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Discussion Paper
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By Michael Gillenwater

Science, Technology and Environmental Policy Program
Woodrow Wilson School of Public and International Affairs
Princeton University

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Redefining RECs (Part 2): Untangling certificates and emission markets

MICHAEL GILLENWATER

Science, Technology and Environmental Policy Program, Woodrow Wilson School of Public and International Affairs, Princeton University, Princeton, NJ (email: gillenwater@alum.mit.edu)

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Abstract

Renewable energy and greenhouse gas emissions markets are currently in a state of confusion regarding the treatment of Renewable Energy Certificate (RECs). How should emission trading schemes treat RECs? How can emission mitigation policies provide real incentives for renewable generation? The objective of REC markets should be to promote additional renewable energy investments. The author asserts that defining RECs in terms of attributes, especially off-site attributes, does not further this goal. Ambiguous language such as "environmental attribute" or "environmental benefit" creates confusion in the marketplace while failing to address the relevant coordination issues with Renewable Portfolio Standard compliance markets, voluntary emission offset markets, or emission cap-and-trade markets. Specifically, defining RECs in terms of off-site attributes creates a number of problems, including that once an emissions cap-and-trade scheme is in place, such definitions of a REC becomes indefensible. The author proposes to redefine RECs in terms of *on-site* attributes. This definition resolves many of the aforementioned problems and allows compliance and voluntary renewable energy and emission markets to function without conflicts. Ideally, environmental commodities should be homogeneous, first best measures of the relevant environmental good, as well as easily measured and verified. The author also provides an analysis of how tradable environmental commodities used within renewable energy markets can achieve these characteristics.

1 Introduction

Market-based policy instruments, especially those using tradable environmental commodities, have been the focus of much attention in the environmental policy community. By definition, a commodity is a relatively homogenous good that trades primarily on price rather than on an individual product bundle's specific characteristics or attributes. Environmental markets that operate with a clearly defined commodity are more likely to have low transaction costs and produce public good benefits.[1] Environmental commodities that lack clear definitions will have higher transaction costs. And when traded in separate markets, poorly defined commodities will more easily come into conflict and cause confusion among market participants.

The generation of electricity with renewable energy technologies is environmentally preferable to using other energy sources. Renewable Energy Certificates (RECs) are a type of environmental commodity that is created when one (net) megawatt hour of electricity is generated from an eligible renewable energy resource. RECs are used in both compliance markets, under government-mandated Renewable Portfolio Standards (RPSs), and in voluntary green power markets.

As discussed in Gillenwater (2007), the conflicts between REC and emission markets are the result of RECs being used for multiple applications. These applications entail conflicting requirements for an environmental commodity. Carefully addressing these conflicts is essential given the interactions between renewable and emission markets.

[1] Environmental markets that lack a commodity and operate using custom bilateral trades have not been overly successful. For an example see King and Kuch (2003).

Although viewed by many as a useful environmental policy instrument, RECs currently fail to meet the definition of a commodity. For RECs and emission markets to operate without conflicts, it is necessary to redefine what we call a REC. In "Redefining RECs (Part 1)," It was shown that a wide array of different REC definitions are in use in both compliance and voluntary markets (Gillenwater, 2007). Many of these definitions imply questionable claims regarding the impact of RECs on electricity markets and pollutant emissions. They also rely on the use of ambiguous language that refers to unspecified environmental attributes or benefits. Part 1 showed that RECs are not equivalent to emission offsets and are an inappropriate tradable instrument if one's objective is to claim emission reductions. Instead, RECs sold in voluntary green power markets are functionally a production subsidy. RECs currently sold in voluntary markets do not pass credible additionality tests and the overall voluntary REC market may or may not have even a marginal impact on investments in renewable energy generation capacity..

This paper continues the discussion on RECs and examines more broadly the interactions between RECs and emission markets. Specifically, the following questions regarding renewable energy markets and emissions markets are addressed:

- What are the relationships between voluntary REC markets, RPSs and emission cap-and-trade schemes?
- How should RECs be redefined to best encourage renewable energy investments without conflicting with emission markets?

This paper sets out some recommendations for redefining RECs to eliminate the conflicts between REC and emission markets, and suggests a policy approach that allows RECs to be fully integrated with an emissions cap-and-trade scheme.

2 RECs and emissions allowances

Should RECs be integrated into emissions trading schemes covering the electric power sector, and if so, how? Because renewables emit no (or few) pollutants, they are economically advantaged by any policy that puts a cost on emitting pollution within the electric power industry. So this question is better framed as: Should RECs be directly included in an emissions trading system as a tradable instrument?

It is important to distinguish the issue of allowance allocation under an emissions cap-and-trade scheme from the issue of how a REC is defined. Renewable energy advocates often argue for renewable generators to be allocated allowances, typically via an allowance set-aside[2] for renewable energy projects or an allocation of allowances to generators based on their electricity output, versus emissions (Bird et al., 2007). Under an emissions cap-and-trade scheme the pollutant cap, not the allocation, determines the degree of environmental improvement.

Because most renewable energy generation is produced from technologies with minimal variable operating costs, allowance allocations to existing renewable generators will have no effect on the quantity of electricity produced. However, an allocation biased towards new renewable generation capacity can provide additional incentives for renewable energy investments, relative to other allocation approaches. For pollutants from electric power plants that are capped, any emission reduction caused by additional renewable energy generation will have no impact on total emissions of the pollutant. Allowances unused by one power plant, for example because its emissions were displaced by the operation of a new wind turbine, will simply be sold to other power plants under the cap. The total amount of pollution will be unchanged. The only way to reduce emissions of a capped pollutant from entities under the cap is to lower the cap or retire allowances such that they cannot be used for compliance. This is the situation with sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) emissions in the United States (Bluestein et al., 2006) and carbon dioxide (CO_2) emissions in Europe.[3] So a scheme that allocates allowances to renewable

[2] A set-aside is a reserve of allowances, under the overall cap, that is dedicated for allocation to a specific category of entities or activities.

