



Market Brief: Status of the Voluntary Renewable Energy Certificate Market (2011 Data)

Jenny Heeter, Philip Armstrong, and Lori Bird
National Renewable Energy Laboratory

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-6A20-56128
September 2012

Contract No. DE-AC36-08GO28308

Market Brief: Status of the Voluntary Renewable Energy Certificate Market (2011 Data)

Jenny Heeter, Philip Armstrong, and Lori Bird
National Renewable Energy Laboratory

Prepared under Task Nos. SA09.3110 and SA12.0324

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.

NOTICE

This report was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

Available electronically at <http://www.osti.gov/bridge>

Available for a processing fee to U.S. Department of Energy
and its contractors, in paper, from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
phone: 865.576.8401
fax: 865.576.5728
email: <mailto:reports@adonis.osti.gov>

Available for sale to the public, in paper, from:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
phone: 800.553.6847
fax: 703.605.6900
email: orders@ntis.fedworld.gov
online ordering: <http://www.ntis.gov/help/ordermethods.aspx>

Cover Photos: (left to right) PIX 16416, PIX 17423, PIX 16560, PIX 17613, PIX 17436, PIX 17721



Printed on paper containing at least 50% wastepaper, including 10% post consumer waste.

Acknowledgments

This work was funded by the U.S. Department of Energy's (DOE's) Office of Energy Efficiency and Renewable Energy (EERE). The authors thank the technology program as well as Carla Frisch of EERE's Corporate Analysis Office for support of this work. For their thoughtful review of the document, the authors thank Blaine Collison of the U.S. Environmental Protection Agency, John Powers of Renewable Choice Energy, Rachael Terada of the Center for Resource Solutions; and Lynn Billman and Robin Newmark of NREL.

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

CEC	Clean Energy Collective
CRS	Center for Resource Solutions
DOE	U.S. Department of Energy
EERE	Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
EPA	Environmental Protection Agency
ERCOT	Electric Reliability Council of Texas
IOU	investor-owned utility
ISO	independent system operator
kW	kilowatt
kWh	kilowatt-hour
MI-RECS	Michigan Renewable Energy Certification System
M-RETS	Midwest Renewable Energy Tracking System
MW	megawatt
MWh	megawatt-hour
NAR	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
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
WECC	Western Electricity Coordinating Council
WREGIS	Western Renewable Energy Generation Information System

Executive Summary

This report documents 2011 trends in the U.S. “voluntary” markets – those in which consumers and institutions purchase renewable energy to match their electricity needs on a voluntary basis. Although a full estimate of the size of the voluntary market is not available for 2011, this review uses available data sources to capture 2011 voluntary market trends. Based on this review, the following key trends have been identified:

- In 2011, indicative data show that voluntary sales of renewable energy continued to increase (Figure ES-1). A comprehensive estimate for 2011 is not available, but several data sources provide indications of market trends. Regional or state renewable energy certificate (REC) tracking systems provide a partial estimate of the market because not all transactions are captured in these systems. In 2011, voluntary market sales captured in REC tracking systems totaled approximately 40 million MWh, up from 20.8 million in 2010—a growth rate of 90%. However, a large portion of this growth likely represents an increase in the use of tracking systems for verifying voluntary market transactions, rather than an increase in purchases in the marketplace. For comparison, NREL estimated the voluntary market at 35.6 million MWh in 2010 based on data provided by market participants.
- Data from other available sources representing portions of the voluntary market show growth rates of approximately 20% for 2011. For example, the Environmental Protection Agency’s (EPA) Green Power Partnership grew to 21.7 million MWh in 2011, representing growth of 22% from 2010. The EPA data capture only purchases of corporate and institutional purchases who are members of the EPA’s program; however, EPA data does capture nearly all of the largest corporate purchases.
- The Center for Resource Solutions’ Green-e Energy program has a preliminary estimate for 2011 showing a total of 27.9 million MWh in 2011, representing growth of 21% from 2010. As not all market transactions are Green-e Energy certified, these data represent a subset of the market. In 2010, NREL estimated that Green-e Energy retail transactions represented about 65% of the total market volume.

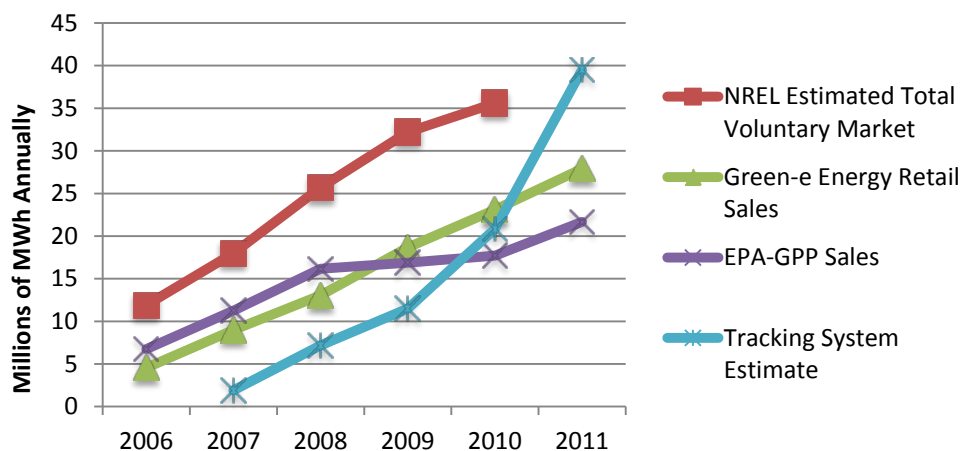


Figure ES-1. Estimated annual voluntary sales by market sector, 2006–2011

Sources: EIA 2012, EPA 2012a, Heeter and Bird 2011, Terada 2012

- On a MWh basis, the Electric Reliability Council of Texas (ERCOT) and the Western Renewable Energy Generation Information System (WREGIS) saw the largest growth in 2011. Voluntary retirements in ERCOT increased by 29% between 2010 and 2011, from 11.8 million MWh in 2010 to 15.3 million MWh in 2011.¹ In 2011, an additional 4.9 million MWh generated in 2009 and 2010 were also retired, for a total of 20.2 million MWh of voluntary retirements in 2011. Voluntary retirements in WREGIS increased to 8.3 million MWh in 2011 from 1.1 million MWh in 2010.
- Based on data now available from EIA, the largest 20 programs that report in the monthly EIA 826 form saw mixed sales results in 2011. A few programs saw sales growth greater than 35%, while others saw losses of similar proportion; the median growth for the sample of programs was 1%.
- Community solar programs have been growing, with 10 programs added in 2011. As of August 2012, nearly 30 community solar programs were operating, totaling 10 MW of combined capacity.

