Local Options on Global Stocks: How the States are affecting the U.S. Debate on Climate Policy

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Abstract: This paper examines some of the implications of local policy-making with regard to the global issue of climate change. First, we assess what one may expect when small open economies, such as states, implement policies designed to affect global pollutants. Next, we briefly analyze some of the legal constraints on state actions. We then catalog some of the specific technologies used in the states to address carbon emissions. Finally, we provide some analysis of how states might implement emission control policies in a way that compensates important interests for some of their increased costs without losing the benefits of efficient policy design.

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1. Introduction

Climate change is a global problem and its solution will require international and probably global cooperation. That would seem to make climate change a problem that is particularly well suited for policy at the national level. However, in the US and in some other nations including Australia, state and local governments have been very active in developing policy. Clearly one justification for policy initiatives at the state and local level is the sense of local political bodies that they have to do something to address the problem. The federal government has not been very active in addressing problems related to climate change, and some states will conclude that it is in their interest to take some steps to address the issue even if they will receive only a very small fraction of the climate change benefits of their own actions. The state policy makers undoubtedly recognize the importance of joint effort and view their own actions, not as ultimate policy solutions but rather as providing an impetus for federal and even international action.

When states craft climate change policy, the policies will likely be designed in a way that maximizes their own net benefits. Thus, locally designed policies on climate change will reflect local conditions; natural resource endowments, concentrations of industry and agriculture, and the distribution of political influence in the state. In addition, state policies will likely act to export costs and import benefits whenever possible. The U.S. Constitution places a variety of constraints on the form and extent of state control over activities within the state's own boundaries, and even tighter constraints on efforts to extend state authority over activities in other states and over the trade of goods across state boundaries. The combination of the local interests and conditions will result in a pattern of regulatory development that results in higher costs of compliance and reduced gains in actual impact on climate change while constitutional constraints limit the ability of states to control the full range of economic activities that result in greenhouse gas emissions from the state.

When businesses encounter regulatory initiatives that vary across states in stringency and method it can raise their costs, and historically one finds business in the position of arguing for federal action to reduce the diversity and even inconsistency of independent state regulatory actions. For those who view pending state regulatory actions as overly strict, the preemptive power of federal rules may provide an avenue for setting less stringent federal standards that preempt the implementation of stricter local policies.

We are interested in motivations for state actions addressing climate change that are in some ways deeper than the desire to provoke federal action. Other motivations include setting a model for federal action, providing a testing ground for policy alternatives, and the possibility that state governments are better placed to address some aspects of the problem. With these motivations in mind, in this paper we investigate the

potential efficacy of state efforts. We examine the political economy of environmental federalism to see how state efforts may influence the federal debate.

States have been famously referred to as the laboratory where learning can occur that can influence federal policy. In a laboratory, experimenters may make discoveries through educated theorizing (guesses), or through trial and error, but always with lots of failed efforts to light the way. How might one consider the array of state initiatives underway in this light? Are state innovations well-designed experiments? Are many destined to fail? Will failed policy experiments be abandoned, or will they become entitlements that hang on as a costly, anachronistic appendages to state policy? Are they a precursor to eventual federal action? Or are they, simply, local efforts to realize local change at a scale where citizen-activists can affect policy (and perhaps not the best scale for ultimately implementing that policy)? Are state policies an end unto themselves, or a path to federal policy? Ultimately, any U.S. effort on climate change will be an amalgam of national and local decision making, and, as such, will undoubtedly bear the markings of its diverse origins.

In what follows, we examine some of the implications of local policy-making with regard to the global issue of climate change. First, we assess what one may expect when small open economies, such as states, implement policies designed to affect global pollutants. Next, we briefly analyze some of the legal constraints on state actions. We then catalog some of the specific technologies used in the states to address carbon emissions. Finally, we provide some analysis of how states might implement emission control policies in a way that compensates important interests for some of their increased costs without losing the benefits of efficient policy design.

2. Some observations about state-level policy initiatives

Greenhouse gases act on a global scale. A unit of greenhouse gas with a given temperature forcing potential has the same effect whether it is emitted in Australia or in Appalachia. The global scale of the effect argues for a global policy response. Yet, in the case of greenhouse gases an effective international response has yet to emerge. Instead, there have emerged a set of regional initiatives that, by themselves, can do little to reduce the anticipated consequences of increasing concentrations of greenhouse gases in the atmosphere. For example, the 10 states of the Regional Greenhouse Gas Initiative (RGGI) have implemented a cap on carbon emissions from the electric utility sector. The total emissions from this sector amount to only around 2% of global carbon dioxide emissions. Energy Information Administration (2004) The reductions in CO_2 emissions due to the full implementation of the RGGI cap is only a fraction of this amount. Thus, a full implementation of the RGGI cap, has only a trivial impact on global carbon emissions.

The Kyoto Protocol, while intending to take a global approach, is largely a unilateral effort by European countries to reduce their contribution to global emissions. An even more dramatic departure from the match of global policy to the global scale of the problem is the case of the U.S., which has declined to establish any national policy of limiting greenhouse gas emissions. Rather, we observe a wide variety of state and local governments and institutions voluntarily undertaking policies that are advertised as efforts to reduce local greenhouse gas emissions.

No city, state, or even region of the U.S. can independently have any appreciable effect on global greenhouse gas emissions. As with the case of Europe and the Kyoto protocol, one interpretation of these efforts at reducing emissions is as an offer to participate in broader cooperation to reduce emissions. By making unilateral emission reductions, a state or group of states are expressing a commitment to a cooperative outcome in the prisoner's dilemma game of exploiting the global atmospheric commons. These early commitments will ultimately be seen as successful by the adopting states if they result in the establishment of a national policy limiting greenhouse gas emissions, and one that is sufficiently stringent that it matches those state-level efforts. By this logic, the early adoption of policies limiting greenhouse gas emissions serve to push the national political agenda in the direction of a national policy on reducing emissions.

What will be the outcome of this topsy turvy pattern of having local policy development driving the national agenda on a global pollutant? How is it likely to differ from the development of an international treaty or from the top-down establishment of a national policy? In this section, we will address some of the implications of local policy experimentation. In the section that follows, we will briefly discuss the political economy of state efforts to control greenhouse gas emission in a federal system.

