall of 2013, most of the revenue from allowance auctions associated with emissions in the electricity sector will be given back to residents as a climate dividend. It is a good start, but our future energy challenges are large. How the world continues to use coal is of critical importance. The PUC first enacted and the state legislature subsequently enacted SB 1368 in 2006, a law requiring new long-term electricity contracts to have an emissions rate standard no greater than that of natural gas combined cycle units. This regulation became the template for a similar proposal from EPA. Coal will remain an energy source for the foreseeable future, however, so research needs to focus on how to make carbon capture and storage a viable option. California and the United States must also work with India and China to attain a more sustainable path for using coal. Fracking of natural gas is another important issue—although it is useful in the short term, it will not get us to our 2050 climate goals of 80 percent below 1990-level emissions. And no matter what polls tell you, consumers do not like price increases and, more often than not, they will reject policies that result in higher prices.

Phil Sharp

President, Resources for the Future

Panel 1. Policy Leadership

When people say "show me where these policies work," the response will be California.

The actions that California takes have a profound reach, domestically and around the world. The state's climate and energy regulations impact national and international firms who operate in California, forcing them to consider more environmentally friendly practices in order to pass regulatory muster. When businesses have to adapt to regulation in California, they can then take those innovations and spread them to their operations in other states. Meanwhile, from tightening fuel standards on the nation's automobile fleet to writing and eventually passing the Waxman–Markey legislation in the House of Representatives to leading the fight against removing EPA's authority to regulate greenhouse gases, California's congressional delegation sets the standard for developing federal solutions.

In the fall of 2010, when skepticism and hostility against climate actions were at their highest nationally, California voters stepped up and rejected Proposition 23, which would have ended the state's efforts to implement the state's climate law (AB 32). It was also encouraging that opposition to Proposition 23 was bipartisan. California now has some difficult design problems to work through as it continues to implement its cap-and-trade system for GHG emissions, but the knowledge it will gain through "learning by doing" and its embrace of social science to develop effective policies will be significant. When people say "show me where these policies work," the response will be California.

Anthony Eggert

Executive Director, UC Davis Policy Institute for Energy, Environment, and the Economy

Panel 2. Transportation and Air Pollution

Meeting California's climate and energy goals in the transportation sector will require a portfolio of technologies and strategies.

Transportation is the largest contributor to California's carbon footprint and the largest component of the state's energy bill: 38 percent of total state emissions comes from transport, not including upstream refining and extraction emissions, and $200 million is spent on transportation fuels per day, including passenger travel and goods movement. Meeting California's climate and energy goals in the transportation sector will require a portfolio of technologies and strategies. Fortunately, several promising solutions are emerging, including zero-emission vehicles, advanced biofuels, and land use strategies that expand mobility choice and reduce emissions. Many of these solutions have the potential to be cheaper than current fossil fuel options. To achieve this potential, however, will require large investments led by the private sector, possibly assisted by a carbon price.

The policies California is pursuing to motivate these investments address the major three components (or "legs") of greenhouse gas generation. The first is the carbon intensity of fuel. The state's low-carbon fuel standard requires a reduction in the average carbon intensity of fuels by 10 percent by 2020. The second is vehicle efficiency. California has already developed emissions rate standards that became a model for federal fuel economy standards through 2025, and it developed a specific program for zero-emission vehicles. The third is transportation demand. As previously mentioned, SB 375 requires and provides incentives for regions and local governments that reduce GHG emissions through land use and transportation planning and development. The state also provides financial incentives of approximately $150 million per year for low-carbon fuels and vehicles and, in 2015, the cap-and-trade program will expand to cover transportation fuel emissions, providing a direct financial incentive for lower-carbon alternatives and increased efficiency—thus becoming the seat that joins the three legs together to become a sturdy policy stool for sustained action on climate change in the transportation sector.

Peringe Grennfelt

Program Director, Mistra Indigo; (formerly) Scientific Director, IVL Swedish Environmental Research Institute

Panel 2. Transportation and Air Pollution

Short-lived climate pollutants such as black carbon and methane may provide a way to begin to better coordinate air pollution and climate policies.