[3] Renewables are ineligible for Joint Implementation (JI) projects under European Union's Emission Trading Scheme linking directive for this reason.

generators versus to other entities will not affect the overall level of pollution.[4] The issue of allocation is a topic for political debate, but it is not the direct cause of confusion in REC markets.

The major voluntary REC standards in the United States recognize this issue and marketers are advised to exclude capped pollutants (i.e., SO_2 and NO_x) from their marketing claims. However, the language used by many REC and green power marketers and in many state RPS definitions of RECs is inconsistent on this issue (Gillenwater, 2007).

Once a greenhouse gas (GHG) cap is placed on power plants in the United States, the purchase of RECs or green power will not reduce emissions, regardless of whether the REC or green power sales lead to additional renewable energy generation. Only retiring GHG allowances so that they cannot be used for compliance will reduce the overall emissions from the electric power sector, regardless of how a REC is defined or what attributes are claimed to be included in a REC.[5]

Recognizing this conflict, REC market advocates, in addition to advocating for the allocation of allowances to renewable generators, have also attempted to define RECs such that they are required to be bundled with emission allowances. The objective of defining RECs in this way is so that when a REC is retired, emission reductions can be claimed by the retiree because an emission allowance was also retired. It is this question of bundling that is a major cause of confusion in REC markets.

The question has been resolved for existing emissions cap-and-trade markets, such as the U.S. Acid Rain Program or the European Union's Emissions Trading Scheme (EU-ETS). Regardless of the REC definitions used or claims made by advocates, RECs and tradable emission allowances are separate commodities that trade separately and the retiring of a REC does not reduce emissions of a capped pollutant. Consumers that wish to reduce emissions of a capped pollutant can purchase and retire an emissions allowance without involving a REC in the transaction.

However, the debate over REC and allowance bundling is far from resolved with regard to future allocations of GHG emission allowances where cap-and-trade markets have yet to be established. Existing definitions of RECs in both RPS compliance and voluntary green power markets frequently make claims that RECs include and/or must be bundled with emission allowances under future cap-and-trade schemes. [6] Sometimes these claims are explicit, while others are implicit in the definitions of a REC used (Gillenwater, 2007).

For example, the language used in the California RPS requires that RECs include "any and all credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, attributable to the generation from the Unit(s), and its displacement of conventional energy generation" (see Appendix A in Gillenwater (2007)). The California definition appears inconsistent with existing federal law governing the ownership of SO_2 and NO_x allowances, which clearly are not included or conveyed with RECs. For GHGs, it is not clear how holders of RECs, even in California, will acquire ownership of allowances allocated to fossil generators in a future cap-and-trade system.

Table 1 summarizes two cases where the process of purchasing and retiring a REC can result in some amount of additional emission reductions from off-site fossil generators. Both of these cases require that the pollutant in question is uncapped and that the REC market creates a scarcity. As discussed in Gillenwater (2007), a REC market is long when the demand for RECs is less than the business-as-usual (BAU) supply. The BAU supply is how many RECs are awarded to non-additional renewable energy projects (i.e., renewable energy generation capacity that would exist and operate regardless of the revenue from REC sales).

Both RPS compliance and voluntary REC markets can be long. However, it is more likely that a RPS compliance market, with defined participation boundaries, will create a scarcity due to the ability of

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[4] See Rathmann (2007) for a discussion of how renewable support policies and greenhouse gas cap-and-trade programs interact to effect electricity prices.

[5] See Appendix A for some proposals that have been made in an attempt to overcome this conflict between capped emission markets and the claims of voluntary REC, green power, and RPS compliance markets.

[6] Often legislation is inconsistent in that it does not place the same requirements on direct purchase of green power under green pricing or competitive electricity markets (i.e., without RECs).

governments to set a quota. A long REC market, however, can exist even with an RPS if the quota established is below the BAU level of renewable generation in the jurisdiction. Again, for a capped pollutant, retiring RECs or increasing the RPS target will not reduce emissions.

Retiring a REC from a market with a REC scarcity indicates that emissions have likely been reduced somewhere, however, it does not mean that specific claims over emission reductions of an uncapped pollutant are justified. Even under the two cases in Table 1 where emissions have been reduced, there are still problems with renewable energy generators obtaining ownership of and quantifying emission reductions (Gillenwater, 2007).

Table 1
Emission reduction outcomes from various actions related to buying and then retiring a REC

Action	**Pollutant uncapped**	**Pollutant capped**
Buy from RPS compliance market (REC market scarcity)	Emissions reduced, although quantity and ownership of reductions is ambiguous	None
Buy from RPS compliance market (Long REC market)	None	None
Buy from voluntary REC market (REC market scarcity)	Emissions reduced, although quantity and ownership of reductions is ambiguous	None
Buy from voluntary REC market (Long REC market)	None	None

Although it would not affect the total emissions of a capped pollutant, an RPS does have the potential to alter the cost structure of emission allowance markets by effectively mandating the portion of emissions mitigation achieved with renewable energy technologies. Given that renewables have a number of benefits relative to fossil generation, RPS mandates may be an appropriate policy. Both an RPS and an emissions cap-and-trade scheme regulate the electric power industry. Therefore, it is important that if an RPS mandate is established that the setting of RPS targets and emission caps be coordinated where their jurisdictional boundaries overlap (Morthorst, 2003).