2.1 Laboratories of democracy

By taking the lead in policy development, the states become the "laboratories of democracy" where new policy innovations in the U.S. may be designed, implemented and evaluated. Strumpf et al. (2002) The model of policy development implicit in this statement would have 50 independent policy laboratories inventing new policies, testing those policies in the field, and selecting the best policies based on the outcome of the design and test cycle. The best policies then will survive to be adopted by other states or by the federal government while the unsuccessful policies will be discarded or sent back to the lab for redesign. By putting many independently developed policies to the test, such a system of policy development might have significant advantages over a single, top-down, federal policy development process.

But is this the way that policy innovation actually plays out in the states? The 'laboratories of democracy' model suggests several pieces of evidence we might examine in order to answer this question. While there is often little data that we can use to fully evaluate these questions, we can develop a qualitative picture that may be instructive.

2.2 Follow-the-leader policy making

Investment in policy design and evaluation can be expensive and can expose innovators to political as well as financial risk. And since innovative policy designs are public goods, a single state cannot hope to capture all or even a significant share of the benefits created by a successful innovation. Strumpf et al. (2002) Insofar as states simply copy policies implemented in other states or coordinate their policy development, then there may be correspondingly fewer different new policies put to the test. "Follow-the-leader" policy development occurs where one state or a few states implement new policies, and these new policies diffuse across other states often before a careful evaluation can be made of the true impact of the new policies. Coordinated policy development may occur through state organizations such as the National Governor's

Association, the Council of State Governments, or the Environmental Council of the States.

This is not to suggest that state-level policy making does not produce good outcomes, only that the process of policy design in the case of "follow-the-leader" or coordinated policy development does not necessarily differ as markedly from federal policy making as the "laboratories" model seems to suggest. It may be true that, in both cases, policy design investments are highly concentrated. One would not necessarily expect to observe a wider variety of policy proposals or even a qualitatively different set of proposals.

2.3 Local experiments will reflect local interests

Probably the key difference in the pattern of regulatory development between the federal and state governments is the voluntary nature of the decision to implement a given state-developed policy initiative. While it is axiomatic that local policymaking must necessarily reflect local interests, probably the most remarkable feature of a state-driven policy agenda on climate change is the apparent imbalance between aggregate local costs and benefits. Even for the larger states such as Texas, California, and New York, each of which contribute a significant fraction of U.S. atmospheric greenhouse gas accumulations, the benefits of a state's actions are spread out over the entire globe while any net costs are local. Aggressive policies to control greenhouse gas emissions in a state must raise costs in that state relative to costs in other places causing economic activity to leak out of the state along with the associated emissions.

So we would expect to observe differences in state policies that reflect differences in the expected *local* gains, the *local* distribution of those gains, and the relative influence of various interests at the *local* level. For example, a recent study estimated the gains and losses to agriculture across the states from increasing temperatures expected from human-induced climate change.[1] The inter-state differences were quite striking, with California *losing* around $1 billion annually and Pennsylvania *gaining* about half that much. Differences such as these may help explain some of the differences in the intensity of the responses that those states have made in reducing the state's contribution to global climate change.

Local policies on climate change will also be driven in part by local interests not necessarily related to climate change, often referred to as 'policy capture.' Agricultural interests within a state may be expected to support bio-fuels subsidies. The forestry industry in a state will benefit from the use of sequestration credits in clean generation portfolio standards. Coal producing states will have constituencies strongly opposing limits on carbon emissions and supporting public expenditures on "clean coal" technologies while states with stocks of oil and natural gas may gain from policies that favor these local stocks over coal imported from other states. The costs of implementing renewable portfolio standards will be shared by owners and ratepayers in states with unregulated electric rates, while in states with rate regulation a larger fraction of the added costs will be passed through to ratepayers.

Every policy designed to address climate change will have winners and losers, and potential winners and losers will attempt to bend regulatory policy in their favor.

[1] Deschênes et al. (2007)

There can be no reasonable expectation that changes to rules in response to these interests will enhance the efficiency or effectiveness of the resulting policy. The relative size and intensity of these interests will vary from state to state and will affect the choice of policies toward climate change. The heavy weighting of local interests in establishing local policies toward global climate change may be expected to result in a mix of policies that greatly increase the aggregate costs of reducing global impacts by driving large differences in marginal control costs. In these laboratories of democracy, the determination of which policy experiments are successful will often depend less on measures of the policy's actual impact on greenhouse gas emissions than it will on the relative intensity of interests between the gainers and losers.

2.4 Policy experiments create entitlements and are hard to eliminate

It naturally follows that once a local policy has been established, it will likely be hard to change because those receiving the benefits of the current policy will be willing to pay to retain the benefit. Their willingness to pay will be directly related to the size of the benefit received. This implies that policy experiments have a natural stickiness or inertia; they are hard to eliminate once they are in place. Policy inertia arises from the tendency of beneficiaries to view the benefits from the policy as an entitlement: every public policy is an entitlement to someone. This policy inertia creates yet another divergence between the ideal laboratory model and actual policy development by the states. Policy inertia and policy capture by interested groups has been amply demonstrated in many areas of regulatory policy. Posner (1974), Stigler (1971)

2.5 Experimentation implies learning from mistakes

The model of states as laboratories of policy experimentation depends on the ability of states to learn from their mistakes. We have already noted that it may be difficult to abandon a policy once it is implemented due to entitlements created by the policy. Learning from mistakes also implies that states evaluate the effectiveness of new policies. However, for a variety of reasons, states do little effective ex post policy evaluation. First, there is the class of policies that are adopted largely because of their redistributive impact. These require no evaluation since any policy effectiveness is largely secondary to the redistribution of resources. Second, the people who vote to have policies put in place risk having their positions proven wrong by *ex post* evaluation and hence have a reduced incentive to conduct such evaluation. Third, like investments in policy development, policy evaluation is a public good, with all adopters of the policy benefiting from the *ex post* evaluation of the state carrying it out.