The seeds for Sweden's actions on climate were planted by its efforts to reduce air pollution that resulted in acid rain. In the 1970s, Sweden suffered a great deal from acid rain and its associated problems. Investments in cleaner energy sources resulted in a 97 percent reduction in sulfur dioxide emissions since 1970. Sweden was then able to take its learning and apply it with similar success in Europe through the Convention on Long Range Pollution in 1979, an international agreement to limit air pollution. Soon after, countries including West Germany made large investments in post-combustion controls, though they were costly retrofits. Others, such as Poland and East Germany acted another decade later when former Eastern Bloc countries began to reform their industrial structure.

The ability for countries to learn from each other is limited now in the EU context for climate policy. It is more difficult for Sweden or others to take the lead because all member states have to adopt the same regulations. Further, the EU failed to develop a combined air pollution and climate strategy in 2008, which could have yielded $20 billion in benefits per year. Short-lived climate pollutants such as black carbon and methane may provide the context to begin to better coordinate air pollution and climate policies, which will be needed in the future.

Josh Linn

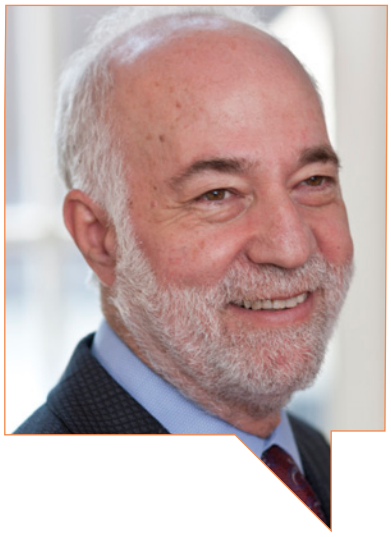
Fellow, Resources for the Future

Panel 2. Transportation and Air Pollution

Programs that encourage learning about consumer acceptance or infrastructure needs may have large benefits.

New automobile standards are driving efficiency and new technology adoption. In recent years, both the United States and Europe have been tightening fleet fuel economy standards, such that the United States will have somewhat similar fuel economy standards as Europe by 2025, although Europe also continues to improve. The drivers of the fuel standards differ between the two regions—California's aggressive regulation helped push the United States toward more stringent standards, whereas in Europe, the failure to meet voluntary standards led to the creation of a new system backed by fines for noncompliance.

A natural experiment in France in 2008 suggests that taxes on carbon dioxide emissions rates affected market shares of new vehicles but that the taxes did not cause manufacturers to adopt new technology. Targeted programs can be a boost to specific technologies, but the costs of such programs may prove to be relatively high, especially if the targeted technologies are not competitive in the market. However, programs that encourage learning about consumer acceptance or infrastructure needs may have large benefits. Finally, if engineers are given incentives to solve problems, they tend to be successful.



Dan Sperling

Founding Director, Institute of Transportation Studies at the University of California, Davis; and Board Member, California Air Resources Board

Panel 2. Transportation and Air Pollution

It is important to be clear eyed about the interaction between market forces and regulations.

California has the most comprehensive and coherent climate policies in the world, and they have the potential to be the most effective. Is the California experience unique or repeatable? Others can follow its example and find success. The state has employed a mix of regulatory and market instruments, some of which are the first of their kind in the world. The central agency for climate policy in the state is the California Air Resources Board (ARB), but the Public Utilities Commission and California Energy Commission have played important roles as well. ARB is unusually competent and sophisticated for a state agency, possessing both a strong technical competence and a culture of engagement with outside stakeholders. It also benefits from being a relatively independent agency in political terms, certainly more so than the US Environmental Protection Agency in Washington, DC.

ARB began with a focus on local air pollution, then grew to integrate climate policy into its operations. Politically speaking, local air is all about health, but linking local air pollution issues to larger climate concerns helps build a broader constituency. ARB is currently crafting a vision plan to integrate all existing air and climate policies with very aggressive goals for air pollution and climate in 2050. In fact, for 2050 regulatory goals, the binding constraint may not be reducing carbon dioxide, but reducing nitrogen oxides.

