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Implications of carbon cap-and-trade for US voluntary renewable energy markets

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Abstract

Many consumers today are purchasing renewable energy in large part for the greenhouse gas (GHG) emissions benefits that they provide. Emerging carbon regulation in the US has the potential to affect existing markets for renewable energy. Carbon cap-and-trade programs are now under development in the Northeast under the Regional Greenhouse Gas Initiative (RGGI) and in early stages of development in the West and Midwest. There is increasing discussion about carbon regulation at the national level as well. While renewable energy will likely benefit from carbon cap-and-trade programs because compliance with the cap will increase the costs of fossil fuel generation, cap-and-trade programs can also impact the ability of renewable energy generation to affect overall CO_2 emissions levels and obtain value for those emissions benefits. This paper summarizes key issues for renewable energy markets that are emerging with carbon regulation, such as the implications for emissions benefits claims and voluntary market demand and the use of renewable energy certificates (RECs) in multiple markets. It also explores policy options under consideration for designing carbon policies to enable carbon markets and renewable energy markets to work together.
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1. Introduction

Voluntary markets for renewable energy, or "green power markets," provide an avenue for consumers to support the development of renewable energy sources by enabling them to choose cleaner electricity sources for their own energy consumption. This market is important in that it empowers consumers to affect the resources used to supply their own energy needs. While, initially, most green power products targeted residential consumers, recent growth in voluntary markets has been primarily fueled by large purchasers, including Fortune 500 companies and other businesses, universities, and government agencies, such as Intel, Pepsico, the US Airforce, and Wells Fargo.[1]

As a result of increased interest among the nonresidential sector, voluntary markets are growing rapidly. In recent years, sales of renewable energy in voluntary markets have increased by nearly 50% annually. At the end of 2006, voluntary consumer purchases of renewable energy totaled 12 million megawatt-hours (MWh) with a large fraction of the purchases by nonresidential customers (Bird et al., 2007). In comparison, state renewable energy standards, which are a primary policy driver for renewable energy development in the US, called for approximately 20 million MWh of new renewable energy generation in 2006, according to estimates from the Union of Concerned

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[1]See the US Environmental Protection Agency's Green Power Partnership web site for a list of organizations that voluntarily purchase renewable energy: http://www.epa.gov/greenpower/toplists/top25.htm.

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Scientists (Swezey et al., 2007). Thus, voluntary markets help to support a significant fraction of new renewable energy generation in the US alongside existing state policies.

While there are a number of benefits of renewable energy sources, many consumers have been motivated, at least in part, to purchase renewable energy because of its greenhouse gas (GHG) benefits. Currently, purchasing green power is an accessible and relatively easy and transparent way in which customers can reduce their carbon footprints. Most utilities and independent marketers that offer green power options promote their products by touting the GHG benefits and, in fact, some marketers actually sell carbon reductions derived from renewable energy generation to enable consumers to "offset" the carbon dioxide (CO_2) emissions associated with their electricity consumption, car and plane travel, and home heating energy use. Likewise, many purchasers point to the GHG benefits of their green power purchases in news releases and other promotional materials.

Emerging carbon regulation in the US has the potential to substantially affect voluntary markets for renewable energy. Carbon regulation is now developing under the Regional Greenhouse Gas Initiative (RGGI, pronounced "Reggie") in the Northeast, the Western Climate Initiative, and the Midwestern Greenhouse Gas Reduction Accord. There is increasing discussion about carbon regulation at the national level as well. To achieve GHG reductions, the regional initiatives plan to implement cap-and-trade programs, which would enable emitters to trade allowances to meet emissions targets. There is precedent for using cap and trade to control emissions, such as the successful national sulfur dioxide (SO_2) cap-and-trade system developed under the Clean Air Act Amendments of 1990 to address acid rain.

In general, renewable energy will benefit from carbon cap-and-trade programs because compliance with the cap will increase the costs of fossil fuel generation, which will improve the cost-effectiveness of renewables and may provide an incentive to capped entities to use renewable energy to meet future load growth. However, the level of the incentive provided for renewables will depend on the stringency of the cap; a loose emissions cap may provide little financial incentive for renewables.

Cap-and-trade programs can also impact the ability of renewable energy generation to affect overall CO_2 emissions levels, depending on the design of the program. If renewable generation sources are not accounted for under the cap (through the retirement of allowances or in setting the level of the cap), then they will not affect the overall level of CO_2 emissions, and purchasers of renewable energy have no basis for claiming overall emission reductions. This is particularly problematic under a loose cap, where renewable energy markets could offer one avenue for further CO_2 reductions. However, if these markets are not given the opportunity to do so (due to the design of the cap-and-trade programs) renewable markets could be comprised. Therefore, the implementation of carbon cap-and-trade programs has important implications for voluntary renewable energy markets.

These same issues also pertain to other types of cap-and-trade programs, such as those for SO_2 and NO_x, but carbon cap-and-trade programs have more significant implications for renewable energy markets. This is true because renewable energy sources offer one of the few options for generating electricity without CO_2 emissions and carbon capture and storage technologies are still under development. In addition, consumers may be more interested in achieving reductions in GHG emissions than emissions of specific air pollutants such as NO_x and SO_x. Furthermore, carbon regulation is beginning to emerge, while emissions trading markets have already been established for SO_2 and NO_x.