¹ A REC is issued to 1 MWh of renewable generation, but is retired when it has been used to meet RPS compliance or to make a voluntary claim.

Table of Contents

Acknowledgments.....	iii
List of Acronyms	iv
Executive Summary	v
Table of Contents.....	vii
List of Figures	viii
List of Tables.....	viii
1 Introduction.....	1
2 Voluntary Market Sales	4
2.1 Voluntary Sales by Market Type.....	7
2.2 Regional Focus	9
2.3 Residential and Nonresidential Customer Sales.....	12
3 Customer Participation.....	14
4 Community Solar Programs.....	18
5 REC Pricing	20
6 Conclusions and Observations.....	22
References.....	23
Appendix A. Leading Purchasers in the EPA Green Power Partnership.....	25
Appendix B. EIA Estimated U.S. Green Pricing Sales by State.....	26
Appendix C. Community Solar Offers	27

List of Figures

Figure ES-1. Estimated annual voluntary sales by market sector, 2006–2011	v
Figure 1. Measurements of the voluntary market for renewable energy by recording entity, 2006–2011	4
Figure 2. Voluntary REC market data from tracking systems, 2007–2011	5
Figure 3. Renewable energy tracking systems in the United States	6
Figure 4. EPA Green Power Partnership annual voluntary sales by classification system, 2006–2012	8
Figure 5. Green-e Energy certified retail sales by product type, 2003–2011	8
Figure 6. Sample of annual green power sales by utility, 2010–2011	9
Figure 7. Green power sales from EIA reporting entities, 2010	10
Figure 8. ERCOT voluntary and compliance retirements, 2007–2011	11
Figure 9. Residential and non-residential voluntary sales, 2006–2010	13
Figure 10. Electricity sales by state for green pricing programs, 2010	13
Figure 11. Sample of annual green power customers by utility, 2010–2011	14
Figure 12. Sample of percent green power customer penetration by utility, 2010–2011	15
Figure 13. Number of participants in EPA’s Green Power Partnership	16
Figure 14. Number and cumulative capacity of community solar programs, January 2006–August 2012	19
Figure 15. Voluntary REC prices, January 2008–June 2012	20
Figure 16. Compliance market (Tier 1) REC prices, January 2008–June 2012	21

List of Tables

Table 1. Public Reporting by REC Tracking Systems	6
Table 2. 20 Largest ERCOT Accounts by Voluntary REC Retirements, 2010	12
Table 3. Estimated Cumulative Green Power Customers by Market Segment, 2006–2010	17
Table A-1. Top 25 Purchasers in the EPA Green Power Partnership Program, as of July 5, 2012	25
Table B-1. EIA Estimated U.S. Green Pricing Sales by State (MWh), 2010	26
Table C-1. Historical Development of Community Solar Offers	27

1 Introduction

Voluntary markets for renewable energy, or “green power” markets, allow consumers and institutions to 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. This report covers all of these approaches:

- *Utility Green Pricing (regulated utility markets).* Utility green pricing programs began in the early 1990s when a small number of utilities offered their customers the option to purchase green power. These programs are offered by utilities in traditionally regulated electricity markets. More than 850 utilities offer green pricing programs.
- *Competitive Green Power (competitive utility markets).* In states with competitive (or restructured) retail electricity markets, electricity customers may have the option of 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.²
- *Voluntary Unbundled REC Market.* 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.³

This analysis reviews 2011 trends in the voluntary renewable energy market based on available data. For more detailed background information, 2010 market data, and historical analysis, see Heeter and Bird 2011. Unlike in previous NREL reports,⁴ we are not able to provide a comprehensive estimate of the market size because we did not collect data from market participants. Instead, we rely on publicly available data sources, which provide an indication of market performance for various portions of the market. However, these estimates cannot be compared to earlier NREL estimates of the size of the voluntary market, because of the differences in methodology and data sources.

² 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.

³ For a 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>.

⁴ Voluntary market data from previous years is captured in earlier versions of the report including: Heeter and Bird 2011; Bird and Sumner 2010; and Bird et al. 2009.

This analysis draws on data from four sources that capture portions of the voluntary market. These data overlap, and are presented separately in order to examine growth trends, but cannot be summed to create a complete picture of the voluntary market in 2011. Each data source covers only a subsection of the voluntary market.

Data sources used in this report are as follows:

1. The **U.S. Environmental Protection Agency's (EPA) Green Power Partnership** provides data on the magnitude of purchases by its corporate, institutional, and government partners on an annual basis, which sheds light on non-residential purchaser trends. EPA works with more than 1,300 U.S. organizations to facilitate the purchase of green power. To be considered a "partner," the entity must buy green power in the voluntary market, meet certain thresholds for "new" renewables as a percent of the organization's annual electricity usage (3%-20%, depending on size), and execute a partnership agreement with EPA.
2. The **Center for Resource Solutions' (CRS) Green-e Energy certification program** provides data on the volume of renewable energy generation sold into voluntary markets and certified by the Green-e Energy program annually. All 2011 figures in this report are preliminary estimates. CRS maintains data on annual sales, by product (e.g. green pricing) and customer type, number of customers, and location of supply and sales by state. The certification ensures that the renewable energy sold is from "new" resources, that sellers undergo marketing compliance review twice per year, that sales are verified annually, and that RECs are not double counted.⁵ Not all voluntary RECs are Green-e Energy certified; though it was the largest certifier in the voluntary market at 23 million MWh of retail sales in 2010, or an estimated 65% of total voluntary market sales, and an estimated 99% of voluntary retail REC transactions.
3. The **U.S. Energy Information Administration (EIA)** collects data on green power sales and customers from utilities and marketers as part of its Form 861 (annual data) and Form 826 (monthly data). Not all competitive retailers report to EIA; therefore, these data underestimate sales, particularly in states with competitive retail markets. The monthly Form 826 collects from a sample of respondents compared to the annual Form 861 and data are released faster. EIA has published monthly Form 826 data beginning in January 2011 through December 2011. EIA's annual data for 2011 is expected to be released in mid-November 2012.
4. Regional **REC tracking systems**, initially created to ensure compliance with renewable portfolio standards (RPSs), are increasingly being used to verify voluntary REC market transactions. Public reports available from regional tracking systems provide the quantity of voluntary RECs issued to generators registered in their system, and in some cases provide the quantity of voluntary