Policy evaluation capable of actually determining whether a new policy had succeeded can often be very expensive. Outcomes can have significant short term variability that masks actual performance or they may have consequences that are inherently difficult to measure. Renewable portfolio standards (RPS), a policy currently favored by 21 states for, among other things, reducing state contributions to global climate change provide an instructive example. An RPS directly reduces carbon emissions by replacing some fossil carbon-based generation with generation that does not use fossil carbon sources. In addition to the direct impact, a state's RPS raises the cost of electricity, lowering demand. Most RPS rules allow utilities to purchase renewable energy credits (RECs) and in some cases carbon offsets in order to meet the standards.

A full evaluation of the consequences of establishing an RPS requires a careful tracing of the effects of the change throughout the economy. Other things equal, an increase in generation costs in one state will cause some generation and some electricity-intensive activity to move to locations where costs are lower and hence where carbon limitations are less binding, and some users of electricity will substitute away from electricity to direct consumption of fossil fuels. Also, a reduction in the local demand for fossil fuels will lower the cost of these fuels to the rest of the world, resulting in some offsetting increase in their use elsewhere. The increased use of RECs will increase their price. This will increase the supply of RECs but will also increase the cost of RECs to others thus reducing quantity demanded at the margin. One must make a realistic determination of how much renewable generation represented by the RECs would have occurred in the absence of the added incentives offered by the RECs.

This partial list amply demonstrates the difficulty states face in fully evaluating the costs and benefits of a given climate change policy. The results of the analysis may depend on very difficult to measure behavioral responses to changed incentives. For example, an increase in the gasoline tax in a state generates behavioral responses at many different margins playing out over many different time horizons; all as the wholesale price of gasoline, the cost of housing, the cost of cars and transit options undergo their own changes on their own multiple time horizons. Unfortunately, without undertaking such an analysis, state policy makers cannot be in a position to make a fully informed decision about whether a policy experiment has promoted the intended goal and, if so, whether it has been worth the cost.

The foregoing analysis offers some insight into some characteristics we might expect in climate policy development at the state level and climate policy development at the federal level. First, experimentation will not be independent and evenly distributed across the states. Some states follow the lead of other states, free riding on their policy development. Second, states have different interests in controlling carbon emissions. Those states with little to gain will not initiate policies. Local policies will reflect local interests and local political conditions. These differences may largely be driven by the distribution of gains and losses in the state and will result in significant differences in marginal reduction costs across states. Policy evaluation is expensive and subject to free riding, so it is likely that many state policy innovations will not be subjected to careful *ex post* analysis. This underinvestment in policy evaluation combined with the stickiness of regulatory entitlements may result in many ineffective or inefficient policies remaining in force and even being emulated by other states.

These enumeration of these characteristics of state policy making on climate issues is not intended as an argument that policy innovation is best left to federal or international agencies. Many of these features are shared by policy development and implementation at any level. However, in choosing regulatory approaches, one should have a realistic expectation about the outcome of distributed policy development.

3. Political Economy of Environmental Federalism

3.1 The "appropriate" level for environmental policy

Choosing the appropriate level of government for implementing environmental policies requires the balancing of a number of important factors. The decision would be

relatively straightforward if the geographic extent of the environmental effects matched the geographical extent of a single government's authority to monitor and enforce. It is an unfortunate characteristic of most important environmental problems that they do not satisfy this geographic identity between the extent of government control and the extent of environmental impact. Perman et al. (2003) As a consequence, an efficient approach to this class of environmental problems require some level of coordination between sovereigns. As between nations, the only tools available are those of international diplomacy. The nature of the strategic dilemmas of international environmental diplomacy are well-documented elsewhere. Here we will be concerned with the relationship between the state and federal governments in the U.S. in addressing climate change.

It is one of the standard results from the environmental economics literature that where diverse localities have diverse valuations of environmental goods, then allowing those localities to set levels of environmental quality according to the local valuation can improve welfare. Perman et al. (2003) A single national standard can, other things equal, lower welfare by having a single level of control that is too strong for some localities and too weak for others. In the long run, people will tend to sort themselves out according to their preferences for environmental quality. For environmental effects that cross jurisdictional boundaries this logic is greatly weakened by the uncompensated effects that one locality's choices have on other localities. A single locality will not be able to set environmental quality standards according to local preferences, and opportunities for individuals to choose their preferred level of environmental quality by choosing where they live will be attenuated. This is clearly the case with climate policy.

Individual states or regional efforts, such as those implemented under RGGI, represent a small fraction of the global economy and their economies are open to interstate and international movement of goods and capital. Local efforts to regulate greenhouse gas emissions are subject to global market forces. Generally speaking, local regulatory efforts will raise local costs but will not change global prices. In this environment, any increase in local costs will result in some tendency for economic activity to shift away from higher cost regions and toward lower cost regions. Any resulting shift of greenhouse gas emissions away from regulated areas toward unregulated areas is referred to as leakage. Leakage may be direct, as when fossil fuel combustion moves from a state with strict greenhouse gas controls to a neighboring state while the resulting production is sold back into the state with the stricter regulations. Or leakage may be indirect due to a general shift in economic activity away from the state with the stricter regulations. Another form of leakage occurs when greenhouse gas restrictions lead to a reduction in the local demand for carbon-based fuels. If the reduction in demand for fossil fuels is large enough to put some downward pressure on fossil fuel prices, then any reduction in price will result in some increase in demand for fossil fuels elsewhere partially offsetting the local reductions resulting from the regulations.[2]

Even when states implement policies that affect only their local businesses, successful policy implementation may benefit from (or even require) cooperation with other states. For example, policy coordination could help prevent the leakage of carbon

[2] This issue is discussed in more detail in section 2.5.

emissions between neighboring states. Coordination may take the form of setting multi-jurisdictional standards. For example, where states have implemented RPS policies, they will generally include some provision for offsetting some of the local requirements with transferable renewable energy credits from other jurisdictions. However, in the absence of uniform standards for what activities may generate such credits and how they may be used, a state-by-state approach will cause the market for credits to become fractured and much of the potential gain in cost effectiveness would be lost.