This paper focuses primarily on the potential effects that emerging mandatory carbon markets will have on voluntary renewable energy markets. First, the paper examines the extent to which GHG benefits motivate consumers to make voluntary renewable energy purchases, and the claims that large commercial and institutional consumers currently make regarding their purchases. Next, the paper summarizes key issues emerging as a result of these overlapping markets, such as the implications for renewable energy marketing claims, the demand for and price of renewable energy certificates (RECs), and the use of RECs in multiple markets (disaggregation of attributes). Then, it describes carbon regulation programs under development in the US, with particular emphasis on the RGGI in the Northeast, and how such programs might affect renewable energy markets in these regions. Finally, the paper presents policy options for policymakers and regulators to consider in designing carbon policies to enable carbon markets and voluntary renewable energy markets to work together.

2. Climate change as motivator for green power purchasers

There are a number of reasons why consumers buy green power, including environmental benefits (air pollutant and GHG emissions), health benefits, fuel diversity, energy security, local economic development, encouraging the development of new technologies, resource protection for future generations, and energy price stability; and, for nonresidential consumers, public relations benefits. (Holt and Wiser, 1999; Holt et al., 2001; Blank et al., 2002; Hanson, 2005)

Residential consumers, in particular, purchase renewable energy for a variety of reasons,[2] so it is difficult to discern the relative importance of GHG benefits as a motivator.

[2]A recent poll of residential customers sponsored by the US Department of Energy found that consumers have a variety of reasons for purchasing or wanting to purchase renewable energy. Respondents indicated the following reasons: to improve today's environment (32%), to leave our children and grandchildren a cleaner environment (30%), to improve US energy security (24%), to support the development of new technology (23%), to create local jobs and improve the economy (21%), to protect against fuel price increases (20%), all of these (58%) (Opinion Research Corporation, 2006.)

However, most consumers believe that they are creating environmental benefits when they purchase green power and consider it to be an important benefit. While some marketers do not focus on environmental messaging for residential consumers, many have found that it is very important to do so.

For nonresidential customers there is clear evidence to suggest that GHG benefits are an important motivator. Nonresidential consumers are often interested in purchasing green power because it is a convenient tool for meeting their internal environmental goals or for taking credit for GHG reductions under a future regulatory regime and, thus, reducing future regulatory risks (Hanson, 2005; Blank et al., 2002; Holt and Wiser, 1999).

To illustrate the importance of the nonresidential voluntary market, purchases by businesses and institutions represented nearly three-quarters of the 12 million MWh of renewable energy sold through voluntary markets during 2006 (Bird et al., 2007). And nonresidential purchasing has accelerated in recent years; for example, purchases by members of the US Environmental Protection Agency (EPA) Green Power Partnership, which encourages organizations to purchase renewable energy as a way to reduce the risk of climate change and the environmental impacts associated with conventional electricity use, doubled during 2005.

Participation in GHG registries is evidence that companies and institutions are motivated to purchase renewable energy because of concerns over climate change. Under these programs, companies and organizations register to protect their early actions as a form of risk management. If carbon emissions are regulated in the future, registration with a credible and transparent reporting system will help credit these early actions toward compliance. In GHG registries, voluntary purchases of renewable energy are generally used to adjust the GHG emissions associated with a company's power purchases, which are considered *indirect emissions* (emissions that are a consequence of an organization's activities, but are not owned or controlled by the organization).

Other evidence of the importance of climate change as a motivator is that many nonresidential green power purchasers point to the GHG benefits of their purchases in news releases, on their Web sites, or in other materials that describe their purchases. Some organizations discuss the need to address global warming in the context of their purchase. For example, HSBC Bank and the State of New Jersey have described their green power purchases as follows:

> *HSBC Bank*: "Recognizing the importance of climate change, last December, HSBC became the world's first major bank to commit to carbon neutrality and today its US banking unit announced that it has offset a substantial quantity of its carbon emissions by purchasing 45,454 MWh of clean, wind energy certificates." http://www.hsbcusa.com/ourcompany/pressroom/2005/news_042205_hsbc_bank_earth_day.html (accessed December 18, 2006)

> *State of New Jersey*: "As a testament to its commitment to promoting renewable energy generation, improving air quality, and reducing greenhouse gases, the state of New Jersey has emerged as the number one purchaser of green power (as a percentage of total load) among all state governments in the country... Benefits include...preventing an estimated 168,948 metric tons of CO_2 emissions, which has helped the state achieve its goal of reducing its greenhouse gas emissions to 3.5 percent below 1990 levels by 2005."
> http://www.state.nj.us/dep/dsr/bscit/GreenPower.pdf (accessed December 3, 2006)

While other organizations may not issue such strong, clear statements, most large purchasers of green power mention the amount of GHG emissions that were prevented from entering the atmosphere as a result of the renewable energy that they are purchasing.

3. Impact of carbon regulation on renewable energy markets

In the US, carbon regulation is beginning to take form as a number of states have initiated their own policies and programs, and Congress is debating appropriate action at the federal level.[3] Several states are also proposing to regulate carbon emissions through cap-and-trade programs. While there are other measures under discussion for limiting CO_2 (e.g., a carbon tax), this article focuses on cap-and-trade as it appears to have the most momentum on the state and federal level, and it is the measure that has the most significant implications for voluntary renewable energy markets.