Moving forward, it is important to be clear eyed about the interaction between market forces and regulations. In the future, regulations may be even more important than they are now, but there will be opportunities to incorporate economic mechanisms to ensure that policies are persistent as well as flexible.

Thomas Sterner

Professor of Environmental Economics, University of Gothenburg;
and Visiting Chief Economist, Environmental Defense Fund

Panel 2. Transportation and Air Pollution

The time to act on climate has never been more urgent. The target of keeping global temperature increases below 2˚C is slipping away. To spur real action, policymakers should increase the price of fossil fuels through taxes or by other means. Fuel taxes are a straightforward and effective solution to reducing emissions.

To spur real action [on climate], policymakers should increase the price of fossil fuels through taxes or by other means.

Increasing fuel taxes or removing subsidies is often controversial because of concerns that higher fuel prices will hurt the poor. Raising prices does frequently result in conflict and social upheaval. The people more likely to be negatively affected are the middle class, though, not the poor. In most developing countries, fuel taxes are progressive policies. In Sweden, fuel taxes are very high, a result of tax reform from the early 1990s. In fact, Sweden has a carbon tax equivalent to $165 per ton of carbon dioxide; and yet, people are reasonably happy and life goes on. The tax is indexed to automatically increase and revenues go to the general treasury. While carbon taxes have increased substantially, overall taxation has been going down over the same timeframe. The lesson from the Swedish experience is that it is possible to have a robust carbon tax and not destroy your country's economy.

Mary Nichols

Chairman, California Air Resources Board

Featured Lecture

Despite many obstacles, California has decided to proceed and link with the cap-and-trade program in Quebec. Barriers include a different language, currency, and distance. Nonetheless, these obstacles can be overcome and the outcome will illustrate that we can broaden the market. The linking will allow for the full interchange of allowances. Offset rules are similar and consistent, but not quite identical. Auctions will be synchronized.

Overall, there is a sense of technological optimism about what can be achieved.

The value of being first—in this case the rewards of linking—accrues to both jurisdictions. Companies that do business in both California and Quebec, and there are many, will see the benefits. The benefits are proportional to the burdens and risks. They include leadership and pride and setting an example; it is not all about just controlling emissions in these two programs.

Linking with other jurisdictions in the same way is not imminent. With Australia, California is linking through consistent treatment of offsets but not through allowance exchange. There is interest in linking with Mexico, where the legislature approved and the president signed legislation enabling the creation in the future of a cap-and-trade program. There is also coordination on the Pacific coast with Oregon, Washington, and British Columbia, though this is not likely to lead to allowance trading in the near future. But there are other types of benefits from coordination. One is the use of a common and consistent registry. California supported the creation of the metric that has now been adopted in many jurisdictions across North America. Also, the offset protocols developed by the registry are some of the most robust in the world and can be standardized across these jurisdictions. Overall, there is a sense of technological optimism about what can be achieved.

Another priority of the Air Resources Board is conventional air pollution. The attainment of air quality standards is actually harder to achieve than the state's climate goals. To make progress, in addition to sources traditionally regulated by the state, California is pushing on federally controlled sources and emissions from shipping. Measures to achieve emissions reductions at these sources will also contribute to reducing greenhouse gases.

Dallas Burtraw

Darius Gaskins Senior Fellow, Resources for the Future

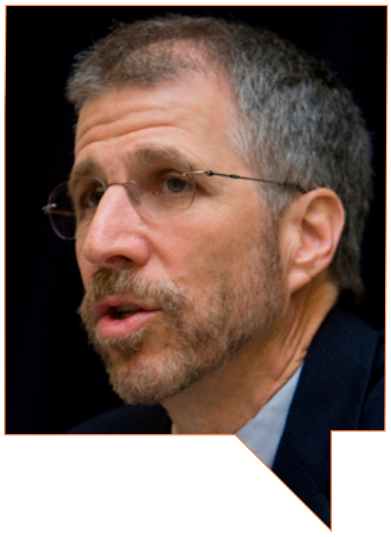
Panel 3. Competitiveness

This panel on competitiveness highlights two ideas. Being first presents an opportunity but it also presents danger. Opportunity stems from innovation. An important question is how jurisdictions can position themselves as leaders to take advantage of innovation and changes in the economy that can be expected to occur as we reduce carbon emissions. Meanwhile, danger stems from the potential leakage of economic activity to other jurisdictions that do not regulate carbon emissions. Policymakers need to understand how real this is and what they can do to protect their jurisdictions, even while they try to make progress in carbon mitigation.