3.2 Constitutional federalism

State efforts to control greenhouse gas emissions reprise all of the major recurrent themes in state and federal relations. The U.S. Constitution apportions powers between the federal government and the states (albeit with determined vagueness) and places a variety of limits on the exercise of both state and federal power. Nowak et al. 1978 States may not place burdens on interstate commerce (unless given permission by the federal government) or international trade, they may not regulate activities in other states, and they may not take actions preempted by a valid exercise of federal power. The history of constitutional law in the U.S. is partly a history of the struggle between the states and the federal government over the apportionment of these powers and limitations.

The case of greenhouse gas controls turns the usual federalist struggle around. It is generally acknowledged by the states that greenhouse gas controls belong at the federal level, but in the absence of any federal policy initiative, the states are combining in regional consortia to initiate change. This bottom-up regulation of a global pollutant presents an unusual set of constitutional obstacles.

Limits on state powers

Section 8 of Article I of the U.S. Constitution, the "commerce clause" gives the federal government the right to regulate trade with other nations, with Indian tribes and among the states. On its face, this language gives the federal government the power to actively control commerce between a state and any other jurisdiction. The first implication of this language is that the federal government has broad, plenary power to regulate commerce. As it has been interpreted, this clause implicitly grants the federal government the power to control matters that, while internal to a state, may affect commerce between a state and other states, countries or Indian tribes. In addition, the "supremacy clause" in Article VI, clause 2, provides that federal law overrides any state law that is in conflict with valid federal legislation. Congress may specifically preempt state authority in matters within its plenary power, or preemption is implied if state laws are in actual conflict with federal action under the commerce clause. Nowak et al. 1978.

While the commerce and supremacy clauses do not explicitly limit state regulation of commerce in areas not the subject of federal legislation, these provisions have been interpreted to imply a passive or "dormant" commerce clause restriction on the permissibility of states passing laws or regulations that place a burden on interstate commerce. Under the dormant commerce clause interpretation, states may not pass laws, under the guise of protecting public health and safety, that place a heavier burden on economic activity originating in other states compared to economic activity originating within the state unless there is no less burdensome or non-discriminatory way of

accomplishing the purpose. In other words, there is a strong constitutional presumption against rules that discriminate against economic activity from outside the state. Interestingly, this does not imply a prohibition against discriminating against economic activity from within the state. The rules are intended to protect commerce from regulations that protect local economic interests at the expense of interests from other states.

Article I, section 10, clause 1 of the Constitution prohibits states from entering into treaties, alliances, or confederations (with other countries). There is no provision for congressional approval to override this prohibition. Further, section 10, clause 3 requires that no state shall enter into any interstate compacts and agreements (with other states) without the consent of Congress. The interstate compacts and agreements language only applies to cases where the cooperation between the states threatens the balance of power between the state and federal governments. Cooperative activities that do not shift the balance of political power need no approval. Nowak et al. 1978.

Finally, Article IV, section 2, clause1 of the Constitution provides that "[T]he Citizens of each State shall be entitled to all Privileges and Immunities of Citizens in the several States." This language may place some restrictions on whether citizens from other states may be limited in their access to goods, services, or licenses provided by a state government. Under some interpretations, this provision may place limits on a state's ability to differentiate it's own citizens from non-citizens in granting access to resources within the state's control.

Experimentation with policies on reducing climate change must take place within the restrictions on state power laid out in the previous paragraphs. A policy intended to reduce a state's greenhouse gas footprint must not conflict with existing federal rules. It must not place non-local economic interests at a competitive disadvantage relative to local interests. It must not require a significant obligation to a foreign government or too great a blending of governmental powers between states. And, any policy concerning a global issue such as climate change from greenhouse gas emissions is ultimately subject to preemption by federal policy.

State climate change policies invariably affect activities well within the reach of the federal power to regulate commerce: electricity generation, energy production generally, and trans-boundary air pollution. For example, states wishing to address the 'leakage' of greenhouse gas generation in response to state regulations on electricity generation will face constitutional constraints on their ability to extend regulatory control over production of electricity imported into the state. Efforts to shift the fuel mix used in a state away from carbon intensive fuels may run afoul of restrictions on states placing burdens on interstate commerce. Also, when states take the lead in establishing policies where there is a reasonable expectation of future federal preemption, the responses of firms to the state policies will take into account the likelihood of future federal policies. As a case in point, regional greenhouse gas trading programs such as RGGI must expect that firm responses to the regional market will reflect firm expectations about how the transition from regional to federal programs will be implemented.

Since the federal power to negotiate and approve international treaty obligations is a plenary federal power, the web of existing global treaty obligations may place substantial constraints on state regulatory options. Trade agreements, international rules

on governing transport, and those covering use of ocean and atmospheric resources may be inconsistent with local climate change policies.

Limits on federal powers

The Tenth Amendment of the U.S. Constitution, the "reserve powers" clause restricts the federal government from applying its powers in a way that threatens the sovereignty of state and (hence) local government. Congress cannot pass a law that unreasonably interferes with a state's exercise of its essential executive (plenary) powers or threatens its independent existence as a state. However, federal power can reach state activities that are not plenary. For example, state-owned power generation facilities would not be considered an exercise of state plenary power and would be subject to federal preemption and regulation.

3.3 The regulatory maze

It is generally accepted that, for firms with a scope of operations that spans multiple jurisdictions, regulatory standards that vary substantially from region to region will impose larger compliance costs than regulations with relative cross-regional uniformity. Given that this is true, then the development of greenhouse gas policies at the state level, may result in higher compliance costs than would policies implemented on the national or even international scale. Standards may not only be different, they may be inconsistent with requirements in one state contradicting requirements imposed by other states. A regulatory standard in one state may encourage the use of a particular type of energy source while another state's standard may specifically prohibit it. A power company selling into both markets will face significant managerial and technological costs in satisfying the joint but inconsistent requirements. Navigating this regulatory maze can place a substantial burden on commerce between jurisdictions, imposing substantial hidden costs on consumers.

State governments have an incentive to export the costs and import the benefits of a given policy. The prevalence of meals and lodging taxes is a testament to state efforts to export their tax burden.[3] The most effective arguments used to support RPS policies in the states probably have less to do with reducing climate change than they do with shifting jobs into the state and reducing exports of money paid to carbon-based energy suppliers. The tendency of states to use policies to export costs and import benefits will undoubtedly contribute to the development of a pattern of state regulations with high compliance costs and low aggregate effectiveness in lowering greenhouse gasses.

