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Executive Summary

With organizations and individuals increasingly interested in accounting for their carbon emissions, greater attention is being placed on how to account for the benefits of various carbon mitigation actions available to consumers and businesses. Generally, organizations can address their own carbon emissions through energy efficiency, fuel switching, on-site renewable energy systems, renewable energy purchased from utilities or in the form of renewable energy certificates (RECs), and carbon offsets. This paper explores the role of green power[1] and carbon offsets in carbon footprinting[2] and the distinctions between the two products. It reviews how leading greenhouse gas (GHG) reporting programs treat green power purchases and discusses key issues regarding how to account for the carbon benefits of renewable energy. It also discusses potential double counting if renewable energy facilities are selling both RECs and carbon offsets.

Green power (i.e., renewable energy purchased through retail electricity providers or in the form of RECs) and carbon offsets overlap to some degree because some consumers and organizations purchase green power to address the carbon emissions associated with their electricity needs. However, one way to distinguish between these two products is that green power is sold in kilowatt-hours, and offsets are sold in metric tons of carbon dioxide equivalent. Also, voluntary GHG reporting programs often make distinctions in terms of the types of emissions each instrument can address. Generally, public reporting programs that allow carbon offsets enable them to be used to offset any type of emissions (including vehicle, travel, and heating fuels) while green power is used to address an entity's purchased electricity emissions, which are also referred to as scope 2 indirect emissions by many GHG reporting programs. There are also differences in certification standards and requirements for green power and carbon offsets; most notably, offsets have stringent additionality requirements (i.e., tests to ensure that the carbon emissions reductions are in addition to business–as–usual emissions levels). Renewable energy projects can provide carbon offsets if they meet offset quality standards, including additionality requirements.

Rules regarding how to properly account for the carbon emissions benefits of renewable energy purchases and offsets in corporate or public emissions inventories are still unfolding in some cases, although a number of existing programs and protocols provide guidance. Most GHG reporting protocols and programs allow organizations that purchase renewable energy from electricity suppliers or in the form of RECs to reflect them with their electricity consumption emissions (scope 2); however, there are some differences among leading programs in how this information is reported or how an adjustment is calculated. For example, some programs calculate the avoided emissions of the RECs based on the location of the generator while others account for the zero or low emissions profile of renewable energy purchases. Also, some programs require that on-site renewable energy facilities must retain the associated RECs to account for the emissions benefits. Additional detailed issues may warrant future consideration, such as:

[1] The term "green power" generally refers to electricity supplied in whole or in part from renewable energy sources, such as wind and solar power, geothermal, hydropower (typically low-impact or small hydro), and various forms of biomass.

[2] Carbon footprinting refers to the process of accounting for one's own carbon dioxide emissions.

- Whether average emissions rates used in voluntary carbon accounting need to be adjusted for voluntary green power purchases
- Whether green power should be subject to further eligibility requirements or "additionality" tests to be used in voluntary carbon accounting
- How utilities or generators should report carbon emissions for renewable generation when the associated RECs have been sold
- Whether carbon accounting practices need to change in instances where a carbon cap is established for the electric sector
- How carbon accounting functions in a capped carbon emissions market with a voluntary market set-aside.

More detailed guidance from leading carbon programs, protocols, and voluntary GHG reporting programs would help clarify remaining issues for the marketplace. In addressing these issues, it is logical to account for green power purchases in a manner that is consistent with the treatment of on-site renewable generation and energy efficiency because green power purchasing is essentially an alternate approach to addressing electricity consumption emissions.

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1 Introduction

Increased interest in addressing greenhouse gas (GHG) emissions in the United States has placed greater attention on issues surrounding what constitutes a quality GHG offset and practices for using renewable energy and offsets in "carbon footprinting"—the process of accounting for one's own carbon dioxide emissions.

Businesses and institutional consumers have a number of options available to them to address the carbon emissions associated with their facilities, including energy efficiency and conservation, fuel switching, the use of on-site renewable energy systems, and green power and carbon offsets purchases. Often businesses undertake a multi-step process in reducing their carbon dioxide emissions or going "carbon neutral" that involves many or all of these activities. Some companies consider the use of green power and offsets to be important components of a GHG mitigation strategy. They may be particularly important for organizations wishing to achieve aggressive emissions reductions goals. For example, the ability to procure renewable energy from off-site facilities can be important when the use of on-site renewable electric systems is hampered by factors such as lack of building ownership or lack of adequate roof space.

Business and institutional customers often purchase green power in the form of renewable energy certificates (RECs), which are sold separately from electricity and represent the emissions attributes of renewable energy. Often RECs are seen as an attractive option for procuring green power because they offer transaction flexibility in purchasing for multiple facilities covering a wide geographic area. Organizations may also be able to purchase renewable energy directly from their utilities or retail electric suppliers. In either case, the organization purchases the renewable energy in kilowatt-hours equivalent to a portion of its electricity use. While non-residential customers may use green power purchases to achieve carbon emission reduction goals, they may also be motivated by other benefits of the technologies, including price stability, other local environmental benefits, and public relations benefits of supporting clean energy technologies (Hanson 2005).

In addition to green power options, markets for carbon offsets also exist. A carbon offset represents the reduction or avoidance of a metric ton of carbon dioxide emissions equivalent; an additional reduction in emissions to what would otherwise have occurred. While carbon offsets can be sourced from renewable energy projects, they are commonly also sourced from other project types that reduce, avoid, or sequester GHG emissions, such as methane-destruction projects, forestry, soil carbon sequestration, and energy efficiency.

The use of carbon offsets and green power in addressing carbon emissions has led to questions about the distinction between them and the appropriate way to account for them in voluntary GHG inventories. This paper discusses the differences and reviews how leading public GHG inventory programs report and account for RECs and other green power purchases and offsets. Finally, the paper discusses the potential for double counting if renewable energy facilities sell both RECs and carbon offsets.

2 Differences between Green Power and Carbon Offsets

The question of whether green power—and RECs in particular, because they are often the mechanism through which business and institutional customers procure renewable energy—can be considered "carbon offsets" has been the subject of some debate in recent years. Greater media scrutiny of offset quality and credibility (Ball 2007) has led to a focus on whether RECs can be considered offsets and whether they drive new renewable energy development to create additional carbon emissions reductions (Elgin 2007; Ball 2008). There has been discussion of whether RECs and other forms of renewable energy purchases should be limited to addressing GHG emissions associated with electricity consumption or whether they can, like carbon offsets can, be used to offset vehicle, heating, and other types of emissions in carbon accounting (Harmon 2008).

While the motivation to purchase both green power and offsets may be driven to some extent by a common interest—addressing carbon emissions and supporting low-carbon emitting technologies—they are widely considered distinct products (EPA 2010; Gillenwater 2008a; Gillenwater 2008b; Jones 2009; Offset Quality Initiative 2009; Trexler in Bayon et al. 2009). One way to distinguish them is that green power is sold in kilowatt-hours, and offsets are sold in metric tons of carbon dioxide equivalent. Green power options enable businesses and consumers to procure zero- or low-emitting renewable energy equivalent to their electricity consumption; offsets represent reductions in carbon dioxide emissions. Aside from the emission benefits, green power may also provide other benefits such as fuel price stability, resource diversity, economic development, or water savings. Offsets may also provide co-benefits, which can vary depending on the source. Perhaps most importantly, green power and carbon offsets are not subject to the same certification standards and eligibility criteria, particularly additionality requirements.[3]

Public voluntary GHG reporting programs also make distinctions in terms of what types of emissions each instrument can address. Generally, eligible carbon offsets can be used to offset any type of emissions (including vehicle, travel, and heating fuels), while RECs and renewable energy purchased through retail electricity suppliers have been limited to addressing purchased electricity emissions (see Section 3 for further discussion of the treatment in GHG accounting programs).

[3] The term additionality refers to whether an action is additional to what would have otherwise occurred under a business-as-usual scenario. Carbon offsets must meet additionality requirements to become certified (discussed in greater detail later in Section 2 under the *Additionality* subheading). Eligibility requirements for renewable energy purchases differ from those required in offset markets. In the United States, renewable energy sold to voluntary purchasers, including renewable electricity products and unbundled RECs, must be above and beyond what is required by regulation (similar to regulatory additionality tests required in offset markets). This means a REC cannot be used both for RPS compliance and sold to a voluntary purchaser. The REC can only be sold into one market—either the compliance market or the voluntary market. This is a requirement of RPS compliance in most states. Further, it is also a requirement of the EPA Green Power Partnership program, which works with most of the major organizations that purchase green power, and the Green-e Energy certification program, which is the leading certifier of green power transactions. There are tracking systems and certification requirements that ensure that RECs are retired only once and for one purpose. In addition, EPA and Green-e Energy standards have a date that defines eligible new renewable energy projects (similar to a timing test in offset standards).

Renewable-energy-derived Offsets

While green power and carbon offsets are distinct products, renewable energy projects that can meet offset quality standards could also be a source of carbon offsets. For example, renewable energy projects have played a significant role in providing offsets in international compliance markets developed through the Kyoto Protocol. Under the Kyoto Protocol's Clean Development Mechanism (CDM), emissions reductions from GHG mitigation projects in developing nations have been used by entities in other countries to meet their binding emissions reductions targets. Joint Implementation (JI), a similar mechanism for countries with economies in transition, enables project-based offsets from sources including renewable energy technologies to be used for compliance. Renewable energy projects are a leading source of offsets for regulatory markets under both the CDM and JI. For a discussion of the role of U.S.-based renewable energy projects in compliance regimes, see Text Box 1.

Text Box 1: Role of U.S.-based Renewable Energy Projects in Compliance Regimes

U.S.-based renewable energy projects are not eligible to participate in international compliance markets developed through the Kyoto Protocol because the United States did not ratify the Protocol. Also, it is not likely that renewable electricity projects would be able to provide compliance offsets in any future U.S.-based cap and trade program on the electric sector. Offsets for a compliance program typically must be sourced outside of the capped sector to avoid double counting. Only renewable energy projects in the capped region that also result in methane reductions, such as biogas digesters, landfill methane, or wastewater methane projects, are generally eligible to provide offsets under a cap and trade program. In these cases, the offset is associated with the methane reduction, not the emissions benefit from the electricity generation. Renewable energy projects that offset natural gas or other fossil fuel use, such as renewable heating or hot water systems, might also be able to provide offsets under an emissions cap on the electric sector.