If a future federal GHG cap-and-trade scheme in the United States did allocate emission allowances to renewable generators (e.g., through a set-aside or output-based allocation), does it make sense to require that these allowances be bundled with RECs? Many of these RECs, except those sold into the voluntary market, will be purchased by LSEs and then submitted to government authorities for compliance with an RPS. If allowances are inseparable from RECs, then state governments will effectively be taking possession of these allowances.[7] Renewable generators will have received no financial benefit from the allocation. It is difficult to see how this arrangement would benefit renewable energy generators or, more importantly, lead to additional investments in renewable energy generation.

Imagine a scenario where a renewable energy generator has signed a long-term contract for the delivery of RECs, which have been defined to include any emission allowances allocated to the generator. Then during the term of the agreement, this renewable generator is allocated CO_2 allowances under a new emissions cap-and-trade scheme. Under the pre-existing agreement, these CO_2 allowances must be transferred, at a previously negotiated price, to the purchaser of the RECs. If the buyer's stated purpose for purchasing RECs was to claim emission reductions then the buyer would need to retire these

[7] It is not clear what state governments would choose to do with these allowances. Renewable energy generators could choose to sell RECs into the voluntary market, instead of the RPS compliance market, in hopes of capturing the value of both RECs and emission allowances. However, demand in the voluntary market is likely to be price elastic, while the demand in the RPS compliance market is inelastic.

allowances to make such a claim.[8] Under this scenario, the result of allocating allowances to renewable generators would be that neither the renewable energy generator nor the REC purchaser financially benefited.[9]

The only clear benefit to requiring that allowances be bundled with RECs is that it helps advocates of voluntary REC markets to continue to make claims that RECs are equivalent to emission offset credits even in the case of a cap-and-trade scheme covering the electric power industry. If REC marketers believe that their business is dependent upon the legitimacy of their emission reduction claims, then a perverse incentive has been created. By defining RECs to include or be equivalent to emission offsets, green power marketers may prefer that pollutants remain uncapped. Once there is a cap in place for GHG emissions from electricity generation, REC marketers will have to purchase and retire allowances in order to continue making claims.

The solution to all of these problems is to redefine voluntary and compliance market RECs in a manner that allows them to function without conflicting with emission markets. The following sections propose such a solution.

3 Redefining RECs

Should RECs be defined to include "all attributes?" Under such a definition, is there any public good attribute that a REC does not include?[10] Does it make sense to define RECs in terms of "attributes" at all? By doing so, have we created a system that will foster the expansion and efficiency of environmental markets?

Defining RECs by using ambiguous terms such as attributes or benefits of activities that occur off-site of a renewable generator's facility creates a situation in which each REC is a unique bundle of attributes. Even if it was feasible to concretely specify each of these off-site attributes, quantity them, and affirm ownership over them, it is not clear that such a system or definition would lead to functional environmental markets. Environmental markets function most efficiently with unambiguous and homogeneous tradable commodities that have clear ownership.[11] The lack of a consistent REC definition across and within voluntary and compliance REC markets prevent RECs from functioning as a homogeneous environmental commodity (Gillenwater, 2007).

For example, the New Jersey RPS includes a special requirement for generation that has produced a market scarcity for solar RECs (SRECs). These SRECs trade at approximately $200/MWh. A manufacturing company took advantage of this situation by installing photovoltaics and selling SRECs into the New Jersey RPS compliance market. The same company then purchased inexpensive RECs in the voluntary market (e.g., for $2/MWh) and retired these RECs to support its claims that it has reduced emissions through its investment in renewable energy. Despite these claims, this substitution of a voluntary market REC for a RPS compliance market REC negated the additionality of the environmental

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[8] Renewable generators should be cautious about entering into long-term REC sales contracts that would inhibit their ability to sell RECs into a future compliance market (e.g., under federal RPS legislation). This issue can be addressed with a "Change in Law Risk" clause in a REC sales contract. Renewable energy generators may also be entering into agreements that transfer their rights to future emission allowance allocations. It does not appear that the current REC market is pricing in the possibility of future allowance allocations to renewable generators. Renewable generators should realize when they sign long-term or future REC delivery contracts that they may be signing away their rights to a valuable environmental commodity.

[9] In negotiating the allocation process, if it was obvious that any allowances allocated to renewable energy generators would be retired and removed from the compliance market, entities needing allowances for compliance would likely resist any such allocation to renewable energy generators.

[10] As discussed in the previous section, regardless of the definition used, RECs effectively exclude allowances for capped pollutants.

[11] Several organizations have collaborated to develop a "Power Scorecard" to rate different green power products to address the lack of standardization in these markets (http://www.powerscorecard.org/index.cfm). Unfortunately, the solution to the problem in REC markets is not more ratings or information to consumers but the definition of an unambiguous and homogeneous commodity that customers can have confidence in.

benefits. A REC with clear additionality was sold into an RPS compliance market and then replaced with a voluntary market REC that was unlikely to have come from an additional project. If the company had retired its original solar REC instead of selling it, then another solar REC would have been created to meet the New Jersey RPS requirement. Assuming that RECs are a homogeneous commodity and fungible with emission reductions creates opportunities for "environmental arbitrage." Such problems arise in a confused marketplace that lacks clear commodity definitions.

The example above is a case where voluntary market RECs are substituted for compliance market RECs, but less stark examples also exist within the voluntary REC market. The ambiguity of REC definitions leads to high transaction costs and leads to price differentiation between RECs. For example, RECs from newer facilities and solar generation tend to sell for higher prices (Holt and Bird, 2005).