Interest in cap and trade is a result of the successful implementation of emission cap-and-trade regulation of SO_2 under the Clean Air Act Amendments of 1990 and the experience under the federal NO_x budget program. There is also precedent for using cap and trade in the European Union as a means to meet its GHG reduction obligations under the Kyoto Protocol. Cap-and-trade systems aim to create reductions at the lowest possible cost by enlisting market forces to determine the cheapest means to achieve the cap.

Before delving into the details and implications of emerging cap-and-trade programs, we focus here on the issues that generally arise for renewable energy markets as a result of cap-and-trade programs. For example, if carbon is regulated under a cap-and-trade program, the claims that can be made by renewable energy generators or marketers with respect to carbon-reduction benefits could be affected.

[3]For example, at the federal level, senators John McCain, Jim Jeffords, Jeff Bingaman, and Dianne Feinstein have all offered proposals for carbon cap-and-trade programs. These have varied in the details, including the level of cap, baseline year vs. intensity, allocation approaches, and what entities would be capped.

Depending on the policy design, this could have implications for the price of RECs and for demand for renewable energy in voluntary markets.

4. Effect of cap and trade on marketing claims

4.1. Achieving carbon reductions under cap-and-trade systems

Under a traditional cap-and-trade system, the cap is set at a fixed level to achieve the desired reduction in emissions from a baseline year (e.g., 10% reduction in emissions from 1990 levels by 2020). Cap-and-trade programs often are designed to achieve greater reductions over time, so the cap may be lowered in subsequent years to enable market participants to gradually achieve emission reductions. To achieve compliance with the capped emission level, market participants are allocated allowances to emit (1 ton per allowance), with the total number of allowances summing to the level of the cap. Market participants can purchase allowances from other participants to cover excess emissions, or sell allowances if they reduce emissions below their allocation.

Under this type of system, a reduction in carbon emissions below the level of the cap can be achieved by retiring an allowance, ensuring that it is not sold to an emitter (Harmon and Hirschhorn, 2006; Jacobson, 2007). Therefore, in order for renewable energy generators to be able to affect emissions levels, they will have to retire allowances that are allocated to them, purchase and retire them, or have allowances retired on their behalf by program administrators. Renewable energy sources could also claim to reduce emissions levels if current and future renewable energy generation is considered when setting the level of the cap.

To illustrate, if a new wind energy facility generates electricity at a time that causes a fossil fuel facility to back down, the emitting fossil fuel facility will generate less electricity and consequently emit less CO_2. This creates excess allowances for the fossil fuel facility, which can then be sold in the open market, allowing other facilities to avoid controlling emissions and emit more CO_2, bringing total emissions back up to the level of the cap.

If the wind generation facility offsets the need for a new fossil fuel plant, then existing emitters will not need to control emissions for the zero-emitting wind plant to come online. In fact, the result of the new wind plant is that there will be less competition among existing emitters for allowances, and the price of allowances will be lower than it would if the new fossil-fuel facility had come online. Because new renewable energy generation will reduce the cost for emitting facilities to meet the cap, it may be more politically feasible to lower the cap in the future, but any such future emission reductions are uncertain. In either case, i.e., whether the renewable energy plant displaces an existing or new fossil plant, the result is the same—the renewable energy facility does not reduce the overall level of carbon emissions.

Another way renewable energy can affect carbon emissions levels is if future renewable energy development is taken into account in setting the level of the cap (i.e., the cap is set lower to account for current or expected zero- or low-emitting renewable energy generation). Under this approach, it can be claimed that the renewable energy or RECs reduce emissions levels, because the cap is set at a lower level to account for the zero- or low-emitting renewable energy facilities. However, under this approach, the renewable energy generators would not have an allowance to sell in emissions markets.

4.2. Allocating allowances to renewables

Traditionally, emissions allowances have been allocated only to emitting power plants, i.e., those that burn fossil fuels, based on historic emissions or on the heat content of the fuels burned (input-based). For example, in the SO_2 acid rain program, emission allowances were allocated to fossil power plants with a few minor exceptions (Wooley and Morss, 2001). Other possible approaches are to allocate allowances in proportion to a generator's share (output-based) or supplier's share (load-based) of the overall electricity market, regardless of how the electricity is generated, or to auction some or all of the allowances to the highest bidders.

The primary argument for excluding renewables from receiving allowances or reducing the cap is that the emissions cap adds cost to the emitting plants, thereby making renewables and other nonemitting plants relatively more cost-competitive. In addition, focusing only on emitters reduces administrative complexity and cost.

Renewables advocates argue that without allocation of allowances to renewable generators, renewables will be excluded as a strategy for reducing emissions beyond those required by the cap. Because carbon caps may not be set at levels that are necessary to address the impacts of global climate change, consumers may want the option to voluntarily reduce emissions below the level of the cap. And a loose cap may provide little incentive for renewables. Renewable energy developers also argue that they should reap financial benefit from the emissions benefits that they provide, although this would not necessarily result in a reduction in emissions, if generators sell allowances to emitters.[4]

There is policy precedent in the US for providing allowances to renewable energy sources, typically through renewable energy set-asides. For example, a small portion of allowances were set aside under the Clean Air Act Title IV SO_2 trading program for energy conservation and renewables, although few allowances were awarded because of restrictions on eligible entities and how they were awarded (Wooley and Morss, 2001).