Opportunity stems from innovation…danger stems from the potential leakage of economic activity to other jurisdictions that do not regulate carbon emissions.

The impact of leakage may be greater with the use of environmental prices than under other regulatory approaches. Even if the use of prices is more efficient from a social perspective, by increasing the delivered price of goods and services it may put a jurisdiction at a competitive disadvantage. In effect, jurisdictions that do not introduce prices are implicitly subsidizing polluting activities. Non-price regulatory policies may be less vulnerable to unfair competition from other jurisdictions.

To date, evidence of the effect of prices in reducing emissions or sparking innovation is mixed; however, evidence of the effect of regulation in achieving emissions reduction is convincing. Most often, economists describe regulations as complementary measures to the use of prices. But through the present phase of climate policy, at least in California, regulation has played the dominant role. One can observe, in fact, that prices are actually the complementary measures to regulation.



Severin Borenstein

E.T. Grether Chair in Business Administration and Public Policy, Haas School of Business, University of California (UC), Berkeley; Co-Director, Energy Institute at Haas; and Director, UC Energy Institute

Panel 3. Competitiveness

Beyond the value of being first, there is a value of going second because one can learn lessons from the experience of others. An important example is the absence of a price floor in the European Union Emissions Trading System, which was the first cap-and-trade system for carbon dioxide. As a consequence of this design, the program has experienced price volatility and declining overall prices that have reduced the relevancy of the cap-and-trade program. The Regional Greenhouse Gas Initiative began two years after the EU and incorporated a price floor in its auction, though at a very low level. One also sees a price floor in the California cap-and-trade program that began this year at a substantially higher level, $10.71 in 2013. In the California trading program, the price floor is implemented as a reserve price in the auction. Recent analysis carried out at the Energy Institute at UC Berkeley's Haas School of Business suggests that the most likely outcome is that the allowance price will remain close to the price floor throughout the 8 years of the program.

Because a large share of low-cost abatement in California is required by other regulations and will be done regardless of the allowance price, the analysis shows that there is fairly little price-responsive abatement available in this market.

Because a large share of low-cost abatement in California is required by other regulations and will be done regardless of the allowance price, the analysis shows that there is fairly little price-responsive abatement available in this market. Some of these regulations impose costs per ton that are greater than the price that is likely to be observed in the cap-and-trade program. These measures may not have been exercised under the trading program if it were the only regulation, but given the measures are in place, they lower the demand for emissions allowances. Also important is the potential shuffling of contracts for electricity imports into the state. In effect, this may lead to emissions leakage but that leakage will reduce the pressure on prices within the program.

As a result, while these other regulations are likely to keep allowance prices low, if a strong economy or other factors drive up emissions, there is relatively little remaining elasticity in the supply of abatement. Thus, if emissions rise, the analysis suggests that the allowance price could jump substantially. The analysis suggests that there is a low probability of such a jump, and that probability will decline further if California expands its renewable electricity mandate beyond the current target of 33 percent by 2020. California's program was designed to be a model for a US program, but the federal government looks very unlikely to make such a move anytime soon. Furthermore, the challenge of restraining emissions from the developing world remains quite daunting. This reinforces the need to invest in research and development—which has historically given California an advantage of being first—to bring down the cost of alternatives to fossil fuels.

Aaron Cosbey

Associate and Senior Climate Change and Trade Advisor,
International Institute for Sustainable Development

Panel 3. Competitiveness

There are general exceptions, but regulatory approaches basically cannot introduce arbitrary discrimination or disguised barriers to international trade.