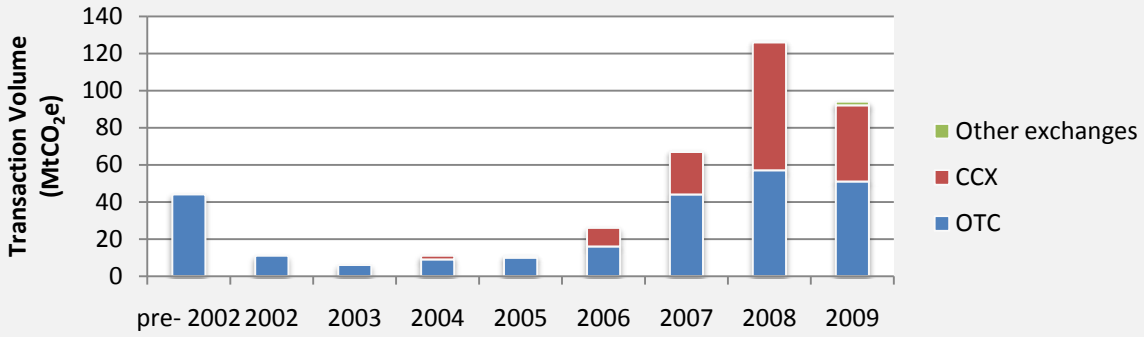
In addition to providing offsets in international compliance markets, renewable energy has played a role in voluntary offset markets through the Chicago Climate Exchange (CCX) and the over-the-counter (OTC) market. The OTC market consists of bilateral contracts that occur outside of formal exchanges. CCX and the OTC market comprise 98% of the voluntary carbon offset market. In 2009, the global voluntary carbon offset market transacted 93 million metric tons of carbon dioxide equivalent ($MtCO_2e$) of offsets for a total of $387 million. Renewable energy (including hydro, wind, and biomass) accounted for approximately 17% of the offsets transacted in the OTC market in 2009 and 13% of the offsets used in CCX in 2008. (Hamilton et al. 2009; Hamilton et al. 2010) For more data on the role of renewable energy in voluntary GHG offset markets globally, see Text Box 2.

Renewable energy projects wishing to provide certified carbon offsets in voluntary markets have to meet offset quality standards. Such standards developed by non-governmental organizations are generally the only restrictions placed on project eligibility in voluntary markets.[4] Typically, the offset project developer chooses what standard to follow or may choose not to become certified at all. Standards vary, although most are heavily influenced by international compliance market rules and have similar rules for eligible project types and certification criteria. When renewable energy projects provide certified carbon offsets, they are typically prohibited from selling RECs in voluntary markets for the same megawatt-hours of generation. This issue is discussed in detail later in Section 4.

[4] For a description and comparison of offset standards, see Kollmuss et al. 2008a and Kollmuss et al. 2008b.

Text Box 2: The Role of Renewable Energy in the Global Voluntary Carbon Offset Market

Transaction volume in voluntary GHG offset markets decreased in 2009 after expanding considerably through 2008 from relatively low historic levels. In 2008, the global voluntary carbon markets nearly doubled from 2007, reaching approximately 127 $MtCO_2e$ (87% growth). However, the markets decreased to 93 $MtCO_2e$ in 2009 (27% decline), as shown in Figure 1 (Hamilton et al. 2010).



Source: Hamilton et al. 2010
Note: CCX bilateral trades are included in the OTC volume.

Figure 1. Transaction volume growth in voluntary markets ($MtCO_2e$)

Generally, individuals or corporate buyers enter into GHG offset contracts directly with retail marketers or suppliers in the form of bilateral contracts. These types of transactions are sometimes characterized as "over-the-counter" (OTC) because they generally occur outside of formal exchanges. In the global OTC market, approximately 17% of the offsets transacted in 2009 were sourced from renewable energy projects (hydro, wind, and biomass) (Hamilton et al. 2010). Most of the renewable energy projects were based in developing countries.

U.S.-based projects, primarily methane reduction projects, have played a significant role in global voluntary offset markets; this is in contrast to compliance markets in which eligibility rules limit U.S.-based projects. The largest fraction (56%) of OTC offset volumes in 2009 was derived from projects in the United States, with 70% of the U.S. voluntary offset volume sourced from methane reduction projects (Hamilton et al. 2010).

The Chicago Climate Exchange (CCX), which recently announced it will cease carbon trading at the end of 2010, was launched as North America's first and only voluntary emission reduction and trading system for all six GHGs in 2003. Participating organizations voluntarily commit to make carbon reductions, which become legally binding targets under the program. Renewable energy (wind and solar) supplied 13% of the total carbon dioxide reductions generated from offset projects in 2008, a five-fold increase from 0.8 $MtCO_2e$ in 2007 to 4.1 $MtCO_2e$ in 2008 (Hamilton et al. 2009). Renewable energy projects that supply offsets to the CCX must retire RECs associated with the equivalent renewable generation.

Voluntary offset prices have varied as a result of many factors, including market (OTC versus CCX) and project type, with renewables garnering higher prices because of their co-benefits and transparency. In 2009, four of the five types of renewable energy projects had the highest volume weighted average prices among offsets, including solar ($33.80/$tCO_2e$), biomass energy ($12.30/tCO_2e), and wind ($8.70/$tCO_2e$) (Hamilton et al. 2010). On the other hand, the project types with the lowest volume weighted average prices were wastewater methane credits at $3.60/$tCO_2e$, geological sequestration credits and industrial gas credits together at $2.40/$tCO_2e$, and agricultural soil credits at $1.10/$tCO_2e$ (Hamilton et al. 2010).

Offset quality standards are largely based around the "R.S.V.P.E." principles; i.e., whether the offsets are Real, Surplus, Verifiable, Permanent, and Enforceable.[5]

- *Real,* meaning that the project-based offset credits represent actual emission reductions. In order to ensure the credibility of offsets, the quantification of the net emission reduction must be accurate and conservative to avoid overstating a project's GHG reductions.
- *Surplus (Additionality),* meaning that a GHG offset project would not have happened absent the offset program (or purchase). Further, the offset project results in emissions reductions from business-as-usual requirements or emissions levels that would have otherwise occurred.
- *Verifiable,* meaning that offset projects must be readily monitored, generally by an independent and qualified third party, to ensure emissions reductions occur.
- *Permanent,* meaning the GHG emission reductions from an offset project cannot be easily reversed (e.g., that trees planted could die).
- *Enforceable (Ownership),*[6] meaning that offsets are backed by contracts or legal instruments that define their creation, provide transparency, and ensure exclusive ownership of the emissions reductions to avoid double counting. In addition, an offset is enforceable if the offset program has sufficient enforcement mechanisms to ensure compliance with its standards.

For renewable energy, the two major challenges with respect to meeting offset quality standards are: (1) additionality and (2) ownership of the emission reductions. Both of these challenges are discussed in turn below.

Additionality

Additionality in the context of carbon offsets refers to the idea that offsets should result in emissions reductions beyond a business-as-usual scenario. Although difficult to measure, additionality is important because the decrease in emissions that is reported or claimed by the offset buyer must be substantiated by a reduction in emissions elsewhere.

Offset standards have different tests for determining additionality. Market participants can choose among various offset standards to seek certification. Because a federal compliance market for carbon offsets has not yet emerged in the United States, there is no nationally accepted offset standard specifically for the U.S. market.[7]

The additionality tests required by a number of the leading offset standards are summarized in Appendix A. Kolmuss et al. (2008a; 2008b) provide background on the variety of offset standards that exist. Under the CDM program, which forms the basis for many of the voluntary

[5] These criteria are commonly cited among organizations developing offset standards, sometimes with minor differences in how the issues are characterized. For one example, see Three-Regions Offsets Working Group 2010.
[6] The ownership issue is sometimes characterized as a verification issue in descriptions of the criteria that offsets must meet.
[7] Even if a compliance market did emerge in the United States, it would not likely include renewable energy offset standards because domestic renewable electric generation facilities could not provide compliance offsets for a carbon cap on the U.S. power sector.

offset standards, additionality is determined on a project-by-project basis. Several types of tests can be applied to a project to determine if it is additional to business-as-usual, such as:

- *Financial additionality test*—whether a project would have been built in the absence of offset revenues
- *Regulatory additionality test*—whether the project is being used to meet policy mandates or other regulatory requirements
- *Barriers test*—whether the project must overcome significant institutional barriers to be built
- *Common practice test*—whether the type of facility is commonly employed
- *Timing test*—whether the facility is newly installed.

While some voluntary offset standards allow other types of tests to be used, most allow projects that can meet CDM standards to be sold into the voluntary market. In some cases, additional restrictions are imposed. For example, both the Voluntary Carbon Standard (VCS) and the Gold Standard allow the CDM methods to be used, but the Gold Standard only certifies renewable energy and energy efficiency projects.

An alternative method of measuring additionality, which has emerged to some extent in the United States, is a performance-based metric. This type of metric evaluates the emissions performance of technologies against a common benchmark to determine their eligibility to provide offsets. Under such an approach, technologies that are not business-as-usual today may be eligible if they can achieve superior emissions performance to a business as usual emissions performance baseline. For example, the Environmental Protection Agency (EPA) Climate Leaders program, the Climate Action Reserve,[8] and the Green-e Climate Protocol for Renewable Energy use this approach. The VCS also allows some performance-based methodologies that do not use a barriers or financial additionality test. Performance-based tests are advantageous in that they may be less costly to implement than project-based evaluations and less subject to gaming than financial additionality tests in particular.

In summary, renewable energy projects seeking to provide carbon offsets in voluntary markets generally must meet additionality tests. There are a variety of standards in the marketplace; generators have some option to choose among certification programs.

Enforceability/Ownership

Aside from additionality, the other key issue for renewable energy projects seeking to provide certified offsets is whether they can establish ownership of the emissions reductions. Establishing ownership can be challenging for renewable energy sources because they provide indirect emissions reductions when they displace fossil fuel generation. The avoided emissions are determined by which types of existing or new fossil generation sources are displaced as a result of the renewable energy generation (see Appendix B for a discussion of calculating avoided emissions from renewable energy facilities).[9]

[8] The Climate Action Reserve does not certify renewable energy projects, however.
[9] This same issue is true for energy efficiency, although it is not the focus of this paper.