[4]Renewable Energy Working Group Steering Committee, "Approaches to Integrating Renewable Energy into Greenhouse Gas Trading Programs," submitted by the Center for Resource Solutions to the Regional Greenhouse Gas Initiative, June 2004. http://www.rggi.org/stakeholder_comments.htm.

In addition, seven states implemented renewable energy set-asides under the federal NO_x Budget-Trading Program (US EPA, 2005). As of spring 2007, several other states have proposed renewable energy set-asides under the new Clean Air Interstate Rule, and at least two states (Wisconsin and Pennsylvania) have proposed an output-based allocation that would include renewable energy sources (Salerno, 2006).

4.3. Effect on marketing claims

If renewable energy marketers receive and retire carbon emission allowances, then, by definition, the generation and use of renewable energy should result in real emission reductions and strengthen environmental marketing claims. But if renewables do not result in retired allowances or lower emissions caps, then environmental claims for renewable energy become problematic.

The Environmental Marketing Guidelines for Electricity, developed by the National Association of Attorneys General (NAAG), provide guidance and general principles for marketers to follow to ensure that consumers are not misled by marketing tactics. Three relevant principles with respect to GHG benefits are *deception*, *substantiation*, *and overstatement of environmental attributes*. According to the NAAG guidelines (NAAG, 1999):

> 2(a) *Deception*—A claim is deceptive, and therefore unlawful, if it contains an express or implied representation or omission of fact that is likely, or has a tendency, to mislead consumers.
>
> 2(b) *Substantiation*—Any party making an express or implied claim that presents an objective assertion about the environmental attributes of an electricity product or company must, at the time the claim is made, possess and rely upon a reasonable basis substantiating the claim. In substantiating technical claims about electricity products or companies, a reasonable basis consists of competent and reliable evidence which supports the claims made.
>
> 2(e) *Overstatement of Environmental Attributes*—An environmental marketing claim should not be presented in a manner that overstates the environmental attribute or benefit, expressly or by implication.

What benefits can marketers (or purchasers) claim if they do not retire an allowance or if the cap is not adjusted for renewable energy demand? If renewable energy does not result in a direct carbon reduction, the simplest claim that generators or marketers might make is that the renewable energy is "emission-free" or "pollution-free." However, under the NAAG Guidelines, claims that an energy product is "emission-free" or "pollution-free" might imply to consumers that by purchasing such energy, they are helping to reduce emissions.

Some stakeholders have suggested that a company that buys renewable energy might claim that it is reducing its own emissions profile because it would lower its indirect emissions (i.e., emissions that are outside of its direct control, such as power purchases) even though overall system-wide emissions of carbon would not be reduced.[5] In this case, a marketer might make a claim that a purchase would offset "your emissions footprint." However, companies may resist the idea of making such claims, because overall carbon levels would be unaffected.

Some renewable energy advocates argue that even if allowances are not granted to renewables, they will provide environmental benefits in the long run. For example, if a significant amount of new renewable energy generation is added to the grid, the added zero-emitting generation may make it more cost-effective and politically feasible to reduce the level of the cap in future years (although, in the short term, it would simply make it easier and less expensive for fossil generators to comply with the cap). This view of long-run benefits, based on a common-sense argument, may justify making claims, but such claims are weaker and more difficult to substantiate than if allowances were allocated directly to renewable generators. Further, this may not prove sufficiently compelling to entice consumers to purchase renewable energy and could translate into weakness in the voluntary market.

Other industry stakeholders argue that if a buyer of renewable energy really wants to make a carbon reduction claim, the market will respond and provide products that meet this need. For example, marketers might purchase an allowance and bundle it with a REC (some call this a "REC-plus" product), or the REC buyer might simply buy an emission allowance separately. However, this approach would likely increase the price for end-use consumers, thereby suppressing demand, or reduce the amount of revenue that goes to the renewable energy generator (see additional discussion below).

If marketers cannot make clear claims of environmental benefits as a result of carbon regulation, this may pose a significant challenge for marketing renewable energy to voluntary purchasers. The lack of GHG emissions from renewable energy sources are generally considered to be the most significant environmental benefit of these technologies. If marketers are restricted from making claims about GHG benefits, they may find it difficult to explain the benefits of an already intangible product to consumers. And it could reduce the motivation for nonresidential consumers, in particular, which could, in turn, stifle voluntary purchases of renewable energy.

5. Effect on price and demand for renewable energy in voluntary markets

Before discussing the influence of carbon markets on the price of RECs, it is helpful to review current market prices for both carbon and RECs, and the factors affecting prices today. During 2006, carbon traded on the Chicago Climate

[5]Conversation with Craig Hanson, World Resources Institute, October 2006.

Table 1
Voluntary market REC prices (new renewables), 2006

Resource	Wind			Solar	Biomass	Geothermal	LFG
Region	SPP	WECC/CA	National	CA	National	WECC/CA	SERC
\$/MWh	1.30–4.50	3.00–5.00	1.80–5.00	21–25	1.00–1.10	1.80–4.00	1.50
\$/MT CO_2e	1.50–5.00	8.20–13.70	2.80–7.90	57–68	1.60–1.80	4.80–10.90	2.40

Source: Evolution markets.
Note: Prices converted to \$/metric ton assuming average regional CO_2 emissions rate from eGRID (US EPA, 2004).