Concern that economic activity may leave the jurisdiction that is regulating carbon has led to consideration of possible remedies. At the international level, international law requires that regulation treats similar products in a similar way. It also requires treatment of different nations in a consistent way. These constraints strongly limit what a nation can do in the international context to address leakage. There are general exceptions, but regulatory approaches basically cannot introduce arbitrary discrimination or disguised barriers to international trade. Rules cannot be aimed at preserving competitiveness but they can be aimed at preventing emissions leakage.

One potential strategy for importing goods from an unregulated economy is the introduction of tax adjustments at the border to match the impact of prices under cap and trade or an emissions tax in the domestic economy. The use of border tax revenue is an important consideration in determining the tax's legality. It is more convincing if it is invested in program-related mitigation. This was an element of Waxman-Markey, which would have put some revenues from a border tax toward efforts to halt deforestation. Another potential strategy is the use of output rebates for the domestic regulated firms. Called by a different name, this is the strategy that California is using for its industrial sector. However, in the international sphere, this is a legally risky approach.

The bottom line is that it is possible to construct an adjustment. A border carbon adjustment would probably be the most successful approach from a legal standpoint within international law.

Carolyn Fischer

Senior Fellow, Resources for the Future

Panel 3. Competitiveness

As others have already indicated, emissions leakage refers to the increase in emissions outside the regulated economy as a consequence of the carbon regulation. There are two channels through which leakage occurs. One occurs through product markets, where, for example, the production of goods in the unregulated economy may become relatively less expensive and that economy may gain a share of global economic activity. A second channel is through changes in energy markets. If the regulated economy reduces its demand for carbon-intensive fuels, this should reduce the price of those fuels on the international market, and this can lead to an increase in their use abroad.

If the regulated economy reduces its demand for carbon-intensive fuels, this should reduce the price of those fuels on the international market, and this can lead to an increase in their use abroad.

Overall leakage can range from 5 to 20 percent. There are several options to remedy this. The most effective would be global carbon pricing, in which case leakage would not be expected to occur. By analogy, the broader the set of countries regulating emissions, the smaller the leakage rate that would be expected. A second option is to reduce ambitions for emissions mitigation, which will lower leakage. The border carbon adjustment is a third option, and output-based rebating for regulated firms or industries is a fourth option. The exemption of specific sectors especially prone to leakage is another possibility. Finally, regulators can opt for a greater use of non-price regulatory policies, which will lessen the difference in prices between the regulated and unregulated economies and reduce leakage.

Åsa Löfgren

Associate Professor, Department of
Economics, University of Gothenburg

Panel 3. Competitiveness

Empirical evidence in Sweden indicates that investments in carbon mitigating technologies have not been driven by the emissions trading system... similar investments also appear among unregulated firms.

Empirical evidence in Sweden indicates that investments in carbon mitigating technologies have not been driven by the emissions trading system. One does observe the expansion of energy efficiency, the use of biofuels, and residential district heating. Among firms that are regulated inside the trading system, one observes small positive investments, but similar investments also appear among unregulated firms. Firms outside the trading system appear to have anticipatory incentives of higher prices or regulation, or perhaps greater awareness due to the EU Emissions Trading System. To some degree, perhaps, activities taken outside the trading system can be attributed to the Emissions Trading System.

Other policies, in addition to the price on carbon under the Emissions Trading System, also matter in explaining the emissions reductions that have been observed. In addition to complementary regulatory measures, other factors include research and development, in-house knowledge, education and information, and characteristics of the management of firms.

Richard Morgenstern

Senior Fellow, Resources for the Future

Panel 3. Competitiveness

California is emphasizing the results of new social science research in fine tuning their cap-and-trade system. One of the questions they are trying to examine in an anticipatory way and perhaps ultimately in a real-time way is the impacts of carbon pricing on competitiveness. To reduce the leakage of emissions as well as jobs in the industrial sector, California is using output-based allocation with updating (similar to output-based rebates that Aaron Cosbey and Carolyn Fischer mentioned). This approach maintains incentives for in-state production by offering an output subsidy. If a firm wants to continue to receive allowances for free in the future, it has to maintain production in the state.