The concern over ownership stems from the fact that a fossil fuel generator that reduces its output as a result of the renewable generation can claim the emissions reductions. If the renewable generation results in displacing the need for new fossil generation, then only one entity exists to claim ownership, so it is not problematic.

Concerns over the ownership issue become more acute if there is anticipation of a carbon emissions cap on the electric sector. If an emissions cap is introduced on the electric sector, the ownership of the emissions reduction will be determined by the specific structure of the cap and trade program.[10] Under traditional cap and trade designs, renewable energy generation that displaces fossil generation enables the fossil generator to take credit for the reduced emissions or sell an allowance that would otherwise have been needed to cover its emissions. Such a situation would prohibit renewable energy generators from selling offsets.[11] This issue is further addressed in Section 3 of this paper under the subsection *Other Issues Related to Carbon Accounting for Green Power.*

Despite the challenges of clear ownership, renewable energy sources have been considered acceptable offset sources under the CDM and internationally.[12] Under these programs, the renewable energy facilities are granted ownership of the emissions reductions and methods have been established for calculating the emission reductions. Public tracking systems and registries also play a role in clarifying ownership claims.

Conclusion: Use of Renewable-energy-derived Offsets

While RECs and other forms of green power are different from carbon offsets, renewable energy projects that meet offset standards can supply voluntary carbon offsets. To date, U.S.-based renewable electric energy projects have played some role, although limited, in voluntary GHG offset markets. Renewable electric projects can likely continue to do so until the imposition of carbon emissions caps, under which they may not be able to show a reduction in emissions beyond what is required by the cap, depending on the policy design. Some renewable energy project types, such as biogas digesters or landfill methane projects, may be able to sell both RECs for the electric generation and offsets from the avoided methane emissions.

Renewable-energy-derived offsets may be of interest to consumers and entities seeking to support clean electric generating sources or for the other co-benefits that they offer, such as avoiding other types of air pollution, avoiding the fuel extraction impacts of mining and transport, relying on renewable sources of fuel as a hedge against fossil fuel price increases, and in some cases, providing local economic benefits.

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[10] Under current cap and trade designs, the emitting entities (i.e., the fossil fuel plants) generally receive emissions allowances (each representing a ton of carbon dioxide) or purchase them through an auction. If a power plant emits less because it is displaced by a renewable energy generator, it would need to retain or procure fewer allowances to cover its emissions. Therefore, while renewables are still zero-emitting sources, they cannot claim ownership of the avoided emissions unless they are granted allowances directly under the program, which are then retired.

[11] Some renewable energy sources may be able to provide offsets for methane reductions benefits but not for their electricity emissions benefits.

[12] Renewable energy sources were included as eligible offsets in the CDM program in part because it was designed to help encourage the development of low-carbon-emitting electric generation technologies in participating developing countries where the availability of other financial incentives to encourage their development has generally been limited.

3 Carbon Accounting for Green Power Purchases

Increasingly, corporations and institutions are tracking the GHG emissions associated with their activities and setting goals for reducing emissions or achieving carbon neutrality. Often companies track these emissions internally while others participate in a growing number of voluntary GHG reporting programs.

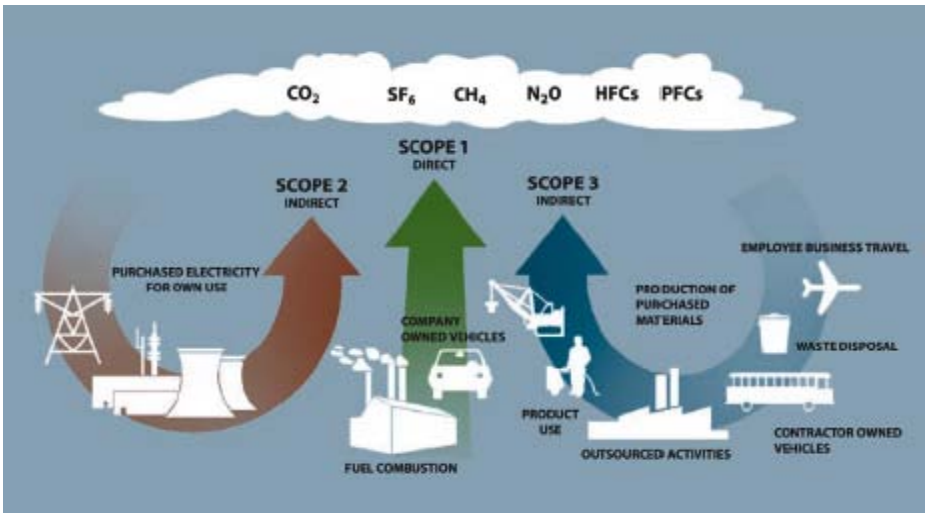
With the increased interest by organizations in GHG accounting, there has been greater attention focused on the question of how to account for the carbon benefits of renewable energy. Trexler, a consultant on GHG accounting, notes that "while RECs are not an appropriate substitute for carbon offsets, companies should be able to use them as one component of achieving carbon neutrality" (Bayon et al. 2009, p. 63). This section explores the treatment of RECs and other forms of renewable energy purchases in carbon accounting.

Treatment of Renewable Energy Purchases in GHG Reporting Programs

To fully understand how renewable energy purchases are treated in corporate or institutional GHG inventories, it is important to understand how most voluntary GHG reporting programs distinguish between direct and indirect emissions. The World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) GHG Protocol Corporate Accounting and Reporting Standard (WRI and WBCSD 2004) serves as the basis for most public GHG reporting programs and a guide for many corporations that develop internal GHG inventories. This standard distinguishes between direct and indirect GHG emissions:

- *Direct emissions*—those directly emitted and under the control of the reporting entity (e.g., vehicles and on-site power generation facilities)
- *Indirect emissions*—those that are not directly emitted or under the control of the reporting entity (e.g., electricity purchased from a utility) (see Figure 2).

Direct emissions are generally referred to as *scope 1* emissions, while indirect emissions associated with power purchases are generally referred to as *scope 2* emissions. *Scope 3* emissions are indirect emissions associated with the manufacturing of purchased products or other lifecycle emissions. Renewable energy purchases are generally matched with purchased electricity (i.e., scope 2 emissions); whereas offsets can theoretically be matched against any type of emissions—direct (scope 1) or indirect (scope 2 or 3) emissions.



Source: WRI and WBCSD 2004

Figure 2. Overview of scopes and emissions

Several voluntary GHG reporting programs have emerged in recent years to enable corporate and institutional customers to publicly report their GHG emissions and demonstrate progress toward meeting reduction goals. These programs are all structured upon the basic framework of accounting based on emissions scopes outlined in the WRI GHG Protocol. However, the detailed treatment of individual measures differs among inventory programs to some degree.

Below, the leading voluntary public GHG reporting programs are reviewed, with a focus on their treatment of green power and RECs. The focus here is on programs in which detailed guidance is provided to participants on how to calculate and report emissions in inventories.[13] Then some specific similarities and differences among the approaches are highlighted. The programs are summarized in Table 1.

[13] For instance, the Carbon Disclosure Project (https://www.cdproject.net/en-US/Pages/HomePage.aspx) enables companies to publicly disclose their greenhouse gas emissions but it does not provide detailed guidance on how to calculate emissions or reductions from mitigation activities. Therefore, we do not address it in this section.

Table 1. Overview of Voluntary GHG Reporting Programs

GHG Reporting Program	Year Begun	Number of Organizations Participating	Method of Accounting for Green Power Purchases
EPA Climate Leaders	2002	194	Reported as adjustment to scope 2 emissions
The Climate Registry - General Reporting Protocol	2007	432	Reported as supplemental information to scope 2 emissions
The Climate Registry - Climate Registered Pilot Program	2009	13	Reported as an adjustment to scope 2 emissions
Local Government Operations Protocol	2008	Estimated at ~300	Reported as supplemental information to scope 2 emissions
Federal Guidance on Executive Order 13514	2010	56[a]	Reported as an adjustment to scope 2 emissions

[a] Number of federal agencies that have submitted Strategic Sustainability Performance Plans, as required by Executive Order 13514.

EPA Climate Leaders Program

The EPA Climate Leaders Program[14] is a voluntary program under which companies develop long-term climate change goals and develop a corporate-wide GHG inventory to track progress. The program's inventory requirements are based on the *Corporate Standard* developed by WRI and WBCSD. Climate Leaders recognizes internal reductions including efficiency, on-site renewable energy, project-based offsets, and green power purchases (including bundled renewable electricity as well as unbundled RECs).[15] In September 2010, EPA announced that it would be phasing out its Climate Leaders Program over the next year and encouraged its participating companies to join another state or non-governmental program. However, it is still useful to examine how the program has addressed GHG accounting of green power, as it provides perspective on how EPA has addressed these issues to date. EPA plans to continue to provide technical assistance on GHG accounting issues.

Renewable energy purchases and RECs can be used to adjust GHG inventory emissions if the RECs meet all the resource eligibility and the additionality performance standard specified by EPA. Partners are able to use green power purchases to reduce GHG emissions associated with their purchased power or scope 2 emissions. Scope 2 emissions can be reduced by the difference

[14] For further information, see http://www.epa.gov/climateleaders/index.html. Accessed July 6, 2010.
[15] For additional information on Climate Leaders protocols for offsets and green power, see http://www.epa.gov/climateleaders/resources/optional-module.html. Accessed July 6, 2010.

between the avoided emission rate and the project emission rate (typically zero for renewable energy), multiplied by the amount of green power purchased.[16]

For on-site renewable generation, no adjustment to the GHG inventory is required, as it will be reflected in GHG inventory (as either a reduction in scope 1 emissions if the project is displacing on-site fossil fuel generation or scope 2 emissions if the project is displacing purchased electricity). However, if the partner sells RECs from its on-site power generation facility, then the remaining energy generation cannot be counted toward GHG reductions; instead, the partner must attribute emissions to the on-site generation, using the EPA's Emissions & Generation Resource Integrated Database (eGRID) non-baseload sub-regional grid emission factor.[17]

Climate Leaders also allows offsets to be used to reduce scope 1, 2, or 3 emissions. The only offsets that can be used are those from eligible project types and for which the program has a methodology for calculating the reductions or other methods that it approves. As of December 2010, the program allows offsets from captured methane, landfill methane, manure management, and reforestation/afforestation projects.