As discussed in Gillenwater (2007), RECs sold in voluntary markets suffer from significant additionality problems. Additionality is an issue for RECs because they are often marketed as being equivalent to offset credits. Most of the attributes claimed as being included in RECs relate to activities occurring off-site of the renewable generation facility. These off-site attributes, unlike on-site attributes, are far more difficult to quantify, verify, and obtain unambiguous ownership rights to (Table 2).[12]

Table 2
Summary of factors for REC on-site and off-site attributes

Issue	**REC on-site attributes (i.e., MWh generated)[13]**	**REC off-site attributes (e.g., indirect GHG emission reductions)**
Additionality	Ambiguous due to the weak tests applied. (e.g., initiation date & regulatory additionality)	Only if REC income was essential to initial investment decision
Ownership	Unambiguous (i.e., generator or contractual designees)	Ambiguous and lacking legal recognition. Prone to double counting. Depends on the legal requirements or ethical expectations of displaced generators.
Quantification	Unambiguous (i.e., meter readings of MWh)	Inherently uncertain in most cases, but can be assumed.

Why are RECs typically defined in terms of off-site attributes? RECs definitions in both voluntary and RPS compliance markets were created by those with a business interest in these markets. These parties have an interest in defining their product such that they can maximize their ability to make marketing claims. In the past there was little to conflict with emission markets and their broad claims of public good benefits.[14] However, this situation is changing with the emergence of voluntary GHG emission offset markets and GHG cap-and-trade markets.

Advocates for voluntary REC markets often assume that the best way to increase the appeal of their product is to convince customers that they are purchasing ownership of something instead of simply making a contribution to a public good. The concept of attributes was developed with the intention of transforming RECs from an accounting tool to be used to meet an RPS quota, into a consumer product.

Yet, do voluntary REC markets depend on customers believing they are purchasing ownership over attributes? Why do customers buy RECs voluntarily, knowing that they represent a public good? This

[12] Holt and Wiser (2007) refer to these as "primary" and "derived" attributes.
[13] Direct emission reductions, such as those resulting from methane captured by a generator combusting landfill gas, can occur "on-site." Although, these direct emission reductions have unambiguous ownership and quantification properties, they may or may not be determined to be additional. In addition, because direct emission reductions are relevant to only a small subset of renewable energy projects, requiring them to be included in a REC creates a different category of RECs for no obvious purpose. A more efficient approach would be to allow these projects to sell separately RECs and GHG offset credits.
[14] The primary exception being SO_2 and NO_x cap-and-trade markets.

question is the same as asking why people give to charity. People are looking to purchase “moral satisfaction” rather than ownership of attributes (Kahneman and Knetsch, 1992; Menges, 2003; Truffer et al., 2000). Most green power customers are not concerned with the specific environmental benefits of their green power purchases (Goett and Hudson, 2000), but they do believe that their purchase is resulting in some environmental benefits (Bird et al., 2007). In situations where there is strong government support for renewables, consumers have not abandoned voluntary green power markets (Menges, 2003).

Many advocates of voluntary REC markets appear convinced that if they cannot claim emission reductions, the demand for their products will disappear. This belief is contradicted by experience in Europe where there are strong renewable support policies and a cap-and-trade scheme for CO_2 emissions from the electric power industry, yet still active voluntary green power and REC markets. REC marketers in Europe typically do not claim that they are transferring ownership or rights to claim emission reductions or refer to attributes (Niermeijer, 2007).[15] Therefore, it does not appear that it is necessary, at least in Europe, to define RECs in terms of off-site environmental attributes, such as GHG emission reductions, for voluntary markets to prosper.

The principal objective of REC markets should be to promote additional renewable energy investments. Defining and marketing RECs in terms of unsubstantiated attributes does not further this goal. More importantly, rooting the voluntary REC market on claims that they are equivalent to GHG emission reductions confuses customers and risks discrediting both green power and emission markets because of the inaccuracy of these claims.

Ambiguous language such as “environmental attribute” or “environmental benefit” also does not address the relevant coordination issues with RPS compliance markets, voluntary emission offset markets, or emission cap-and-trade markets.[16] Plus, insisting that emission allowances be bundled with RECs prevents renewable generators from maximizing and optimizing the financial gains from the sale of these two environmental commodities.[17]

4 Redefined certificate types

Given the problems discussed above, are RECs an inherently flawed environmental instrument? They are not. However, RECs must be redefined in order to function as a homogeneous commodity for each market application and to secure consumer confidence. Failure to appropriately define certificates risks discrediting environmental markets more broadly.

Table 3 presents four certificate types specifically defined to function as a homogeneous commodity for a specific market application.[18] Different definitions are needed, in part, because of the lack of common boundaries among markets. All four certificate types could converge into a single commodity in

[15] REC marketers in Europe do state in their marketing materials that the climate is changing and that generating electricity from renewable sources is a good way to contribute to combating this problem.

[16] California Public Utilities Commission (CPUC) has begun to grapple with some of these issues in their January 2007 decision on the state’s emission performance standard (EPS). The California EPS establishes minimum greenhouse gas emissions intensity per energy unit of electricity output for any long-term financial commitment by a LSE to supply baseload generation by power plants outside of California (see California Senate Bill 1368). The CPUC decided that the transfer of RECs would not be factored into determinations of compliance under the EPS. “…RECs cannot be used to offset emissions for EPS-compliance purposes” (CAPUC, 2007). This decision is equivalent to saying that neither the direct emissions profile of a generator nor any indirect emissions reductions are embodied in a REC. Renewable generators that sell their RECs are not treated as “brown power” under the EPS, nor are fossil generators that purchase RECs then considered to be zero emission power. The CPUC’s reasoning was in part based on the practical difficulties of determining what emission rate should be assigned to renewable generators that sold their RECs. The CPUC noted, though, that their decision regarding RECs under the EPS (phase I) did not prejudice a decision under future regulation, such as a state cap and trade system (phase II).