Exchange (CCX), a voluntary but legally binding emissions trading system in the US, at prices ranging from about \$2 to \$4.50 per metric ton (MT) of CO_2.equivalent.[6] Prices in this market have remained relatively low, because it is a small voluntary market. In comparison, in the European Union where carbon is regulated, prices have been as much as an order of magnitude higher, ranging from \$8/MT to \$40/MT of CO_2 equivalent.[7] US carbon prices are widely expected to be higher in a regulated market environment than the voluntary CCX, but, of course, the stringency of the regulation will determine prices.

RECs sold in large-volume transactions in voluntary markets in the US have ranged from \$1/MWh to \$5/MWh in 2006, except for solar, which has reached \$25/MWh or more. Table 1 presents voluntary market REC prices by resource type and location, with prices converted to \$/CO_2 displaced, using regional average CO_2 emissions rates. On this basis, REC prices range from \$2/MT to \$14/MT of CO_2 displaced. In voluntary markets, REC prices are determined by consumer willingness to pay for renewables, competitiveness of renewable energy generation, perceived quality of the product offered, and other factors such as RPS market demand.

5.1. Impact of carbon regulation on REC prices and demand

With the introduction of carbon regulation, REC markets will gain an additional layer of complexity, affecting supply and demand. The form of carbon regulations will determine the magnitude of the impacts on REC markets. If carbon is regulated under cap and trade in a manner such that renewables cannot make clear emission-reductions claims, this will likely reduce voluntary demand for renewable energy and put downward pressure on the price of RECs. Furthermore, if RECs no longer convey GHG benefits, their value will be diminished.

[6]Data obtained from CCX http://www.chicagoclimatex.com/trading/stats/monthly/index.htm, accessed December 17, 2006.

[7]Data for 2006 from the European Climate Exchange http://www.ecxeurope.com/index_flash.php for 2006. Prices converted to US dollars assuming an exchange rate of 1.30978 USD/Euro (December 17, 2006). Prices on the EUETS peaked on April 19, 2006, and then crashed in late April as countries began reporting a surplus in allowances (e.g., France, Sweden, and the Czech Republic). For additional information, see "Emissions Prices Drop to 13-Month Low After Sweden Shows Surplus," May 2, 2006 http://www.ecxeurope.com/pages/page553.php.

As mentioned earlier, consumers interested in achieving carbon reductions through their green power purchases would need to purchase and retire carbon allowances in conjunction with the REC. This would add cost to the product (REC-plus carbon allowance), likely increasing the price to the end-use consumer, which would suppress demand, or lowering the value of the REC. Alternatively, buyers seeking only the carbon claim might simply buy allowances, retire them, and not bother buying renewable energy or RECs, again lowering demand.

An important consequence of falling demand and lower prices for RECs is that renewable generators would receive less revenue. This would weaken the financial projections of project developers when they seek financing and could reduce investment in new renewable energy projects. A number of renewable energy developers have pointed to the benefit of having multiple markets for their output to reduce risks in undertaking projects. Financiers have only recently begun to value RECs as a source of project revenues, and some discount RECs markets as a source of stable, long-term revenues; therefore, any further weakening of these markets could reduce their ability to support new project development.

Another implication for REC markets is that it is conceivable that under future carbon regulation, carbon allowance prices could exceed voluntary market REC prices, reversing the current value relationship. In this case, any product conveying both an allowance and a REC would be more expensive than under current market conditions. This would be true if the renewable energy generators were to receive allowances or if allowances were purchased separately from the REC (REC-plus product). In the case in which generators received carbon allowances that they could sell in the emission market, they would be unwilling to sell the allowance bundled with a REC for less than they could receive in the two markets separately. This would lead to an increase in prices for products conveying emissions benefits, which would suppress voluntary market demand. Under high allowance prices, generators would have greater incentive to sell allowances in emissions markets, separate from the RECs, which could lead to a devaluation in RECs prices, but generators would be compensated by revenues from carbon allowances.

Taking a broader market perspective, renewables generally will benefit from carbon regulation because it will increase prices for fossil generators and, thus, improve the cost-effectiveness of renewable energy generation. However, the level of the cap will determine the financial incentive provided for renewables; a loose cap may provide little incentive.

While renewables will likely reap benefits from carbon regulation, the role of voluntary markets is typically to support investment in renewables beyond what is supported through mandates or other types of policy support. Carbon caps may be insufficient to address the threat of climate change; therefore, additional action may be necessary to avoid potential impacts. If the viability or credibility of voluntary renewable energy markets is diminished, one avenue for consumers to affect change above and beyond regulatory measures will be lost. Although renewables are one possible long-term strategy for addressing climate change, declines in voluntary markets or their ability to stimulate new renewable energy development could limit near-term investments in renewable energy technologies that are important for improving the technology as a longer-term solution.

6. Emerging cap-and-trade programs: Regional Greenhouse Gas Initiative

States are gaining interest in cap-and-trade programs and several regional- or state-based initiatives are emerging in the US. The first such program to emerge was the RGGI, which currently covers 10 states in the Northeast and is scheduled to take effect in 2009. Currently, participating states are in the final stages of establishing rules for the RGGI program. In addition, the Western Climate Initiative comprised of six Western states and two Canadian provinces, is in the process of developing a regional GHG cap-and-trade system and expects to unveil detailed plans in 2008. Most recently, a number of Midwestern state governors signed onto the Midwestern Greenhouse Gas Reduction Accord, which aims to develop a regional GHG cap-and-trade system among other things. Cap and trade is also being debated at the national level, where a number of bills have been introduced in Congress. The following section provides an overview of the RGGI program and focuses on its implications for voluntary renewable energy markets. We focus here only on RGGI because it is the cap-and-trade program that is furthest along in its development.