The Climate Registry

The Climate Registry (TCR)[18] is a non-profit organization that provides standards for businesses and governments to calculate, verify, and publicly report their North American carbon footprints in a single, unified registry. TCR supports both mandatory and voluntary reporting programs and is guided by a Board of Directors comprised of 41 U.S. states and the District of Columbia, 13 Canadian provinces and territories, 6 Mexican states, and 4 Native Sovereign Nations. TCR was established in 2007 as an extension of the California Climate Action Registry (CCAR), which has been helping companies in California voluntarily report direct and indirect emissions from their operations since 2001.

TCR's General Reporting Protocol (GRP) gives entities the option to report renewable energy purchases as supplemental information to their scope 2 emissions data. The GRP calls for entities to report their scope 2 emissions based on the system average emissions mix but entities can calculate the benefits of green power purchases and provide that as supplemental information.[19] However, there is no direct adjustment for renewable energy purchases, as in the Climate Leaders program.

TCR is currently conducting a pilot program in which renewable energy purchases (including RECs) can be used to adjust scope 2 emissions (Foran 2010). The program, called the Climate Registered Program, was announced in December 2009 and is designed to recognize leading organizations that meet GHG emissions reduction goals consistent with the program's silver,

[16] For further information on Climate Leaders guidance on GHG accounting for green power and RECs, see http://www.epa.gov/climateleaders/documents/greenpower_guidance.pdf. Accessed November 22, 2010.
[17] The EPA's Emissions & Generation Resource Integrated Database (eGRID) provides data on power plant emissions, such as pounds of carbon dioxide per megawatt-hour of generation, on regional and sub-regional levels.
[18] For further information, see http://www.theclimateregistry.org. Accessed November 22, 2010.
[19] For further information, see page 101 http://www.theclimateregistry.org/downloads/GRP.pdf.Accessed November 22, 2010.

gold, and platinum leadership levels.[20] Under the program, participating organizations can use renewable energy purchases (including RECs) or offsets to meet a portion of their GHG reduction goals. The green power purchases can be reported as an adjustment to scope 2 (purchased electricity) emissions by matching the megawatt-hours of green power or RECs with the megawatt-hours of electricity purchases, starting with the electricity purchases in the cleanest region. For example, a company that purchases electricity for facilities in California and Illinois would first credit the green power purchases against the electricity consumed in California, which has a lower regional GHG emissions rate.

In contrast to the Climate Leader's methodology, the Climate Registered pilot does not rely on estimating the avoided emissions based on the region in which the renewable energy generator supplying the green power is located. Instead, this methodology allows organizations to reduce the megawatt-hours of purchased electricity with estimated emissions based on regional grid emissions factors in which the organization is located and by the megawatt-hours of zero-emitting green power they have purchased.

The pilot program guidance states, "the Registry views the purchase of a REC in a corporate inventory as a means of contractually demonstrating the consumption of one MWh of zero emissions power. While there is not a guarantee that a REC constitutes a reduction of global carbon, when purchased by an organization it can demonstrate a reduction in corporate responsibility for indirect emissions."[21]

Under the pilot program, participating organizations will report two scope 2 emissions levels: (1) an unadjusted estimate of emissions based on the local emissions of the purchased electricity (using EPA eGRID regional emissions factors), and (2) an adjusted estimate of emissions including any Registry-accepted utility-specific emission factors and any renewable energy purchases or offsets (TCR 2010). The Climate Registered pilot runs through the end of 2010, after which the charter members will submit their reports. TCR plans to review the pilot in the spring of 2011.

TCR has also developed a protocol for the power sector that allows utilities to include the environmental benefits of RECs in the descriptions of the power they deliver to their consumers, thus enabling consumers to include the GHG emission profile of RECs in their own scope 2 emissions.[22] Under TCR's Electric Power Sector Protocol, utilities have the option to report utility-specific "delivery metrics" that represent the emission characteristics of the power they are delivering to their consumers and, as part of that, reflect REC purchases made to comply with a renewable portfolio standard (RPS) or to supply a green power program. This optional delivery metric is separate from what the utility reports as its "generation metric," which includes only the power generation owned by the utility. The optional delivery metrics are

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[20] News Release, "North American Government and Industry Leaders Unite to Launch Climate Registered Program,: December 14, 2009 http://www.theclimateregistry.org/downloads/2009/05/North-American-Government-and-industry-leaders-unite-to-launch-Climate-Registered-program.pdf

[21] Climate Registered Leadership Program: Draft Accounting and Reporting Requirements, p 4-5 http://www.theclimateregistry.org/downloads/2010/08/Draft-Climate-Registered-Leadership-Program-Reporting-Requirements.pdf, accessed January 13, 2011

[22] For more information on the electric sector protocol, see http://www.theclimateregistry.org/resources/protocols/electric-power-sector-protocol/. Accessed July 6, 2010.

designed to be used by organizations located in the utility's service territory; an organization participating in the utility's green power program could thus use a delivery metric provided by the utility that accounts for the REC purchases made by the utility to supply the green power program. The protocol does not yet provide guidance on how to account for RECs sold by a utility.

Local Government Operations Protocol

In 2008, a consortium of organizations collaborated to develop the Local Government Operations (LGO) Protocol, a program-neutral GHG protocol that is designed to allow local governments throughout the United States and Canada to quantify and report GHG emissions resulting from their operations.[23] Contributors to the Protocol included the California Climate Action Registry (CCAR), the California Air Resources Board (CARB), ICLEI Local Governments for Sustainability (ICLEI), and TCR. The main body of the LGO Protocol (Parts 1–4) contains general guidance. Each of the contributing programs has developed supplemental guidance with additional details in its own program-specific appendix. The LGO Protocol partners encourage local governments to develop a baseline emissions inventory and then update their inventory on an annual basis.[24]

The LGO Protocol does not allow deductions from scope 2 emissions for local governments that purchase renewable energy or RECs. However, local governments are encouraged to report renewable energy purchases as supplemental information in their GHG inventories and as measures in their climate action plans. In the LGO Protocol, this supplemental information is called an "Information Item" and includes RECs, green power purchased from electric suppliers, and carbon dioxide from biogenic fuels. Although no formal reporting mechanism exists for local governments to centrally report their Information Items, ICLEI is working to improve its collection of inventory data to create a robust picture of its members' emissions and reduction measures. ICLEI is also planning to create a protocol or guidance document for local governments to follow when quantifying the effect of emission reduction projects (Ewing-Thiel 2010).[25]

For local governments generating on-site renewable energy, the LGO Protocol does not require any adjustment. The generation from the on-site system will decrease the grid electricity that is purchased, therefore decreasing scope 2 emissions. The LGO Protocol currently does not require any adjustment of reported emissions if RECs are not retained with on-site systems. Local governments can report offsets they purchase and retire as supplemental information.

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[23] For further information, see The Local Government Operations Protocol http://www.icleiusa.org/programs/climate/ghg-protocol/local-government-operations-protocol. Accessed August 9, 2010.

[24] ICLEI, an association of local governments interested in sustainable development, is currently in the process of developing another protocol for local governments to provide a standard methodology for measuring emissions from an entire city or jurisdiction and plans to release the protocol in mid-2011. Like the LGO Protocol, the Community Protocol will focus on a baseline accounting of emission without delving into guidance or recommendations on specific emissions reduction measures.

[25] This document will provide a national standard for emissions reductions accounting and will build off of ICLEI's existing tools like the Climate and Air Pollution Planning Assistant. The process for developing this measure's standard will follow that of the LGO Protocol and the Community Protocol with ICLEI assembling a steering committee, technical committees, and planning public comment periods over the course of 6 months to a year. The process will begin in mid-2011 with an expected completion date of mid-2012.

Federal Guidance on Executive Order 13514

Executive Order 13514 was signed on October 5, 2009, and requires federal agencies to make reduction of GHG emissions a priority. Each federal agency is directed to establish a percentage reduction target relative to a fiscal year 2008 baseline and to complete a GHG inventory of fiscal year 2010 emissions by January 31, 2011. The Federal GHG Accounting and Reporting Guidance ("Guidance") was developed by the Department of Energy's Federal Energy Management Program (FEMP) in coordination with other federal agencies. The final Guidance was released on October 6, 2010.[26]

According to the Guidance, federal agencies may reduce their scope 2 emissions by purchasing renewable energy or RECs. Purchases of electricity from renewable energy generators must include ownership of the RECs in order for it to qualify as renewable. The Guidance requires GHG emissions adjustments for renewable energy purchases to be calculated based on the non-baseload eGRID emission rate of the region where the renewable generator is located.

On-site renewable generation, when the associated RECs are owned by the agency, will reduce scope 1 emissions if the renewable generation is displacing on-site non-renewable generation. If the on-site renewable generation is displacing purchased electricity, scope 2 emissions will automatically be reduced. If an agency does not own the RECs from their on-site renewable generation, the agency must adjust its scope 1or scope 2 emissions by reporting emissions for the electricity associated with the REC as if it were conventional electricity by using the emissions factor for the eGRID sub-region of the on-site renewable generation system. The federal guidance also requires federal agencies to report transmission and distribution losses associated with electricity purchases from utilities or retail suppliers in scope 3. The use of on-site systems eliminates the need to report these emissions and therefore reduces scope 3 emissions.

The Guidance does not currently allow offsets to be used to reduce an agency's emissions because "the area of carbon offsets is broad…[and] more time and deliberate focus is necessary in understanding how the market for carbon offsets and use of those offsets could be applied consistently across the Federal community" (The White House 2010, p. 28).

Other Guidance on Renewable Energy GHG Accounting or Environmental Claims

In addition to guidance from GHG reporting programs and protocols, the International Standards Organization (ISO) has developed a standard on GHG accounting, the Federal Trade Commission (FTC) is in the process of updating its Guides for the Use of Environmental Marketing Claims, or "Green Guides," and WRI has initiated a stakeholder process to develop guidance on accounting for green power purchases.