[17] Under some state RPS legislation, RECs have an expiration date. If allowances are required to bundled with RECs, it is not clear what happens to allowances if a REC expires.

[18] These four types do not suffer from the flaws of the custom defined RECs in the ACORE/EMA master agreement (Gillenwater, 2007).

a scenario with a national stringent RPS (i.e., one that creates a scarcity for RECs) and load-based emission cap-and-trade scheme (described below). A national certificate registry for the on-site attributes, similar to that being developed in Europe, of all electricity generation would facilitate the integration of markets.[19]

Table 3
Redefined certificate types, their application, and characteristics

Market application	Type of certificate	Type of instrument	Additionality tests	Ownership	Quantification
Voluntary green power markets	Voluntary Renewable Energy Certificate (V-REC)[a]	Production subsidy	Unnecessary	Generator or contractual designee	Metered MWh
RPS compliance market	RPS Compliance Renewable Energy Certificate (C-REC)[a]	Quota	Unnecessary	Generator or contractual designee	Metered MWh
Voluntary or RPS compliance markets	Renewable Energy Offset Credit (REOC)	Offset credit	Similar to CDM projects[b]	Generator or contractual designee	Metered MWh
Load-based cap & trade market	Generation Emission Attribute Certificate (GEAC)[a]	Quota	Unnecessary	Generator or contractual designee	Metered MWh and on-site emissions per MWh

[a] In cases where the jurisdictions of these markets overlap, each of these certificate types are equivalent. Voluntary market customers can also treat C-RECs as being equivalent to REOCs if an RPS creates a market scarcity for RECs.
[b] Clean Development Mechanism (CDM) under the United Nation's Framework Convention on Climate Change.

4.1 Redefining voluntary market RECs as a production subsidy

As discussed in Gillenwater (2007), RECs sold into voluntary markets function as a production subsidy, where the voluntary market buyers are subsidy providers.[20] This framing of RECs is accurate because in voluntary REC markets additionality tests are either not applied or are weak. The purchase of RECs from voluntary markets is more than an act of charity, however. By commoditizing RECs, consumers can function as a subsidy provider because each unit of generation (i.e., MWh) receives a unit subsidy and double counting is prevented.[21] The amount of this subsidy is set by the market price of RECs.

Under this definition, V-RECs do not include off-site attributes such as emission reductions from displaced fossil fuel generators. Instead, both V-RECs and C-RECs would be defined and certified based on a MWh of electricity generated from a facility using an eligible renewable energy resource. RECs are then simply a tracking tool, in keeping with how they were originally intended when proposed for use under RPS mandates. No determination of additionality is required, which reduces the transaction costs of

[19] The European terminology is Guarantee of Origin (GoO).
[20] The term subsidy may have a negative connotation with many, but if the subsidy is provided for the purpose of supporting a under-supplied public good, it should not. For marketing purposes, many in European green power markets simply refer to RECs as providing financial support for renewables.
[21] The United Kingdom's draft best practice guidance addresses the issue of double counting of emission reductions from renewable generation when the electric power industry is covered under a cap-and-trade scheme. The guidance states that offsets should be treated like a "charitable donation" and that they may or may not be additional to existing regulatory mechanisms (see paragraph 4.13) (DEFRA, 2007). By not defining RECs in terms of off-site attributes, double counting of emissions is avoided.

monitoring and verification. There are also no ownership or quantification issues because no claims are made over emission allowances or emission reductions. Therefore, renewable generators can sell RECs, emission offset credits, and allowances separately to maximize their financial return.

4.2 RECs for RPS compliance

Certificates from eligible renewable facilities under an RPS scheme should be differentiated from voluntary market RECs. Ideally, the characteristics of a V-REC and a C-REC should be identical, except that the jurisdictional boundaries of a C-REC may be more restrictive (e.g., from generation within a particular state).[22] Both types of RECs function as a tracking instrument to prevent double counting of mega-watt hours. However, because the drivers of demand for V-RECs and C-RECs differ (i.e., voluntary market demand versus an RPS quota), their prices may also significantly differ.

Assuming that the RPS scheme creates a market scarcity for C-RECs (i.e., the RPS quota is set above the BAU quantity of renewable energy generation), then C-RECs will likely sell at a higher price than V-RECs. If the boundaries of both markets coincide, then the prices for V-RECs and C-RECs will converge because renewable generators will have the option of selling into either the RPS compliance or voluntary green power market.[23]

4.3 Defining an a REC with additionality

4.3.1 Renewable Electricity Offset Credits

Although certificates sold in voluntary markets typically come from projects that fail to pass tests that adequately demonstrate additionality (Gillenwater, 2007), there is no reason that a new Renewable Electricity Offset Credit (REOC) could not be defined in a way that satisfies a credible additionality determination. Such a determination should be based on multiple additionality tests and include at least one strong test (e.g., see the CDM Tool for the demonstration of additionality (UNFCCC, 2006)). As discussed above, this determination should be made with reference to a project developer's investment decision, and investors need to be guaranteed a reasonable crediting period over which they can sell offset credits.