RGGI was initiated in 2003, when New York Governor George Pataki invited Northeast and Mid-Atlantic states to participate in discussions about a regional cap-and-trade system for reducing GHG emissions. In response, nine of those states sent representatives to initiate the discussions: Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. In addition, Maryland, Pennsylvania, the Eastern Canadian Provinces Secretariat, and the Province of New Brunswick sent observers to the talks (RGGI, undated).

In December 2005, the governors of seven states (all of the aforementioned participating states except Massachusetts and Rhode Island) signed a memorandum of understanding ("MOU") agreeing to implement RGGI. Since then, Massachusetts, Rhode Island and Maryland have opted in, while Pennsylvania is evaluating the possibility of joining (Litz, 2007; Morgan, 2007). Several Eastern Canadian Provinces continue to observe the process. In August 2006, participating states issued a Model Rule, which will provide the basis for implementation in the individual states.[8] The governors of each of the participating states have agreed to propose legislation based on the Model Rule by December 31, 2008. The states will create and maintain a regional organization to oversee administration of the program.

6.1. Program details

RGGI will begin by capping CO_2 emissions only, from electricity generating sources that have a capacity of 25 MW or larger. If successful, RGGI may expand to cover other emissions from other sources. It is up to each state to develop specific rules for implementation, within the framework of the Model Rule.

Implementation of RGGI will begin in January 2009, at which point the states have agreed to stabilize and cap regional CO_2 emissions at current levels (188 million short tons) continuing through 2015.[9] Beginning in 2015, the goal is to reduce regional emissions by 2.5% each year, for a total of a 10% reduction by the end of 2018.

The regional emissions budget is divided among the participating states. The states' budgets will remain the same through 2014, at which point they will ratchet down by 2.5% each year through 2018. Each state has the authority to allocate its own emissions allowances (each allowance equals 1 ton of carbon emissions). However, each state must use at least 25% of its allocation for consumer benefits or strategic energy purposes (e.g., energy efficiency programs, customer rebates, and renewables). At the end of each 3-year compliance period, entities must have allowances equivalent to the amount of CO_2 they emitted. They can achieve this by reducing emissions, purchasing allowances from the market, or creating credits through an offset project (discussed below). Entities with a surplus of allowances may either bank them for future use or sell them.

RGGI also allows entities to use offsets to account for up to 3.3% of their total emissions. Offsets can be obtained by investing in GHG emission-reduction projects outside of the electricity sector. These projects can take place within or outside of the RGGI regulated area, but projects outside of the area must follow certain specifications laid out in the amended MOU and the Model Rule.[10]

[8] The MOU and the Model Rule can be found online at: http://www.rggi.org/modelrule.htm, accessed December 13, 2006.

[9] This regional budget covers the 10 states currently participating. If Pennsylvania joins, it will be changed accordingly.

[10] Offset projects from outside the participating states must occur under the regulatory watch of a cooperating agency in that state. States or other US jurisdictions not participating in RGGI will need to enter into a

To limit compliance costs, RGGI also includes several "safety valves." For example, if the average annual price of an emissions allowance increases above $7, an entity may invest in offsets for 5% of their total emissions. If the price increases above $10, entities may use offsets for 10% of their reported emissions (at this point, offsets from international projects will also be allowed). Under these circumstances, the compliance period may be extended as well.

The structure of the RGGI program raises issues for the ability of renewable energy sources to affect overall GHG emissions levels, depending on how states choose to implement it. States have significant discretion in determining how to allocate allowances and implement the cap-and-trade program, therefore, the effects may vary by state. As of January 2008, all states that have released draft rules for implementing RGGI have committed to nearly 100% auctioning of allowances. If an auction is used, then this will limit the GHG benefit claims that renewable energy sources can make, unless they purchase and retire allowances. However, the RGGI model rule does allow states to implement a voluntary market set-aside that would retire allowances equivalent to voluntary renewable energy purchases, which would enable green power purchasers to affect emissions levels. This is discussed in greater detail in the next section.

7. Policy design options

This section describes several policy options that would enable renewable energy generation to affect emissions levels under a cap-and-trade program. The following options are discussed in turn: retiring allowances on behalf of renewable energy purchases, lowering the cap to account for future renewable energy development, and allocating allowances to renewable energy generators that can then be retired to lower emissions levels.

7.1. Retire allowances on behalf of renewable energy sales

The RGGI Model Rule offers a policy option that states can include to enable voluntary purchases to affect emissions levels. States may choose to create what RGGI refers to as a "voluntary renewable energy set-aside" in which allowances are retired on behalf of consumers who make voluntary purchases of renewable energy. Under this approach, states would estimate voluntary market purchases at the beginning of each compliance period, and set aside an equivalent number of allowances. Then, at the end of the compliance period, the state would retire allowances equivalent to the actual voluntary REC sales, and true-up any difference between the actual and projected sales in the next compliance period. According to the Model Rule, each MWh of renewable energy purchased should be multiplied by the CO_2 emissions rate in the region where the generation occurred. If this is not available, the regulatory agency will need to determine an average emissions rate (RGGI Model Rule, 2006).

