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Status and Trends in U.S. Compliance and Voluntary Renewable Energy Certificate Markets (2010 Data)

Jenny Heeter and Lori Bird

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Technical Report
NREL/TP-6A20-52925
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Additional information on green power market trends and activities can be found on the DOE's Green Power Network website at http://greenpower.energy.gov.

List of Acronyms

ACP	alternative compliance payment
aMW	average megawatt
CEC	California Energy Commission
CO_2e	carbon dioxide equivalent
CPUC	California Public Utility Commission
CRS	Center for Resource Solutions
DOE	Department of Energy
EDC	electric distribution company
EERE	Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
EPA	Environmental Protection Agency
ERCOT	Electric Reliability Council of Texas
FTC	Federal Trade Commission
GATS	Generation Attribute Tracking System
GHG	greenhouse gas
GIS	Generation Information System
IOU	investor-owned utility
ISO	independent system operator
kW	kilowatt
kWh	kilowatt-hour
LSE	load-serving entity
MI-RECS	Michigan Renewable Energy Certification System
MISO	Midwest Independent System Operator
M-RETS	Midwest Renewable Energy Tracking System
MW	megawatt
MWh	megawatt-hour
NARR	North American Renewables Registry
NC-RETS	North Carolina Renewable Energy Tracking System
NEPOOL-GIS	New England Power Pool-Generation Information System
NREL	National Renewable Energy Laboratory
NVTREC	Nevada Tracks Renewable Energy Credits
NYSERDA	New York State Energy Research and Development Authority
OREC	offshore wind renewable energy certificate
PJM-GATS	PJM-Generation Attribute Tracking System
PUC	public utility commission
REC	renewable energy certificate
RPS	renewable portfolio standard
RTO	regional transmission organization
SMUD	Sacramento Municipal Utility District
SREC	solar renewable energy certificate
WECC	Western Electricity Coordinating Council
WREGIS	Western Renewable Energy Generation Information System

Executive Summary

This report documents the status and trends of U.S. "compliance" markets—renewable energy certificate (REC) markets used to meet state renewable portfolio standard (RPS) requirements—and "voluntary" markets—those in which consumers and institutions purchase renewable energy to match their electricity needs on a voluntary basis. Compliance and voluntary REC markets continue to exhibit growth and provide an important stimulus for renewable energy development. Voluntary green power markets provide an additional revenue stream for renewable energy projects and raise consumer awareness of the benefits of renewable energy. Based on this review, the following key trends have been identified:

- In 2010, RECs required for compliance outpaced voluntary REC sales for the first time. Compliance demand in 2010 is estimated at 55 million MWh, while voluntary demand totaled 35.6 million MWh (Figure ES-1). Compliance demand is expected to grow to more than 150 million MWh, or more than 40,000 MW, by 2015.

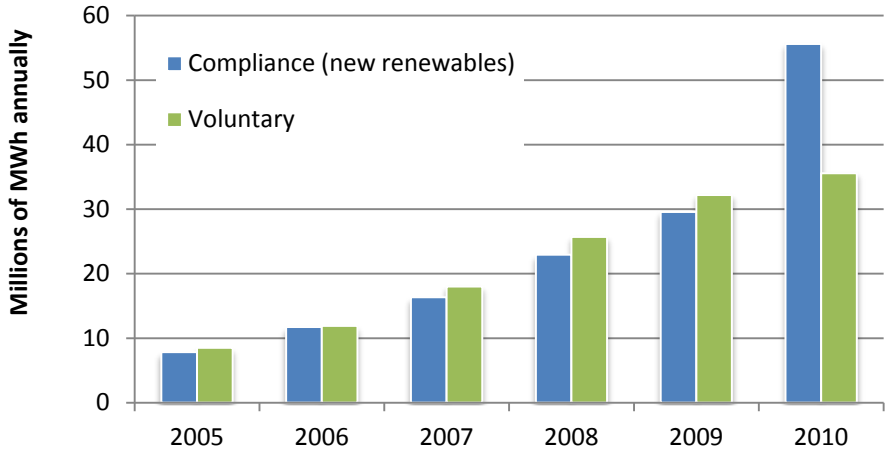

Figure ES-1. Comparison of compliance and voluntary markets for new renewable energy, 2005–2010

- For the most part, states have been achieving RPS policy targets using RECs, though some shortages have existed. "Compliance" in this sense means meeting the requirements using RECs. In the future, states are expected to be more fully in compliance, particularly because in 2010, compliance REC prices declined in most markets, with prices stabilizing in early 2011 to less than $20/MWh in most markets. Massachusetts and Rhode Island REC prices increased in mid-2011 to nearly $30/MWh.
- Solar REC (SREC) markets are relatively young but are expected to grow rapidly in coming years as state solar requirements ramp up. Of the 10 jurisdictions that allow and anticipate the use of SREC trading, SREC trading is expected to increase from more than 520 MW in 2011 to nearly 7,300 MW in 2025. SREC prices dropped in 2011 in most markets to less than $200/MWh, except Massachusetts and Ohio in-state, where pricing remains in the $400–$550 range. Pricing for SRECs is higher than RECs because of state carve-out policies, higher technology costs, and higher alternative compliance payment (ACP) levels.

- In 2010, total retail sales of renewable energy in voluntary markets exceeded 35 million MWh, an increase of 11% in 2010 (18% from unadjusted 2009 figures) (Figure ES-2). Wind energy continues to provide the most renewable energy to voluntary markets at 83.1% of total green power sales.

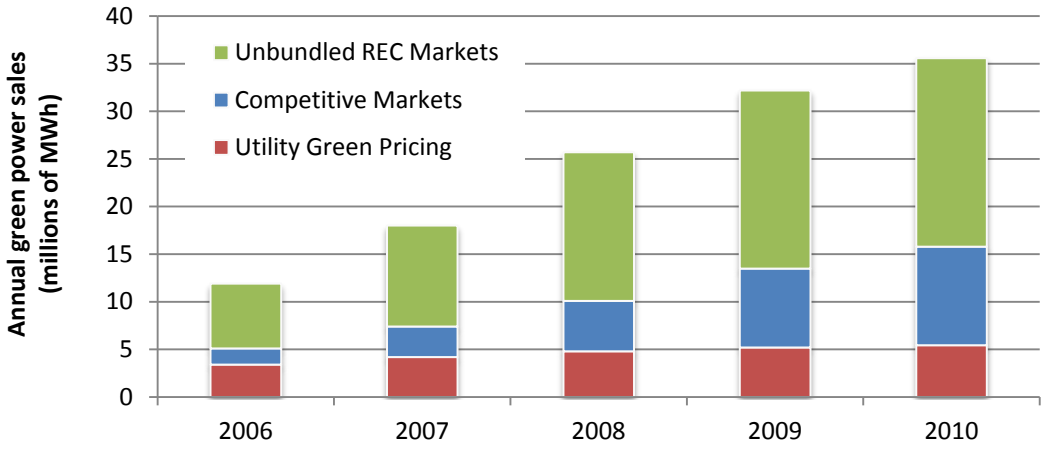

Figure ES-2. Estimated annual voluntary sales by market sector, 2006–2010

- Community solar programs have been growing recently and are supported by state policies in Colorado and Washington. Programs have been developed by utilities and third parties to enable customers to purchase a share of a solar array and receive the benefits of the energy that is produced by their share.
- Overall, the total number of residential and non-residential customers voluntarily purchasing green power increased by approximately 25% in 2010, with gains coming from the competitive market in Texas and the residential REC market.
- In voluntary markets, both Green-e Energy and the U.S. Environmental Protection Agency's (EPA's) Green Power Partnership have increased their threshold for what is considered "new" renewable energy. Previously, "new" was defined as facilities put into service on or after January 1, 1997, which is generally considered to be the inception of the voluntary green power market. Both Green-e Energy and EPA have announced that they will transition to a rolling "new date" in 2011 and 2012, respectively.
- The Federal Trade Commission's proposed revised Green Guides clarify how organizations can make defensible renewable energy claims.
- The Dodd-Frank Act enables the Commodities Futures Trading Commission (CFTC) to regulate "swaps," "swap dealers," and "swap participants," but the CFTC has not yet developed final regulations that may specify whether RECs would fall under its regulation.

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1 Introduction

Growth in renewable energy development over the past decade has led to the increasing adoption of renewable energy certificates (RECs) as a means to track and trade the environmental benefits of renewable energy generation. RECs can be sold either unbundled (separate from electricity) or bundled (included with the sale of electricity). RECs are used in both compliance and voluntary markets to meet obligations to purchase renewable energy, substantiate claims, and as a mechanism to transfer attributes from one party to another.

"Compliance" markets refer to RECs that can be used to meet state renewable portfolio standard (RPS) requirements. As of October 2011, 29 states, Puerto Rico, and Washington, D.C., have adopted RPS policies, or requirements that retail electricity providers obtain a certain fraction of their electricity from renewable energy sources. Most of these policies establish ultimate targets for the penetration of renewable energy in 2015, 2020, and 2025, often with interim targets as well. Generally, ultimate targets call for utilities or obligated entities to procure renewable energy to satisfy between 10% and 30% of retail electricity sales, although policies vary considerably. Most states allow or require the use of RECs to demonstrate compliance with RPS targets. The use of RECs emerged to simplify contracting, facilitate compliance tracking, and enable trading among obligated entities, resulting in a more efficient flow of capital to renewable energy projects. RECs procured in the compliance market can be either bundled with electricity or unbundled.

"Voluntary" markets for renewable energy, or "green power" markets, are those in which consumers and institutions purchase renewable energy to match their electricity needs on a voluntary basis. Entities can make voluntary purchases of renewable energy through utility green power programs and green power marketing activities in competitive electricity markets, as well as in unbundled REC markets. RECs are generally present in all of these types of products, but in some cases the RECs are bundled at the wholesale level with electricity and provided to the consumer, while in others, entities may purchase RECs at retail separate from electricity. Nevertheless, all of these approaches are covered in this report:

- *Utility Green Pricing (regulated utility markets).* Utility green pricing programs began in the early 1990s when a small number of utilities offered options to their customers. These programs are offered by utilities in traditionally regulated electricity markets. Today, more than 860 utilities offer green power programs to their customers. As a result, more than half of U.S. electricity customers have an option to purchase some type of green power product directly from a retail electricity provider. In utility green pricing programs, RECs are obtained by the utility and offered to customers. Utilities differ in how they procure RECs for their green pricing programs but often enter into power purchase agreements for the energy and RECs. In other cases, they may procure unbundled RECs.

- *Competitive Green Power (competitive utility markets).* In states with competitive (or restructured) retail electricity markets, electricity customers can often buy electricity generated from renewable sources by switching to an alternative electricity supplier that offers green power. In some of these states, default utility electricity suppliers offer green power options to their customers in conjunction with competitive green power marketers so that switching is not required. More than a dozen states that have opened their markets to retail competition have experienced some green power marketing activity.[1]
- *Voluntary Unbundled REC Market (separate from electricity).* Regardless of whether customers have access to a green power product from their retail power provider, they can purchase green power through unbundled RECs. More than 25 companies offer unbundled RECs to retail customers via the Internet, and a number of other companies market RECs solely to commercial and wholesale customers.[2]

The data on voluntary market trends presented in this report were formerly reported in the annual report, *Green Power Marketing in the United States: A Status Report* (Bird and Sumner 2010).[3] Voluntary market data are based primarily on figures provided to the National Renewable Energy Laboratory (NREL) by utilities and independent renewable energy marketers. NREL also supplements this data with information from REC certifiers, REC tracking systems (see ERCOT 2011), and press releases describing large voluntary green power purchases. Because data cannot be obtained from all market participants, the estimates presented here likely represent an underestimate of the market size. Data on the competitive markets is particularly challenging to obtain due to market sensitivity and rapid changes in offerings; therefore, estimates of the competitive market are more uncertain.

This report documents REC activities and trends in the United States. First, the compliance REC market is addressed, including discussions of REC trading, regional REC markets, REC tracking systems, types of compliance RECs, and compliance REC pricing trends, as well as an overview of compliance with RPS polices. Second, the voluntary REC market is addressed, presenting data and analysis on voluntary market sales and customer participation, products and premiums, green pricing marketing and administrative expenses, voluntary REC pricing, and the voluntary carbon offsets market. The report concludes with a discussion of key market trends and issues: upcoming guidance from the Federal Trade Commission (FTC) on green marketing claims, the emergence of community solar programs, and the potential impact of Dodd-Frank regulations on the REC market.

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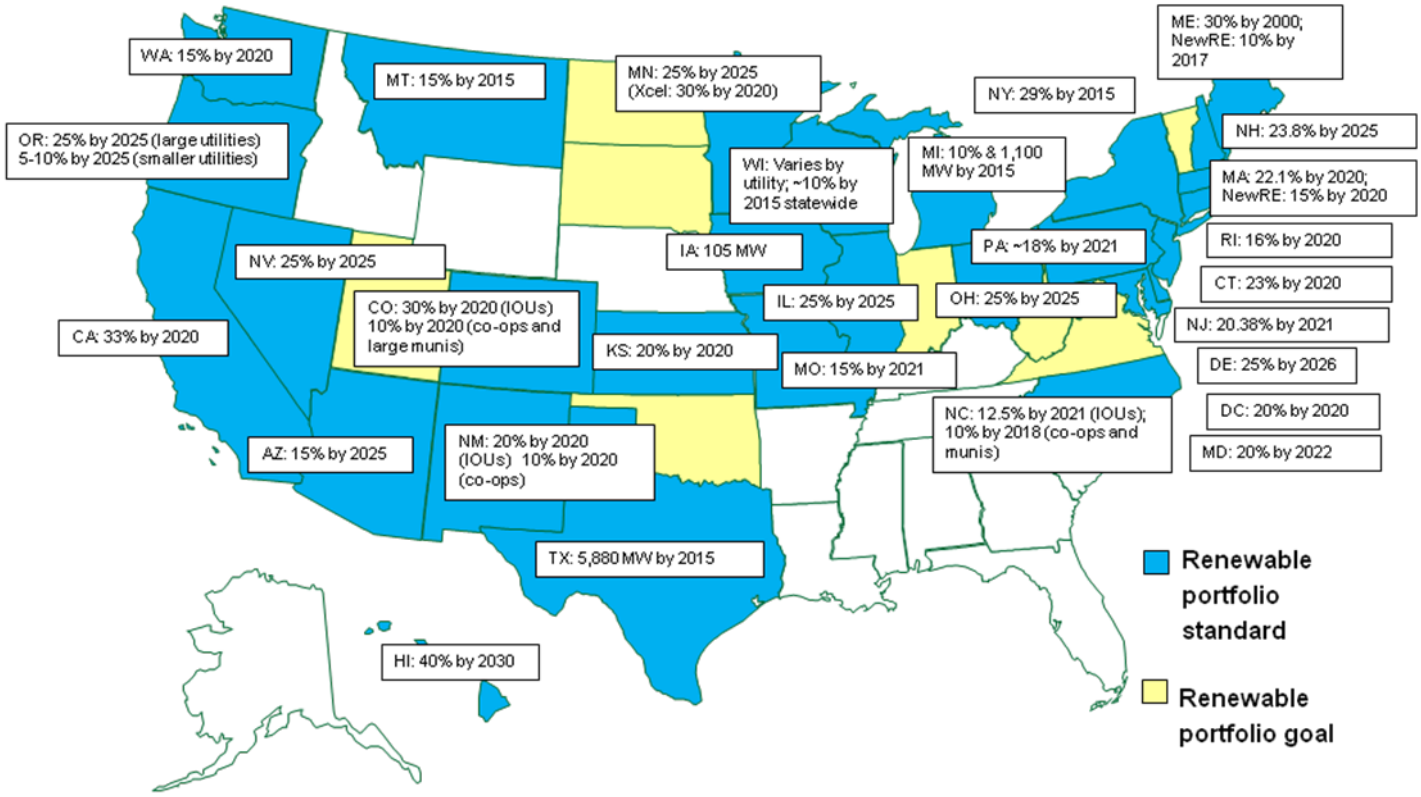
[1] States with competitive offerings include Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Texas, and Washington, D.C.

[2] For a current list of companies offering voluntary REC products, see the DOE's Green Power Network website: http://apps3.eere.energy.gov/greenpower/markets/certificates.shtml?page=2.