Creating a new offset credit commodity, denoted in megawatt-hours, for renewable energy generation would allow consumers to credibly claim that they caused an additional MWh of renewable energy to be generated for every REOC they purchased and retired. As discussed above, such claims are not credible for RECs sold in voluntary markets. For the same reason, REOCs should trade at a higher price than V-RECs.[24]

A REOC could also function as an offset credit instrument for RPS compliance markets, similar to how emission offset credits are linked to cap-and-trade markets. Load serving entities could source REOCs from renewable projects outside of the RPS boundaries to meet their quota.[25] For example, Klaus Töpfer, former executive director of the United Nations Environment Programme and Germany's former environment minister, has suggested that European countries could meet their renewable energy targets by investing in renewables in developing countries. He suggested that the European Union should decide on a 25 percent target for the renewable share in 2020, of which 5 percent could be located in developing countries.[26]

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[22] Renewable generators within the jurisdiction of an RPS have the option of selling RECs into the voluntary market or ROCs to LSEs for RPS compliance. A single registry system can easily ensure double counting between ROCs and RECs is prevented.

[23] Assuming the eligibility requirements for generators are identical, which would be preferable to create a homogeneous commodity that is fungible between markets.

[24] REOCs will also face higher transaction costs from the verification of project additionality.

[25] Policy makers may choose to restrict the use of out of region REOCs for RPS compliance in favor of the local environmental benefits of renewable energy generation.

[26] See also Del Rio (2006) for a discussion of how CDM credits and RECs can be sold separately from the same project.

A REOC would provide an instrument for customers to credibly claim they have offset their electricity consumption from non-renewable generation sources (e.g., fossil fuel generation). However, does it make sense for customers to purchase such an instrument? The answer to this question depends on the objectives of the customer.

One approach for voluntary market customers to ensure the additionality of their purchases that does not require the creation of something like a REOC is for them to purchase C-RECs from an RPS compliance market where there is a scarce supply of C-RECs.[27] This approach would alleviate the need for a project-specific additionality determination. The RPS mandate has created a demand for C-RECs, so voluntary buyers can be confident that every REC they purchase and retire will likely cause another MWh of renewable energy to be generated to meet the compliance demand of LSEs.

4.3.2 REOCs or emission offsets credits?

Although REOCs address the additionality problems with RECs, they do not address the ownership and quantification issues associated with claims on off-site attributes such as emission reductions (see Table 2). Claims on emission reductions are limited to cases in which pollutants from the electric power industry are not covered under a cap-and-trade scheme (see Table 1).

If the objective of consumers or policy makers is to reduce emissions, such as GHGs, then V-RECs, C-RECs, and REOCs are all second best instruments. They do not directly measure or modify the desired behavior (i.e., emitting pollution). Second best instruments are appropriate when first best instruments are either unavailable or less cost-effective. However, tradable commodities and instruments addressing direct emissions from power plants are readily available (e.g., GHG emission allowances and offset credits). If the objective of a customer is to offset GHG emissions, whether their direct emissions or indirect from electricity consumption, then it is more appropriate to purchase emission offset credits and thereby utilize a first best instrument. REOCs are not measured in terms of a specific environmental benefit—if they were, they would not be a homogeneous commodity—instead they are measured in terms of an activity (i.e., MWh) that is assumed to be a proxy for environmental benefits.

If the objective of the customer is to increase the relative amount of renewable energy generation, then REOCs could be a useful instrument because they directly measure the desired behavior. Customers purchasing and retiring REOCs can be confident that they have offset their electricity use with renewable generation. Specific claims regarding emission reductions or other environmental benefits, though, are better addressed with first best instruments. For reducing GHG emissions, a first best instrument would be a GHG offset credit or an emission allowance.

4.4 Tradable certificates for a load-based cap-and-trade scheme

If GHG emissions are capped and RECs are disaggregated from off-site attributes, voluntary REC market advocates worry how renewable generators will benefit from their production of zero emission electricity. Again, any policy that places a cost on emitting GHGs will economically privilege renewable energy generators. However, advocates often demand that renewable generators be able to participate directly in emission commodity markets to ensure their advantaged. The design of a policy to enable such participation is possible.

California is considering the implementation of a load based cap-and-trade scheme to regulate GHG emissions. A generator-based cap-and-trade schemes, such as the U.S. Acid Rain Program or the EU-ETS, places regulatory requirements on power plants to obtain and submit emission allowances for each ton of pollution they emit. In contrast, a load-based scheme operates similar to an RPS in that load serving entities (LSEs), rather than generators, are the target of regulation. Instead of placing a quota on the portion of renewable electricity LSEs supply, such as under an RPS, a load based cap-and-trade

[27] It is unnecessary to burden an RPS market with additionality tests. Policy makers can ensure that additional renewable energy investments result from an RPS simply by setting the quota sufficiently high. A clear sign that an RPS has created REC market scarcity is if the market price of RECs is at or near the penalty set for non-compliance (Agnolucci, 2007).

scheme places a cap on the total GHG emissions that can be associated with a load-serving entity's (LSE's) electricity purchases (Cowart, 2006a, b). Tradable emission allowances are allocated to LSEs and the emissions intensity of each MWh of wholesale electricity purchased by the LSE is tracked. The benefit of such a system is that it has the potential to better address emissions leakage resulting from electricity imports and exports as well as having the potential to provide incentives for energy efficiency and renewable energy investments.

In the United States and in Europe, certificate tracking systems are being developed and implemented to support a variety of policies, including RPS compliance, environmental disclosure in LSE billing, and voluntary certificate markets.[28] These tracking systems function like registries for other environmental commodities. Certificates can be created not only for renewable generation, but also for non-renewable generation. A certificate is created for each MWh generated within the boundaries of the system. The certificate can include information on a variety of attributes associated with that generation, such as its GHG emission intensity (i.e., tonnes of CO_2 equivalent emitted per MWh). These are on-site attributes (e.g., direct emissions from the facility) not off-site attributes; therefore, their ownership and quantification are unambiguous (see Table 2).