Similar to the GHG Protocol Corporate Accounting and Reporting Standard, in 2006, the ISO completed its standard on GHG accounting. The ISO 14064 standard does not endorse any particular methodology for addressing renewable energy in GHG accounting but rather identifies best practices for management, reporting, and validation and verification of GHG assertions. The standard requires "GHG emissions or removal factors that are derived from a recognized origin, are appropriate for the GHG source or sink concerned, are current at the time of

[26] For further information, see the Guidance for Federal Greenhouse Gas Accounting and Reporting, http://www.whitehouse.gov/sites/default/files/microsites/ceq/GHG%20Guidance%20Document_0.pdf. Accessed October 6, 2010.

quantification, take into account the quantification uncertainty and are calculated in a manner intended to yield accurate and reproducible results, and are consistent with the intended use of the GHG report" (ISO 14064-2:2006).

The FTC is currently updating its Green Guides. These FTC guidelines are not specific guidance for corporate GHG accounting but relate to how corporations need to substantiate environmental claims and thus have relevance for using renewable energy to meet emissions goals. For the first time, the document (as proposed) includes guidance on making renewable energy claims and specifies that renewable energy claims cannot be made by a marketer who generates renewable energy but sells the associated RECs (FTC 2010). Further, the proposed FTC guidance would prohibit any renewable energy or emissions claims from on-site facilities that do not retain the associated RECs. The FTC requested public comment by December 10, 2010, and will subsequently issue final guidance on the Green Guides.

WRI has initiated an effort to develop guidelines for GHG accounting and reporting for green power. A stakeholder workshop was held in the United States in December 2010, and WRI plans to develop draft guidance for comment by spring of 2011 (WRI 2010). These guidelines aim to address technical accounting issues for green power purchases and renewable-energy-derived offsets.

Comparison of GHG Reporting Program Treatment of Renewable Energy and RECs

This section discusses some of the key issues for the treatment of green power purchases and RECs in GHG inventories, including key differences and similarities among rules established by some of the leading voluntary GHG reporting programs. One underlying difference is that some programs require organizations to report GHG emissions and then separately document reduction instruments, while others only require reporting emissions that have already been adjusted to account for these reductions. Therefore, the program rules affect the way in which renewable energy and other measures are applied and reported. Also, some of the programs are still in the process of developing more detailed guidance for the treatment of external reduction measures not otherwise captured in the GHG inventory, including RECs and offsets.

- *Reporting green power and REC purchases.* Most GHG reporting programs allow for RECs and renewable energy purchased through retail electric providers to be recognized or reported in some way. Climate Leaders and the federal Guidance allow organizations to adjust their scope 2 emissions to account for renewable energy purchases. TCR's Climate Registered pilot program requires the reporting of a baseline inventory and then allows for the quantification of an adjusted scope 2 total to account for utility-specific emission factors and REC purchases. Therefore, green power purchases can be used to meet carbon reduction goals under all of these programs. While the LGO Protocol and TCR's General Reporting Protocol do not currently allow a direct adjustment of scope 2 emissions, they allow renewable energy purchases to be reported as supplemental information to the baseline GHG inventory. The supplemental information, including any green power purchases, reported to ICLEI or TCR provides data on how local governments are meeting their internal GHG reduction targets.

- *Crediting on-site renewable energy systems when RECs are not retained.* In GHG inventories, reporting entities with on-site renewable electric generation systems will see reductions in their scope 2 emissions, as the output of the on-site system requires the owner to purchase less electricity from the utility.[27] Thus, reporting the emissions benefits of on-site renewable energy systems will be automatically reflected in the inventory as reductions in scope 2 emissions. However, if the reporting entity sells the RECs associated with its on-site renewable generation, it can no longer claim the renewable benefits of the generation. Some GHG reporting programs have developed methodologies that require organizations that sell the RECs from on-site renewable generation to adjust their inventory emissions upwards to reflect the fact that they have sold off the claim to the renewable energy.

  EPA's Climate Leaders program requires that partners report the indirect emissions associated with the electricity equivalent to the RECs sold from the on-site renewable facility, using an emission factor for the region where the renewables are being generated. Similarly, the federal Guidance requires agencies to report conventional grid electric emissions if RECs from on-site facilities are not retained. The LGO Protocol and TCR's Electric Power Sector Protocol do not specifically address the sale of RECs from on-site renewable generation.

- *Reporting emissions when load-serving entities purchase RECs.* TCR has developed a methodology for treating unbundled RECs purchased by load-serving entities (e.g., utilities) that are reporting utility-specific delivery metrics, although most other reporting programs have not addressed this issue to date. A utility might develop a specific delivery metric for a green pricing program, for example, so that participating customers can reflect the zero or low emissions profile of that product in their inventory. In its Electric Power Sector Protocol,[28] TCR has an option through which utilities or load-serving entities can account for unbundled REC purchases in a delivery metric that can be used by the utility's customers to quantify their own scope 2 emissions. This method is only for unbundled REC purchases because when RECs are bundled with electricity and the power flows in the utility or load-serving entity's system, they are inherently reflected in the delivery metric. Utilities that purchase unbundled RECs (separate from electricity) can reflect the zero or low emissions profile of the renewable generator that was the source of the RECs in their utility-specific power delivery metric.

- *Accounting for the emissions benefits of RECs.* One notable difference between reporting program methodologies is the approach to calculating the emission benefits of RECs. One method is to convert REC purchases to carbon dioxide emissions avoided based on the location of the generator before crediting against scope 2. Another method instead bases the credit on the emissions profile of the RECs (e.g., wind energy has zero emissions) and subtracts the megawatt-hours of green power purchased from the megawatt-hours of the reporting entity's purchased electricity. This is an issue primarily for REC purchases, as opposed to bundled renewable

[27] If the on-site renewable generation is displacing on-site fossil fuels (or non-renewable generation), no adjustment is needed, as the organization will have reduced scope 1 emissions from the displaced on-site generation.
[28] For more information on the electric sector protocol, see http://www.theclimateregistry.org/resources/protocols/electric-power-sector-protocol/. Accessed July 6, 2010.

electricity, because the renewable energy generators providing RECs may not be in the same region in which the organization is purchasing electricity; thus, the amount of emission reductions embodied in the credit may differ depending on the location.[29]

Climate Leaders and the federal Guidance convert green power and REC purchases to carbon dioxide emissions avoided before crediting those emissions reductions against scope 2. In contrast, TCR's Climate Registered pilot program credits RECs on the basis of the green power product's emissions profile but with the further restriction of crediting the renewable energy first against the reporting entity's electricity purchases from regions with the lowest emissions profile.

The avoided emission approach, which is similar to a calculation method for offsets, is based on the emissions impacts of the renewable energy generation on the grid, and thus might more accurately reflect the change in actual grid electricity emissions. On the other hand, focusing on the emissions profile of the renewable generator providing the RECs is advantageous because it would be consistent under policies that can impact the disposition of avoided emissions, such as carbon caps. Also, the emissions profile approach does not require the purchaser to know the exact location of the renewable energy generation. Location information may not be disclosed to purchasers of some REC products (i.e., some products may be sourced from a variety of generators in different regions). Perhaps more importantly, the emissions profile approach would not encourage organizations to seek RECs from regions with higher carbon dioxide emissions levels, which would enable them to procure fewer RECs to adjust their scope 2 emissions.

- *Accounting for carbon offsets (including offsets derived from renewable energy sources).* GHG reporting programs vary with respect to the treatment and definition of eligible carbon offset types. The federal Guidance does not allow for the use of carbon offsets at this time. The Climate Leaders program primarily allows carbon offset project types for which it has created protocols. While no protocol has been developed for renewable energy sources that generate electricity, the program may allow offsets from other proposed project types subject to program review, which could theoretically include offsets derived from renewable electricity generation that meet offset standards. Protocols do exist for renewable energy projects that result in methane reductions. The TCR pilot program allows carbon offsets that meet specific offset certification standards (e.g., VCS); thus, offsets derived from renewable energy sources that meet those standards could be counted toward carbon goals under the pilot program. TCR and the LGO Protocol baseline inventories would allow offsets to be supplied as supplemental information, but ICLEI has not developed specific guidance on the use of offsets as measures to meet municipal carbon reduction goals.

[29] The avoided emissions of a renewable energy facility can vary significantly if it is in a region with a large amount of coal or a region with a low-emissions profile electricity mix with a significant fraction of hydropower, nuclear, or natural gas. For example, the average emissions factor in the Northeast Power Coordinating Council is 876 lbs CO_2/MWh while the eGRID average emissions factor in the Midwest Reliability Organization is 1,824 lbs CO_2/MWh (see Appendix B). Thus, an organization wishing to displace all of its scope 2 emissions with RECs could purchase fewer megawatt-hours of RECs from a region with a dirtier power mix.

Other Issues Related to Carbon Accounting for Green Power

Aside from the methods and reporting issues already discussed, some issues have not been comprehensively addressed by GHG reporting programs to date. Also, some questions have arisen in the debate about how to properly account for emissions. This section explores these issues and questions in further detail.

Are Average Emissions Rates Used in Carbon Accounting Impacted by Voluntary Green Power Purchases?

An issue that has been raised is how to account for voluntary renewable energy purchases in emissions factors that are used to estimate scope 2 emissions. Gillenwater (2008c) characterizes this issue as follows:

> When organizations calculate their indirect GHG emissions from electricity consumption [scope 2 emissions], they typically use an average emissions factor for all generation supplied to the grid. This factor includes electricity from renewable generators that green power market consumers claim as their zero-emitting electricity. The absence of a mechanism to exclude everyone else on the grid from claiming this zero-emitting power as part of their average mix causes the basic definition of ownership to be violated. Under these conditions, green power market consumers cannot claim to be purchasing zero-emitting electricity (pp. 15–16).

Gillenwater (2008c) proposes that this problem could be solved by using a "credible and consistent average scope 2 emissions factor for the grid that nets out green power participation and REC retirements, which could be published and regularly updated" (p.16). However, the challenge is that data are not readily available today with respect to the magnitude and emissions profiles of voluntary purchases by region to make such adjustments to regional avoided emissions rates. Eventually, REC tracking systems may be able to provide such data, but they would have to make that data available on a uniform basis, which most systems currently do not.[30] Further, as most GHG reporting programs rely on EPA eGRID data for regional emissions data, there would need to be coordination with the EPA eGRID program to accomplish such a task. Another challenge is that there is a several year lag in the emissions data reported in eGRID.