[3] Voluntary market data from previous years is captured in earlier versions of the report including: Bird et al. 2009; Bird et al. 2008; Bird et al. 2007; Bird and Swezey 2006.

2 Compliance REC Markets

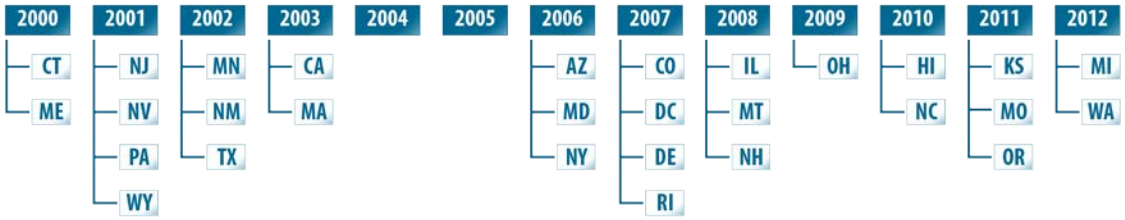
To date, 29 states, Puerto Rico, and Washington, D.C., have adopted RPS policies (Figure 1). Another eight states have nonbinding goals to increase the amount of renewable energy in the electric generation mix. Policies vary considerably; California, Colorado, and Minnesota have the highest standards. California calls for 33% renewables by 2020, Colorado requires 30% renewables by 2020 for investor-owned utilities (IOUs), and Minnesota's largest IOU, Xcel Energy, is required to obtain 30% renewables by 2020.



Source: NREL (September 2011)

Figure 1. State RPS policies map

While some of these policies have existed for more than a decade, a number of others are in early stages of implementation. Of the 31 jurisdictions that have an RPS, 7 (Hawaii, Kansas, Michigan, Missouri, North Carolina, Oregon, and Washington) will have their first compliance year in 2010 or later (see Figure 2). Several states have nearly 10 years of implementation experience (Connecticut, Maine, New Jersey, Nevada Pennsylvania, Wisconsin, Minnesota, New Mexico, and Texas).



Note: Puerto Rico's RPS takes effect in 2015.

Figure 2. Initial compliance year for state RPS policies

RPS policies call for an increasing amount of renewable energy in coming years. New generation required by RPS policies is estimated to be more than 150 million MWh, or more than 40,000 MW, by 2015 (Figure 3). In capacity terms, 40,000 MW of new generation is equivalent to approximately 3.9% of anticipated electric power capacity in 2015.[4] Note that some states provide multipliers for generation that can be used to meet RPS compliance. For example, Colorado offers a bonus of 25% to generation located in-state. These policy details have been incorporated into the analysis. The largest state markets in 2020 for new renewables required include California, Illinois, Texas, Minnesota, and New Jersey (Figure 3).[5]

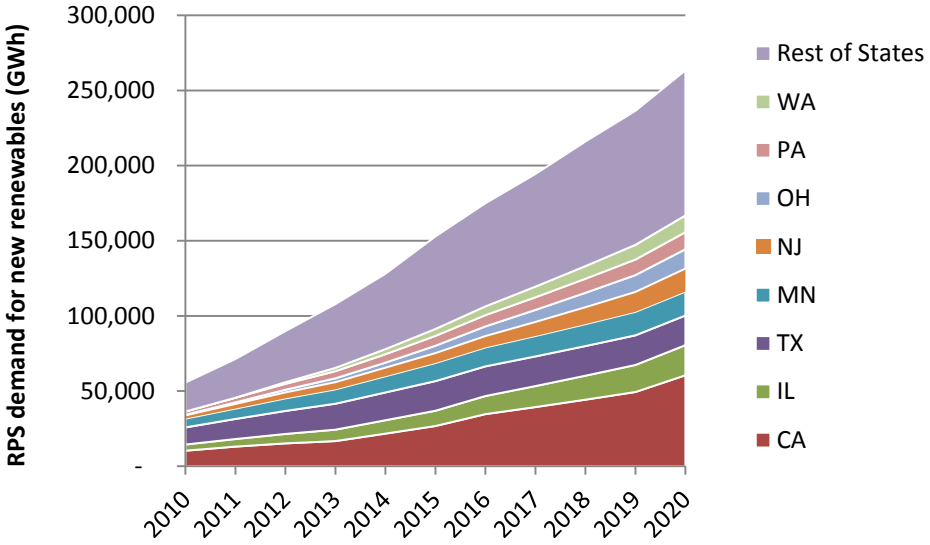
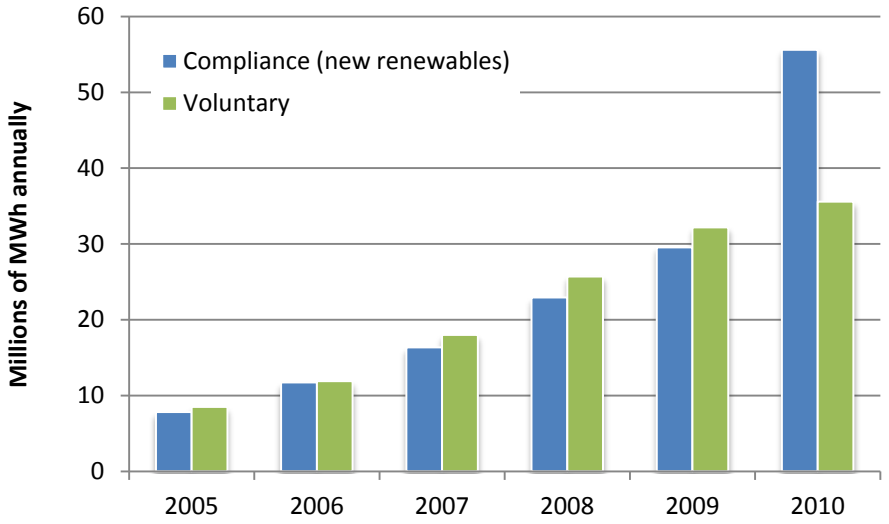


Figure 3. Historic and projected estimated demand for new renewable energy due to state RPS requirements, 2010–2020

[4] Based on the EIA's Annual Energy Outlook 2011 reference case total electric power capacity of 1,025.3 GW (EIA 2011c).

[5] These figures are based on state requirements, not accounting for early action by states. Texas has already reached its 2015 requirement of 5,880 MW.

Historically, the size of the voluntary market has slightly exceeded the compliance demand for new renewables (Figure 4). However, in 2010, the compliance market called for utilities to procure about 55 million MWh of new renewable energy generation (Barbose 2010), a large increase from 2009.[6] This is because many states set significant targets for 2010. Voluntary green power market sales totaled about 35.6 million MWh in 2010. Figure 4 shows that between 2005 and 2009, voluntary market demand slightly exceeded compliance market demand for new renewable energy. In 2010, compliance demand for new renewable energy generation exceeded voluntary demand, and the gap is expected to grow in future years. By 2015, compliance demand for new renewable energy due to existing state RPS policies is expected to be more than 150 million MWh; voluntary market growth rates would have to increase to keep pace.



Note: Estimates of compliance market demand assume that RPS targets are fully met.

Figure 4. Comparison of compliance and voluntary markets for new renewable energy, 2005–2010

2.1 REC Trading

In order to facilitate compliance with RPS policies, most RPS states allow or require REC trading.[7] Trading is more common in the eastern United States, where restructured electricity markets prevail. Because customers can switch utility suppliers in restructured electricity markets, future electricity load is often uncertain. Therefore, obligated utilities in restructured states are more likely to purchase RECs in short-term increments. (For more on this topic, see Holt et al. 2011.)

[6] Although RPS policies generally allow pre-existing renewable energy generation sources (i.e., those installed prior to the adoption of the RPS) to meet their targets, the estimates presented here reflect only the amount of new renewable energy generation that these policies are expected to stimulate. These figures are compared to the voluntary market estimates because voluntary markets primarily support generation from new renewable energy projects (i.e., those installed after voluntary green power markets were established). Estimates of compliance market demand assume that RPS targets are fully met.

[7] Unbundled RECs cannot be used in Iowa, Arizona, or Hawaii for RPS compliance. Iowa adopted its standard before RECs existed and has already met its requirement (Holt and Wiser 2007).

In the western United States, RECs are more commonly used as a verification tool. Utilities in the western United States primarily operate in regulated markets and use RECs as a means to demonstrate compliance with RPS policies. Western utilities may contract for renewable energy through a power purchase agreement, and in doing so, also contract for the RECs. Utilities may also own their renewable facilities, in which case, RECs will accrue as long as the utility does not sell them to another party.

The western REC trading market may become more active in future years as California begins to allow some use of unbundled RECs from outside of California to count towards its RPS. California's expanded RPS, which was signed into law in April 2011 and increases the obligation of utilities to 33% by 2020, clarifies the role of RECs. In the first compliance period (through 2013), unbundled RECs are allowed to contribute not more than 25%. In the second compliance period (2014–2016), unbundled RECs can only be used for not more than 15% of a utility's obligation, and after 2016, unbundled RECs are limited to not more than 10%. (California SBX 1 2)

2.2 Regional REC Markets

Regional REC markets exist in some parts of the country because many state RPS policies define regionally delivered RECs as eligible to meet state requirements (Table 1). The primary regional markets for RECs exist in New England and the Mid-Atlantic states. All New England states with an RPS allow RECs to come from within or be delivered to Independent System Operator New England (ISO New England), the wholesale electricity market for the region. Similarly, most states with RPS policies in the PJM-Interconnection allow for RECs to come from within or be delivered to PJM. These regional geographic restrictions have resulted in the creation of regional REC trading markets. Other states require that electricity be delivered to or generated in-state, which limits the level of REC trading.

In addition to regional markets, a small national market for RECs exists in both the compliance and voluntary markets, though it is more common for voluntary purchasers to buy nationally sourced RECs. Only three RPS states have no restrictions on the geographic source of RECs, and each offer a bonus to in-state generation. In both Colorado and Missouri, there are no restrictions on the location of RECs; however, in-state generation receives 125% credit under each RPS policy. In Kansas, in-state megawatts receive 110% credit. Some states (California, Illinois, Ohio, North Carolina, and Michigan) allow part of the RPS requirement to be met with out-of-state generation.

In Illinois, the preference for in-state generation is set to expire after 2011. Until then, there is a cost-effectiveness test: in-state resources must be used unless there are insufficient resources. If that is the case, then RECs from adjoining states may be used, and if those are not cost effective, then RECs from other regions may be used. After 2011, in-state and adjoining state generation is treated equally, but if insufficient cost-effective resources are available, then RECs from outside that area may be used.

Table 1. Geographic Eligibility and Delivery Requirements

	Delivered to region requirement
CT	Within New England ISO or from NY, PA, NJ, MD, or DE if the Connecticut Department of Public Utilities determines these states have an RPS comparable to Connecticut's.
DC	Located in adjacent state's ISO; must deliver to region. Load-serving entities (LSEs) may also purchase unbundled RECs from states that are adjacent to PJM.
DE	Generators anywhere outside region must deliver electricity to region.
MA	Located in adjacent state's ISO; must deliver to region.
MD	Located in adjacent state's ISO; must deliver to region. LSEs may also purchase unbundled RECs from states that are adjacent to PJM.
ME	Generators anywhere outside region must deliver electricity to region.
MN	RECs must originate in the Midwest Renewable Energy Tracking System region.
NH	Located in adjacent state's ISO; must deliver to region.
NJ	Generators anywhere outside region must deliver electricity to region.
OR	Unbundled RECs must originate from the U.S. portion of the Western Electricity Coordinating Council (WECC) region; electricity deliveries must come from the U.S. portion of WECC and be delivered to the LSE.
PA	Within PJM or Midwest ISO (in areas served by MISO).
RI	Located in adjacent state's ISO; must deliver to region.
WA	Deliver electricity to region if outside region. If outside Pacific Northwest, delivery to state.
	In-state or delivered to state requirement
AZ	Electricity delivery to state or LSE.
HI	Must be in-state generation.
IA	In-state generation requirement but allows location in broader utility service area.
MT	Electricity delivery required to state or to LSE.
NM	Electricity delivery required to state or to LSE.
NY	Electricity delivery required to state or to LSE; strict hourly scheduling to state and strong preference for in-state resources in solicitation process.
NV	Direct transmission inter-tie between generators and state; allows limited sharing of transmission inter-tie with other generators.
TX	Direct transmission inter-tie between generators and state; disallows sharing of transmission inter-tie with other generators.
WI	Electricity delivery required to state or to LSE; projects must be owned by or under contract to LSE.
	Partial in-state requirement
CA[a]	Up to 25% of requirement can be met with unbundled RECs from outside California through 2013.
IL	Cost-effectiveness test: in-state unless insufficient cost-effective resources, then from adjoining states, then from other regions; after 2011, equal preference to in-state and adjoining states.
OH	At least 50% of the renewable energy requirement must be met by in-state facilities, and the remaining 50% with resources that can be shown to be deliverable into the state.
NC	Up to 25% compliance can be met with unbundled RECs from outside the state (no limit for one LSE, Dominion); remainder must be in-state or delivered to LSE.
MI	Generally, RECs may be obtained from in-state facilities or from out-of-state facilities located within the retail electric service territory of a utility (or subsequent expansions) as recognized by the public service commission. Alternative electric suppliers are generally not permitted to meet the standard using out-of-state resources.
	No restrictions
CO	No restriction on location of RECs creation.
KS	No restriction on location of RECs creation.
MO	No restriction on location of RECs creation.[b]

[a] In 2014–2016, 15% of the requirement can be met with unbundled RECs from outside of California, and in 2016 onward, 10% of the requirement can be met with unbundled RECs from outside of California (California SBX 1 2).
[b] Rules developed by the Missouri Public Service Commission to implement Missouri's RPS originally required that renewable energy must be delivered into Missouri; however, Missouri's Joint Committee on Administrative Rules voted to disapprove that rule.
Sources: DSIRE 2011; Wiser and Barbose 2008

2.3 REC Tracking Systems

States have created REC tracking systems to verify compliance with RPS targets. These electronic tracking systems ensure that RECs are only "retired" (used to meet compliance) once by assigning a unique serial number to each megawatt-hour of renewable energy generation, which constitutes a REC. The systems also track the attributes of RECs, such as the type of renewable energy facility (e.g., wind or biomass), the project location, and the generation date.

In compliance markets, tracking systems are used by both obligated utilities and by public utility commissions (PUCs) that oversee compliance. Utilities use the systems to manage their REC portfolios, transfer RECs to others, and ultimately to demonstrate compliance with the RPS by transferring RECs into retirement accounts. RECs deposited into retirement accounts can no longer be traded. PUCs use retirement accounts to verify the number of RECs a utility is using to comply with RPS requirements. Tracking systems are also used in voluntary markets, though their use is not as predominant as in compliance markets. The Green-e Energy certification program, a leading certifier and auditor of RECs in the voluntary market, allows green power suppliers to use tracking systems to simplify some parts of the Green-e audit process. The use of tracking systems to meet Green-e Energy requirements has increased in the past few years (Terada 2011).