3.4 Conflicts over ownership

Ownership of common pool resources (CPRs) such air and water is generally seen as vested in the public. Legal writers often refer to these resources as being held in "public trust" for the benefit of the public. One of the beneficial uses of these common

[3] If a state can manage to 'export' its tax burden by imposing taxes that fall predominantly on citizens of other states, then its own citizens will be better off since their government services will be paid for partly by others. Meals and lodging taxes are paid by travelers. As such, a higher proportion of these taxes are paid by people from other jurisdictions than are property taxes or general sales taxes.

pool resources has been the disposal of waste products. This use of air and water has always had very substantial economic value; a value that was implicit rather than explicit because there was no mechanism for explicitly establishing a value for resources not traded in markets. The historic conflicts over air and water pollution have been over what share of these public resources should be allocated to waste disposal services and what share should be reserved to protect public consumption of air and water. For as long as environmental policy was viewed primarily as an issue of what regulations to apply to the use of the air and water, the value of environmental resources remained implicit and the issue of ownership did not arise. Rather the discussion was in terms of what level of government had the power to establish and enforce regulatory standards.

With the advent of environmental policies such as Pigouvian taxes and allowance trading which are based on establishing market-like incentives for users of the air and water, the disposal services of these resources are transformed into an asset with a stream of valuable monetary returns. The power to regulate now implies the power to determine the disposition of the stream of valuable returns on the regulated activity adding a critical complication to the struggle between the states and the federal government over the allocation of regulatory powers. The issue of control is now also an issue of income.

Although no one seemed to remark on it at the time, the 1990 Clean Air Act Amendments transferred a valuable ownership interest from the states to the federal government by transferring the right to allocate the economic value of sulfur dioxide (SO_2) emissions from sources covered by the law. The law created an asset with substantial market value and gave the asset to the regulated firms free-of-charge. An asset that had been held in trust by state government, for all intents and purposes, became the property of the federal government. As a rough measure of the magnitude of this transfer, the current annual market value of SO_2 allowances is approximately $5 billion or just under 1% of all state expenditures in 2006.

The next large federal air pollution control program to use a cap and trade structure followed a different pattern. The EPA rule to control the effects of the transport of NOx over state lines, the NOx SIP call, was developed through a process of negotiation among the states. These negotiations led to the establishment of state budgets for allowable emissions of NOx. The states retained control over how the allowances were allocated to firms. The EPA rulemaking explicitly acknowledged the possibility that the states had the authority to charge for the allowances if they saw fit. While most of the states covered by the NOx SIP call have chosen to give all of their allowances away for free, there were two notable exceptions. In 2004, Kentucky sold 5% of its NOx allowances into the NOx spot market. Also in June of 2004, Virginia held an auction for 8% of its NOx allowances for the 2004 and 2005 compliance years. This auction raised $10.5 million for the state's general fund.

A conflict between the states and the federal government over ownership of air allowances is inevitable. Bush administration's "Clear Skies" initiative for modifying the clean air act proposed expanded use of allowance trading programs and specified that, over time, increasing shares of allowances should be auctioned, and the revenues would have accrued to the federal government. The Congressional Budget Office (2005) has estimated the impact of a variety of air pollution fees on the federal budget.

The amount of money at stake rises dramatically with the prospect of limits on greenhouse gas emissions. A policy aimed at holding carbon emissions steady through

taxes or allowances would generate tens of billions of dollars each year. Efforts by the Regional Greenhouse Gas Initiative and other state efforts to control carbon and raise revenue could serve to establish state ownership of the value of carbon assets prior to the establishment of a federal program. The states are, in fact, making a claim of ownership to assets that federal proposals would claim for the U.S. Treasury.

4. Technology Policy

One of the ways state and local governments consistently exercise authority in recent decades is in the promotion of policies that chart a course for technology development. These policies take shape in two venues. One is legislative, at the state level, where states have occasionally offered tax credits and other support policies for specific types of technological development. The second venue is regulatory, where for example state public utility commissions influence investment and operation of the electricity system. Our major focus in this discussion will be on these state policies affecting the electricity sector.

4.1 Supply-Side Measures in Electricity Generation

By the early 1990s activity before state commissions that regulate the electricity industry was so great that it led some critics to suggest a theory of capture of state regulators by local interests (Joskow, 1992). The 1992 Energy Policy Act reversed this trend by accelerating the introduction of competition into wholesale power markets and in many jurisdictions also into retail markets. With that change the role of public utility commissions in resource adequacy planning was diminished, especially in states that deregulated. This removed a primary way that PUCs influenced technology. It is more than coincidence that states that deregulated their retail services were also among the most proactive states in setting technology policy through the PUC, and these also were the states with highest electricity prices (Ando and Palmer, 1998). One perspective on this coincidence is that stakeholder involvement in state regulation raised the cost of electricity service and thereby fueled the drive to deregulate. Another perspective is that stakeholder involvement did not cause but actually came as a response to high prices. A third is that these states were generally sensitive to environmental issues, were located away from fuel supply, were relatively populous, and this led to tighter markets that drove up prices.

Although the Energy Policy Act and subsequent deregulation in many states in the 1990s stripped the momentum and sometimes the authority for PUC activity, slowly since then there has been a recovery of interest in technology policy affecting the electricity sector in these states. Sometimes the new generation of policies is implemented through the legislature and sometimes through the PUC. These policies have two paths of influence: policies reflecting technological preferences in local supply local resources and policies promoting demand side efficiency.