To determine the relative magnitude of this issue, it is possible to estimate the impact of including voluntary green power purchases on national average emissions. National average system emissions can be calculated by using eGRID data on carbon dioxide emissions from electricity generation and Energy Information Administration (EIA) data on the retail sales and direct use of electricity. The effect of selling RECs to the voluntary market can be accounted for by subtracting voluntary green power purchases from total retail sales and direct use of electricity. Using 2008 and 2009 estimates of the size of the voluntary green power market, the difference between netting out voluntary purchases and not netting them out is about 0.4%–0.5%. The Center for Resource Solutions has also estimated the difference at less than 0.5% (CRS 2009). Regional emissions rates might be more heavily affected if renewable energy purchases are concentrated in a particular region, but given the magnitude of the national effects,

[30] Currently, only NEPOOL-GIS, and PJM-GATS track all generation in their region.

this is likely not a concern at current purchase rates. To address this issue, TCR's Electric Power Sector Protocol specifies that in future reporting, regional emission factors will be adjusted if the amount of voluntary purchases claimed would result in a change of more than 5% to any regional emission factor.

While this issue is inconsequential currently because of the small impact on emissions rates, it could become more important if voluntary markets grow considerably. Therefore, efforts to create adjusted emissions data would be useful even though the current error introduced in inventory calculations is negligible.

Should Green Power Be Subject to Further Eligibility Requirements or Pass Additionality Tests to Be Used in Carbon Accounting?

Another question is whether green power should be subject to further eligibility requirements or "additionality" tests to be used to displace emissions in carbon accounting. Most GHG reporting programs have some eligibility requirements for green power and RECs, such as facility on-line dates, eligible technologies, and requirements that the RECs cannot also be used to meet regulatory requirements (which is akin to regulatory additionality). However, most do not currently require green power or RECs to meet other additionality tests.[31]

The EPA Climate Leaders program does require green power and RECs to meet a performance-based additionality test in order for them to be used as an adjustment to purchased electricity emissions in participants' inventories (EPA 2008). This requirement means that only renewable energy sourced from eligible technologies can be used to adjust emissions. The performance threshold is designed to identify technologies that are not business-as-usual and that have carbon emissions lower than the performance benchmark.

Applying additionality requirements to green power and RECs blurs the distinction between green power and renewable-energy-derived offsets. As discussed earlier, renewable energy projects that meet offset standards, including additionality tests, could potentially be used to offset emissions in any scope (1, 2, or 3). If green power and RECs are indeed distinct from offsets, as discussed earlier, it may be reasonable to have different eligibility requirements for each type of product. If green power represents the emissions profile of the underlying renewable electricity, not avoided emissions as in the case of offsets, it would not need to demonstrate that the emissions reductions were additional to a business-as-usual baseline.

Also, the need for demonstrations of additionality may differ by scope. Arguably, additionality may be more important for offsetting direct GHG (scope 1) emissions, because scope 1 inventories are designed to reflect actual emissions to the atmosphere, whereas scope 2 emissions represent an entity's portion of electricity generation emissions, already reported by the generation owner in scope 1. Thus, it may be more important to hold offsets applied to scope 1 emissions to stricter additionality standards.

[31] As noted earlier, green power markets have procedures in place to ensure that green power is in addition to that required by regulations (which is akin to regulatory additionality in offset markets). Most states with RPS policies in place do not allow the same REC to be used for RPS compliance and be sold into the voluntary market—it can only be used in one market. This is also a requirement of the EPA Green Power Partnership program, which works with most of the major organizations that purchase green power, and the Green-e certification program, which is the leading certifier of green power transactions.

This issue largely remains an open question and may deserve further consideration. Aside from a performance-based metric used by Climate Leaders, other approaches to addressing additionality or limiting the eligibility of RECs or other forms of green power when used for emissions adjustments in GHG accounting may also be feasible.

Factors that could be considered include:

(1) specifying that green power can only be derived from new renewable energy facilities that meet more stringent facility on-line dates than currently required

(2) requiring the renewable energy be derived from the region in which they are being matched to load[32]

(3) requiring that the green power be from generation that is eligible to meet RPS requirements (Gillenwater 2008a)

(4) requiring that purchase contracts be for a certain duration (e.g., 3 years or more)

(5) placing limitations on the renewable energy project size, as often small projects are more expensive and need more forms of support

(6) applying a discount factor to the renewable energy purchases used to displace scope 2 emissions, an idea proposed for carbon offsets (Kollmuss et al. 2010).

There are advantages and disadvantages to all of these approaches that are beyond the scope of this report to address. Another consideration is whether it is feasible for GHG reporting programs to establish detailed additionality or eligibility criteria or whether such programs should rely on product certification standards already developed in the marketplace.

Will Carbon Accounting Practices for Green Power Need to Change if a Carbon Emissions Cap is Established?

One regional cap and trade program has already been implemented on the electric sector in the United States, and there is a possibility that future emission caps could be established, as other regional programs are under development and federal policy has been recently considered by Congress. Will the implementation of carbon cap and trade programs in the United States affect the accounting of green power in GHG inventories?

The concern is that under an emissions cap on the power sector, renewable energy generation would not necessarily reduce total emissions. Under current cap and trade designs, the emitting entities (i.e., the fossil fuel plants) generally receive emissions allowances (each representing a ton of carbon dioxide) or purchase them through an auction. If a power plant emits less carbon dioxide because it is displaced by a renewable energy generator, it would need to retire fewer allowances to cover its emissions, freeing up allowances for it to sell to other emitters. As a result, the overall emissions level would remain at the level of the cap.

[32] This would prohibit entities from procuring RECs from the most cost-effective projects nationally but rather encourage purchases from a diversity of regions, including those with more modest renewable resource potential (e.g., lower wind speeds).

The potential inability of renewable energy generation to affect total emissions under a cap has lead to questions about whether green power purchases could be reflected as emission mitigation measures in GHG emissions inventories. The answer may depend on whether the basis of the adjustment is on the emissions profile of the renewable energy generator or on the avoided emissions of the renewable energy facility. The emissions profile of the renewable generation (e.g., zero emissions from wind) will remain unchanged even if carbon emissions caps are adopted. However, under a traditional cap without set asides (as discussed below), it would not be possible to justify a change in avoided emissions.

Another consideration in determining how to account for green power in GHG inventories under emissions caps is consistency with the accounting for energy efficiency and on-site renewable electric generation. The inability to affect total emissions under an electric sector cap pertains to on-site renewable generation facilities and energy efficiency, as well as green power purchases. However, emissions caps would not affect the reporting of efficiency or on-site renewable energy systems in GHG inventories, because the emissions displacement occurs automatically. Efficiency and on-site renewable electric facilities reduce the need for purchased electricity, so reporting entities automatically report fewer scope 2 emissions.

Arguably, if green power purchases are reflected as adjustments to scope 2 emissions based on the emissions profile (e.g., zero emissions) of the renewable generation facility, such an approach would not need to be modified under an emissions cap. This is logical in that it would be consistent with GHG inventory treatment of on-site renewable electric systems and efficiency under emissions caps.

While on-site renewable systems, efficiency, and green power would not necessarily reduce total GHG emissions under an emissions cap (e.g., without set-asides), it would still be logical for them to be reflected in scope 2 emissions inventories once a cap is implemented. Scope 2 emissions are not intended to represent direct or global GHG emissions as scope 1 emissions are, but rather are intended to represent the emissions associated indirectly with the reporting entity's electricity consumption, which physically take place outside of the entity's GHG inventory boundary. Furthermore, companies and organizations, including those that are not regulated emitters, will continue to address their electricity emissions even if carbon cap and trade programs are adopted, and the need to reflect their mitigation actions in voluntary, public GHG inventories will continue to be important.

How Does Carbon Accounting Function under a Voluntary Market Set-aside in Cap and Trade?

The use of set-asides in cap and trade programs for voluntary renewable energy purchases may require examination of how best to report such purchases in GHG accounting. For example, the Regional Greenhouse Gas Initiative, the only operating emissions cap and trade program in the United States covering 10 states in the Northeast, includes a voluntary renewable energy set-aside for consumers and businesses that purchase renewable energy. All states but one participating in RGGI retire a portion of allowances equivalent to the emissions avoided by voluntary purchases of renewable energy.[33] The program is designed to ensure that consumers

[33] For additional information on voluntary market set asides in participating RGGI states, see Holt 2008 and http://www.epa.gov/greenpower/events/oct23_webinar.htm. Accessed November 22, 2010.

are able to affect carbon emissions levels with their voluntary actions, and it enables them to essentially make the emissions cap more stringent. Similar provisions are under consideration in California and the Western Climate Initiative (WCI).[34]

Under this type of set-aside program, a reduction in emissions below the cap (because of the retired allowances) is clearly attributable to the voluntary renewable energy purchaser. Could renewable energy purchases be used to offset scope 1 or scope 3 emissions in this case? One argument for doing so is that the renewable energy results in an unambiguous reduction in emissions and that the ownership of that reduction is clear. However, to be considered an offset, there may be a need to ensure that the emission reduction is in addition to a business as usual scenario. For example, in the case of a cap in which allowances are over allocated, the retirement of the allowance might not result in an additional emission reduction.

Implementation challenges may arise by allowing some renewable purchases to count toward scope 1 emissions, while others are able to count only for scope 2 emissions. If the adoption of such set-aside programs among regional cap and trade programs were inconsistent, only some renewable energy purchases would be eligible for an adjustment of scope 1 or scope 3 emissions. This would add a degree of complexity in verification of reported GHG adjustments, but data could be obtained from REC tracking systems and state cap and trade administrators to verify that the purchase was associated with an allowance retirement.

Currently, to the authors' knowledge, existing GHG reporting programs make no distinction for renewable energy under set-aside programs. However, it is an issue that may deserve additional consideration, particularly if similar policies are adopted by other regional or federal cap and trade programs.

[34] The preliminary draft rules issued recently in California include a similar provision (CARB 2009), but federal proposals do not, as of July 2010. The WCI has included an optional set-aside mechanism in its program design. It will be up to each WCI partner jurisdiction to decide whether to adopt the mechanism. The Midwest Greenhouse Gas Reduction Accord has not yet addressed the issue.