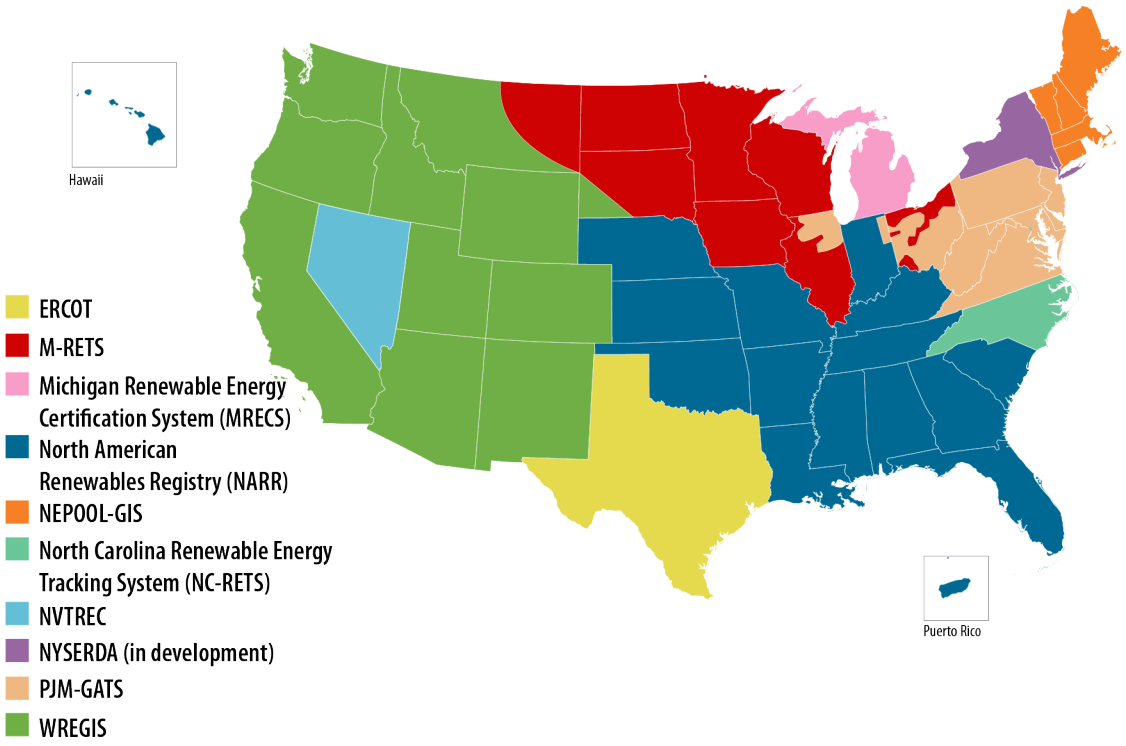
In the United States, there are currently nine different tracking systems (Table 2). Tracking systems operate primarily on a regional basis, since many state RPS policies allow RECs from regions to contribute. REC tracking systems in some cases follow the same boundaries as local regional transmission organizations (RTOs) or ISOs (Figure 5).

The Texas Renewable Energy Credit Program, started in 2002, was the first system to launch. Since then, the number of systems has grown and tracking systems now exist, which together cover all 50 states. Regional systems serve groups of states: New England Power Pool-Generation Information System (NEPOOL-GIS) serves New England; PJM-Generation Attribute Tracking System (GATS) serves areas of PJM Interconnection, mostly in the Mid-Atlantic; Western Renewable Energy Generation Information System (WREGIS) serves western states; and the Midwest Renewable Energy Tracking System (M-RETS) serves the Midwest.

In addition to the regional systems, some tracking systems have been developed to serve a particular state. Individual state systems include the Texas Renewable Energy Credit system, Nevada Tracks Renewable Energy Credits (NVTRECS), Michigan Renewable Energy Certification System (MI-RECS), and the North Carolina Renewable Energy Tracking System (NC-RETS). Finally, the North American Renewables Registry (NARR) was created in 2009 to track any state or province not covered by one of the other tracking systems. Missouri has elected to use NARR to track compliance with its RPS.

Table 2. REC Tracking Systems Overview

Tracking System	Primary Region(s)	Launch Date
Texas Renewable Energy Credit Program	Texas	January 2002
NEPOOL-GIS	New England	July 2002
PJM-GATS	Delaware, Indiana, Illinois, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Washington, D.C.	Sept 2005
WREGIS	Alberta, Arizona, British Columbia, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming	June 2007
M-RETS	Illinois, Iowa, Manitoba, Minnesota, Montana, North Dakota, South Dakota, and Wisconsin	July 2007
NVTREC	Nevada	2007/2008
NARR	States and provinces not covered by the regional markets	February 2009
MI-RECS	Michigan	October 2009
NC-RETS	North Carolina	2010



Source: Updated from ETNNA 2011
Note: NARR covers states and provinces not covered by a NYSE Blue tracking system.
Note: Nevada uses both NVTREC and WREGIS.

Figure 5. Renewable energy tracking systems in North America

The ability of tracking systems to transfer RECs in and out of their system (exporting or importing of RECs) has increased over the past few years (see Table 3). Transfer capability is important because some states allow RECs from other states to be used to meet state RPS targets. For example, in North Carolina, 25% of compliance can be met with RECs from out of state (anywhere in the United States). North Carolina established its own REC tracking system, which can now receive RECs from NARR, M-RETS, WREGIS, and the Electric Reliability Council of Texas (ERCOT). REC import/export capability may also be important for the voluntary market. This additional functionality has been improved due in part to the fact that one service provider, APX, Inc. (now NYSE Blue^{SM}), developed most of the regional REC tracking systems.

Table 3. Export/Import Capability of REC Tracking Systems

Exporting From	Exporting To
NARR	NC-RETS
NC-RETS	NARR
MIRECS	NARR
MIRECS	PJM-GATS
M-RETS	NARR
M-RETS	NC-RETS
M-RETS	MI-RECS
PJM-GATS	MI-RECS
WREGIS	NARR
WREGIS	NC-RETS
ERCOT	NC-RETS

Source: NARR 2011

Tracking systems can be important providers of public market information. They can provide information on the number of RECs retired in a given year. The Texas PUC has encouraged public access to REC market data by requiring ERCOT to report annually the aggregate quantity of RECs retired for voluntary and compliance purposes. In the current reporting year, confidentiality is ensured to account holders, which may be retiring compliance or voluntary RECs, but after one year, confidentiality is expired, and ERCOT documents how many RECs were retired by each account holder.[8] PJM-GATS also recently developed a public report on RPS retired certificates by reporting year.[9] This report allows users to see how many RECs were retired in a PJM state in a given compliance year, as well as the resource type (e.g., solar or wind) and the state where the REC was generated.

2.4 Solar and Other Types of Compliance RECs

In addition to a primary, or "Tier 1," compliance obligation, many state RPS policies encourage the use of specific types or vintages of renewable or alternative energy generation through a secondary, "Tier 2," obligation. Also, a number of states have

[8] ERCOT's Annual Report on the Texas Renewable Energy Credit Trading Program can be found at https://www.texasrenewables.com/reports.asp.

[9] PJM-GATS RPS Retired Certificates (Reporting Year) public report can be found at http://www.pjm-eis.com/reports-and-news/public-reports.aspx.

technology-specific carve outs, primarily for solar but also for distributed generation or offshore wind.

Tier 2 requirements, often referred to as "Class 2" or "Tier II" requirements, typically include alternative resources such as trash-to-energy facilities, certain types of hydro, or older renewables facilities. New Jersey adopted an offshore wind REC program in 2010 that requires a certain percentage of electricity come from offshore wind projects. In order to facilitate this program, the New Jersey legislature created offshore wind RECs (ORECs).

Solar or distributed generation carve outs exist in 17 jurisdictions (DSIRE 2011), and 10 of these jurisdictions have opted to allow the use of solar renewable energy certificates (SRECs) to facilitate compliance with solar targets (Bird et al. 2011).[10] New Jersey was the first to rely heavily on SRECs as a market mechanism for encouraging solar energy development and meeting its solar carve out. Initially New Jersey established a rebate program to incentivize systems, but due to the high cost and constraints on the state budget, switched to a market-based SREC program in 2007 (Hart 2010). Thereafter, a number of states in the Mid-Atlantic and surrounding regions have used SRECs to enable obligated entities to meet their solar carve outs.

Of the 10 jurisdictions that allow and anticipate the use of SREC trading, the solar carve outs are scheduled to grow from more than 520 MW in 2011 to nearly 7,300 MW in 2025. Targets for solar generation vary from 0.2% to 3.5% of retail electric sales. New Jersey has dominated the SREC market to date, requiring approximately 320 MW of solar capacity in 2011 and climbing to more than 4,000 MW in 2025 (see Table 4). However, SREC requirements in other states are growing, and projects are being implemented in a broader region. The next largest near-term markets are Massachusetts, Pennsylvania, and Ohio. The Maryland market, while relatively modest in 2011, is scheduled to increase rapidly, making it the fourth largest market by 2015 and second largest market after New Jersey in 2020.

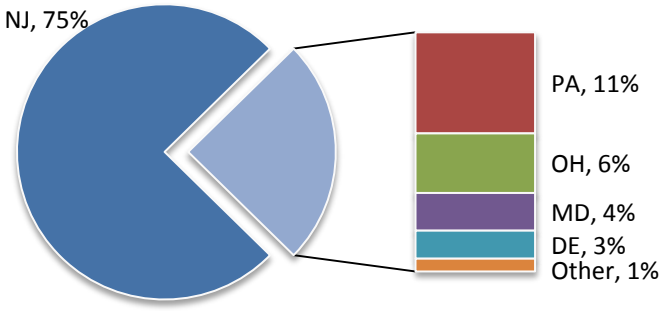
[10] For more information on SREC markets and trends, see Bird et al. 2011.

Table 4. Capacity Required in SREC Markets (MW)

State	2011	2015	2020	2025
DC	> 3	63	146	240
DE	10	69	162	261
MA	69	299	312	312
MD	22	179	693	958
MO	11	28	59	93
NC	18	121	181	190
NH	6	22	23	24
NJ	319	829	1,825	4,053
OH	31	155	363	553
PA	33	264	546	567
Total	**> 522**	**2,029**	**4,310**	**7,251**

Note: Most states have annual targets based on a percentage of retail electric sales. These estimates use the megawatt-hour target and convert it to megawatts using default capacity factors in PVWatts.[11] The capacity factors used assume that there is a 0.77 derate from direct current to alternating current kilowatts, that systems are south-facing, and that the tilt is equal to the latitude of the state. The Massachusetts solar requirement, while not based on a percent of retail sales, requires a cumulative installment of 400 MW of solar capacity. These figures assume that Massachusetts's solar requirement is not adjusted for under- or over-supply.
Note: In Washington, D.C., the 2011 compliance obligation is uncertain because contracts entered into before July 12, 2011, are exempt from the District's increased solar requirement. This analysis assumes that existing contracts will expire before 2015 (Council of the District of Columbia 2011).
Source: Barbose 2011, with updates

The vast majority (75%) of SRECs issued within the PJM Interconnection in 2010 were sourced from New Jersey, according to data from PJM-GATS (Figure 6). The next most active states serving as a source of retired SRECs are Pennsylvania, Ohio, and Maryland. PJM data provide a good indication of activity as most states with SREC policies are in the PJM balancing authority, but a few states—Massachusetts, Missouri, and North Carolina (in some instances)—are outside of PJM and use separate tracking systems.[12]



Source: PJM-GATS 2011b

Figure 6. SRECs issued in PJM-GATS, 2010

[11] http://www.nrel.gov/rredc/pvwatts/.
[12] PV systems in North Carolina must choose whether to register in the NC-RETS or the PJM-GATS system.

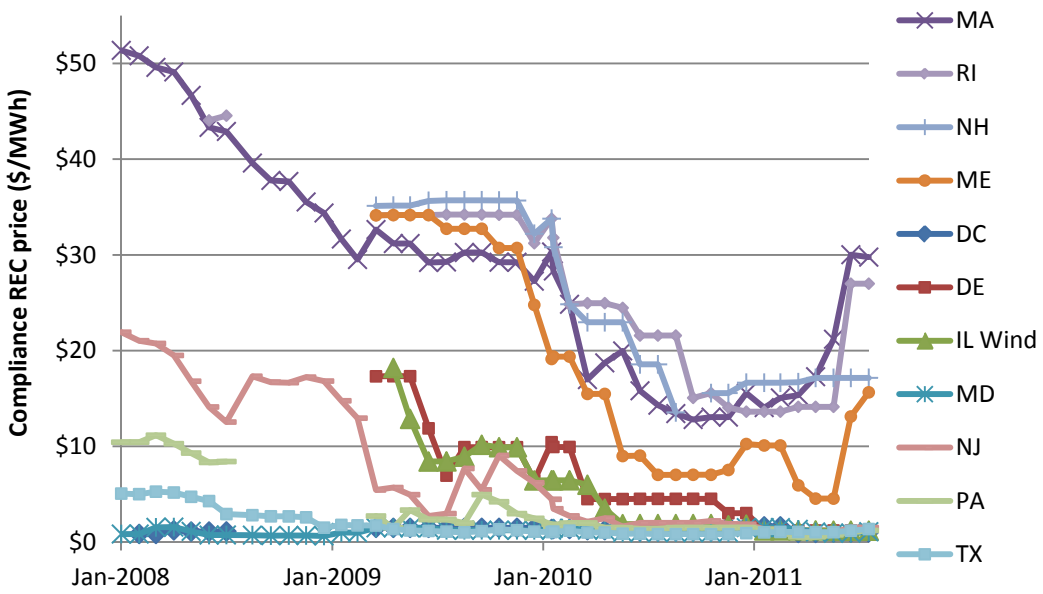
In some western states, SRECs are used to track compliance with solar carve outs, but there is no active trading market. In some cases SRECs may be sold into voluntary markets in which consumers, businesses, and institutions purchase renewable energy equivalent to their electricity needs, although SRECs have played a limited role in these markets to date.

2.5 REC Pricing in Compliance Markets

This section is an overview of wholesale REC prices in compliance markets in recent years based on indicative data available from brokers and third-party data providers. With a few exceptions, there is little price transparency in REC markets. Most transactions are conducted as bilateral contracts between parties, and prices are not reported. In addition, prices can vary widely by region. Therefore, data presented here are only indicative and should be used with caution.

In general, REC values depend on a number of factors, including the technology, the vintage (year in which it was generated), the volume purchased, and the region in which the generator is located. Natural gas prices can also affect the cost competitiveness of renewable energy generation, which is reflected in REC prices.

The region from which RECs are sourced is particularly important because often there are regional differences in renewable energy resource quality (e.g., wind speed) and electricity prices that determine the cost effectiveness of the renewable generation. In addition, the supply and demand of RECs often varies regionally. In 2010, REC prices declined in most compliance markets, with prices stabilizing in early 2011 to less than $20/MWh (Figure 7). Massachusetts and Rhode Island REC prices increased in mid-2011 to nearly $30/MWh. In previous years, regions with shortages of renewable energy have seen compliance REC prices at or close to the ACP level of $50–$55/MWh, whereas, in other states or regions, compliance RECs have sold for less than $2/MWh. Figure 7 shows the wide variation in compliance REC prices among states for which data are available.



Note: Plotted values are the last trade (if available) or the mid-point of bid and offer prices for the current or nearest compliance year for various state compliance RECs.

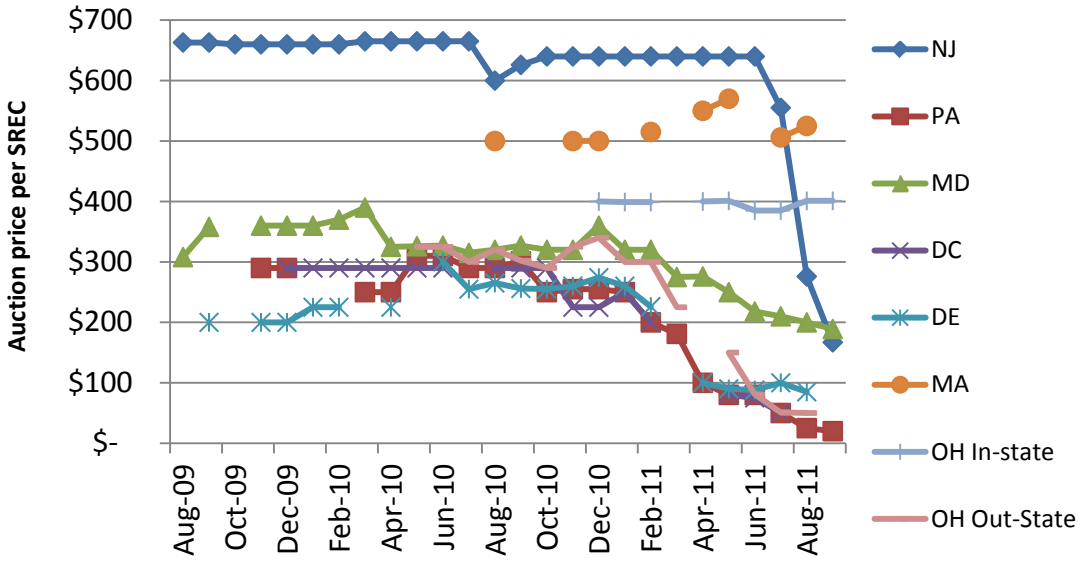
Sources: Evolution Markets 2007; Spectron Group 2011

Figure 7. Compliance market (Tier 1) REC prices, January 2007–August 2011

SRECs have higher values than RECs from other resource types in compliance markets. This is true for a number of reasons. First, 16 states and Washington, D.C., have specific provisions to encourage solar or customer-sited generation (DSIRE 2011), which creates a different supply and demand dynamic than for REC markets. Second, the ACP level is often set higher for solar/distributed generation tiers than for standard RPS compliance because of the higher cost of solar relative to other renewables that may be used to meet the main RPS targets. For example, solar ACPs generally range from about $400–$700/MWh compared to about $55/MWh for the main RPS (Tier 1).