To reduce the leakage of emissions as well as jobs in the industrial sector, California is using output-based allocation with updating.

Policymakers need to know how much compensation is necessary. Ongoing research draws on the natural experiment embodied in historic fuel price variation across states over time. The focus is on how the value of shipments—that is, the level of economic activity as well as employment—has varied in response to changes in relative fuel prices between California and competing jurisdictions. Confidential plant-level data from the US Census Bureau is available to researchers on a restricted basis to conduct the research. Results can be expected within the next year.

Birgitta Resvik

Head of Corporate Relations, Fotum

Panel 3. Competitiveness

From the viewpoint of industry, a successful regulation is one that provides the incentives for innovation and investment.

In the south of Germany, one already observes that solar photovoltaic systems are economically viable compared to other new generation investments without subsidies, if one does not have to pay for connections to the grid. The programs that have promoted renewables have contributed to an emerging market reformation. From the viewpoint of industry, a successful regulation is one that provides the incentives for innovation and investment. This appears to be true with respect to renewable support policies in Germany. Today, the EU Emissions Trading System does not provide that incentive because the price of allowances is too low.

The success of financial support for renewables has created its own set of challenges because now all the renewable sources that have been developed have to be integrated into the electricity grid. The large penetration of renewable energy makes integration into the electricity grid difficult. But large penetration was the intent of the policy in the first place. Solving the grid interconnection is the next step in reducing the carbon intensity of electricity generation.

Renae Steichen

Project Manager, Collaborative Economics Inc.

Panel 3. Competitiveness

In the last decade, California has provided evidence of a culture of innovation. The state's success can be measured in various ways, including the magnitude of investments, patents, and job growth. The jobs associated with innovation in the clean technology field were much more resilient to the recession than the California economy generally and have increased 17 percent between January 2001 and 2011. In addition, California GDP per capita increased 16 percent since 1990, while the state achieved a 17 percent drop in GHG emissions per capita over the same time period. The experience in California is that there is a benefit of being first with respect to efforts to improve the environment in general and reduce carbon emissions in particular—and that value accrues in important ways to citizens of the state.

The jobs associated with innovation in the clean technology field were much more resilient to the recession than the California economy generally.

Authors

Dallas Burtraw, Daniel F. Morris, and Lars Zetterberg

Dallas Burtraw

Daniel F. Morris

Lars Zetterberg

Dallas Burtraw is the Darius Gaskins Senior Fellow at Resources for the Future (RFF) in Washington, DC, and Daniel F. Morris is a center fellow in RFF's Center for Climate and Electricity Policy. Lars Zetterberg is a senior scientist and director of business development at IVL Swedish Environmental Research Institute in Stockholm. Funding for this workshop was provided by Mistra's Indigo Research Program, ClimateWorks, and Resources for the Future.

More information about the workshop, including full bios for each speaker, the workshop agenda, and speaker presentations, is available at the event webpage: www.rff.org/CA-SwedenWorkshop.

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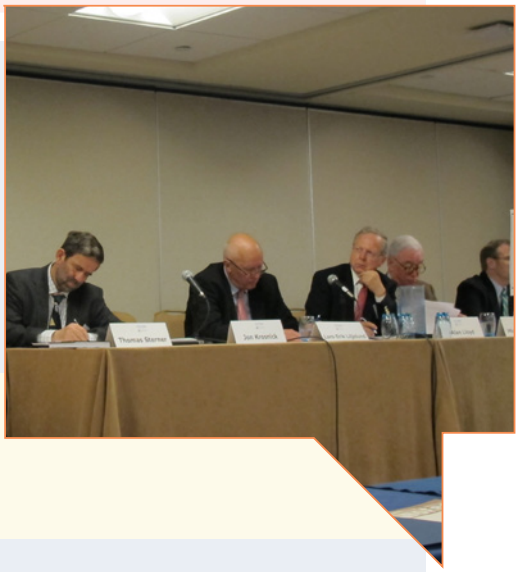

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