4 Double Counting: Carbon Dioxide and RECs

Another question that arises when renewable energy facilities are eligible to participate in carbon offset markets is whether the REC and the carbon dioxide embodied in an offset credit can be sold separately from the same megawatt-hour of renewable energy generation. The question of double counting pertains to the situation where a REC is sold to an entity for compliance with an RPS or to a voluntary purchaser of renewable energy, while the avoided carbon dioxide emissions from the same megawatt-hour of renewable generation are sold separately into the voluntary carbon market.

Most certification programs or standards do not allow the same megawatt-hour of renewable energy generation to be sold as both a REC and as metric tons of carbon dioxide avoided. Under CCX, the RECs and associated environmental attributes had to be retired (for the portion of the project output sold into CCX) for renewable energy projects to count as an offset. Therefore, the same output of these projects cannot be resold in voluntary markets or used for compliance with a state RPS.

Similarly, the Green-e Climate and Green-e Energy programs also do not allow the same megawatt-hour of renewable generation to be sold separately as both a REC and avoided metric tons of carbon dioxide. The Green-e Climate Standard states, "When a GHG reduction claim is made on the basis of a REC, the REC must be retired in the tracking system (or reserved in NEGIS or PJM GATS) and cannot be resold or claimed for any other purpose or by any other party. For each generator from which GHG emission reductions are included in a GHG reduction product, the generator owner or its authorized representative must sign a legally binding attestation that they understand and agree to comply with the above requirements" (Green-e 2010). However, projects that generate electricity and result in methane emissions reductions, such as landfill gas projects, can generally sell RECs associated with the facility's electric generation and offsets associated with the methane reductions.

With respect to state RPS policies, it is often unclear whether a state would allow a carbon offset to be sold separately when a megawatt-hour of renewable energy (or REC) is used for RPS compliance. Most state RPS regulations do not address this issue directly or are ambiguous about whether the carbon dioxide emissions benefits could be sold separately. A handful of states require that any derived emissions benefits be included with the REC used for RPS compliance, while at least three states do not require the inclusion of carbon dioxide or other emissions (Holt and Wiser 2007). In the remaining states, it is largely unclear. Many states generically define a REC as including environmental attributes but without specifying exactly what that means (Holt and Wiser 2007). WREGIS, the REC tracking system that encompasses most the western United States, requires a REC to contain all of the direct and indirect carbon attributes.

If carbon dioxide emissions caps are implemented, the disposition of the avoided emissions would be determined based on the design of the cap and trade program. Under traditional cap and trade program design, renewable energy sources would not be eligible to sell avoided emissions because the fossil fuel emitters would likely take title to those emissions in the form of allowances. Therefore, renewable energy generators would not be able to sell the avoided carbon emissions in the form of carbon offsets unless there are specific set-asides or other provisions that allocate or credit renewables with the avoided carbon dioxide benefits.

5 Summary and Conclusions

As a no or low carbon emissions source for power generation, renewable energy is widely regarded as one part of the solution to rising GHG emissions. However, different approaches have been used to account for the carbon benefits of renewable energy. This paper has examined current practices and issues surrounding GHG accounting for green power and carbon offsets derived from renewable energy sources.

Green power and carbon offsets are widely considered distinct products, although both could be sourced from renewable energy. There is also overlap because the motivation to purchase both green power and carbon offsets may be driven to some extent by an interest in addressing carbon emissions and supporting low-carbon emitting technologies. One way to distinguish them is that green power is sold in kilowatt-hours and offsets are sold in metric tons of carbon dioxide equivalent. Purchasing green power is a method of procuring zero- or low-emission renewable energy equivalent to one's electricity consumption. Offsets represent reductions in carbon dioxide emissions. Further, and perhaps most importantly, green power and carbon offsets are not subject to the same certification standards, such as additionality requirements.

GHG accounting protocols also make distinctions in terms of what types of emissions each instrument can address. Generally, carbon offsets can be used to offset any type of emissions (including vehicle, travel, and heating fuels—scope 1, 2, or 3 emissions), while green power purchases have been limited to addressing only purchased electricity emissions (scope 2 emissions).

While green power and offsets differ, businesses and organizations that wish to address their own carbon emissions footprints may wish to use one or both of these instruments alongside other emission reduction options such as energy efficiency and conservation, fuel switching, and on-site renewable energy systems. The use of green power and offsets may be an important component of emission reduction plans, particularly for organizations wishing to achieve aggressive emissions reductions goals or that face barriers to installing on-site systems.

Based on a review of leading program practices, voluntary GHG reporting programs are consistent in allowing green power purchases to be applied to an entity's scope 2 emissions, which is logical in that it is consistent with how energy efficiency and on-site renewable energy systems are reflected in inventories. However, the reporting programs differ in their approaches to reporting and calculating the emissions benefits and in some cases rules are still unfolding. Some programs allow an adjustment to a reporting entity's inventory, while others allow green power or offset purchases to be provided as supplemental information.

One of the key differences is whether to calculate the avoided emission benefit of the REC based on its location or to use the emissions profile of the green power product (e.g., the zero emissions attributes of the wind energy). While the former approach may yield a more accurate estimate of the grid emissions impacts, the focus on avoided emissions is akin to an offset methodology. The latter approach has advantages in its simplicity, and it would avoid encouraging organizations to make smaller green power purchases by seeking RECs from regions with a more carbon-dioxide-intensive grid mix.

While the reporting of on-site renewable electric systems is generally straightforward because systems typically reduce the quantity of electricity purchased by the reporting entity (i.e., a reduction in scope 2 emissions), the ownership of RECs for on-site systems can complicate reporting. Some GHG reporting programs require on-site renewable electric facilities to retain the associated RECs to account for the emissions benefits.

An open question is whether REC purchases should be subject to further eligibility restrictions or additionality tests to be used as an adjustment to scope 2 emissions in inventories. The Climate Leaders program has instituted a performance-based requirement for green power and RECs, while other inventory programs have not. Additional guidance from leading programs and protocols would help to clarify remaining issues and provide guidance to the marketplace.

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Appendix A: Additionality Requirements of Selected Offset Standards

Table A-1. Additionality Requirements of Selected Offset Standards

Name of Program	How is Additionality Determined?
CDM	Specified by individual methodologies or additionality tool version 4 (not all steps are required): Step 1: regulatory surplus Step 2: investment analysis or barrier analysis Step 3: common practice Step 4: impact of CDM registration
JI	Requires either CDM requirements or demonstrated use of conservative assumptions based on comparability of the project with another Accredited Independent Entity determined (registered) project.
CCX	Additionality testing not as a distinct step. However, CCX rules explicitly define project eligibility requirements on the basis of these indicators: • beyond/before regulatory requirements, • new projects, and • highly unusual practices.
Gold Standard	CDM additionality tool version 4 and for both certified emission reductions (CERs) and verified emission reductions (VERs), previous announcement checks for all project types
Voluntary Carbon Standard (VCS)	Project-based test, based on CDM: Step 1: regulatory surplus Step 2: implementation barriers: investment barrier, technological barrier, or institutional barrier Step 3: common practice Performance-based tests are possible, but all approved methodologies are currently project-based.
VER+	Specific additionality requirements of CDM approved methodologies or most recent version of CDM additionality tool. Performance tests have not yet been developed.
The Voluntary Offset Standard (VOS)	Accepts CDM, JI, and Gold Standard CER and VER credits.
The Climate Trust	Project-based determination, using three tests: 1) regulatory surplus test 2) barriers test 3) common practice test
Green-e Climate Protocol for Renewable Energy	Requires all three tests: 1) the legal, regulatory, or institutional test; 2) the timing test; and 3) the performance and technology test

Appendix B: Calculating Avoided Carbon Dioxide Emissions from Renewable Electric Generation

The issue of converting megawatt-hours to metric tons of carbon dioxide arises when renewable energy facilities want to participate in carbon offset markets; some inventories also rely on such approaches to account for renewable energy purchases. Typically offset calculation methods are more involved than methods used for determining the benefits of green power purchases. This section focuses on methods for determining the carbon emissions benefits of renewable energy generation.

Most renewable energy sources are zero-emitting because there are no direct emissions from the generation source or the life cycle emissions are typically small.[35] *Direct emissions* from the renewable energy facility are generally straightforward to determine; for wind and solar facilities, the emissions are zero. However, the carbon emissions *reductions* associated with the operation of renewable energy sources—often called the "*derived*" or "*avoided"* emissions—are determined by the emissions rates of the power plant that is displaced by the renewable energy generation. Therefore, avoided carbon dioxide emissions must be calculated.

Calculating Avoided Emissions

While simple in principle, avoided emissions calculations are complicated by the fact that some renewable energy generators, such as wind and solar, produce varying amounts of electricity depending on the time of day and season, therefore displacing different types of power plants (with different emissions rates). When they operate, renewable energy facilities displace the last power plant that would have been dispatched at that point in time—often referred to as the marginal unit. The type of power plant that is on the margin can vary by the time of day, load levels, and order in which power plants are dispatched to meet load. For example, often natural gas generation is displaced during periods of peak demand, while coal may be displaced in non-peak demand periods in some regions.

In order to determine the avoided emissions from renewable energy generators with a relatively high degree of accuracy, detailed electric sector modeling can be conducted to determine what fossil fuel plants would not operate as a result of the operation of a particular renewable energy facility. However, this kind of modeling is expensive and requires significant effort.

To address the need for standardized and transparent approaches that rely on readily available data, more simplified methodologies have been used in some voluntary and regulatory programs. A number of programs, including EPA Climate Leaders and states participating in RGGI, have developed methodologies for calculating the avoided emissions from renewable energy facilities using available regional power plant emissions data. Often these methods are for determining the emissions benefits of green power purchases. Typically, these methodologies rely on either average emissions factors, an average of emissions from all power generation facilities operating in a region, or marginal emissions factors, which represent the units that are last in the power

[35] For biomass power, typically the lifecycle emissions associated with the generation are considered because carbon dioxide is absorbed during the life of the plant material and methane emissions from decomposition may be displaced. The emissions characteristics of the facility can vary depending on the feedstock, harvesting methods, and the efficiency of the power plant, among other factors.

plant dispatch order and those that would likely be displaced by renewable energy facilities. Some approaches, typically used for carbon offsets, also account for whether the renewable energy facility displaces generation from existing plants (often referred to as the *operating margin*) or generation from new facilities that would be needed if the new renewable energy capacity were not added (the *build margin*).