Spot pricing for SRECs is publically available by platforms like SRECTrade and FlettExchange.[13] SRECTrade hosts a monthly auction, while Flett Exchange is an online exchange. Both platforms cover markets in PJM states, Massachusetts, and Ohio, and similar price trends can be seen in reported data from both companies. Figure 8 shows SREC prices for the current or nearest compliance year. Price declines have been seen in most other markets in 2011, with the exception of Massachusetts and Ohio in-state SRECs.

[13] See www.srectrade.com and www.flettexchange.com.



Source: SRECTrade 2011

Figure 8. Compliance market SREC spot prices, August 2009–September 2011

In New Jersey, spot market prices for SRECs have been falling dramatically. Energy year[14] 2011 SRECs have traded at lower prices than energy year 2010 vintage SRECs, trading between $400/MWh and $500/MWh in recent months, a drop from levels of around $600/MWh in recent years, indicating that the SREC market is becoming oversupplied in New Jersey. Spot prices for energy year 2012 SRECs in New Jersey were trading at less than $200/MWh in September 2011, compared to $500/MWh in May 2011 (Flett Exchange 2011).

Long-term pricing information on New Jersey SRECs can also be obtained from auctions held by electric distribution companies (EDCs). In October 2010 and February 2011, average 10-year SREC contract prices ranged from $280/MWh to $448/MWh, depending on the project size and timing of the solicitation (NJBPU 2010–2011).

In Pennsylvania, energy year 2011 SREC spot prices dropped to less than $50/MWh in mid-2011, from around $300/MWh in mid-2010 (Figure 8), presumably due to oversupply in the market. Long-term (8.5–10.0 years) SREC contracts held by EDCs in Pennsylvania have seen prices ranging from $149/MWh to $286/MWh in contracts solicited in 2010 and 2011 (First Energy Corporation 2011a; First Energy Corporation 2011b; PPL Electric 2011a; PPL Electric 2011b).

In Washington, D.C., SREC spot prices dropped to between $50/MWh and $80/MWh in summer 2011. In 2010, SREC spot prices were considerably higher, closing between $200/MWh and $300/MWh. Because out-of-district SRECs were allowed, the market was swamped with SRECs from other states. The Council of the District of Columbia addressed these issues by closing the door to new out-of-district resources (current out-

[14] New Jersey operates on an energy year rather than calendar year. New Jersey's energy year runs from June to May and is defined by the year in which the energy year ends. Energy year 2010 runs from June 2010 to May 2011.

of-district resources will be grandfathered in) and increasing the ultimate solar requirement from 0.4% to 2.5% by 2023.

2.6 Achieving Compliance Targets

Compliance obligations are still relatively young and do not require a large percentage of renewables to be obtained. For the most part, states have achieved high compliance levels with RPS policy targets. In 2006, 9 of the 14 states with compliance obligations achieved compliance levels of greater than 95%, with the average-weighted compliance level of 94% for all 14 states (Wiser and Barbose 2008).[15] Recent declines in REC prices indicate that more supply is coming online in the Northeast and Mid-Atlantic, and in California, utilities may be allowed to meet compliance over a three-year period.

Connecticut, Delaware, and New Hampshire have seen shortfalls that have resulted in retail providers paying ACPs to meet the RPS, though each state has met an increasing share of its RPS in recent years using RECs. Connecticut saw shortfalls through 2007, but in 2008 (the latest year for which data is available), 15 of 19 companies subject to the RPS met the Class I standard, 14 companies met the Class II standard, and 15 companies met the Class III standard. Total ACPs for 2008 were only $113,730. The Connecticut PUC noted that, "Overall, REC procurements are keeping pace with the increasing RPS mandates. This provides a clear indication that supply is meeting demand" (CT DPUC 2011, p. 14).

Delaware has seen minor shortfalls in previous years, primarily in reaching the solar set-aside target. In 2008, utilities met 84% of the solar obligation, and in 2009, they met 94% of the obligation using RECs. Solar ACPs totaled $36,500 in 2008 and $18,050 in 2009 (DE PSC 2010). Delaware SREC pricing has decreased from near $300/MWh in 2009 to around $100/MWh in mid-2011, indicating that there may be sufficient supply to meet the solar set-aside target in the near-term. Delaware REC pricing has also dropped considerably since 2009 (from more than $15/MWh to less than $5/MWh), indicating that utilities may be able to meet more of their Tier I compliance obligation in 2010 and 2011.

In 2010, New Hampshire faced shortages in meeting its RPS, however, the shortage was primarily in Class III (existing biomass/methane) and Class IV (existing small hydroelectric). Utilities there paid $1,538,783 in Class III ACPs and $700,332 in Class IV ACPs (NH PUC 2011). In New Hampshire, REC prices have dropped from around $35/MWh in 2009 to less than $20/MWh in the first half of 2011, indicating that compliance may be easier to meet in the future.

In California, utilities have demonstrated a deficiency in meeting the RPS targets, though compliance has not been formally assessed since 2006. In 2010, large IOUs supplied 17.9% of their electricity with RPS-eligible generation (CPUC 2011a). The RPS target for 2010 is 20%, though the California PUC (CPUC) has determined that deficits can be deferred for up to three years if the utility has an "allowable excuse" (CPUC 2011b). The

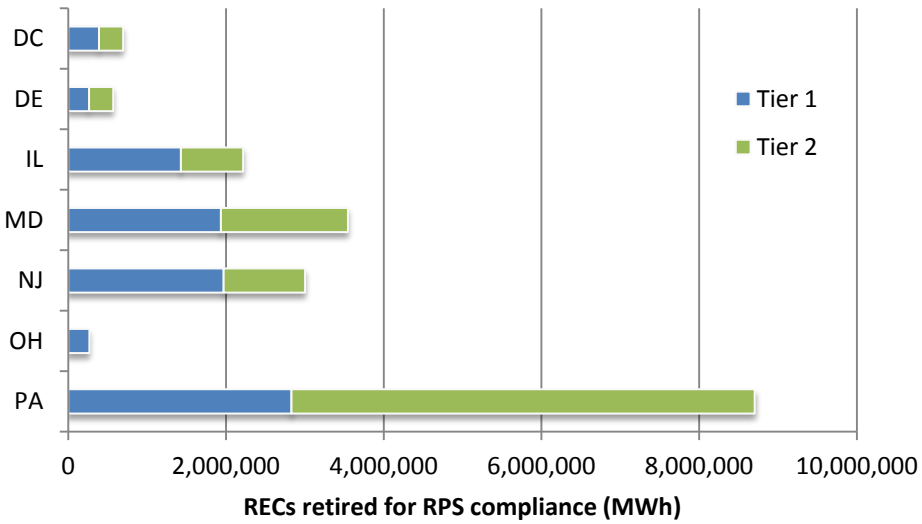
[15] Compliance is defined in this case by the use of renewable electricity or RECs, in addition to applicable credit multipliers (e.g., 125% for in-state generation), but excluding the use of ACPs.

CPUC is responsible for determining compliance with the RPS targets, and before they do so, the California Energy Commission (CEC) must verify the amount of renewable energy procured and verify that there has been no double counting. The CEC has currently only issued verification reports for 2004, 2005, and 2006. The 2006 verification report was issued in July 2010.

New York does not have a compliance target until 2015 and has been increasing its procurement of renewables in order to meet the target in 2015. The New York State Energy Research and Development Authority (NYSERDA) is the administrator for the RPS, which is responsible for centrally procuring renewable energy for utilities. Utilities collect a fee on retail power bills and turn the funds over to NYSERDA, but the utilities themselves are not subject to compliance. At the end of 2010, NYSERDA expected to procure approximately 4 million MWh by 2015, which represents only 39% of its 2015 RPS target (NYSERDA 2011). In a 2009 review of the state's RPS, independent contractors found that the RPS program was being administered efficiently, but the approved funding levels would not enable the state to meet its internal 2013 RPS target (NYSERDA 2009).

2.6.1 Quantity of RECs Retired

In addition to utility compliance reports and state PUC reports on RPS compliance, PJM-GATS provides a public report on the number of RECs retired for compliance purposes (PJM-GATS 2011a). These data indicate the magnitude of RPS retirements. In 2010, Pennsylvania had the largest amount of Tier 1 REC retirements, followed by New Jersey and Maryland (Figure 9). Pennsylvania also has a substantial Tier 2 requirement, 4.2% of total electricity sales from new and existing waste coal, distributed generation, demand-side management, large-scale hydro, municipal solid waste, wood pulping and manufacturing byproducts, and integrated gasification combined cycle coal technology. The majority of Tier 2 resources used to meet Pennsylvania's requirement in 2010 were hydro-pumped storage (3.1 million RECs) and residual fuel oil/waste coal (1.1 million RECs).



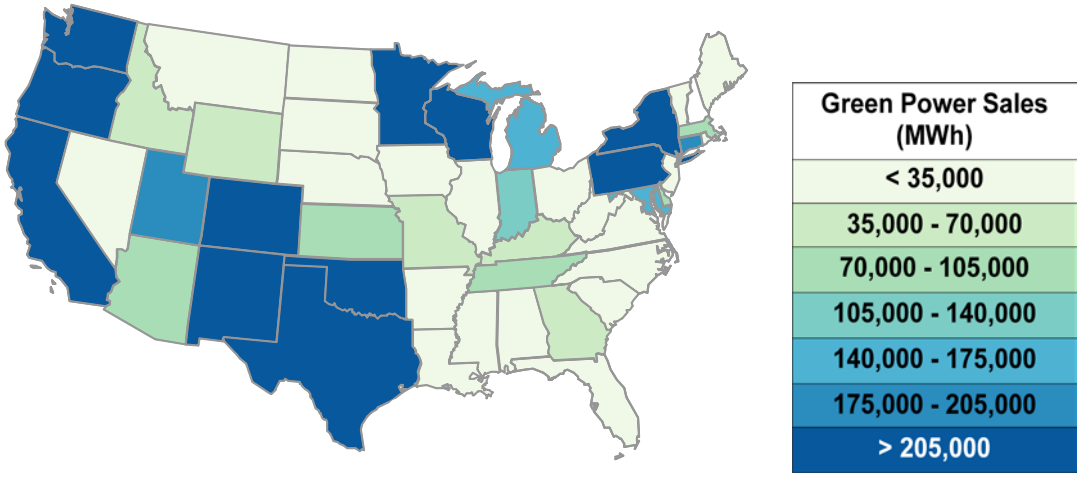
Note: States operate on different compliance years. Washington, D.C., Maryland, and Ohio operate on a calendar year; therefore, these data represent January–December 2010 retirements. Delaware, Illinois, New Jersey, and Pennsylvania operate on an energy year; therefore, these data represent June 2010–May 2011 retirements.
Source: PJM-GATS 2011a

Figure 9. RECs retired for RPS compliance in PJM states, 2010

3 Voluntary REC and Green Power Market

Voluntary consumer purchases of renewable energy represent a market support mechanism for renewable energy development. In the early 1990s, a small number of U.S. utilities began offering "green power" options to their customers. Since then, these products have become more prevalent, offered by traditional utilities and renewable energy marketers operating in states that have introduced competition into their retail electricity markets or offering RECs online. Today, more than half of all U.S. electricity customers have an option to purchase some type of green power product directly from a retail electricity provider, while all consumers have the option to purchase RECs.

Utility green power and competitive market sales are predominant in certain states.[16] State data on utility and competitive market sales for 2009 are publically available from the Energy Information Administration (EIA) (Figure 10). EIA collects data directly from utilities and marketers as part of its Form 861; however, it should be noted that not all competitive retailers report to EIA, and therefore, these data underestimate sales, particularly in states with competitive retail markets.[17] The top states in terms of total sales include California, Oregon, Washington, Colorado, New Mexico, Texas, Oklahoma, Minnesota, Wisconsin, New York, and Pennsylvania (Figure 10). See Appendix B for a table of sales by state in 2009.



Source: EIA 2011a

Figure 10. Utility green power and competitive market sales by state, 2009

[16] Data on the geographic source of unbundled RECs is not available from EIA.
[17] According to EIA, Form EIA-861 is completed by "electric utilities, wholesale power marketers (registered with the Federal Energy Regulatory Commission), energy service providers (registered with the states), and electric power producers. Responses are collected at the business level (not at the holding company level)" (EIA 2011a).

3.1 Voluntary Market Sales

Overall, retail sales of renewable energy in voluntary green power markets exceeded 35 million MWh in 2010, or nearly 1% of total U.S. electricity sales.[18] Estimates presented in this report are primarily based on data provided by utilities and marketers and supplemented with other available data.[19] Because we are unable to obtain data from all market participants, the estimates presented here likely underestimate the size of the entire market.

In terms of resources used, wind energy represented 83.1% of total green power sales reported here, followed by biomass energy sources, including landfill gas (8.5%), hydropower (primarily low impact or small hydro; 7.3%), geothermal (0.3%), solar (0.2%), and unknown sources (0.6%) (Figure 11). Based on the sales data presented in this report, we estimate the market value of green power sales (the above-market cost of the green power) in 2010 to be between $168 million and $285 million.[20]

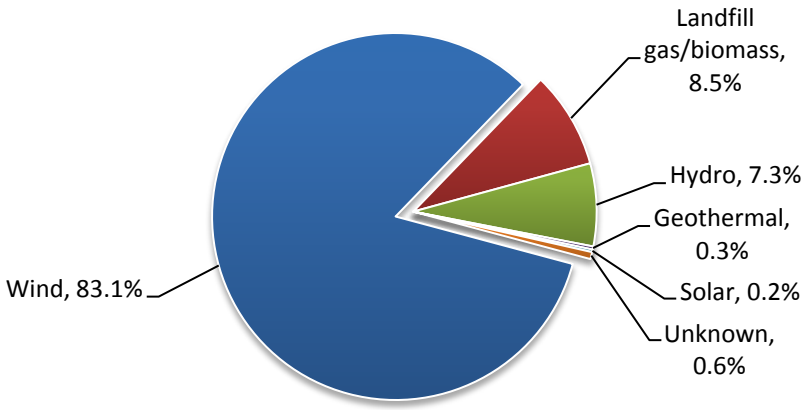


Figure 11. Estimated green power sales by renewable energy source, 2010

Green power sales (in megawatt-hours) increased by 11% in 2010 from 2009, with a compound annual growth rate of 31% since 2006 (see Table 5 and Figure 12). Sales were up 18% from 2009 estimates previously reported in Bird and Sumner (2010). In this report, 2009 market figures have been revised upward 7% to reflect additional growth in the Texas market not previously captured. [21]

[18] U.S. electricity sales totaled 3,597 million MWh in 2009 (EIA 2011b).The remaining renewable energy generation is rate-based by utilities or used to meet RPS policies.

[19] Other sources include REC certifiers, REC tracking systems (see ERCOT 2011), and press releases describing large voluntary green power purchases.

[20] Estimates of the above-market value of green power sales are determined by multiplying green power sales in megawatt-hours in three subsectors (utility green pricing programs, residential competitive markets, and nonresidential competitive and REC market) by a low and high estimate of prices in each of the sectors.

[21] Voluntary retirement data are published annually in a report by ERCOT to the Texas PUC. Retirements from the most current year (2010) are reported in aggregate, while retirements from the previous year

REC markets represent 56% of all green power sales but have seen slower growth rates in recent years than competitive markets.[22] The REC market saw an increase in annual sales in 2010, but much saw lower growth than in previous years. Annual growth rates in the utility green pricing sector continued to decline in 2010. Growth rates in the competitive market were slower than in 2009, but we may be underestimating growth in the Texas market because 2010 data are not yet available from the Texas PUC. We used 2009 data from the Texas PUC to estimate the size of the market in 2010.