⁵ The Green-e Energy National Standard and EPA's Green Power Partnership both consider "new" projects to be those that have online within 15 years prior to the sale of the green power.

RECs retired.⁶ Not all voluntary RECs transactions are verified in a tracking system and Green-e Energy's rules allow for a 21 month window to retire RECs for a calendar year.⁷ Therefore, this data source presents an incomplete picture of total voluntary sales. Tracking systems operate primarily on a state or regional basis, often following the same boundaries as local regional transmission organizations (RTOs) or ISOs.

⁶ A REC is *issued* to 1 MWh of renewable generation, but is *retired* when it has been used to meet RPS compliance or to make a voluntary claim.

⁷ For example, for certified sales made in calendar year 2011, generation could have come from July 2010 through March 2012.

2 Voluntary Market Sales

In 2011, growth in voluntary market sales can be seen by examining the various available data sources, although none represent a comprehensive picture of the market. Both EPA and Green-e reported growth rates in renewable energy purchased or certified of about 20% in 2011. Data from REC tracking systems, which is the most comprehensive data source, but excludes transactions that occur outside of these systems, show about 40 million MWh of renewable energy in voluntary markets in 2011 (see Figure 1). While this figure is up 90% from 2010, much of the growth may be attributed to the increased use of REC tracking systems to verify voluntary market transactions, rather than an increase in the total market volume.

Data from tracking systems and other sources cannot be directly compared to market estimates prepared by NREL in the past. Historically, NREL has produced a comprehensive annual sales estimate, which has exceeded sales documented in tracking systems, EPA's Green Power Partnership, and CRS' Green-e Energy program. NREL's comprehensive estimate was drawn from gathering data directly from utility green pricing programs, competitive marketers, and REC brokers, supplemented with data from REC certifiers, ERCOT, and press releases describing large voluntary green power purchases. In 2010, tracking systems represented about 60% of the NREL estimated total market volume of about 35 million MWh.

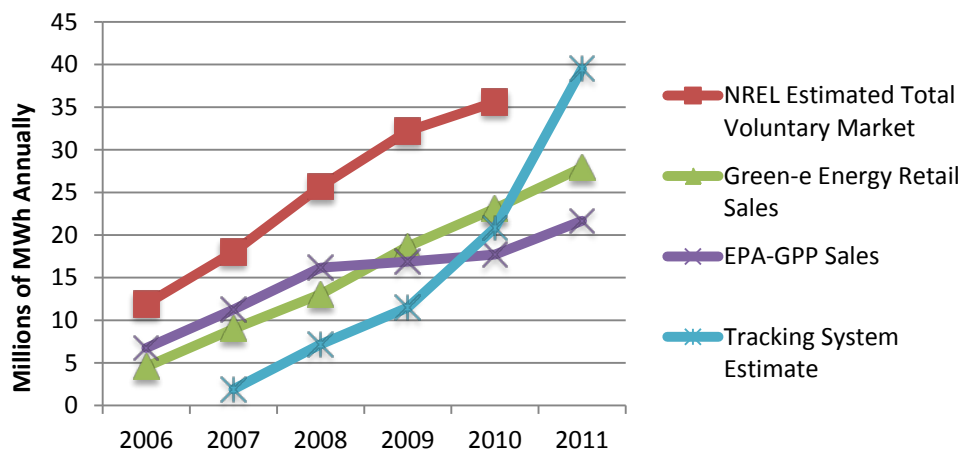


Figure 1. Measurements of the voluntary market for renewable energy by recording entity, 2006-2011

Sources: EIA 2012, EPA 2012a, Heeter and Bird 2011, Terada 2012

EPA's Green Power Partnership saw continued growth in 2011, with sales increasing by 22% over 2010. Between 2006 and 2011, sales increased at a compound annual growth rate of 26%. Data through June 31, 2012 show that 2012 sales are up 10% relative to year-end 2011, indicating that if the second half of 2012 performs similarly, 2011-2012 growth should be similar to the year-to-year pattern in 2010-2011. In 2011, sales growth

was driven by an increase in the average and median purchase size of partners with large load, which increased by 17% and 37%, respectively.⁸

In 2011, Green-e Energy retail sales increased to an estimated 27.9 million MWh, or 21%, similar to growth from 2009 to 2010. Green-e Energy retail sales increased to 23.1 million MWh in 2010, up from 18.7 million MWh in 2009, representing a 24% increase. From 2006 to 2011 Green-e Energy retail sales have seen a compound annual growth rate of 44%.

In 2011, estimated voluntary sales in tracking systems increased to 39.5 million MWh from 20.8 million MWh in 2010 (see Figure 2). From 2007 to 2011, estimated voluntary sales in tracking systems increased at a compound annual growth rate of 114%. However, this growth likely reflects the increased use of tracking systems as a verification tool for voluntary market RECs, not just market growth. Tracking system use is becoming more common because generators want to participate in the RPS compliance markets, which often require generators to use a tracking system, and generators and others are seeking to simplify the Green-e Energy verification and audit process.