There are a variety of policies now promoted at the state level that promote supply side renewable technologies. Some examples are:

- Renewable portfolio standards
- Net metering
- Green pricing
- Public benefit fund

- Renewable energy credit tracking
- Power plant offsets
- 'Resource efficiency' standards
- Tax holidays on energy efficient appliances
- State governments purchasing green power

Among the most common of these and one that has been widely studied is the use of renewable portfolio standards (RPS). As described above, these policies generally work by requiring that a minimum percentage of electricity generated or sold to customers is provided using the eligible set of technologies. National proposals usually allow flexibility in how the mix of technologies used to meet the standard is determined and allow for the use of tradable renewable energy credits, so that the owners of the eligible resources need not have a direct contractual relationship with the entity subject to the minimum requirement. Out front of the federal government, Figure 1 shows that 21 states and the District of Columbia have adopted renewable energy standards. These programs generally make retail utilities responsible for compliance. Unlike the federal proposals, only a handful of state policies allow credit trading among utilities so under most state policies retail utilities do have to have direct contracts with renewable suppliers. Several have specific targets or requirements for particular types of renewables such as solar under broader RPSs.

There are a variety of motivations for promoting renewables. Figure 2 reports on a recent study (Chen, Wiser and Bolinger, 2007) that surveyed policies across the nation to identify explicit motivations. The motivations are organized into three groups: environmental concerns, risk mitigation and macroeconomic development. These concerns help to explain the fact that there often are a variety of restrictions on what types of renewables qualify.

Of the variety of restrictions on tradability in these programs, the restriction on geography appears the most robust common thread. While there is a general characteristic toward promoting environmentally benign policies, there is an over-arching tendency to promote policies that make states and regions more self-sufficient. This is one manifestation of state self-interest as noted previously. Although there may be flexibility in the specific measures that are taken to achieve a standard, state policies consistently limit flexibility to a geographic area defined by a political or economic region.

Some explanations for the geographic focus include the desire to promote local jobs and to develop a supply chain in the state or region for emerging technologies. Restrictions on geography raise the cost of policies that promote specific technologies, but come at the benefit that revenues collected in utility bills or tax revenues are spent in the local economy and are thereby expected to have indirect economic benefits.

The geographic limitation on renewable energy credits in various programs places program goals in conflict because it raises the cost of achieving specific penetration rates for renewables. Palmer and Burtraw (2005) found that a national renewable energy portfolio standard aimed at achieving fairly stringent goals of 15% or 20% non-hydro renewables by 2020 could lead to a decline in electricity prices in areas that are rich in renewables. However, in many areas of the nation it appears virtually impossible to achieve penetration rates at this level without incurring large costs for new capabilities in biomass or solar technologies. On the other hand some states have plentiful opportunities

for development of renewable resources. One specific example is California, which according to Palmer and Burtraw could achieve over 30% of in-state generation from renewables and export renewable energy credits to other states under a national trading program. Although this level of renewables would be expensive even in California, electricity prices in California would fall if the resources were developed by the investor owned utilities that are regulated by cost of service regulation in the state. The sale of renewable credits out-of-state at the national marginal cost of a renewable credit would bring revenues into the state in excess of development costs. Nonetheless, we see that California is no different from other regions that have pursued renewable policies. California too has implemented policies that limit geographic tradability, even when it would seem to be in the state's interest to promote an example of tradability. California's policy originally would not have allowed trading between various parts of the state, although that has now been relaxed to allow trading among the investor-owned utilities in the state.

Finally it is noteworthy that it is not always the usual definition of renewables that qualify under these technology programs. In Pennsylvania waste coal is considered a renewable resource that qualifies for credit. Moreover, one of the more prominent issues in the last decade has been the efforts by several states to promote the use of in-state coal (usually high sulfur coal) to comply with Title IV of the 1990 Clean Air Act Amendments. The promotion of in-state coal was accomplished with policies that gave regulatory preference for cost recovery for investments that promoted economic development in the state, which historically has been a common focus of state public utility commissions and that is sometimes even part of their charter in state constitutions (Bohi 1994; Burtraw 1996; Rose 1997; Arimura 2002; Sotkiewicz 2002).

4.2 End Use Efficiency Measures in Electricity Consumption

The complement to supply side electricity policies are those that target demand side by promoting end use efficiency. While policies affecting supply are altering the usual course of investment priorities, the motivating issue on the demand side is the general overall lack of investment. Historically in electricity markets revenue is linked to sales, so utilities have a disincentive to invest in efficiency measures to reduce sales because it will reduce revenues. In addition, they often lack an ability to recover the cost of investments in the demand side.

State policies affecting building energy demand involve direct standards affecting the efficiency of new infrastructure and financial incentives for involvement of utilities to affect energy use in existing infrastructure. New infrastructure is affected by the following types of policies:

- Residential building energy codes
- Commercial building energy codes
- Green building standards for state buildings
- Appliance efficiency standards
- Decoupling revenues and sales
- Incentives for achieving efficiency targets

States, rather than the federal government, have typically been the first mover in adopting or strengthening these kinds of energy codes and they are well placed to fill this role because they can accommodate local conditions and preferences. However, ultimately the

development of standards is more efficient at the federal level, especially for appliance standards because the extent of the market for appliances is national.

Engineering studies typically identify a vast opportunity to improve end-use efficiency at low cost. One study involving three national laboratories identify an achievable energy savings potential for electricity of 24% (Interlaboratory Working Group, 2000).[4] Other studies find similar results for various regions of the country (Nadel et al., 2004). However, a variety of institutional and market barriers impair the ability of investors to harvest these opportunities. In addition, due to the diffuse nature of these opportunities it is often an unrecognized or low priority for busy firms and households.

Policies promoting end use efficiency measures target retail electricity companies. Most consumers have an exclusive relationship with their electricity companies, and these companies may be best placed to deliver energy efficiency services. Many regulators have asserted that retail power companies in fact have an obligation to provide these services and created policies to do so, which have taken two forms. One is mandated public benefit fees applied to every unit of electricity sales that is directed to programs for direct investment. The usual target has been industrial customers and relatively high-income residential customers who have the knowledge and desire to subscribe to various energy efficiency programs.

The other form has moved away from mandated investments and toward correcting the incentives for end use efficiency. Step one in this process is decoupling of revenues from sales. Decoupling involves the calculation of expected revenues, often indexed to weather and other exogenous components of demand, and guaranteeing the regulated firm that this level of revenue independent of the number of kilowatt-hour of sales. This step was initially taken in about one half dozen states in the 1990s, but the policy atrophied with industry deregulation. Decoupling removes the *disincentive* for investment in end use efficiency, but it does little to provide a positive incentive. The second step in this process involves giving company shareholders a profit on invested capital in end use efficiency measures. In the fall of 2007 the California Public Utility Commission adopted a policy framework that would allow utilities to earn additional profit if they exceed energy efficiency goals.