Table 5. Estimated Annual Voluntary Sales by Market Sector, 2006–2010[a] (Millions of MWh)

Market Sector	2006	2007	2008	2009	2010
Utility Green Pricing	**3.4**	**4.2**	**4.8**	**5.2**	**5.4**
% Change from previous year	*39%*	*23%*	*15%*	*7%*	*5%*
% Nonresidential	*38%*	*38%*	*45%*	*45%*	*46%*
Competitive Markets	**1.7[b]**	**3.2**	**5.3[c]**	**8.3[c]**	**10.4**
% Change from previous year	*-20%[d]*	*88%*	*64%[c]*	*56%[c]*	*25%*
% Nonresidential	*41%*	*44%*	*32%*	*40%*	*35%*
Unbundled REC Markets[e]	**6.8**	**10.6**	**15.6**	**18.7**	**19.8**
% Change from previous year	*75%*	*55%*	*49%*	*20%*	*6%*
% Nonresidential	*99%*	*98%*	*99%*	*99%*	*99.8%*
Retail Total	**11.9**	**18.0**	**25.7[c]**	**32.2[c]**	**35.6**
% Change from previous year	***40%***	***51%***	***43%[c]***	***25%[c]***	***11%***
% Nonresidential	***73%***	***75%***	***75%***	***76%***	***73%***

[a] Includes sales of new and existing renewable energy. Totals and growth rates may not compute due to rounding.
[b] 2006 sales figures may be underestimated because of data gaps.
[c] 2008 and 2009 competitive market sales were revised upward in this report to reflect data on green power markets in Texas published by the Texas PUC in 2010 and 2011.
[d] 2006 number is likely underestimated because of data gaps.
[e] Includes only RECs sold to end-use customers separate from electricity (unbundled).

(2009) are reported by marketer. These voluntary retirements include both bundled and unbundled REC purchases. In order to provide an accurate estimate of competitive market sales in Texas, which we incorporate into total competitive market sales, the 2009 data reported to the Texas PUC were adjusted to account for marketers and utilities that had already provided data to NREL. Of this leftover total, NREL included sales of bundled RECs into the competitive market category. For 2010, data are not yet available by marketer; in order to provide a conservative estimate of the competitive market, the amount of sales added in 2009 were also added to 2010 figures, multiplied by the growth rate that was seen from 2008 to 2009 in missing data. Data from 2010 may need to be modified if individual marketer data for 2010, due to be released in May 2012, are different from our current estimate.

[22] The REC sales figures reflect sales to end-use customers separate from electricity. RECs bundled with electricity and sold to end-use customers through utility green pricing programs or in competitive electricity markets are counted in other categories.

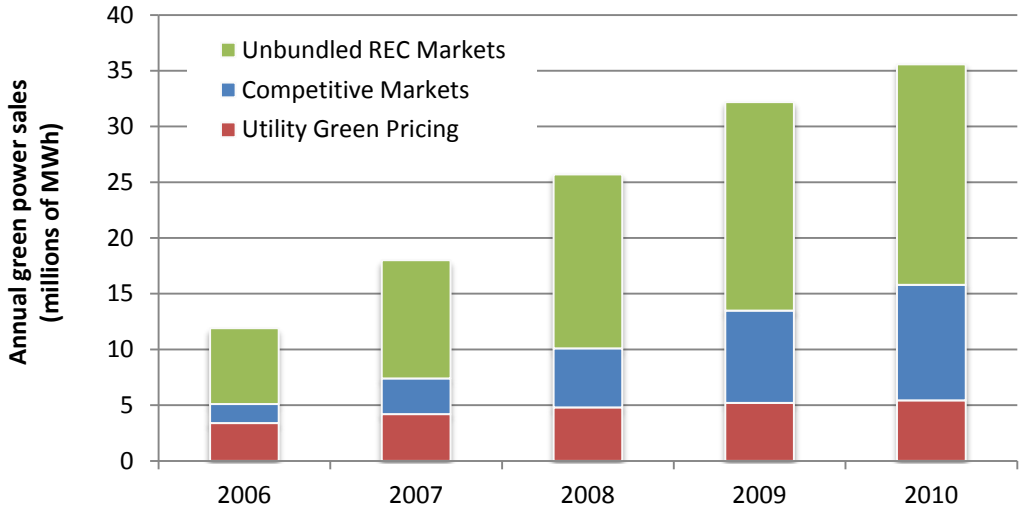


Figure 12. Estimated annual voluntary sales by market sector, 2006–2010

3.1.1 Utility Green Pricing Sales

Utility green pricing sales continue to exhibit some growth, but growth has slowed in recent years. Collectively, utilities in regulated electricity markets sold about 5.4 million MWh of green power to customers in 2010 (Table 5). Green pricing program sales to all customer classes grew by 5% in 2010, exhibiting slightly less growth than in 2009 and markedly slower growth from previous years, when rates ranged from 15% to 43% (Table 5). While some programs continue to grow robustly, the slower growth in this sector may be a result of many factors, such as the decline in new utility program development, decline in the economy, decreased emphasis on marketing programs, or it may be possible that green pricing sales are reaching the top of the standard "S" curve. Under the standard "S" curve, a new market initially sees slow annual growth rates, followed first by a period of exponential growth and then with a slower growth rate, indicating that the market may be saturated.

In utility green pricing programs, the average residential purchase in 2010 (approximately 5,400 kWh/year) increased from 2009 but still remained lower than in 2008. The average nonresidential purchase decreased slightly in 2010 to near-2008 levels (approximately 142,000 kWh/year) after nearly doubling between 2007 and 2008.[23]

In 2010, green pricing sales represented a small proportion of a utility company's overall energy sales. On average, renewable energy sold through green pricing programs in 2010 represented 1.1% of total utility electricity sales (on a megawatt-hour basis). The average percentage of green power sold compared to total utility electricity sales in 2010 remained relatively unchanged from 2009, while the median percentage increased slightly. Top performing programs saw rates ranging from 3.4% to 22.6%. Due to a large nonresidential purchase, one small utility reported that 22.6% of its total retail electricity sales were green power sales (see Appendix C).

[23] For data from previous years, see Bird and Sumner 2010.

3.1.2 REC and Competitive Market Sales

In REC markets and competitive green power markets (i.e., in states with retail competition), an estimated 30.1 million MWh of renewable energy was sold to retail customers in 2010 (Table 5). Overall, 2010 was again a mixed year for both REC marketers and competitive marketers; some saw large gains in sales, while others saw sales remain flat or even down compared to 2009.

In competitive electricity markets, an estimated 10.4 million MWh were sold as a bundled green power product in competitive electricity markets—a 25% increase from 2009. Due to the challenges of obtaining data from competitive marketers and the lack of current data on the Texas market, which has seen a dramatic increase in the number of companies offering renewable energy products, it is likely that the sales figures for the competitive market are underestimated. There were 69 green power offerings in Texas as of September 2011, compared to 50 as of February 2010 (Power to Choose 2011). Because our estimate of 2010 Texas sales uses 2009 data as a proxy until 2010 data is released by ERCOT, our estimate does not capture programs that were added in 2010 or 2011.

The increasing number of suppliers in Texas has been accompanied by increasing growth in voluntary retirements of RECs in Texas. Voluntary REC retirements in Texas, as reported by competitive marketers and utility green power programs to ERCOT, increased by 33% between 2009 and 2010, from 8.9 million MWh in 2009 to 11.8 million MWh in 2010 (ERCOT 2011). In 2010, voluntary retirements in Texas surpassed compliance retirements for the third year in a row (ERCOT 2011). A retirement occurs when a REC is used for voluntary purposes and will no longer be traded or claimed.

The competitive-market sales figure includes renewable energy sales through default utility/marketer programs or individual utility/marketer partnerships in competitive markets, which amounted to approximately 763,000 MWh in 2010, a 13% decrease from 2009. The losses came primarily from two programs; however, most programs saw flat or small declines in sales.

Retail REC sales (unbundled RECs) increased by 6%, reaching 19.8 million MWh in 2010. This represents a substantially slower growth than in previous years, where year over year growth ranged from 20% to 75% (Table 5). The EPA's Green Power Partnership saw green power use among its members increase by 8% from 2009 to 2010, from 17.8 million MWh to 19.2 million MWh (Collison 2011). Though the program has continued to see strong growth due to new partners and commitments, attrition rates have increased a bit in the last two years. For example, PepsiCo, which was purchasing 1.8 million MWh of green power in December 2010, dropped its primary REC purchase and decided instead to invest over $30 million in new on-site renewable projects over three years (Collision 2011; Environmental Leader 2010). Generally, the slower growth in retail REC sales could be due to the economic downturn, or a shift from REC purchasing to more on-site generation projects.

3.1.3 Residential and Nonresidential Customer Sales

Sales to nonresidential customers continued to outpace those to residential customers, with 73% of all sales by volume to the nonresidential sector in 2010, consistent with previous years (Table 5). Figure 13 delineates green power sales by customer segment. Residential customers played a larger role in green pricing programs and competitive markets than in REC markets. Residential customers accounted for 54% and 65% of green pricing sales and competitive market sales, respectively (Table 5).

Nearly all REC sales on a megawatt-hour basis were to business and institutional customers. Generally, nonresidential customers find REC-only products attractive because of their flexibility and the greater potential for cost savings because they can be sourced from renewable energy projects in more favorable resource locations; also, the electricity does not have to be delivered directly to the customer, which lowers transaction costs. For commercial and institutional customers that operate facilities in multiple locations across the country, RECs may also provide a more efficient green power sourcing solution than working with utilities in each individual utility territory.[24] On the other hand, residential customers may not be aware that RECs are available or may not understand what they convey.

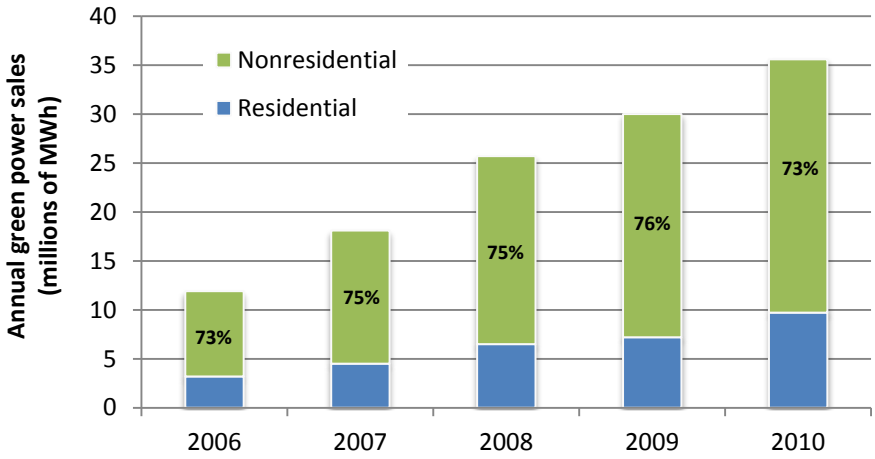


Figure 13. Residential and nonresidential voluntary sales, 2006–2010

3.1.4 Capacity Equivalent of Green Power Sales

At the end of 2010, megawatt-hour sales of renewable energy in voluntary markets represented a generating capacity equivalent of approximately 11,200 MW, with about 9,400 MW of that from new renewable energy sources (see Table 6).[25,26] Since 2007,

[24] For example, the EPA Green Power Partnership reports that the majority of its Top 25 partners purchase RECs (see Appendix A). For more information, see http://www.epa.gov/greenpower/.

[25] Capacity estimates are calculated based on reported green power kilowatt-hour sales, assuming capacity factors for each renewable resource type. For wind, a capacity factor of 33% was assumed, 90% for landfill gas, 80% for biomass, 96% for geothermal, 40% for hydroelectric, and 15% for solar electric.

[26] "New" renewable energy capacity defined here is capacity that was sourced from renewable energy systems that were built or repowered after January 1, 1997.

when total renewable capacity supplying the green power market was 5,100 MW, the amount of renewable energy capacity serving green power markets increased more than two-fold.

Table 6. Estimated Cumulative Renewable Energy Capacity Supplying Green Power Markets, 2008–2010 (MW)

Market	2008 Total RE[a] Capacity	2008 New RE Capacity	2009 Total RE Capacity	2009 New RE Capacity	2010 Total RE Capacity	2010 New RE Capacity
Utility Green Pricing	1,500	1,400	1,700	1,600	1,700	1,600
Competitive Markets and Unbundled RECs	5,800	4,900	7,700	6,400	9,400	6,800
Total	**7,300**	**6,300**	**9,400**	**8,000**	**11,200**	**9,400**

Note: "New" renewable energy capacity is a subset of total renewable energy capacity supplying green power markets.
[a] RE = renewable energy.

3.2 Voluntary Market Customer Participation

More than 1.8 million electricity customers nationwide purchased green power products in 2010 through regulated utility companies, from green power marketers in a competitive-market setting, or in the form of RECs (Table 7).[27] This represents a 25% increase in participation from 2009. While not as strong as the 2009 growth of 44%, the growth is stronger than other previous years (2006–2008). Participation in competitive markets increased about 45% primarily due to substantial customer increases reported by one marketer operating in states with retail competition. REC market participation also increased considerably, due to an increase in residential customer participation. Participation in utility green pricing programs was up slightly, due to increases in residential customer participation.

[27] It is important to note that there is greater uncertainty in our customer estimates for competitive and REC markets because of data limitations. For more detailed estimates by state for 2007 and 2008, see data from EIA 2009 in Appendix C. Generally, our estimates are consistent with the EIA estimates when adjusted for customers in Ohio who participated in community aggregations in 2005 and earlier. We excluded these customers from our estimates because they purchase products with very low renewable energy content (1%–2%).

Table 7. Estimated Cumulative Green Power Customers by Market Segment, 2006–2010

	2006	2007	2008	2009	2010
Utility Green Pricing	**490,000**	**550,000**	**550,000**	**550,000**	**570,000**
Residential	*470,800*	*526,700*	*519,700*	*526,300*	*544,700*
Nonresidential	*15,500*	*20,200*	*26,100*	*26,000*	*22,900*
% Residential Growth	*23%*	*12%*	*-1%*	*1%*	*4%*
% Nonresidential Growth	*37%*	*30%*	*29%*	*-1%*	*-12%*
Competitive Market	**~ 210,000**	**300,000**	**390,000**	**830,000**	**~ 1,200,000**
Voluntary REC Market	**~ 10,000**	**> 10,000**	**30,000**	**< 20,000**	**> 60,000**
Retail Total	**~ 710,000**	**~ 860,000**	**~ 970,000**	**~ 1,400,000**	**~ 1,830,000**
% Change	*~ 22%*	*~ 21%*	*~ 13%*	*~ 44%*	*~ 25%*

Note: In some cases, estimates have been revised from those reported in previous NREL reports as updated data have become available. Totals may not add due to rounding.

3.2.1 Utility Green Pricing Participation

Utility green pricing programs had about 570,000 customers participating at the end of 2011 (Table 7).[28] As in the past, a relatively small number of green pricing programs account for the majority of customers, with just 10 programs accounting for 75% of all participants (see Appendix C).[29] In 2010, residential participation rebounded slightly, increasing 4%, while nonresidential participation fell by 12%. Nonresidential growth has been slowing in recent years, and absolute numbers of nonresidential participants have declined since 2008.

The decline in the economy likely contributed to smaller gains in residential participation and a decrease in nonresidential participants relative to previous years. Of the 66 utility programs that reported participation data in both 2009 and 2010, 33 utilities (50%) saw net declines in participation, 23 utilities (35%) saw net gains in participation, and 10 utilities (15%) had exactly or nearly the same number of participants.

Table 7 delineates residential and nonresidential customer participation in utility green pricing programs over time. Nearly all participants are residential customers (96%), with nonresidential customers accounting for only 4% of all participants. From 2002 to 2008, nonresidential participation was growing at a faster rate than residential participation; however, in 2009, this trend reversed and continued through 2010, with nonresidential customers declining by 12% and residential customers increasing by 4%.

At the end of 2010, the average participation rate in utility green pricing programs among eligible utility customers was 2.1% with a median of 1.0%. These industry-wide rates have shown little change in recent years. Top-performing programs have demonstrated

[28] NREL attempted to contact all utility green pricing programs and received data for about 60% of programs in 2009, including all of the major programs. The remaining programs, which are smaller in size, do not have a large impact on overall participant numbers. Wherever possible, other sources and previously reported data were used to estimate data gaps.