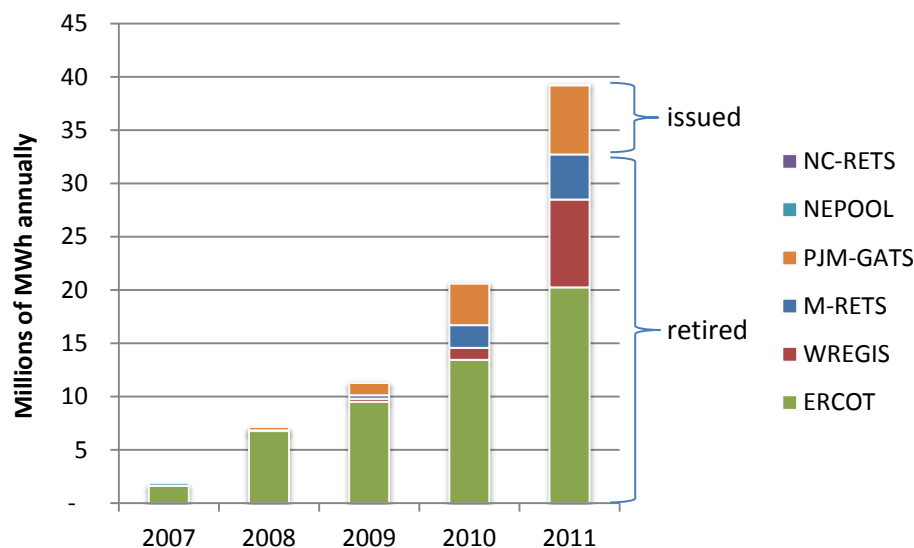


Figure 2. Voluntary REC market data from tracking systems, 2007-2011

Note: The ERCOT, M-RETS, and WREGIS tracking systems report data for retired RECs; NC-RETS, NEPOOL, and PJM-GATS do not report retired REC data and are thus represented with issued REC data.

Estimates of market volume from tracking systems is based on data from the eight state or regional tracking systems in Table 1 (see also Figure 3). Data on retired certificates are used when available, but issued certificates are used as a proxy for systems that do not publicly report retirements. While all tracking systems provide the number of issued certificates publically, not all publically report the number of retired certificates (Table 1). Because voluntary certificates may be issued in one year but retired in a future year,

⁸ Large partners are defined as partners with more than 100,000 MWh of load annually.

the issued data from NC-RETS, NEPOOL, and PJM-GATS may overestimate retired voluntary certificates.

Table 1. Public Reporting by REC Tracking Systems

Tracking System	Number of Issued Certificates	Number of Retired Certificates
ERCOT	Yes	Yes
NEPOOL-GIS	Yes	No
PJM-GATS	Yes	No
WREGIS	Yes	Yes
M-RETS	Yes	Yes
NAR	Yes	No
MI-RECS	Yes	No
NC-RETS	Yes	No

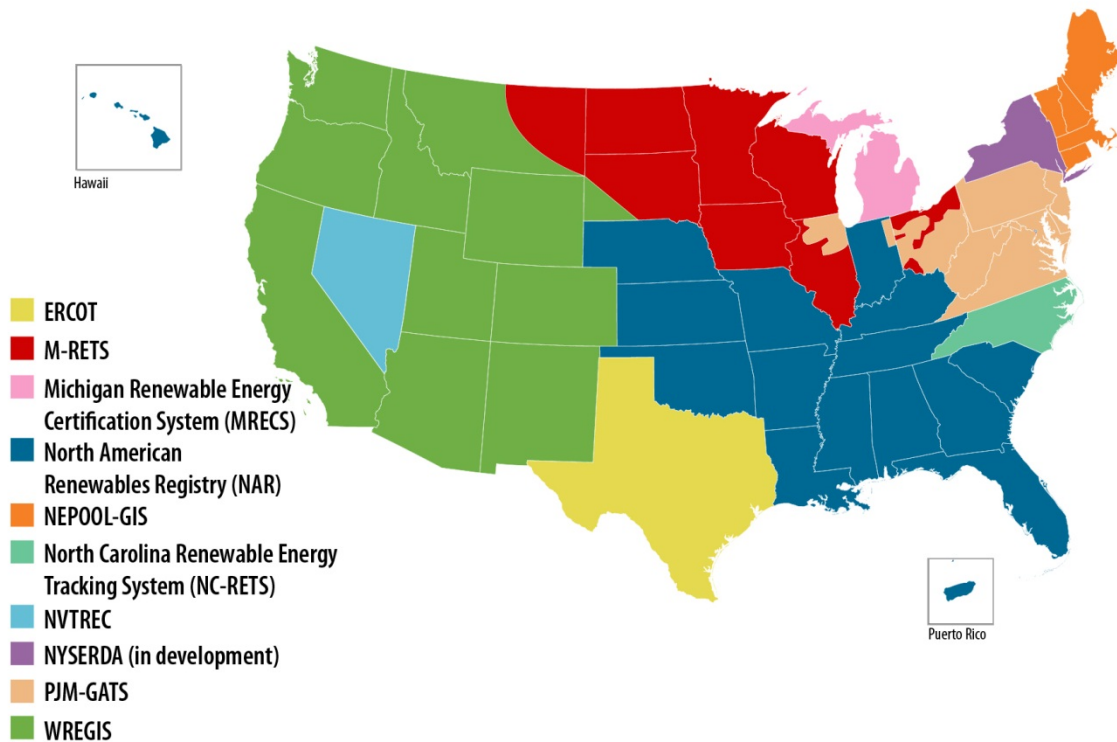


Figure 3. Renewable energy tracking systems in the United States

Source: Updated from ETNNA 2011

Note: NAR covers states and provinces not covered by a NYSE Blue tracking system.

WREGIS saw the largest increase in voluntary REC retirements, increasing from 1.1 million MWh in 2010 to 8.3 million MWh in 2011. An increasing number of utilities are using WREGIS to track their voluntary green pricing programs, and these programs are also growing on a MWh basis (Coon 2012). ERCOT saw about a 50% increase from 13.4

million MWh in 2010 to 20.2 million in 2011. ERCOT represented nearly half of the entire volume of transactions verified in REC tracking systems in 2011. The Texas market is further discussed in Section 2.2.

2.1 Voluntary Sales by Market Type

Historically, REC markets have represented the largest share of the voluntary market—larger than the volumes of green power sold through utility programs or competitive retail suppliers.⁹ In 2010, 56% of all green power sales occurred as REC only transactions that are separate from electricity sales.