The RGGI approach does not actually lower the cap, but it has a similar effect by taking allowances associated with projected voluntary demand off the top of the cap and then setting them aside before allocating the remaining allowances. These reserved allowances are later retired based on actual purchases, with the desired effect of reducing CO_2 emissions. If adopted by the states into their own rules, this could preserve the ability of renewable energy marketers to claim that purchases will reduce emissions. As of January 2008, six states (Connecticut, Maryland, Massachusetts, New Hampshire, New York, and Rhode Island) have included the voluntary market set-aside in draft or final legislation, regulation, or both. Two states (Maine and Vermont) did not include it in implementing legislation, while Delaware and New Jersey have yet to address this issue.

7.2. Reduce the cap to account for renewable energy demand

Another approach that would enable renewables to affect emissions levels is if regulators consider demand for renewable energy when setting the cap, or periodically reduce the cap to reflect growing demand for renewable energy. Renewable energy demand could include both mandatory demand from state RPS policies as well as projected voluntary demand from retail consumers purchasing differentiated green power products.

Periodic reductions in the cap could be based on either projected demand or on actual demand after the fact. In setting the RGGI emissions cap, for example, analysts modeled the projected renewable energy generation needed to meet state RPS targets. Setting the cap, however, was not based directly on this projected demand. As described by one participant, modeling this energy demand reduced the economic impacts of various cap levels; but, ultimately, the cap was set by a policy and political exercise that balanced numerous factors including electricity price impacts, price uncertainty, emission reductions, projected emissions leakage, among other things (Sherry, 2007).

This experience suggests that reducing emissions caps based on projected demand for renewable energy would be difficult to achieve.

7.3. Set-aside allocations to renewable generators

Ensuring that renewable energy generators are allocated allowances is another way to credit renewable generation with the emissions benefits they provide under a cap-and-trade program. A renewable generator can convey an allowance with the sale of renewable energy or RECs, and the retirement of the allowance is a clear basis for making an emissions-reduction claim.

(*footnote continued*)
memorandum of understanding with the RGGI state agencies and agree to incur certain administrative obligations to ensure the credibility of the offset projects.

One approach for allocating allowances to renewable generation is through a set-aside. With this approach, regulators specify—or set aside—a certain percentage of total allowances to be granted for defined eligible activities, usually renewable energy and energy efficiency. Renewables do not compete with emitting fossil plants for the set-aside allowances, but they must apply for them and demonstrate that they are eligible and meet other criteria.

Set-asides have been established under the SO_2 cap-and-trade program and the federal NO_x budget-trading program.[11] Under the latter program, seven states have adopted set-asides for renewables and energy efficiency.[12] Under the new CAIR trading program for NO_x, several additional states are likely to include renewables through a set-aside approach (Salerno, 2006).

While set-asides have been used to date in conjunction with free allocations to emitting facilities, the set-aside approach could also work with an allowance auction.[13] In this case, the set-aside would be available to eligible activities, such as renewable generation, while the remainder of allowances would be auctioned. The revenue from auctioning allowances could also be used to support renewable energy development, although an auction by itself would not enable claims of emission reductions.

7.4. *Output-based allocations to renewable generators*

Output-based allocation is another way to allocate allowances to renewables. With output-based allocations, allowances are granted to generators based on the quantity of electricity produced by each electric generator under the cap. Allocations are made proportionately to a generator's percentage of the total generation times the pool of allowances available for the allocation period. A renewable generator could, thus, earn its proportionate share of allowances and sell them to emitters who need them, or sell them for retirement with its RECs.

There is some precedent for output-based allocation. The EPA's Clean Air Interstate Rule (CAIR) includes a partial output-based allocation for new sources (post-2001); however, the allocation applies only to fossil-generating units.[14] Both Wisconsin and Pennsylvania have proposed a full output-based allocation, including to renewables, under CAIR (Wisconsin, 2006; Pennsylvania, 2007). Both of these states would allocate, based on output, to new renewables that commenced operation after a specified date.

As to output-based allocation of allowances under CO_2 cap and trade, such programs are just emerging. Output-based allocation was discussed in the development of RGGI, but the RGGI Model Rule does not specify a particular allocation approach. Instead, states can choose their own approach to allocating allowances. However, none of the RGGI states has yet proposed an output-based allocation, and a number of states have expressed interest in auctioning all allowances.

According to the US EPA, there are several generic benefits of output-based allocation that go beyond the inclusion of renewable energy. First, output-based allowances encourage energy efficiency at the plant level, because generators make more money if they can minimize their fuel input while maximizing electricity output. Second, because output-based emission regulations promote increased fuel-conversion efficiency and a corresponding reduction in fuel consumption, they promote pollution prevention and reduced multipollutant emissions. Third, output-based approaches provide a transparent measure of the emissions impact of generating electricity because they take into account the output and efficiency of the production process. This facilitates "apples to apples" comparisons of the emissions impacts of different facilities.[15]

On the other hand, awarding allowances based on output creates a subsidy for production. Encouraging output in this way may result in lower wholesale prices (which is good for consumers), but may lead to less energy efficiency at the end-use level if electricity is cheaper.

Output-based allocation, like an allowance set-aside, does not provide an automatic solution for emission-reduction claims by voluntary purchasers, if renewable energy generators sell allowances in the carbon market and do not include them with the REC. If this occurs and some RECs include allowances and others do not, buyers will have to be much better-informed and more discriminating.