[29] NREL issues five different Top 10 lists based on total sales of renewable energy to program participants, total number of customer participants, customer participation rates, green power sales as a fraction of total utility sales, and the premium charged to support new renewable energy development. These lists can be found in Appendix C or at http://apps3.eere.energy.gov/greenpower/markets/pricing.shtml?page=3.

improvement over time, with participation rates ranging from 5.3% to 21.5% in 2010, compared to a range of 3.9% to 11.1% in 2003, though participation rates in top performing programs have remained relatively unchanged since 2007.

In 2010, utilities reported that an average of 7.0% and a median of 4.7% of customers dropped out of green pricing programs, a slight decrease from 2009 when utilities reported that an average of 7.8% and a median of 6.3% of customers dropped out. The decrease in customer dropouts is likely due to an improvement in the economy.

3.2.2 Competitive Market Participation

In the competitive green power market, participation continued to expand in 2010 as a result of a large increase in customers reported by one marketer in Texas. In 2010, approximately 1.2 million customers were participating, an increase of 45% from 2009. This increase was not as great as that in 2009, when participants in competitive markets more than doubled. It is a particular challenge to obtain data about the competitive market, so it is likely that these figures underestimate the number of participants in competitive market programs.

As noted earlier, the Texas market has seen dramatic growth in the number of green power offerings and participants in recent years. As a result, the number of customers purchasing green power has grown substantially, although data are not yet available for 2010. According to the most recent published EIA data (for 2009), the number of green power customers in Texas increased by 123% over two years, from 142,000 customers in 2007 to 316,000 customers in 2009 (see Appendix B).[30]

While the number of green power purchasers has expanded during the past few years in markets with retail competition, participation has been less consistent over time, as some markets have grown and then contracted (such as in California and Pennsylvania). In the last few years, growth in competitive markets has been concentrated in Texas and a few programs in the Northeast. During 2009, EIA data show an increase in customers in Washington, D.C., and Virginia. There was a substantial decline in the number of customers in Maryland and a slight decline in customers in Pennsylvania in 2009 (see Appendix B).

Nationally, participation in utility/marketer partnership programs in competitive markets increased through 2009 (Bird and Sumner 2010) but then declined in 2010 to less than 120,000 customers.

Competitive markets experienced green power customer penetration rates ranging from 1.7% to 2.5% in the states with the most active markets, and in Texas, participation at the state level is much higher. Participation in competitive markets has generally been more volatile than in traditionally regulated markets.

[30] The EIA figures include customers in both utility green pricing programs and competitive market programs but do not include all competitive retailers; therefore, these estimates underestimate the total number of customers, but serve to show at a minimum the level of growth in Texas.

3.2.3 Unbundled Voluntary REC Market Participation

The number of REC-only buyers has varied in recent years, ranging from less than 10,000 to 30,000 in 2008, but saw rapid growth to more than 60,000 customers in 2010 (Table 7). Most of the increase is due to new residential customers. This could be a result of REC marketers more specifically targeting the residential sector. Often residential customers may not be aware of the option to purchase RECs from the Internet. The Natural Marketing Institute found that in 2010, only 14% of the general population was aware that they had the option to buy renewable power from their electric or other company, even though all consumers have the option to buy RECs (NMI 2011).

While most of the REC buyers are residential customers, the majority of REC sales on a megawatt-hour basis are made to nonresidential customers due to the much larger purchase sizes. As a result of large nonresidential REC purchases, REC sales represent 56% of total green power megawatt-hour sales (Table 5) and have grown dramatically in recent years (see Appendix A for a list of top green power purchasers).

3.3 Voluntary Market Products and Premiums

3.3.1 Utility Green Pricing Products and Premiums

Typically, green pricing programs are structured so that customers can either purchase green power for a certain percentage of their electricity use (often called "percent-of-use products") or in discrete amounts or blocks at a fixed price ("block products"), such as a 100 kWh block. Most utilities offer block products but may also allow customers to buy green power for their entire monthly electricity use. Utilities that offer percent-of-use products generally allow residential customers to elect to purchase 25%, 50%, or 100% of their electricity use as renewable energy, while a few offer fractions as small as 10%. Under these types of programs, larger purchasers, such as businesses, can often purchase green power for some fraction of their electricity use as well.

More recently, the concept of community solar has emerged through which customers purchase a share of a community solar system. In return, customers obtain a proportionate share of the system output, which is credited on their utility bill. These programs are offered by utilities or third parties operating in conjunction with utilities. Community solar programs differ in terms of the upfront cost and return payment received by participants. One program, the Holy Cross Energy solar project, sells upfront shares for $3.15/W and credits participants at a rate of $0.11/kWh for the production of their shares (Green Power Network 2010). Community solar programs are addressed in more depth in Section 4.2.

In 2010, the price of green power for residential customers in utility programs ranged from 0.14¢/kWh to 6.50¢/kWh above standard electricity rates, with an average premium of 1.67¢/kWh and a median premium of 1.50¢/kWh. These premiums have been adjusted to account for any fuel-cost exemptions granted to green power program participants.[31] In 2010, the 10 utility programs with the lowest premiums for energy derived from new

[31] For example, a small number of utilities exempt green pricing customers from monthly or periodic fuel charges imposed to pay higher-than-expected fossil fuel costs. For a more detailed discussion of this topic, see Bird et al. (2008).

renewable sources had premiums ranging from 0.14¢/kWh (a savings) to 0.84¢/kWh. On average, consumers spent about $6.30 per month above standard electricity rates for green power through utility programs, which is slightly higher than expenditures in previous years of around $5.40.

Since 2002, the average price premium has dropped at a compound annual rate of 6% (see Figure 14). Some of this reduction can be attributed to lower market costs for renewable energy supplies or increased competitiveness with conventional generation sources. The competitiveness of wind and other renewables with conventional generation, as well as regional demand from state renewable energy standards, will affect premiums in coming years.

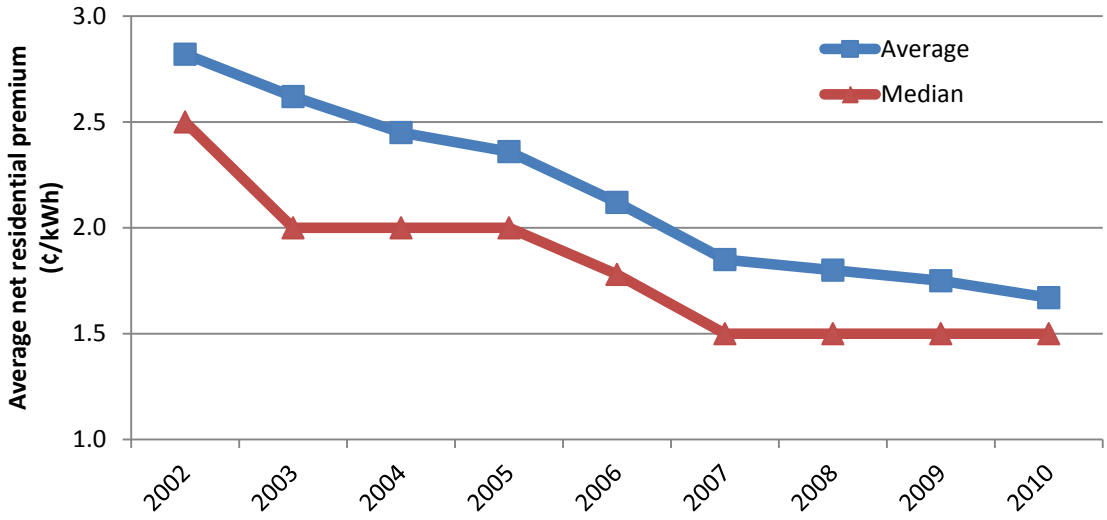


Figure 14. Trends in utility green pricing premiums, 2002–2010

3.3.2 Unbundled REC and Competitive Market Products and Pricing

Green power products offered in electricity markets with retail competition tend to differ from those offered by utilities in regulated markets, as they are more likely to be sourced from RECs because suppliers may be less able to enter into long-term contracts with generators. In addition, price premiums may fluctuate more frequently.

Initially, green power marketers in competitive markets were often forced to offer existing renewable energy sources because of a lack of new renewable energy supplies, but most marketers now offer primarily new renewable energy. In 2010, about 83% of competitive-market and REC sales were supplied from new renewable energy sources. This movement toward increased reliance on new sources has also been encouraged by green power product certification programs, which set standards for product quality and have required increasing amounts of new renewable energy. Both Green-e Energy[32] and

[32] Administered by the Center for Resource Solutions, the Green-e Energy program certifies retail and wholesale green power products that meet its environmental standards, product content, and marketing standards. For details on the Green-e Energy National Standard, see the Green-e website at: http://www.green-e.org/.

the U.S. Environmental Protection Agency's (EPA's) Green Power Partnership[33] have increased their threshold for what is considered "new" renewable energy. Previously, "new" was defined as facilities put into service on or after January 1, 1997, which is generally considered to be the inception of the voluntary green power market. As of July 15, 2011, the Green-e Energy National Standard has a 15-year rolling "new date," meaning that projects must have come online within 15 years prior to the sale of the green power in order to be classified as new. As of January 1, 2012, the EPA's Green Power Partnership will define the "new date" as January 1, 1998, and advance one year each year thereafter (EPA 2010).

The price premium charged for competitive-market products depends on several factors including the price of default service and the cost of renewable energy generation available in the regional market. Some marketers have charged prices close to or even below the prevailing cost for system power in recent years (e.g., in Texas); others have offered fixed-price products, providing customers with protection against increasing prices for a specified period of time—usually one year.

Competitively marketed green power products generally carry a price premium between 1.0¢/kWh and 2.5¢/kWh for residential and small commercial customers, although offerings have ranged from small discounts to a premium of about 10¢/kWh in recent years. For utility/marketer programs offered in states with retail competition, the average price premium for green power was about 2.3¢/kWh. In addition, price premiums can change frequently with changes in market conditions. Higher-priced products often contain a larger fraction of new renewable energy content or resources that are more desirable to consumers, such as new wind and solar.

Retail prices charged for REC products typically range from about 0.5¢/kWh to 2.5¢/kWh for residential and small commercial customers. In most cases, large commercial customers are able to negotiate lower prices. Nearly all REC products are sourced from new renewable energy generation projects as a result of product certification requirements.

REC buyers often seek certification out of concerns over double counting and to ensure a level of oversight and auditing because RECs are generally not subject to the same regulatory scrutiny as electricity and mandatory renewable requirements. Buyers may also be interested in using the Green-e Energy label in communication materials. Table 8 shows Green-e Energy certified retail transactions in 2009 and 2010. Green-e Energy certified more than 23.1 million MWh of retail transactions in 2010 (Terada 2011). Compared to NREL's total voluntary market retail sales figure of 35.6 million MWh, Green-e Energy certified 65% of voluntary market retail sales.

[33] See the EPA's Green Power website at: http://www.epa.gov/greenpower.

Table 8. Total Retail Sales of Green-e Energy Certified Renewable Energy, 2009 and 2010 (Thousand MWh)

	Residential		Commercial		Total Retail	
Year	2009	2010	2009	2010	2009	2010
RECs	40	342	15,653	19,323	15,693	19,665
Green Pricing	1,552	1,508	1,103	1,152	2,555	2,660
Competitive Electricity	224	276	188	491	411	767
Total	**1,816**	**2,126**	**16,843**	**20,967**	**18,659**	**23,092**

Note: Totals may not add due to rounding.
Source: Terada 2011

The Green-e Energy program also certifies wholesale renewable energy transactions, which totaled approximately 10.2 million MWh in 2010. It is important to note that 5.8 million MWh sold in certified wholesale transactions were resold in Green-e Energy certified retail transactions. The remaining 4.5 million MWh were sold in non-Green-e Energy certified transactions, most likely to utilities and electric service providers, power marketers, or retail customers.

Removing the instances of renewable energy certified by Green-e Energy at both the wholesale and retail levels, Green-e Energy certified sales of 27.5 million unique MWh in 2010. This is an increase of 26% from 2009. Assuming that all megawatt-hours certified at the wholesale level were ultimately sold in retail voluntary sales, 77% of the total megawatt-hours sold in the retail voluntary market in 2010 were involved in a Green-e Energy certified transaction at some point in their chain of custody.

3.4 Green Pricing Marketing and Administrative Expenses

Retail product pricing typically reflects the costs involved in attracting and servicing retail customers to some degree. Data on marketing and administrative expenses are challenging to obtain. Some utilities do not keep track of specific program expenses closely: in 2010, when asked how closely they tracked marketing and administrative costs, with 1 being not at all and 5 being very closely, 23 out of 67 utility respondents indicated a 1 or 2. These programs are primarily run by small utilities, with 50,000 or fewer total electric customers in their service territory.

Marketing and administrative expenses increase with the size of the utility (measured as the number of eligible green power customers in their service territory). For those utilities that track expenses closely (reporting a 4 or 5 out of 5), average marketing and administrative costs are presented in Figure 15.

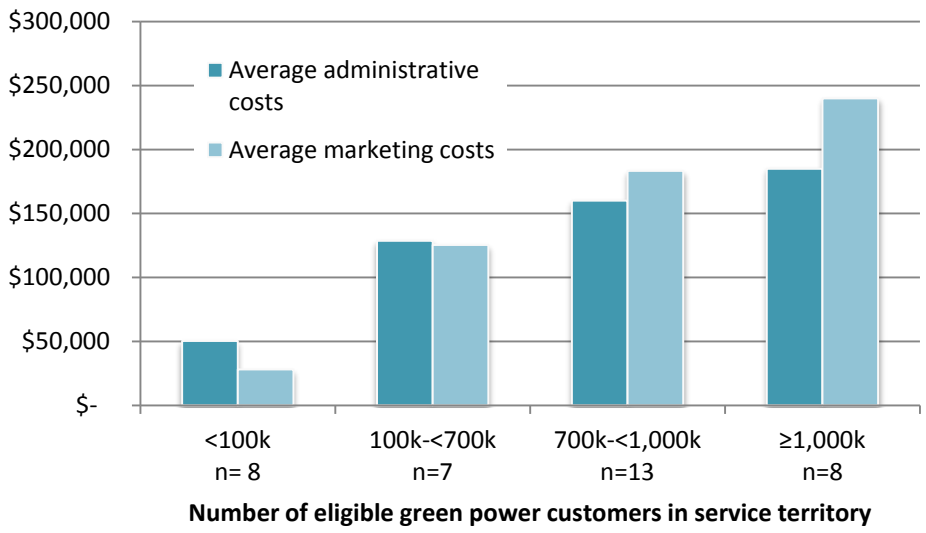


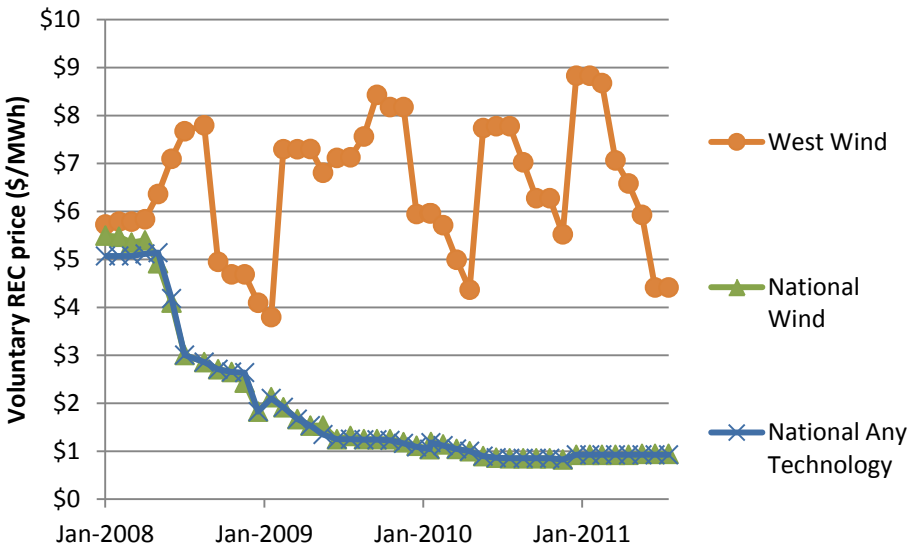
Figure 15. Estimated average marketing and administrative costs for utilities' tracking expenses (responding 4 or 5), 2010

Utilities, in some cases, are working with third parties to market their programs. In 2010, 24% of programs reported that they were working with a third party. On the other end of the spectrum, 30% of utilities reported not actively marketing their program in 2010.