One approach to a load-based scheme would be to use unbundled certificates to track the emissions associated with an LSE's electricity purchases (Breidenich and Gillenwater, 2007; Gillenwater and Breidenich, 2007). An LSE would be required to purchase Generation Emission Attribute Certificates (GEACs) equivalent to its delivered load. Each certificate would provide information on the emissions intensity of the generator that sold it. Each LSE's total emissions for the purpose of compliance would then be determined by the sum of the emission rates on its certificates. An LSE would then have to submit allowances equivalent to that amount of emissions.

The resulting price dynamics would result in a subsidy for renewable and low GHG emitting generators from the additional revenue they would receive from certificate sales. Demand by LSEs for electricity generated from coal and other GHG intensive sources would be reduced because LSEs would have to submit more allowances for electricity purchases from these sources. GEACs could also be used by LSEs for RPS compliance and for public disclosure purposes.[29]

A full discussion of the use of unbundled certificates with a load-based cap-and-trade scheme is provided in Gillenwater and Breidenich (2007). In sum, a load-based scheme offers the potential to make tradable emission allowances and RECs fungible within the electric power industry.

4.5 White tags

A new type of environmental commodity based on energy efficiency savings is in use, especially in Europe (Bertoldi and Huld, 2006; Bertoldi et al., 2005; Capozza, 2006; Hamrin et al., 2007). These certificates are referred to as Energy Efficiency Certificates or as "white tags". They are a type of offset credit instrument because they require the application of project-based accounting rules (i.e., additionality, baselines, leakage, ownership, quantification) to determining the amount of electricity saved by a particular energy efficiency project relative to some BAU baseline (Langniss and Praetorius, 2006; Mundaca, 2007). White tags are denoted in MWh of energy savings and therefore suffer from ownership and quantification issues similar to RECs if the objective is to claim emission reductions and integrate them into emission trading markets. In Europe, white tags are not linked to the EU-ETS (Oikonomou et al., 2007).

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[28] Certificate tracking systems in operation in the United States include the Generation Attribute Tracking System (GATS) in the PJM Interconnection, the Generation Information System (GIS) for ISO New England, and a system for the Texas RPS. The Western Renewable Energy Generation Information System (WREGIS) and the Midwest Renewable Energy Tracking System (M-RETS) are expected to be operational in 2007. The European Energy Certificate System (EECS) is being developed under the Association of Issuing Bodies.

[29] Even under this type of emission trading scheme where on-site emission attributes are represented by a certificate, consumers who wish to reduce emissions should still purchase and retire emission allowances instead of GEACs because it is ambiguous how many tonnes of emissions are avoided by removing a GEAC with a zero emission rate.

Like REOCs, white tags could function as an offset credit instrument under an RPS or as the commodity under a separate energy efficiency portfolio standard. Unlike REOCs, they could be obtained from projects within the boundaries of the RPS.[30] An RPS that was expanded to allow the use of white tags for compliance would allow LSEs to utilize energy efficiency investments as a compliance strategy.

5 Discussion and conclusion

Environmental markets that trade in emissions and renewable energy commodities are currently in a state of confusion. How should emission trading schemes treat RECs? How can emission reduction policies provide real incentives for renewable generation?

Experience in renewable energy and emissions markets has indicated that voluntary markets do not have a significant effect on the supply of non-localized environmental public goods. Voluntary markets are not a substitute for government policies, but voluntary markets can co-exist and supplement government policies (Markard and Truffer, 2006).

In the United States several bills have been introduced in Congress that would establish a national RPS and a generator-based GHG cap-and-trade scheme.[31] Recently, an agreement on an EU-wide renewables target of 20 percent was reached. National and multinational schemes such as these will necessitate the development of standardized certificate definitions and registries. Will these developments eliminate voluntary green power markets?

By defining renewable energy commodities only in terms of on-site attributes, voluntary REC and green power markets can efficiently operate along with emission cap-and-trade systems. Defining RECs in terms of off-site attributes, such as emission reductions from fossil fuel fired plants, presents a number of problems. For example, once an emissions cap-and-trade scheme is in place, such definitions of a REC becomes indefensible.

Requiring RECs to be bundled with emission allowances allocated to renewable generators is also likely to lead to inefficient market outcomes and puts RPS policies in conflict with cap-and-trade policies without providing additional financial incentives for renewable energy investments. There is no inherent problem with renewable energy generators being permitted to sell RECs and allowances.

Environmental markets are powerful tools for policy makers and voluntary action. However, for these markets to develop and expand, environmental commodities must be defined in a way that allows markets to operate as efficiently as possible and prevents conflicts over property rights or environmental benefit claims. Environmental markets are already burdened by complications that most other market transactions are not (e.g., monitoring and verification to ensure the value of an intangible good). It is unnecessary to further burden environmental markets by defining tradable environmental commodities in a way that causes them to be heterogeneous and second best measures of a public good. Ideally, environmental commodities should be homogeneous, first best measures of the relevant environmental good, and easily measured and verified. RECs currently do not have these characteristics if the relevant environmental good is emissions or emission reductions.[32]

This paper offers a proposal for redefining renewable energy commodities so that both compliance and voluntary renewable energy and emission markets can function without confusion or conflicts. The

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[30] The assumption here is that a MWh of electricity saved is at least equivalent to a MWh of electricity generated from a renewable source in terms of its environmental benefits.

[31] S.309 Global Warming Pollution Reduction Act – Sen. Bernard Sanders [VT] (introduced 1/16/2007); S.485 Global Warming Reduction Act of 2007 – Sen. John Kerry [MA] (introduced 2/1/2007); H.R.969 To amend title VI of the Public Utility Regulatory Policies Act of 1978 to establish a Federal renewable energy portfolio standard for certain retail electric utilities, and for other purposes - Rep Udall, Tom [NM-3] (introduced 2/8/2007). H.R. 1590 Safe Climate Act - Rep. Henry Waxman [CA-30] (introduced 3/20/2007). Sen. Jeff Bingaman [NM] is also expected to introduce national RPS and greenhouse gas emission legislation.