8. Summary and conclusions

Voluntary markets for renewable energy have been growing rapidly in recent years, fueled partly by interest among businesses and consumers in reducing GHG emissions. Currently, these markets provide a convenient way in which consumers can support the development of

[11]The Title IV SO_2 trading program provided a set-aside (the Conservation and Renewable Energy Reserve) for renewables but was little-used, for several reasons: The price of allowances was lower than anticipated, providing little economic incentive to take advantage of the set-aside; the program did not provide a long-term incentive—only renewables that came online before 2000 were eligible; only utilities were eligible to get allowance from the set-aside; and the award of one allowance for 500 MWh of generation did not reflect the emissions actually avoided (see Wooley and Morss, 2001).

[12]These states are Indiana, Maryland, Massachusetts, Missouri, New Jersey, New York, and Ohio (US EPA, 2005).

[13]For more on allowance auctions, see US EPA (2003) and RAP (2006).

[14]The Clean Air Interstate Rule (CAIR) caps emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) in 28 eastern states and the District of Columbia. For additional information, see http://www.epa.gov/cair, accessed December 14, 2006. EPA already allocated emission allowances for SO_2 to sources subject to the Acid Rain Program; however, for the NO_x trading program, the affected states may allocate their allowance budget as they see fit.

[15]For additional information, see http://www.epa.gov/chp/state_resources/output_based_reg.htm, accessed December 14, 2006. For more detail, see US EPA, Office of Atmospheric Programs, Climate Protection Partnerships Division, *Output-Based Regulations: A Handbook for Air Regulators*. Draft final report prepared by ERG and Energy and Environmental Analysis Inc., August 2004. http://www.epa.gov/chp/pdf/OBR_final_9-1-05.pdf, accessed December 14, 2006.

renewable energy technologies and address the emissions associated with their own electricity consumption. In an era of carbon regulation, voluntary renewable energy markets can continue to play an important role because many consumers may be interested in supporting investment in renewable energy beyond what is required through mandates or other types of policy support. Some consumers may not be satisfied that emissions caps or other regulatory actions are sufficient to address the threats of global warming. In addition, many businesses and organizations may not be subject to carbon regulation, but may be interested in taking action to reduce the impacts of their own emissions footprints. Businesses and consumers may want to help support renewable energy today in order to help transform the technology to meet long-term emission-reduction goals. Voluntary markets for renewable energy may also be important because renewables provide advantages beyond no (or low) emissions, such as energy security and economic development benefits.

The design of carbon regulations will have implications for the ability of consumers to affect emissions levels through their green power purchases, however. If cap-and-trade programs are designed and implemented so that renewable energy sources do not reduce CO_2 levels below the level of the cap, then consumer purchases of renewable energy would not affect overall emissions levels, unless they purchased and retired an allowance separately. For residential consumers, in particular, this may be problematic, because they are unlikely to understand these complex market interaction issues and may believe that their purchases of green power from zero- or low-emitting renewable energy sources result in emission reductions. This could also reduce business and institutional interest in purchasing RECs to the extent that they are motivated by GHG benefits. REC marketers may still make claims that their product is "emissions-free", however, this could be problematic under the NAAG Guidelines, as these claims might imply to consumers that by purchasing such energy, they are helping to reduce emissions.

Under carbon cap and trade, both the methods for setting the emissions cap and for allocating allowances are important for emission-reduction claims. Allocating allowances to renewable energy generators (either through a set aside or output-based allocation) is one way to credit renewable generation with the emissions benefits they provide. A reduction in carbon emissions below the level of the cap can be achieved by retiring an allowance, ensuring that it is not sold to an emitter. A renewable energy marketer could convey an allowance with the sale of renewable energy or RECs, and the retirement of the allowance is a clear basis for making an emission-reduction claim. However, there is no guarantee that the allowances will remain bundled with the RECs, as generators will seek to maximize revenues in all available markets. Other approaches, such as reducing the cap or automatically retiring allowances to account for current and future renewable energy generation, would enable consumers to affect GHG emissions levels with their renewable energy purchases, but would not provide renewable energy generators the option of selling allowances in emissions markets. Thus, policy structures that are best suited for voluntary renewable energy markets are not necessarily the preferred policy options for renewable energy generators.

In the absence of policies that would enable renewables to affect emissions levels, consumers could reduce emissions by purchasing a so-called "REC-plus" product in which an allowance would be purchased and retired on their behalf and bundled with renewable energy or RECs. Or a consumer could simply purchase carbon emission allowances without the renewable energy component. Either case would result in a clear, verifiable emission reduction and enable a strong claim. However, a REC-plus product would likely either increase the costs considerably to the end-use consumer, suppressing demand, or reduce the amount of revenue that would go to support renewable energy generation, which would reduce the ability of voluntary markets to support new renewable energy development. The latter approach of simply retiring an allowance would not necessarily lead to near-term support for renewable energy because efficiency improvements at fossil plants may dominate near-term compliance actions.

Because of the substantial overlap in renewable energy and emissions markets, regulators and policymakers need to be cognizant of the policy-interaction issues and market implications of new and emerging policies. The voluntary renewable energy market is growing rapidly and provides a convenient and readily available mechanism for consumers to affect the impacts of their electricity consumption today. However, this market needs credibility, consistency, and the ability to articulate clear benefits in order to continue to provide consumers with a viable option for affecting change.

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