3.5 REC Pricing in Voluntary Markets

Pricing for voluntary RECs differs from compliance REC pricing and from pricing offered by utility green pricing programs. Unlike compliance RECs, which generally must be sourced from within some geographic region to be eligible for RPS compliance, voluntary RECs can be sourced either regionally or nationally. Utility programs tend to serve small, residential purchasers rather than large businesses and organizations and require some premium in order to market their program to the residential market.

Voluntary REC prices will differ based upon the location of the REC generator. Most utility green pricing programs or marketers selling bundled electricity and REC products source their products from local or regional resources, with some exceptions. Buyers of nationally sourced voluntary RECs are often large corporations that have facilities in multiple locations across the country. In voluntary markets, RECs that are sourced locally (within the region) may have to compete with RPS demand or be subject to regional resource limitations. Therefore, regionally sourced voluntary RECs often sell at a premium to nationally sourced voluntary RECs, which are often derived from the most cost-effective renewable resources.



Sources: Evolution Markets 2007; Spectron Group 2011

Figure 16. Voluntary REC prices, January 2008–August 2011

Data on wholesale REC prices are available from brokers. As shown in Figure 16, wholesale RECs used in voluntary markets have generally traded in the range of $1/MWh to $10/MWh (0.1¢/kWh to 1.0¢/kWh) based on available indicative data from brokers. In 2010, prices paid for nationally sourced voluntary RECs from any technology ranged from about $0.80/MWh to $1.20/MWh. Nationally sourced voluntary wind REC prices were comparable to nationally sourced voluntary RECs for any technology, while wind from the western United States earned higher prices. Prices differ not only by the technology and location but also by the vintage. Voluntary RECs sold in a given year can only be Green-e Energy certified if the renewable energy with which they are associated is generated in the calendar year the product is sold, the first three months of the following calendar year, or the last six months of the prior calendar year (CRS 2011).

3.6 The Voluntary Carbon Offsets Market

A greenhouse gas (GHG) offset (sometimes referred to as a carbon offset) is a tradable commodity representing a unit of GHG emissions reduction or avoidance—typically, one metric ton of carbon dioxide equivalent (CO_2e). Offsets sourced from renewable energy differ from green power in that they are sold in metric tons of CO_2e, while RECs and other forms of green power are sold in megawatt-hours.

GHG offsets can be derived from a variety of project types that reduce or avoid GHG emissions, which use diverse methods for measuring these reductions; for GHG offsets sourced from renewable energy generation projects, the equivalent emissions reduction of replacing conventional generation with renewable generation must be calculated. More

than 25 companies offer offset products derived, at least in part, from renewable energy generation projects.[34]

Six offset providers that offer products at least partially sourced from U.S.-based renewable generation reported 2010 offset sales to NREL. The carbon offsets sourced from renewable energy totaled more than 483,000 metric tons of CO_2e, which is equivalent to about 593,000 MWh of renewable energy generation (Table 9).[35] While the general trend in sales is increasing, it is difficult to determine precise trends due to the sporadic reporting by GHG offset providers; for example, providers may have submitted data in 2009 but not 2010.

Table 9. GHG Offsets Sourced from U.S.-Based Renewable Energy Sources, 2008–2010

	Carbon Offset Sales (Metric Tons CO_2e)			Carbon Offset Sales (MWh Equivalent)		
Year	2008	2009	2010	2008	2009	2010
Residential	31,200	45,400	38,800	43,500	67,800	50,200
Nonresidential	214,700	293,800	444,300	299,000	417,900	541,600
Total	**245,900**	**339,200**	**483,000**	**342,500**	**485,700**	**591,800**

Note: 2009 sales have been adjusted from previous reports to account for new data.

[34] The Green Power Network tracks GHG offset providers and products that are available nationally and derived, at least in part, from U.S.-based renewable energy generation projects.

[35] The EPA's national average electricity emissions factor for non-baseload generation (eGRID 2010) was used to estimate the equivalent in megawatt-hours for companies that did not report their sales in megawatt-hours.

4 Market Issues and Trends

As the compliance and voluntary markets continue to grow, a few trends and issues have surfaced. This section highlights proposed guidance by the FTC on renewable energy claims and discusses the emerging trend of community solar programs. It concludes with a discussion of the Dodd-Frank Act and how it may impact REC markets.

4.1 Federal Trade Commission's Proposed Guidance on Renewable Energy Claims

In October 2010, the FTC proposed revisions to its Green Guides, which provide guidance to marketers to help them avoid making misleading environmental claims (FTC 2010). Last revised in 1998, the proposed revisions for the first time address issues related to renewable energy use claims.

One key issue addressed in the proposed guidelines relates to claims that can be made for renewable energy systems in which the RECs are sold. The FTC's proposed guidance states that it would be deceptive for a company to represent, either directly or by implication, that it uses renewable energy if it is generating renewable energy but selling the RECs. For example, many companies have installed solar on their facilities but will sell the RECs to utilities that need them for compliance obligations or to others in order to make projects more cost effective. In this case, even though the company may have a solar facility on-site, the FTC's proposed guidance says that the company cannot claim that it uses renewable energy.

In the past, some marketers have encouraged companies in such a situation to make a claim that it "hosts" a renewable energy facility. The term "host" has been used to convey the fact that the company has a renewable energy facility on-site but does not claim the environmental attributes. However, the FTC found that reasonable consumers would likely misinterpret a "host" claim to mean that the company uses renewable energy. Thus, the FTC has proposed that making a host claim would be deceptive. Several organizations commented on this proposal, noting that there is a need for organizations to be able to explain why they have highly visible renewable projects on their land. The organizations suggested that without some sort of hosting claim, it becomes unclear how organizations could describe their projects to the public. Organizations encouraged the use of qualified hosting claims to explain that a renewable project is being used to meet a utility's mandated solar requirement.

The Center for Resource Solutions (CRS) advises that while the FTC guidelines are being finalized, system hosts who are selling RECs should not make claims, such as "I generate 100% renewable electricity," "I have PV on my roof," or "I host/own a solar PV system," without also clearly disclosing that some or all of the RECs are sold to others (CRS 2010).

The FTC also proposed that marketers should not make unqualified renewable energy claims if part of the power used to manufacture any part of a product was derived from fossil fuels. For example, if a company uses 50% wind to manufacture a product, it could not make an unqualified claim that the product was made with renewable energy; instead,

the company would have to qualify the type of resource it is using (wind) and the percentage used (50%).

The FTC accepted public comment on the proposed revision through December 10, 2010, and expects to issue final guidance in 2012.

4.2 Community Solar Programs

Increasingly, utilities and third parties are developing community solar programs[36] through which customers can purchase a share of a renewable system developed in the local community. In return, customers receive the benefits of the energy that is produced by their share. This section includes only programs where participants purchase a share of the solar project and receive credit for their solar production. Many different definitions of community solar exist in the industry, such as efforts to purchase solar in bulk in order to obtain pricing discounts or programs that encourage community members to donate funds to put a solar system up on a community building, but those types of programs are not discussed here. For example, the Holy Cross Energy solar project in El Jebel, Colorado, is an 80 kW PV system supported by 18 community participants that purchase shares at an upfront cost of $3.15/W ($3,150/kW) and then receive a credit on their bill each month at a rate of $0.11/kWh (Green Power Network 2010). Typically, community solar programs require an upfront investment in a "share" or "panel" of the project, which can cost hundreds of dollars. However, that is not always the case; Delta-Montrose Electric Association's Community Solar Array program sells shares in $10 increments (Green Power Network 2011).

Advantages of community solar programs include potential cost savings due to economies of scale, as community solar programs may be able to offer a lower price per watt. Community solar programs typically also allow consumers to keep their shares if they move within the utility's service territory. Finally, community solar may be an option for consumers who do not have adequate roof space or have shading issues that preclude the installation of a system on their homes.

The majority of new utility programs introduced in recent years have been community solar programs. Between January 2008 and September 2011, 12 community solar programs were developed by or in conjunction with utilities, and many have expanded program sizes over that time period (Table 10).

[36] For an examination of how to develop a community solar project, see DOE 2011.

Table 10. Historical Development of Community Solar Offers

Utility/Provider	Program	Program Size (kW)	Program Start
Ellensburg (WA)	Community Solar Project	27	2006
Ashland (OR)	Solar Pioneers II	63	2008
Florida Keys Electric Cooperative (FL)	Simple Solar	117	2008
Sacramento Municipal Utility District (CA)	SolarShares	1,000	2008
Bainbridge Island (WA)	Solar for Sakai	5	2009
St. George (UT)	SunSmart	250	2009
United Power (CO)	Sol Partners Coop. Solar Farm	10	2009
Holy Cross Energy/Clean Energy Collective (CO)	Mid Valley Solar Array	80	2010
Delta-Montrose Electric Association (CO)	Community Solar Array	20	2011
Holy Cross Energy/Clean Energy Collective (CO)	Garfield County Array	858	2011
Poulsbo Project (WA)	Poulsbo Middle School	75	2011
Trico Electric (AZ)	Trico Sun Farm	193	2011
Seattle City Light (WA)	Community Solar	24	2011

Community solar programs in the United States have a combined capacity of more than 2,700 kW as of June 2011 and have been growing rapidly, particularly due to the development of Sacramento Municipal Utility District's SolarShares program and Garfield County Array by Holy Cross Energy and the Clean Energy Collective (Figure 17). From 2006 to 2011, combined capacity grew at a compound annual growth rate of 152%.

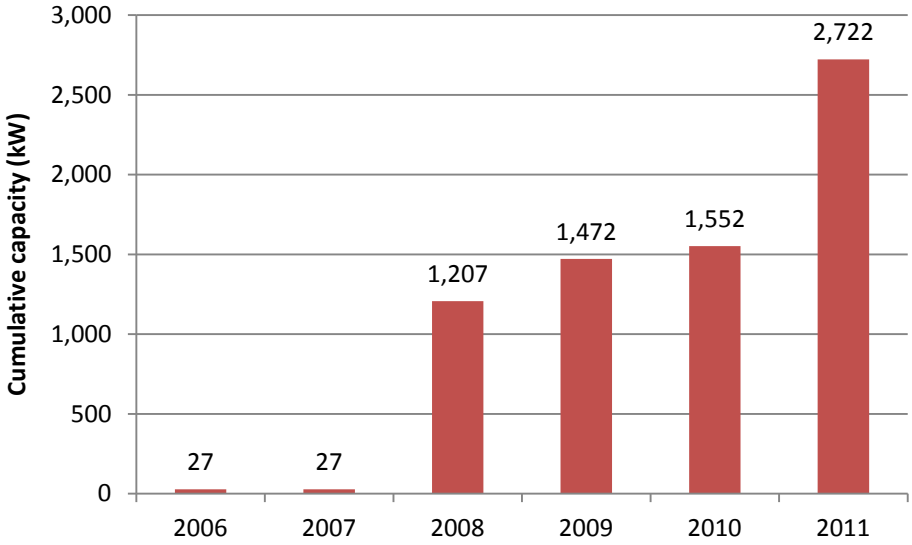


Figure 17. Cumulative capacity of community solar programs, January 2006–June 2011

In some cases, community solar programs have been enabled by state legislation. In May 2009, Washington passed SB 6170, which enables community solar participants to qualify for the state's production incentive program (DSIRE 2011). Projects up to 75 kW are eligible. The production incentive can range between $0.12/kWh and $0.54/kWh,

depending on whether the project qualifies for certain local content multipliers, and each participant in a community solar project is eligible to receive the incentive, which is capped at $5,000 per year per participant (DSIRE 2011).

In Colorado, legislation was passed in June 2010 requiring that IOUs develop plans to acquire RECs from community solar gardens. The bill required the PUC to set a minimum and maximum purchase of electrical output for each utility. In order to comply, the state's largest utility, Xcel Energy, will offer a new Solar*Rewards Community program, which will offer to purchase the energy and RECs from up to 3 MW of solar each year from 2011 to 2013. The details of the program are still under regulatory review; however, Xcel has proposed solar incentives beginning between $0.11/kWh and $0.14/kWh, depending on the system size, and decreasing over time (Xcel 2011).

4.3 Potential Dodd-Frank Act Regulation of RECs

The Dodd-Frank Act, passed in July 2010 in response to the financial crisis, gives authority to the Commodity Futures Trading Commission (CFTC) and Securities Exchange Commission (SEC) to regulate certain financial instruments.[37] The new regulation was adopted as part of an effort to "reduce the risk, increase transparency, and promote market integrity within the financial system" (CFTC 2011). Of particular interest to REC markets and broader environmental commodities markets is the CFTC's charge to define "swap," "swap dealer," and "major swap participant" and regulate those products and entities.

These terms are important because the Dodd-Frank Act imposes clearing requirements for swaps. A clearing requirement would mean that entities participating in REC transactions would be required to post collateral deposits. The CFTC has not said what level of deposit would be required, but industry participants have suggested that the requirement could be between 5% and 25% (Mickelson 2011a). This type of requirement would reduce the amount of capital that developers would have available to fund projects.

The CFTC does offer exemptions from regulation. One type of exempt product includes a "nonfinancial commodity ... for deferred shipment or delivery, so long as the transaction is intended to be physically settled (Section l a (47)(B)(ii))." While the CFTC has not defined "nonfinancial commodity" or "physically settled," one argument is that RECs are "non-financial commodities" and are "physically settled" because there is physical delivery of a title when RECs are bought or sold. If that were the case, then RECs could be exempt from regulation as a "swap" under Dodd-Frank.

The CFTC and SEC issued joint proposed rules on June 7, 2011, seeking comments on definitions of these terms by July 22, 2011. The CFTC has yet to issue final regulations, though they are likely to be published before January 1, 2012, as many other Dodd-Frank rules that incorporate swap definitions are scheduled to take effect then (Mickelson 2011b).

[37] The CFTC is an independent agency that was established in 1974 to regulate commodity futures and option markets. The SEC was created in 1934 to regulate the stock market.

5 Conclusions and Observations

Compliance and voluntary REC markets continue to exhibit growth and provide an important stimulus for renewable energy development. Green power markets provide an additional revenue stream for renewable energy projects and raise consumer awareness of the benefits of renewable energy. Based on this review, we have identified the following market trends:

- In 2010, RECs required for compliance outpaced voluntary REC sales for the first time. Compliance demand in 2010 is estimated at 55 million MWh, while voluntary demand totaled 35.6 million MWh. Compliance demand for new renewables is expected to grow to more than 150 million MWh, or more than 40,000 MW, in 2015.
- For the most part, states have been achieving RPS policy targets. Some shortages have existed in the Northeast and California. In California, large IOUs supplied 17.9% of their electricity with RPS-eligible generation in 2010, compared to the target of 20%. Recent REC pricing in most markets indicates that states will not be facing shortages in the short term.
- SREC markets are relatively young but are expected to grow rapidly in coming years as state solar requirements ramp up. Of the 10 jurisdictions that allow and anticipate the use of SREC trading, the solar carve outs are scheduled to grow from more than 520 MW in 2011 to nearly 7,300 MW in 2025. Pricing for SRECs is higher than RECs because of state carve-out polices and higher ACP levels. SRECs prices dropped in 2011 in most markets to less than $200/MWh, except Massachusetts and Ohio in-state, where pricing remains in the $400–$550 range. Price drops have occurred because some markets are now oversupplied and ahead of near-term compliance targets.
- In 2010, compliance REC prices declined in most markets, with prices stabilizing in early 2011 to less than $20/MWh in most markets. Massachusetts and Rhode Island REC prices increased in mid-2011 to nearly $30/MWh.
- In 2010, total retail sales of renewable energy in voluntary purchase markets exceeded 35 million MWh. Total market sales increased by 11% in 2010. Compared to unadjusted 2009 figures, the increase would have been 18% in 2010. Wind energy continues to provide the most renewable energy to voluntary markets, at 83.1% of total green power sales.
- Utility green pricing sales exhibited growth of 5% in 2010, similar to growth in 2009 (7%), but less than in previous years. Increasingly, utilities and third parties are developing community solar programs. These programs enable utility customers to purchase a share of a system and receive the benefits of the energy produced by their share. Between January 2008 and September 2011, 12 community solar programs were launched and many have expanded program size over the same time period.