REC-only products appeal to nonresidential customers because of their flexibility and the potential cost savings created by sourcing 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. RECs may have a smaller appeal to residential customers because they may not be aware that RECs are available or may not understand what they convey.

EPA's Green Power Partnership tracks which sources partners are using to meet their voluntary commitments. In 2011, REC purchases represented 74% of total green power purchases under the Partnership, a level that has remained fairly steady since 2007. Sales through June 30, 2012 show that RECs represent 75% of total purchases in the Partnership (Figure 4).

⁹ The REC market 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.

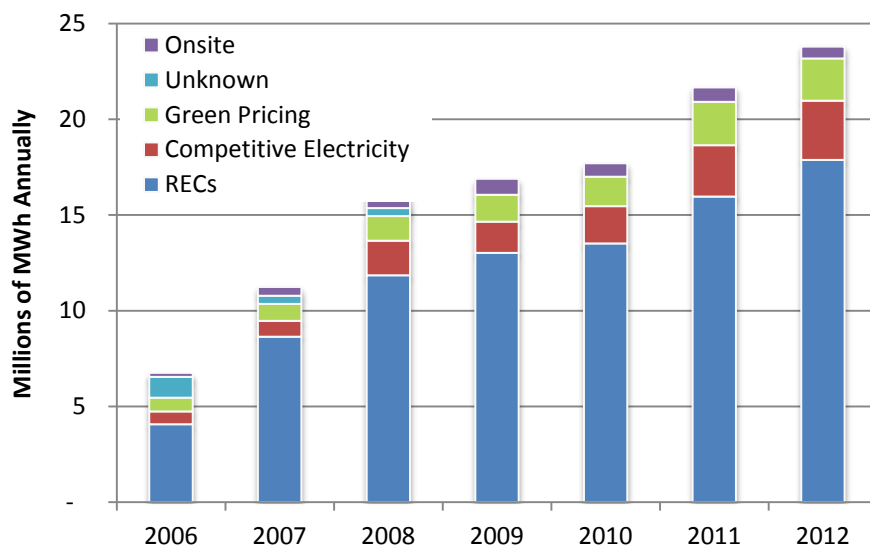


Figure 4. EPA Green Power Partnership annual voluntary sales by classification system, 2006-2012

Source: EPA 2012a

Note: 2012 data are through June 30, 2012.

The Green-e Energy certification program began with a focus on competitive electricity products, but has increasingly certified REC sales (Figure 5). In 2004, REC sales represented 4% of total Green-e Energy sales, while in 2011, REC sales represented approximately 84% of total Green-e Energy sales.

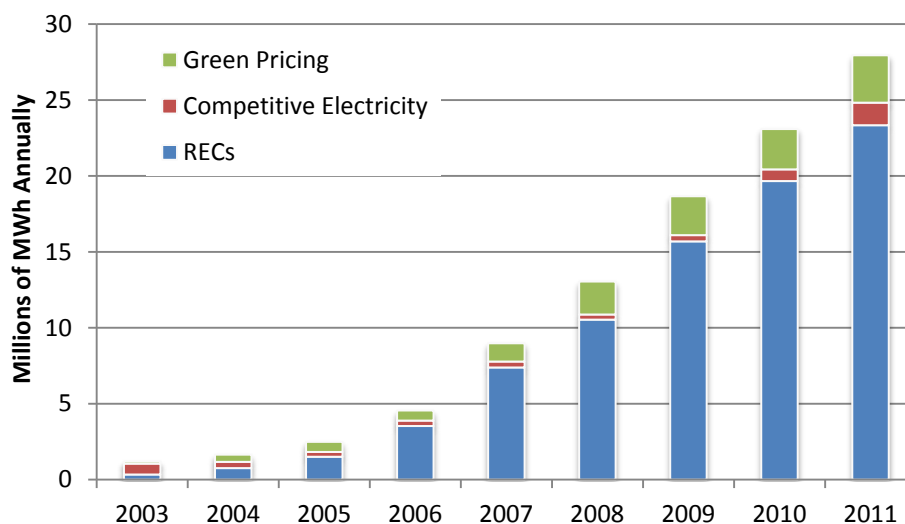


Figure 5. Green-e Energy certified retail sales by product type, 2003-2011

Source: Terada 2012

Utility green pricing sales for 2011 are available for those utilities that report to EIA under Form 826.¹⁰ Figure 6 presents 2011 sales growth for a sample of green pricing programs based on EIA data. Note that while NREL has included “Top 10” rankings of programs in past reports, Figure 6 does **not** represent a similar ranking of top programs because data are incomplete.¹¹ Some green pricing programs, including Austin Energy, do not report to EIA under the 826. In the sample of programs examined from EIA 826 data, some programs increased sales while others saw sales decline, with the median sales growth at 1% from 2010 to 2011. The largest programs for which 2011 data is available saw increases in annual sales ranging from 2% to 9%: Portland General Electric increased by 740,000 MWh, PacifiCorp by 606,000 MWh, SMUD by 409,000 MWh, and Puget Sound Energy by 342,000 MWh.