Now and in the future, supply-side policies affecting the choice of technology for electricity generation may be determined primarily at the federal level; however, demand side policies in the electricity sector are likely to remain the prerogative of state and local government.

4.3 Transportation Measures

There are a variety of other policies emerging at the state level affecting transportation with relevance for land use and other issues in the local government domain. Some examples include

- Vehicle GHG emissions standards
- Mandates and incentives promoting biofuels
- Promoting transit

[4] The achievable potential is constrained by the rate at which homes and business will actually adopt energy saving technologies and practices.

Many of these policies at the state level are not about carbon policy directly. Some policies such as promotion of transit are policies targeting services to specific communities. But climate policy is a contributing and growing motivation for this suite of policies. As with demand side policies in the electricity sector, transportation-related policies are likely to remain the prerogative of state and local government.

5. State Leadership on Climate Policy

The plethora of climate-relevant policies shares the stage with explicit campaigns to cap overall carbon dioxide emissions. There are now several important state initiatives. The first to be implemented will be the Regional Greenhouse Gas Initiative (RGGI) that involves ten northeastern and Mid-Atlantic States who will cap emissions from the power sector beginning in 2009. This policy aims to reduce emissions from the electricity sector by about 35% from what they would otherwise be by 2020. Other initiatives include California's greenhouse gas legislation (AB 32) passed in 2006 that mandates emission reductions to 1990 levels by 2020. The state agencies are empowered to implement the policies, but a specific plan is not expected with implementing actions until 2012. State legislation declares that market based approaches such as cap and trade *may* be used to achieve these goals; however, the governor and many other interests in the state are aggressively pursuing this option.[5]

5.1 Electricity Sector Cap and Trade

Although the RGGI policy is relatively moderate, it is the first law in the United States mandating emission regulations and the second such law in the world after the EU Emissions Trading Scheme. RGGI's most important contribution may already be accomplished – the architecture of the design of cap and trade. The RGGI architecture mirrors the design of the region's NOx trading programs, where emission budgets were developed for each state but discretion was left to individual states to implement the policy including the allocation of emission allowances to sources that were able to trade allowances in the market. This approach is evident also in the EU Emission Trading Scheme, where individual member states have obligations under a system wide cap. Individual member states also have the authority to decide how to distribute emission allowances within guidelines that prohibited more than 5% of emission allowances from being auctioned in the program's first phase (2005-2007) and no more than 10% in the second phase (2008-2012). This restriction on auctions has contributed to a disproportionate share of program costs falling on consumers and extra-normal profits for producers (Sijm, et al. 2005).

Modeling shows a similar result would be likely to occur from cap and trade programs in the US. At the national level, Burtraw and Palmer (2007) show that a moderate climate policy imposes costs on the industry equal to just 6% of the value of emission allowances created by the program. Free allocation would be likely to lead to windfall profits for the industry, with an increase in the market value of virtually every

[5] California's Market Advisory Committee issued its report (CA MAC 2007) on the design of a potential cap and trade program in June 2007 after receiving extensive public comment almost unanimously in favor of such an approach, at least as a to complement other state policies.

incumbent firm in the industry. In the RGGI region, Burtraw et al. (2006a) find a similar result under free allocation. Under 100% auction, they find that 11 of the 23 largest firms are strictly winners in the sense that the change in revenues from the increase in electricity price outweighs the change in costs for these companies, and the net present value of existing assets actually increase.

The innovation in the RGGI architecture, compared to the EU ETS, is the imposition of a floor rather than a ceiling on the portion of allowances that are to be auctioned. Every state is required to dedicate at lest 25% of the value of allowances to strategic public benefit purposes such as investments in efficiency, and the presumed way to liquidate the allowance value is through an auction. In practice, states in the northeast are headed toward an auction of the vast majority of allowances. This policy architecture is based not only on the desire to avoid windfall profits, but also on the idea that auctions can be a potentially dramatically more efficient way to initially distribute emission allowances.[6] At the time of this writing six of the ten states have announced their allocation plans and all six are implementing 100% auction. The RGGI decision coupled with information about windfall profits in Europe appears to have already had an important influence on the national debate, where various proposed legislation suggests a substantial role for an auction and that role has been growing as proposed legislation has evolved, in part certainly in response to the experience in the EU ETS and due to the RGGI precedent.[7]

Another aspect of the RGGI precedent is the designation of how the strategic public benefit resulting from expenditure of allowance value is implemented. In modeling on behalf of the State of Maryland, CIER (2007) found that investing this money into end use efficiency could reduce demand to a sufficient degree that it offset the increase in electricity price that otherwise would occur when the state joins the regional initiative.

The states may have another role to play in the design of federal policy. The single largest hurdle in the federal debate, after identifying the stringency of the policy, is how the emission allowances should be distributed. The problem is confounded at the national level due to the variation among states in how the electricity sector is regulated. Nearly half of the nation including most of the northeast has deregulated its electricity industry. In these regions, roughly speaking, the wholesale electricity price is determined by the marginal cost of the most expensive generation unit brought into service. Whether this change in cost includes the value of emission allowances depends on whether the unit has allowance costs. Since some firms own a relatively clean portfolio of generation assets they can strictly win under such a policy. In contrast in the rest of the nation electricity price is set by the average cost of providing service. In these regions one can assume that long run profits are zero under any policy because the regulator allows for reasonable recovery of costs.

Figure 3 illustrates results by Burtraw and Palmer (2007) on the distribution in the change in the market value of firms under each of this type of market structures under two alternative approaches to the distribution of allowances – free allocation and an auction. The vertical axis represents the amount of generation capacity that experiences

[6] Goulder et al. (1999), Parry et al. (1999).