- Competitive markets saw the largest percentage growth in sales in 2010 (25%), likely due to the increasing number of suppliers in the Texas market. There were 69 green power offerings in Texas as of September 2011, compared to 50 as of February 2010.
- REC markets remain the largest market segment, representing more than half of the total voluntary market in 2010, but the sector saw slower growth in sales (6%) than in previous years. This slower growth rate is consistent with data reported by EPA's Green Power Partnership and could be due to economic downturn or companies shifting from REC purchasing to developing on-site generation projects.
- Overall, the total number of customers purchasing green power increased by approximately 25% in 2010, with gains coming from one competitive offering in Texas and increases in the residential REC market. The number of green power offerings in Texas continues to increase, up from 50 in February 2010 to nearly 70 as of September 2011.
- Wholesale RECs used in voluntary markets have generally traded in the range of $1/MWh to $10/MWh in recent years, based on available indicative data. Nationally sourced voluntary RECs from any technology ranged from about $0.80/MWh to $1.20/MWh in 2010.
- Upcoming regulations could affect both voluntary and compliance markets. The FTC's proposed revisions to the Green Guides will help marketers avoid making misleading environmental claims. Under the proposed guidance, it would be deceptive for a company to claim that it hosts a renewable energy system if it is selling the RECs. The Dodd-Frank Act allows for regulation of "swaps," "swap dealers," and "major swap participants" by the CFTC, potentially resulting in a clearing requirement for REC transactions; however, the rulemaking process is ongoing, and it is unclear whether RECs and REC market participants will be covered by the rules.

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Appendix A. Leading Purchasers in the EPA Green Power Partnership

Table A-1. Top 25 Purchasers in the EPA Green Power Partnership Program, April 6, 2011

Company & Rank	Annual Green Power Usage (kWh)	Green Power % of Total Electricity Use	Green Power Resources
1. Intel Corporation	2,502,052,000	88%	Solar, Wind
2. Kohl's Department Stores	1,418,065,000	100%	Biomass, Small Hydro, Solar, Wind
3. Whole Foods Market	817,657,623	100%	Solar, Wind
4. Commonwealth of Pennsylvania	500,000,000	50%	Various
5. City of Houston, Texas	438,000,000	34%	Wind
6. Starbucks	421,921,000	52%	Wind
7. Johnson & Johnson	416,510,688	39%	Biomass, Solar, Wind
8. Staples	341,524,408	52%	Biogas, Solar, Wind
9. City of Dallas, Texas	302,880,000	40%	Wind
10. HSBC North America	300,000,000	112%	Wind
11. Cisco Systems, Inc.	270,209,528	29%	Biomass, Wind
12. Wal-Mart Stores, Inc./California and Texas Facilities	263,533,433	8%	Biogas, Solar, Wind
13. U.S. Environmental Protection Agency	262,100,000	100%	Biogas, Biomass, Solar, Wind
14. District of Columbia	244,267,000	50%	Wind
15. U.S. Air Force	243,942,872	3%	Biogas, Biomass, Solar, Wind
16. TD Bank, N.A.	240,333,272	100%	Wind
17. BNY Mellon	225,000,000	75%	Wind
18. City of Chicago, Illinois	215,000,000	20%	Wind
19. BD	200,631,536	38%	Wind
20. University of Pennsylvania	200,194,600	48%	Solar, Wind
21. U.S. Department of Energy	188,599,600	4%	Various
22. Kimberly-Clark Corporation	176,533,000	7%	Biomass
23. State of Illinois	176,000,000	33%	Wind
24. Deutsche Bank	170,000,000	114%	Wind
25. Pearson, Inc.	157,096,000	101%	Biogas, Wind

Source: EPA 2011

Appendix B. Estimated U.S. Green Pricing Customers and Sales by State[38]

Table B-1. Estimated U.S. Green Pricing Customers by State and Customer Class, 2008 and 2009

State	2008 Total Participating Customers	2009 Total Participating Customers	2009 Residential Participating Customers	2009 Nonresidential Participating Customers	2009 Electric Industry Participants[a]
AK	460	-	-	-	-
AL	1,816	1,861	1,831	30	24
AZ	4,345	7,620	7,396	224	6
AR	25	25	24	1	3
CA	83,610	85,535	81,961	3,574	12
CO	58,236	54,739	52,545	2,194	28
CT	146	19,965	19,398	567	5
DC	5,515	2,283	589	1,694	1
DE	12,453	5,523	4,227	1,296	10
FL	38,484	3,247	3,199	48	4
GA	9,356	8,509	8,314	195	23
HI	-	-	-	-	-
ID	5,127	4,835	4,690	145	6
IL	4,265	4,781	4,752	29	4
IN	6,208	6,554	6,424	130	18
IA	9,265	8,977	8,220	757	39
KS	1	98	94	4	4
KY	3,058	3,436	3,399	37	25
LA	395	519	485	34	2
ME	2,221	2,756	2,512	244	2
MD	59,027	16,148	9,819	6,329	3
MA	10,212	13,717	13,356	361	8
MI	28,128	31,125	30,873	252	12
MN	44,433	46,219	45,241	978	100
MS	258	255	244	11	13
MO	4,338	5,416	5,332	84	19
MT	564	536	507	29	9
NE	7,646	7,295	7,273	22	3
NV	31	28	27	1	2
NH	1	-	-	-	-
NJ	2,268	2,001	1,971	30	3
NM	3,429	20,688	18,638	2,050	13
NY	28,535	67,880	64,127	3,753	9
NC	14,223	12,959	12,722	237	24
ND	3,109	1,656	1,643	13	6
OH	3,755	4,346	4,203	143	15
OK	10,421	15,858	14,744	1,114	12
OR	113,098	127,290	123,480	3,810	24
PA	37,554	35,335	34,577	758	6
RI	5,206	4,765	4,640	125	1
SC	10,380	6,310	5,878	432	21

[38] Figures reported in this section do not include all sales and customers from competitive retailers and therefore underestimate sales and customers in states that allow retail competition.

State	2008 Total Participating Customers	2009 Total Participating Customers	2009 Residential Participating Customers	2009 Nonresidential Participating Customers	2009 Electric Industry Participants[a]
SD	612	557	543	14	6
TN	12,699	20,774	19,805	969	65
TX	205,725	316,585	288,779	27,806	22
UT	25,898	27,750	27,136	614	8
VT	4,792	4,936	4,690	246	2
VA	1,062	6,183	6,111	72	3
WA	47,907	50,931	49,476	1,455	25
WV	74	131	128	3	2
WI	48,118	50,015	47,669	2,346	63
WY	4,506	4,826	4,493	333	7
Total	**982,995**	**1,123,778**	**1,058,185**	**65,593**	**722**

[a] Includes entities with green pricing programs in more than one state

- = No data reported.

Note: Nonresidential may include some customers for whom no customer class is specified.

Note: Totals may not add due to rounding.

Source: EIA 2011a

Table B-2. Estimated U.S. Green Pricing Customers by Customer Class, 2002–2009

Year	Electric Industry Participants	Participating Customers		
		Residential	Nonresidential	**Total**
2002	212	688,069	23,481	**711,550**
2003	308	819,579	57,547	**877,126**
2004	403	864,794	63,539	**928,333**
2005	442	871,774	70,998	**942,772**
2006[a]	484	606,919	35,937	**642,856**
2007	591	773,391	62,260	**835,651**
2008	643	918,284	64,711	**982,995**
2009	722	1,058,185	65,593	**1,123,778**

[a] In 2006, the single largest provider of green pricing services in the country discontinued service in two states. More than 297,600 customers in green pricing programs reverted to standard service tariffs, predominantly in Ohio and Pennsylvania.
Note: Nonresidential may include some customers for whom no customer class is specified.
Source: EIA 2010

Table B-3. EIA Estimated U.S. Green Pricing Sales by State (MWh), 2009

State	2009 Sales (MWh)	State	2009 Sales (MWh)
AK	-	MT	6,308
AL	7,659	NE	15,067
AZ	104,548	NV	81
AR	18,497	NH	-
CA	809,262	NJ	18,369
CO	345,377	NM	219,210
CT	192,971	NY	358,271
DC	29,612	NC	12,898
DE	90,160	ND	34,761
FL	14,983	OH	24,468
GA	56,306	OK	231,508
HI	-	OR	1,130,908
ID	48,820	PA	300,515
IL	25,181	RI	33,150
IN	112,885	SC	28,351
IA	34,458	SD	263
KS	73,435	TN	73,160
KY	42,685	TX	5,102,146
LA	3,350	UT	180,173
ME	17,862	VT	16,674
MD	171,138	VA	23,584
MA	83,746	WA	579,015
MI	172,649	WV	855
MN	276,516	WI	449,843
MS	1,113	WY	42,935
MO	58,890		
		Total	**11,674,616**

Source: EIA 2011a

Appendix C. Top 10 Utility Green Pricing Programs

Table C-1. Green Pricing Program Renewable Energy Sales (as of December 2010)

Rank	Utility	Resources Used	Sales (kWh/year)	Sales (aMW)[a]
1	Austin Energy[b]	Wind, Landfill Gas	754,203,479	86.1
2	Portland General Electric[c]	Wind, Biomass, Geothermal	735,745,202	84.0
3	PacifiCorp[bde]	Wind, Biomass, Landfill Gas, Solar	587,373,391	67.1
4	Sacramento Municipal Utility District[b]	Wind, Hydro, Biomass, Solar	395,537,564	45.2
5	Xcel Energy[bf]	Wind, Solar	388,837,429	44.4
6	Puget Sound Energy[bg]	Wind, Landfill Gas, Biomass, Small Hydro, Solar	314,892,507	35.9
7	Connecticut Light and Power/ United Illuminating	Wind, Hydro	229,408,999	26.2
8	CPS Energy[h]	Wind	186,880,675	21.3
9	National Grid[i]	Biomass, Wind, Small Hydro, Solar	167,149,902	19.1
10	We Energies[b]	Wind, Landfill Gas, Solar	164,546,605	18.8

[a] An "average megawatt" (aMW) is a measure of continuous capacity equivalent (i.e., operating at a 100% capacity factor).

[b] Product is Green-e Energy (www.green-e.org) certified.

[c] Marketed in partnership with Green Mountain Energy Company.

[d] Some Oregon products marketed in partnership with 3Degrees Group, Inc.

[e] Includes Pacific Power and Rocky Mountain Power.

[f] Includes Northern States Power, Public Service Company of Colorado, and Southwestern Public Service.

[g] Residential product marketed in partnership with 3Degrees Group, Inc.

[h] Data period: February 2010–January 2011.

[i] Includes Niagara Mohawk, Massachusetts Electric, Narragansett Electric, and Nantucket Electric.

Table C-2. Green Pricing Program Total Number of Customer Participants (as of December 2010)

Rank	Utility	Program(s)	Participants
1	Portland General Electric[a]	Clean Wind, Green Source, Renewable Future	77,907
2	PacifiCorp[bc]	Blue Sky Block[d], Blue Sky Usage[d], Blue Sky Habitat[d]	76,322
3	Xcel Energy[e]	WindSource[d], Renewable Energy Trust	66,401
4	Sacramento Municipal Utility District	Greenergy[d]	51,498
5	PECO[f]	PECO WIND	32,629
6	Puget Sound Energy[g]	Green Power Program[d]	29,398
7	Connecticut Light and Power/ United Illuminating	CTCleanEnergyOptions	24,283
8	Iberdrola USA: NYSEG and RG&E[f]	Catch the Wind	23,011
9	We Energies	Energy for Tomorrow[d]	22,306
10	National Grid[h]	GreenUp	21,475

[a] Marketed in partnership with Green Mountain Energy Company.
[b] Includes Pacific Power and Rocky Mountain Power.
[c] Some Oregon products marketed in partnership with 3Degrees Group, Inc.
[d] Product is Green-e Energy certified.
[e] Includes Northern States Power, Public Service Company of Colorado, and Southwestern Public Service.
[f] Marketed in partnership with Community Energy, Inc.
[g] Residential product marketed in partnership with 3Degrees Group, Inc.
[h] Includes Niagara Mohawk, Massachusetts Electric, Narragansett Electric, and Nantucket Electric.

Table C-3. Green Power Sales as a Percentage of Total Retail Electricity Sales (in kWh) (as of December 2010)

Rank	Utility	Program(s)	% of Load
1	Waterloo Utilities[a]	Renewable Energy Program[b]	22.6%
2	Edmond Electric[c]	Pure and Simple	9.9%
3	Portland General Electric[d]	Clean Wind, Green Source, Renewable Future	8.1%
4	City of Palo Alto Utilities[e]	Palo Alto Green[b]	7.4%
5	River Falls Municipal Utilities	Renewable Energy Program[a]	7.2%
6	Austin Energy	Green Choice[b]	6.3%
7	Madison Gas and Electric	Green Power Tomorrow	4.5%
8	Pacific Power – Oregon Only[f]	Blue Sky Block[b], Blue Sky Usage[b], Blue Sky Habitat[b]	4.3%
9	Sacramento Municipal Utility District	Greenergy[b]	3.9%
10	Park Electric Cooperative[g]	Green Power Program	3.4%

[a] Power supplied by WPPI Energy.
[b] Product is Green-e Energy certified.
[c] Power supplied by Oklahoma Municipal Power Authority.
[d] Marketed in partnership with Green Mountain Energy Company.
[e] Marketed in partnership with 3Degrees Group, Inc.
[f] Some Oregon products marketed in partnership with 3Degrees Group, Inc.
[g] Power supplied by Basin Electric Power Cooperative.

Table C-4. Price Premium Charged for New, Residential Customer-Driven Renewable Power (as of December 2010)

Rank	Utility	Resources Used	Premium (¢/kWh)
1	Indianapolis Power & Light Company[a]	Wind	0.14
2	Edmond Electric[bc]	Wind	0.27
3	Avista Utilities	Wind, Landfill Gas, Hydro	0.33
4	City of Onawa	Wind	0.40
5	Flathead Electric Cooperative[d]	Wind	0.50
5	Moorhead Public Service	Wind	0.50
5	Sacramento Municipal Utility District[a]	Wind, Hydro, Biomass, Solar	0.50
8	OG&E Electric Services[e]	Wind	0.72
9	Emerald People's Utility District	Landfill Gas, Wind, Biomass	0.80
10	Xcel Energy (Minnesota only)[ac]	Wind	0.84

[a] Product is Green-e Energy certified.
[b] Power supplied by Oklahoma Municipal Power Authority.
[c] Premium is variable; customers in these programs are exempt or otherwise protected from changes in utility fuel charges.
[d] Power is supplied by Basin Electric Power Cooperative.
[e] 0.72¢/kWh represents the average price premium paid. The premium varies from .7 ¢/kWh to .9 ¢/kWh, based on purchase quantities.

Table C-5. Customer Participation Rate (as of December 2010)

Rank	Utility	Program(s)	Customer Participation Rate	Program Start Year
1	City of Palo Alto Utilities[a]	Palo Alto Green[b]	21.5%	2003
2	Portland General Electric[c]	Clean Wind, Green Source, Renewable Future	12.6%	2002
3	Farmers Electric Cooperative of Kalona	Green Power Project	11.2%	2009
4	Madison Gas and Electric	Green Power Tomorrow	9.0%	1999
5	Sacramento Municipal Utility District	Greenergy[b]	8.7%	1997
6	City of Naperville, IL[d]	Renewable Energy Program	8.0%	2005
7	Silicon Valley Power[a]	Santa Clara Green Power[b]	7.8%	2004
8	Pacific Power – Oregon Only[f]	Blue Sky Block[b], Blue Sky Usage[b], Blue Sky Habitat[b]	6.9%	2000[g]
9	River Falls Municipal Utilities[e]	Renewable Energy Program[b]	6.4%	2001
10	Lake Mills Light & Water[e]	Renewable Energy Program[b]	5.3%	2001

[a] Marketed in partnership with 3Degrees Group, Inc.

[b] Product is Green-e Energy certified.

[c] Marketed in partnership with Green Mountain Energy Company.

[d] Marketed in partnership with Community Energy, Inc.

[e] Power supplied by WPPI Energy.

[f] Some products marketed in partnership with 3Degrees Group, Inc.

[g] Blue Sky Habitat & Blue Sky Usage programs began in 2002.