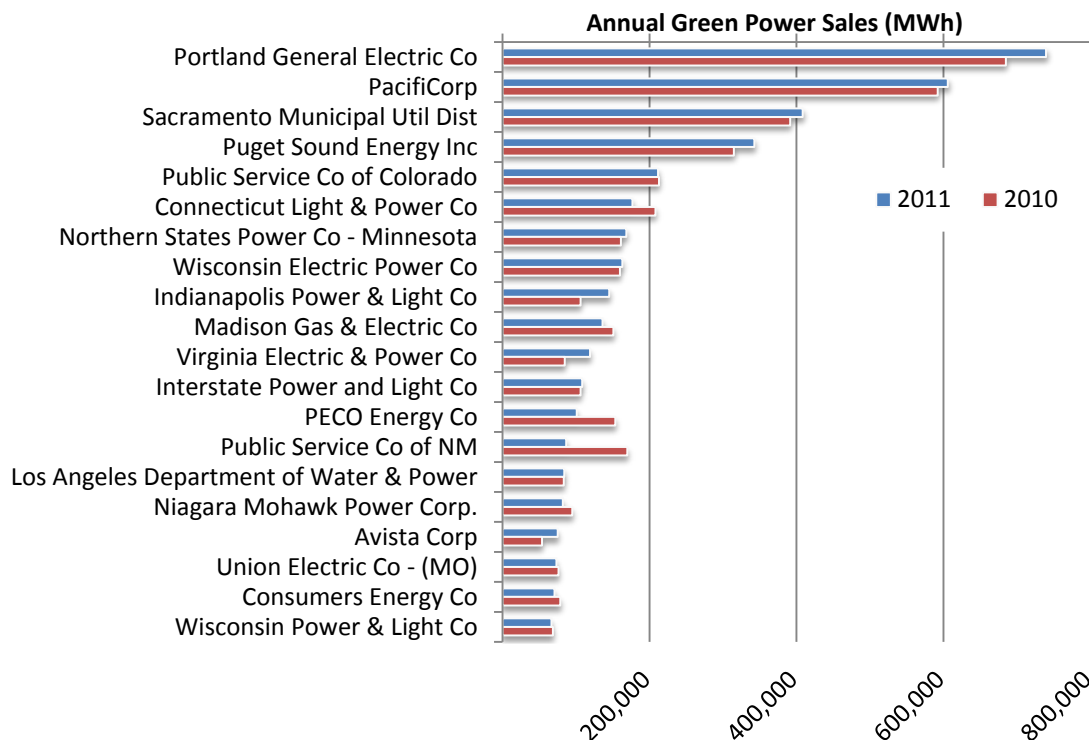


Figure 6. Sample of annual green power sales by utility, 2010-2011

Sources: EIA 2012, EIA 2011

2.2 Regional Focus

Utility green power and competitive market sales are predominant in certain states.¹² The top states in terms of total green power sales include California, Illinois, Maryland, Oregon, Texas, and Washington (Figure 7). State data on utility and competitive market sales for 2010 are publically available from the Energy Information Administration (EIA)

¹⁰ EIA data were spot-checked for reporting errors but otherwise not validated by NREL. Madison Gas & Electric Company provided a revised 2011 green power sales figure to NREL.

¹¹ Previous NREL lists have also presented data on a program basis rather than a utility basis (e.g. sales for a utility program that operates in multiple states have been aggregated).

¹² Data on the geographic source of unbundled RECs is not available from EIA.

(Figure 13 and Appendix B), which collects the data directly as part of its Form 861. However, because not all competitive retailers report to EIA, these data underestimate sales, particularly in states with competitive retail markets, such as Texas.¹³

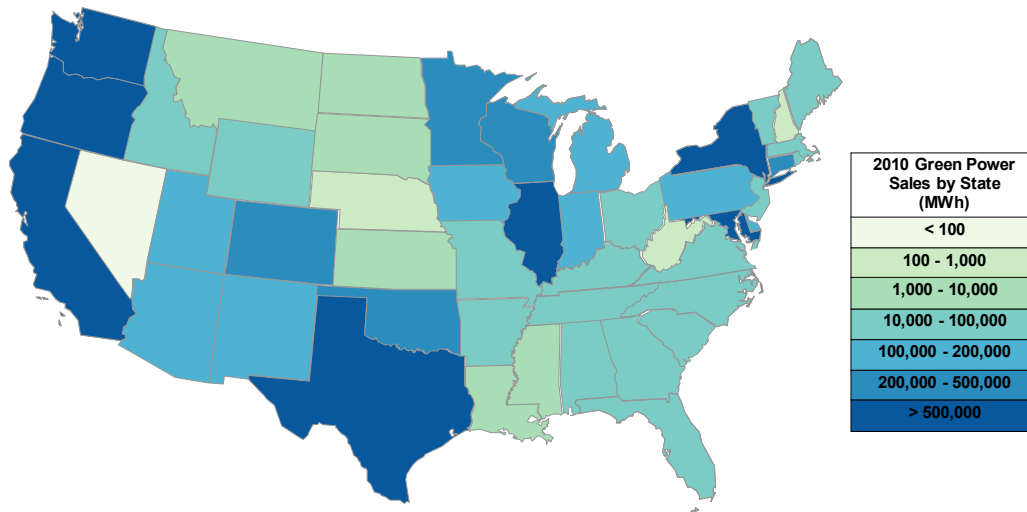


Figure 7. Green power sales from EIA reporting entities, 2010

Source: EIA 2011

Spotlight: Texas

In Texas, an increasing number of green power retail suppliers has in part driven growth in voluntary retirements of RECs. According to data reported by competitive marketers and utility green power programs to ERCOT, voluntary REC retirements in Texas increased by 29% between 2010 and 2011, from 11.8 million MWh in 2010 to 15.3 million MWh in 2011 (ERCOT 2012). In addition, some RECs issued in previous years were retired in 2011, raising the overall market total. In 2011, an additional 4.9 million MWh generated in 2009 and 2010 were also retired (Figure 8), for a total of 20.2 million MWh of voluntary retirements in 2011. In 2011, voluntary retirements in Texas surpassed compliance retirements for the fourth year in a row (ERCOT 2012).

¹³ According to EIA, Form 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 2011).”