[7] http://www.rff.org/rff/News/Releases/2007Releases/July2007ClimateChangeBillsinCongress.cfm. Accessed July 13, 2007.

each level of change in value. Under both free allocation and an auction roughly half the nation is excluded from the figure because under cost of service regulation producers are assumed to be held relatively harmless. In these regions it is consumers that feel the effects of different approaches to allocation. In regulated regions, free allocation subsidizes electricity prices and provides compensation to consumers. However, under an auction the original cost of acquiring allowances is passed on to consumers through changes in electricity prices.

Table 1 illustrates that that no one approach can achieve the perception of fairness. In competitive regions compensation in the form of free allowances goes to firms, and consumers are made strictly worse off by the program (ignoring the benefits of the policy). In regulated regions that compensation goes to consumers, and firms are held harmless. Finding a uniform federal approach to allocation proves illusive, because any approach that compensates consumers in one type of region fails to do so in the other type of regions.

Since the fundamental feature that governs the effects of the initial distribution of emission allowances is the status of electricity market regulation, which is firmly the prerogative of the state, the RGGI architecture may prove a useful federal model. Taking this state decision about electricity regulation as a given, the only way to achieve the appearance of fairness is to delegate the allocation decision to the state. Then the decision to auction or use another means to initially distribute allowances can be made in a way that complements state policy with respect to electricity regulation. Former Senator Jeffords (I-VT) proposed legislation that would have accomplished this by apportioning to the states approximately two-thirds of the allowances under a national cap and trade program.

The significance of existing state policies in this regard is important. RGGI has established a precedent that in the northeast region states should auction the majority if not all of the emission allowances in the electricity sector. In California a market-based program is not yet policy, but the state's Market Advisory Committee for the implementation of AB32 has recommend a philosophical principle of moving toward 100% allocation (California Market Advisory Committee, 2007). These state decisions may have a significant influence in a national program especially if the states play a role in the allocation decision.

5.1 Efficient Compensation

The apportionment to the states not only is useful for political economy but also may be relatively efficient, to the degree that policymakers attempt to deliver compensation for severely affected entities. Burtraw and Palmer (2007) examine ways in which compensation can be delivered to producers that are most harmed by climate policy. They consider various decision rules for free allocation of emission allowances including allocation based on technology characteristics or emission rates for the fleet of power plants owned by companies. The authors consider whether these rules can be more effectively implemented by the federal government or state governments. They measure effectiveness according to the number of allowances that have to be given away for free, using various allocation rules, in order to achieve a given target of compensation for producers.

The answer as to whether compensation is delivered more efficiently at the federal or state level is not obvious because there are two offsetting factors. On the one hand, state governments provide a more precise characterization of technological characteristics and emission rates for a typical fleet of facilities than does the same measure taken from the national perspective because differences among states can be sorted out. However, there also is a problem at the state level that firms that own facilities that lose value in one state may own facilities that gain value in another state. From a federal perspective these effects may net out, leaving no justification for a free allocation, but from a state perspective facilities that lose value may appear to deserve compensation.

The conclusion is that free initial allocation to compensate firms is more cost effectively accomplished by apportionment to states and allowing states to determine rules for allocation than by attempting to compensate at the federal level. Nonetheless, compensation is very expensive. Even under the best of circumstances at the state level the cost of delivering $15 billion in deserved compensation is $27 billion in allowance value, because of the difficulty in matching compensation to need. At the federal level, however, the cost of just the last $2.6 billion in compensation requires the free allocation of $26 billion in allowance value at the federal level because of the difficulty in targeting compensation rules.

5.2 The Challenge of Federal Preemption under Cap and Trade

A crucial question is: What is the role for state climate programs in the future if federal legislation passes that establishes cap and trade policy? The existence of a hard cap at the federal level implies that any efforts at the state level, whether cap and trade or other types of policy, will be practically irrelevant. If one state were to exercise leadership by exceeding the federal standard, then its emission reductions would appear in some other state under a federal cap and trade program.

If states want to continue to be involved in climate policy in the face of a hard federal emission cap, there are two options. One would be to adopt state rules that require the surrender of emission allowances for emissions in the state that exceed the rate at the federal level. This type of legislation may face legal challenges. A second option would follow from a federal architecture that delegated some portion of emission allowances to the states in order for states to play a role in allocation to sources, or potentially to auction the allowances. In this case states could decide to hold some portion of emission allowances out of the market. Could it be in the states financial interest to do so?

If a state were to withhold emission allowances out of the market in a federal cap and trade program, two effects would follow. The state would have fewer allowances to issue through an auction or other allocation mechanism, and the national price of emission allowances would rise as a result of greater scarcity. The greater price means that any other emission allowances that were auctioned would fetch more revenue.

From the perspective of any single state it would not be cost effective to try to affect the national price of emission allowances by holding allowances out of the market. However, if there were strategic cooperation among a group of states—say a group of northeast states and California—our analysis indicates that the group could actually increase the revenue it received from its allowance auction by withholding allowances. In this case the change in price could be more important than the decline in quantity for the

states. This type of strategic cooperation could enable states to remain in a leadership role and actually benefit fiscally from efforts to promote emission reductions. This is one way that states could remain permanently in a leadership role in the implementation of climate policy.

6. Conclusion

State-level efforts to adopt climate policy are continuing to proliferate. Yet, it seems inevitable federal policy will emerge. The degree to which the federal policy preempts state efforts will be an important factor shaping the future types of activities among the states. To date, however, probably the major contribution of state efforts has not been direct emission reductions but instead indirect shaping of a policy architecture that affects the federal policy debate. At the federal level, the same political forces that have constrained national climate policy to this juncture will also affect the design of policy in the future. State efforts have changed the political environment at the federal level.

In this decade, we are still at the early stages of addressing climate change. Many climate scientists implore policy makers to act now, because the effects of global heating are already occurring and major ecological change will be irreversible if we wait another decade. Nonetheless, it would not be a contradiction to suggest that the design of climate policy is more important than the stringency at this juncture. Climate policy involves the design of new institutions that most expect to have an important effect on the way we use energy in the future. These institutions have to be well designed if they are going to facilitate the level of public commitment to climate policy that the scientists feel will be necessary. The political interests that align in the states that are providing leadership already may coincidentally align to help us achieve the best architecture.

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