[32] Similar characteristics are desirable for other environmental commodities such as white tags, renewable fuel certificates, combined heat and power certificates, automotive fuel economy certificates, water quality trading allowances, etc.

implementation of a load-based GHG cap-and-trade scheme that utilizes unbundled certificates could allow RECs and emission commodities to interact without conflicts in a single marketplace.

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Appendix A – Proposals to integrate RECs with emission trading markets

The Center for Resource Solutions (CRS) has proposed an approach for incorporating the voluntary REC market into the Regional Greenhouse Gas Initiative (RGGI). Their recommendation was to forecast the quantity of CO_2 emissions from fossil fuel generators that would be avoided as a result of voluntary market sales of RECs and green power. They then proposed allowances equal to this forecast amount be retired from the total cap on GHG emissions from the electric power industry. The purpose of this pre-allocation "off the top" retirement of allowances was solely so that participants in the voluntary green power markets could make claims that RECs were equivalent to GHG emission offsets even under an emission cap-and-trade regime.

There are several problems with this proposal. The most critical problem is that the proposal assumes that voluntary market RECs and green power generation is additional (e.g., renewable facilities without the revenue from REC sales would not have generated electricity). The proposal does not address whether the voluntary REC market actually creates a scarcity, and if so, the marginal affect the market has on renewable generation. Assuming that every MWh associated with RECs and/or green power sales results in additional emission reductions from fossil power plants will require retirement of allowances in significant excess of the actual impact of the voluntary green power market. The excess reduction in the supply of allowances will benefit the environment (i.e., the cap will be reduced), but it will also increase compliance costs. Recognizing this, stakeholders in the cap setting negotiations will likely fight to raise the cap to account for the lack of additionality in this "off the top" retirement, thereby making reduction claims by REC and green power market participants equivalent to hot air.

Other problems with the proposal relate to forecasting a business-as-usual level of renewable generation and capacity additions for several years. Multiple unpredictable factors could significantly change the quantity of investment in renewable generation in the future (e.g., reauthorization of the federal Production Tax Credit , prices of wind turbines and natural gas, likelihood of a national RPS mandate). There is also the problem of predicting which generation sources will be displaced by future renewable generation generation. The degree to which the forecast is incorrect could have significant implications for the price of allowances.

For a description of the original proposal see: CRS, 9/16/05, http://www.rggi.org/docs/crs_voluntary_re_9_16_05.pdf
Also see CRS, "Recommendations for Including Renewables in a Cap-and-trade System in California,": http://www.climatechange.ca.gov/climate_action_team/meetings/public_comments/cap_and_trade/CRSrecommendationsforCACapandTrade.pdf

The Model Rule under RGGI includes an optional provision allowing participating states to create an CO_2 emission allowance set-aside for the voluntary REC and green power market a portion.[33] Participants in renewable energy markets would then be able to petition the state to receive an allocation from this set-aside based on documentation of renewable energy purchases.

By structuring this provision as a set-aside, it does not change the cap (in comparison to an offset crediting instrument, which would effectively increase the cap). Therefore, it implicitly assumes that RECs and green power are not offset credit instruments because of the double counting problem with fossil generators covered under the cap. A set-aside is simply a part of the overall allowance allocation process.

The model rule provision leaves it up to each state how it will process applications to receive allowances under the set-aside. Additionality tests and other eligibility requirements will be necessary to select recipients from the limited pool of allowances within the set-aside. It is also important to note that in order for renewable market participants to claim emission reductions any allowances they received

[33] See RGGI Model Rule "Voluntary renewable energy market set-aside allocation" subdivision (d), page 47.

would have to be retired. It is then the act of retiring the allowances, not the act of purchasing RECs or green power, which is the ultimate cause of emissions being reduced below the cap.

Currently, no RGGI state has indicated that they will utilize this provision.[34] If it was implemented by a state, it could create interesting opportunities for arbitrage between REC and emission allowance markets.

A copy of the RGGI model rule can be accessed at: http://www.rggi.org/modelrule.htm

The U.S. NO_x Budget Trading Program renewable generators can receive allowances. States have the discretion to decide how NO_x allowances are allocated within the state. Renewable generators could obtain allowances under two methods of allocating to renewable generators: a renewable energy set-aside or a output-based allocation(Bluestein et al., 2006). Because of the variable cost structure of renewable generation, allocating allowances to existing renewable generators does not effect the amount of electricity they generate. Only an allocation that alters investment decisions will result in additional renewable generation.

Several states have established set-asides for renewable generators. Renewable generators may then petition state regulators to be allocated allowances from a set-aside upon demonstration that they meet certain eligibility requirements. Currently, these set-aside programs have been under utilized for a variety of bureaucratic and financial reasons (Bluestein et al., 2006). For example, under the typical allocation formula and at current NO_x allowance prices, one MWh of renewable generation would receive allowances worth about 75 cents.[35]

Jacobson (2007) provides a case study and discussion of how RECs can be used to obtain allowances from the NO_x Budget program. The case study also discusses the issues that states and municipalities face in receiving State Implementation Plan credit from EPA for a renewable energy purchases. The overall process currently faces high transaction costs.

Bird et al. (2007) also provides a summary of proposals to include renewable energy generators into GHG cap-and-trade markets.

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[34] Most RGGI states have indicated they will auction 100 percent of allowances. The other states have not yet indicated their intentions.

[35] Market price data from http://www.evomarkets.com/emissions/index.php?xp1=sipnox/