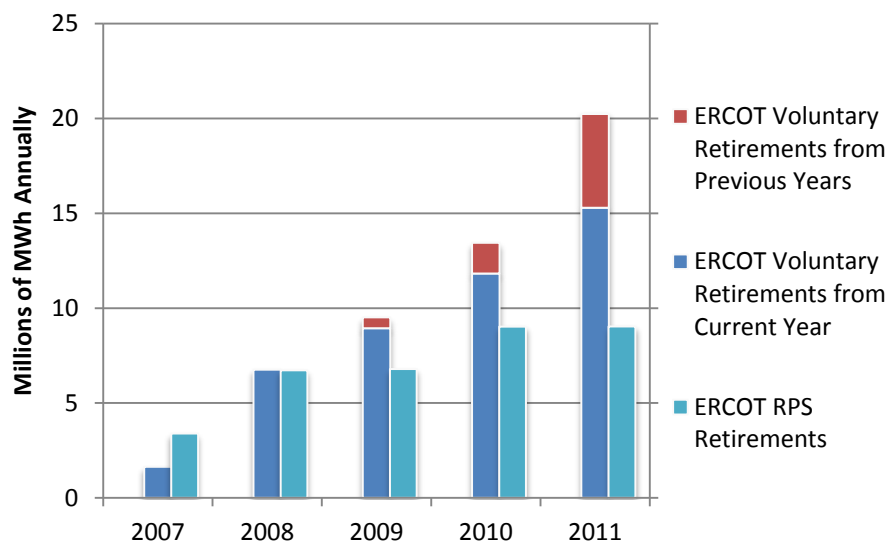


Figure 8. ERCOT voluntary and compliance retirements, 2007-2011

Sources: ERCOT 2012, ERCOT 2011, ERCOT 2010, ERCOT 2009, ERCOT 2008

The Texas Public Utility Commission (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, ERCOT documents how many RECs were retired by each account holder.¹⁴ ERCOT data on the voluntary retirements by account holder for 2010 show that the top 5 largest voluntary retirements were completed by Reliant Energy, Green Mountain Energy, CPS Energy (San Antonio), NextEra, and Austin Energy. Table 2 shows that ERCOT account holders may be entities that operate and are selling RECs generated in Texas to end-consumers outside of Texas. From 2009 to 2010, the largest increases in retired voluntary RECs came from Reliant Energy, Green Mountain Energy, NextEra, Renewable Choice, and First Choice Power.

¹⁴ ERCOT's Annual Report on the Texas Renewable Energy Credit Trading Program can be found at <https://www.texasrenewables.com/reports.asp>.

Table 2. 20 Largest ERCOT Accounts by Voluntary REC Retirements, 2010

Account Holder	Number of RECs Voluntary Retired in 2010
Reliant Energy Retail ,LLC	2,581,954
Green Mountain Energy Company	1,714,209
CPS Energy	1,605,437
NextEra Energy Power Marketing, LLC	978,693
Austin Energy	855,020
Renewable Choice Energy	741,968
First Choice Power Special Purpose, LP	395,529
SUEZ Energy Resources NA, Inc. - Super Green	329,037
SUEZ Energy Resources NA, Inc.	323,095
Washington Gas Energy Services	276,931
Nexant Clean Energy Solutions	268,528
Capricorn Ridge Wind II, LLC	231,726
Direct Energy LP - Green-e Retirements	224,694
Denton Municipal Electric	141,732
Gexa Corp.	139,389
Community Energy, Inc.	133,611
Clean Currents	122,327
3Degrees Group, Inc. (Green-e)	80,000
Green Mountain Energy Commercial Service	78,880
Dell USA, LP	64,095

Source: ERCOT 2012

2.3 Residential and Nonresidential Customer Sales

No data are available for 2011 on sales by customer class, but some earlier data are available. Sales to nonresidential customers have represented between 73% and 76% of total sales from 2006 to 2010 (Figure 9). Figure 15 delineates green power sales by customer segment over time.

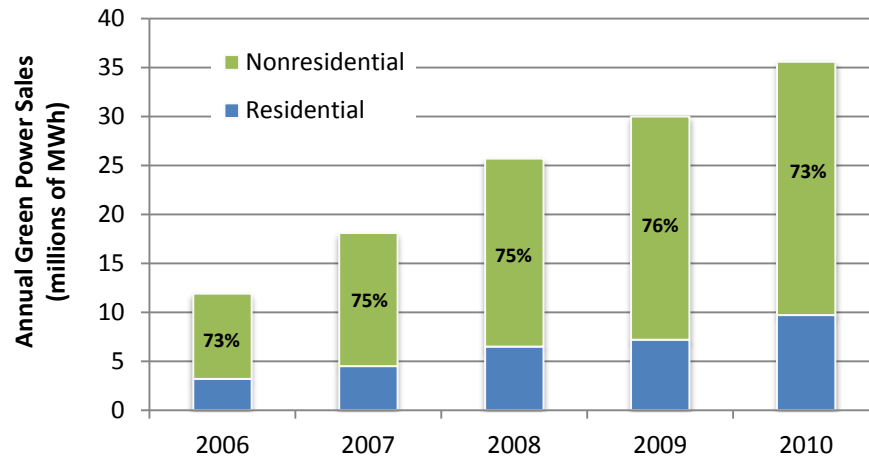


Figure 9. Residential and non-residential voluntary sales, 2006–2010

Source: Heeter and Bird 2011

EIA's 2010 data show that while non-residential sales dominate in some states, residential sales contribute more than 50% of green power sales reported to EIA in Texas, Oregon, New York, California, Washington, and Wisconsin (Figure 10). Texas in particular has seen a rapid increase and uptake in the number of customers by wind energy from retail electricity suppliers.

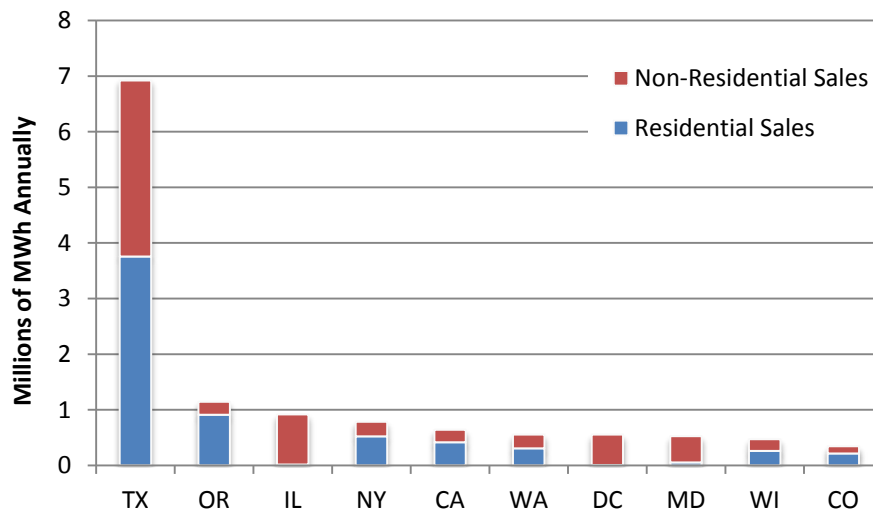


Figure 10. Electricity sales by state for green pricing programs, 2010

Source: EIA 2011

3 Customer Participation

Comprehensive data on customer participation in 2011 are unavailable, but data are available for some utilities, as well as from EPA's Green Power Partnership. For the largest 20 programs (in terms of customers) that report in the EIA 826 Form, customer participation totaled roughly 488,000 in 2011, up 6.5% from 458,000 in 2010 (EIA 861 data) (Figure 11). The largest four programs (in terms of green power customers) that reported data in the EIA 826, Portland General Electric, PacifiCorp, SMUD, and Puget Sound Energy, saw customer gains in 2011 ranging from 5% to 10%.