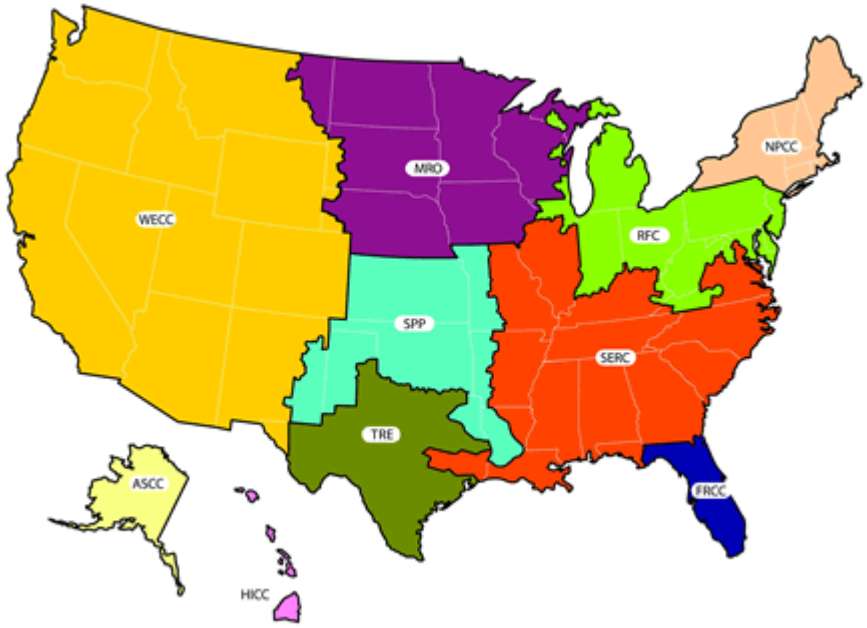
Marginal versus Average Emissions Rates

Average emissions rates are sometimes used in simplified methods because of data limitations, yet their use may not accurately represent the emissions that would likely be displaced by the renewable generation. The use of average emissions rates can be inaccurate if there is a large amount of low or high carbon-dioxide-emitting energy generation in the system mix that may run whether or not renewable generation is present. For example, an average emissions factor could include a large amount of nuclear generation, which would not likely be displaced by renewable energy because it is often first or near first in the economic dispatch order of power plants. In such a case, the use of average emissions rates might underestimate the actual avoided emissions. The opposite may be true if the average emission rate includes a significant amount of coal-fired generation, but the renewable energy facility generally displaced gas-fired generation.

Alternatively, marginal emissions factors provide a better estimate of the avoided emissions from renewable energy generation. Marginal emissions factors are generally more accurate because they determine the amount of carbon dioxide avoided by displacing the generation from the last plant that would have otherwise come online.

The eGRID provides average emissions data, with a lag time of several years, while more recent emissions data may be available through EIA, FERC, or other sources. The EPA eGRID system has developed a "non-baseload emissions"[36] dataset for each electric reliability region as defined by the North America Electric Reliability Corporation (NERC) and sub-regions. EPA's eGRID non-baseload estimates are an approximation of the marginal emissions rate for each region (Figure B-1) and because they are widely available, have been used in a number of methodologies. The eGRID non-baseload estimates are designed to reflect generation that is typically dispatched last when electric load increases and is typically reduced first as load decreases. For this reason, non-baseload generation is most likely to be displaced by renewable energy generation, while baseload generation would generally be unaffected.

[36] eGRID non-baseload electricity generation emissions factors represent generation from power plants that combust fuel and have capacity factors less than 0.8. Capacity factor is used as a surrogate for dispatch order to identify baseload and non-baseload generation.



Source: EPA

Figure B-1. NERC region representational map

Build Margin versus Operating Margin Emissions

Offset certification programs typically use more detailed approaches that address whether the renewable energy facility will displace the need for new conventional power plants. The more detailed methodologies take into account build margin emissions—emissions from new power plants that would be needed if renewable energy generation were not installed. A 2007 report by WRI describes a protocol for quantifying the GHG reductions from grid-connected electricity projects that includes estimating the marginal emissions reductions from operating power plants (the operating margin) as well as methods for estimating emissions avoided from potential new generation sources (the build margin) (Broekhoff 2007). This protocol and the use of both operating and build margin emissions has been adopted by a number of organizations to calculate the emissions from grid-connected renewable energy projects.

Incorporating the build margin requires an estimate of how much the renewable energy facility is expected to displace operating plants versus new plant construction. Addressing build margin emissions may be particularly important if estimating the avoided emissions of a renewable energy project in future years. Because the renewable energy facility may displace some of both operating and new generation, a weighted average of the operating and build margin emissions rates could be used. This rate can differ depending on whether the renewable energy facility is intermittent (e.g., wind or solar) or whether it is dispatchable and can provide baseload power (e.g., biomass or geothermal). Renewable energy facilities that can provide baseload power have greater ability to displace the need for new power plants.

Table B-1 compares eGRID average and non-baseload emissions rates per megawatt-hour in various regions of the country with build margin emissions rates.[37] It is important to note that the non-baseload emissions can vary significantly from average emissions, particularly if there are large amounts of hydro or nuclear in the average emissions mix or if there is a large amount of coal in the generation mix, but natural gas is at the margin. For example, non-baseload emissions rates are significantly higher than the average rates in the Northeast (NPCC), Mid-Atlantic (RFC), Southeast (SERC), and Alaska (ASCC), while non-baseload rates are lower than the average emissions rates in the Southwest (SPP). Build margin emissions can vary depending on whether there are plans to add significant new coal or natural gas plants.

Table B-1. Comparison of Average, Non-baseload, & Build Margin Emissions Factors

NERC Region	eGRID Average Emissions Factor (lbs CO_2/MWh)	eGRID Non-baseload Emissions Factor (lbs CO_2/MWh)	Build Margin Emissions Factors (lbs/MWh)
Alaska Systems Coordinating Council (ASCC)	1,089.79	1,397.83	1,541
Florida Reliability Coordinating Council (FRCC)	1,318.57	1,353.72	1,109
Hawaiian Islands Coordinating Council (HICC)	1,731.01	1,800.75	1,456
Midwest Reliability Organization (MRO)	1,823.69	2,092.64	1,433
Northeast Power Coordinating Council (NPCC)	875.74	1,413.51	1,142
Reliability First Corporation (RFC)	1,427.21	1,882.91	1,083
SERC Reliability Corporation (SERC)	1,368.85	1,726.81	1,306
Southwest Power Pool (SPP)	1,751.37	1,560.25	1,034
Texas Regional Entity (TRE)	1,324.35	1,118.86	1,306
Western Electricity Coordinating Council (WECC)	1,033.12	1,218.34	1,179

Sources: EPA 2005; Green-e 2007

[37] The build margin estimates were developed by the Green-e Climate Protocol for Renewable Energy based on the EIA data on electric generation facilities added to the U.S. electricity sector between 2000 and 2005 and the electric generation facilities planned for construction between 2006 and 2010.

Comparison of Methodologies for Estimating Avoided Carbon Dioxide Emissions

Table B-2 summarizes methodologies used by various certification programs or government programs to calculate the avoided emissions from renewable energy projects. Typically, offset programs use more detailed calculation methods. Several programs simply use a marginal emissions rate, including CCX, Climate Leaders, and most of the states participating in the Regional Greenhouse Gas Initiative (RGGI) with voluntary renewable energy set-asides. While the majority of the RGGI states use marginal emissions factors, a few use average emissions factors. The CDM protocol and the Green-e Climate Protocol for Renewable Energy, both offset certification programs, use the more detailed calculations that account for both build and operating margin emissions.

In most cases the calculations of avoided emissions are based on the location of the renewable energy generator, which is a more precise method. However, some of the RGGI states with voluntary renewable energy set-asides determine the calculations based on the state's emissions or based on the location of the renewable energy purchaser.

Table B-2. Summary of Selected GHG Conversion Methods for Renewables

Program	Program Description	GHG Conversion Method	Data Source
EPA Climate Leaders	Voluntary partnership between organizations and EPA. Organizations agree to complete a GHG inventory, set reduction goals, and report annually to EPA.	Marginal emissions rate (non-baseload) for generator's region	eGRID non-baseload regional emission rates
CCX	North American voluntary, legally binding market for all six GHGs	Offsets issued based on emissions rate for generator's region	eGRID regional emissions rates
Green-e Climate Protocol for Renewable Energy	Certification program for carbon offsets	Estimate of build and operating margin for generator's region	eGRID non-baseload regional emission rates; Green-e Climate build margin data
RGGI States Voluntary Market Set-Aside	RGGI states retire CO_2 allowances equivalent to voluntary renewable energy purchases to create additional emissions reductions	Use of marginal or average emissions rate for region where generator is located (or in some cases, location of purchaser)	Varies, unspecified
CDM	Allows for Kyoto parties to meet reduction goals by purchasing certified emission reduction credits from projects in developing countries	Estimate of operating, build, and combined margin for generator's region	Varies

Sources: CCX 2004; EPA 2008; Green-e 2007; Holt 2008; UNFCCC nd

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14. ABSTRACT *(Maximum 200 Words)*

With organizations and individuals increasingly interested in accounting for their carbon emissions, greater attention is being placed on how to account for the benefits of various carbon mitigation actions available to consumers and businesses. Generally, organizations can address their own carbon emissions through energy efficiency, fuel switching, on-site renewable energy systems, renewable energy purchased from utilities or in the form of renewable energy certificates (RECs), and carbon offsets. This paper explores the role of green power and carbon offsets in carbon footprinting and the distinctions between the two products. It reviews how leading greenhouse gas (GHG) reporting programs treat green power purchases and discusses key issues regarding how to account for the carbon benefits of renewable energy. It also discusses potential double counting if renewable energy generation is used in multiple markets.

15. SUBJECT TERMS
green power; carbon offsets; greenhouse gas; GHG; emissions; carbon dioxide; renewable energy certificates; REC; EPA; Climate Registry; carbon footprinting; renewable energy

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