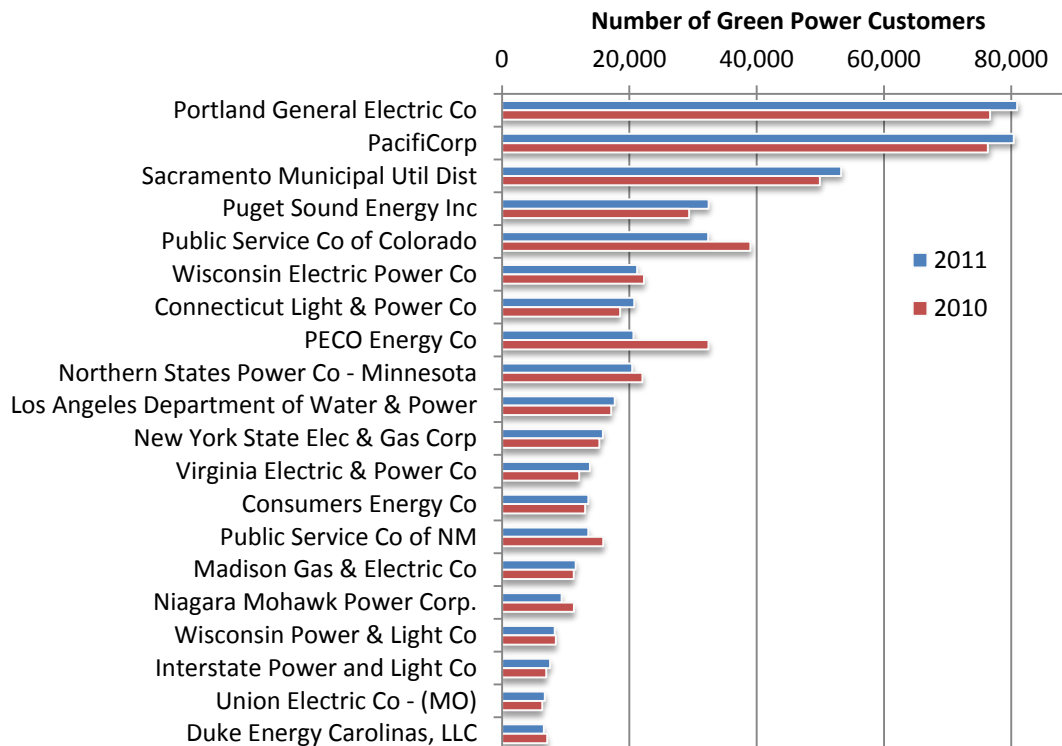


Figure 11. Sample of annual green power customers by utility, 2010-2011

Sources: EIA 2012, EIA 2011

The average participation rate for the largest 20 programs in terms of green power customers in 2011 was 2.9%, ranging from 1.9% to 9.8% (Figure 12) while the average participation rate for all programs reported in the EIA 826 Form in 2011 was 0.9%.

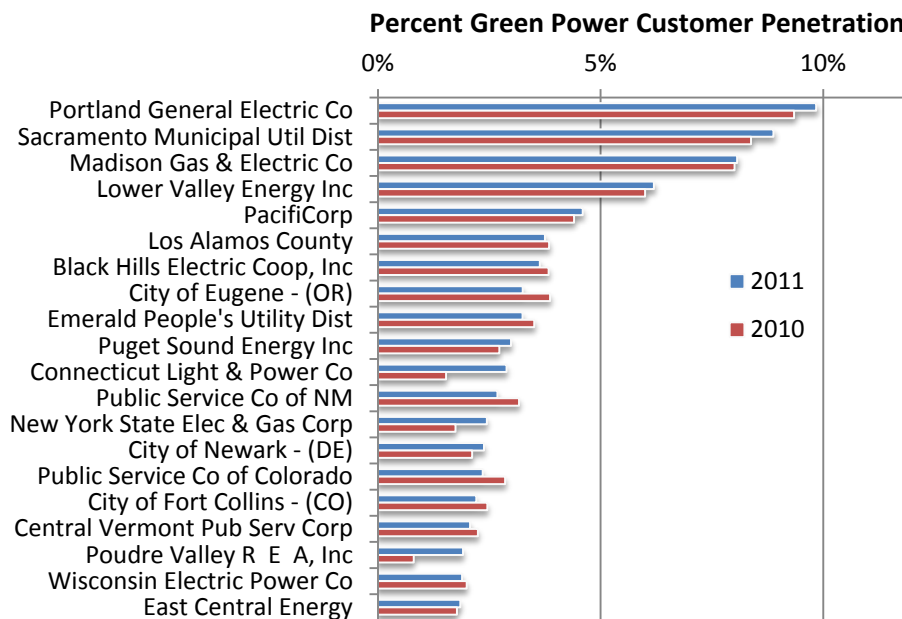


Figure 12. Sample of percent green power customer penetration by utility, 2010-2011

Sources: EIA 2012, EIA 2011

The number of participants in EPA’s Green Power Partnership began to rise in the first half of 2012, after seeing nearly flat net participation from 2010 to 2011 (Figure 13). Notably, in 2011, a larger number (142) of small partners left the program than in previous years; although net participation was nearly flat, new organizations did join the program (EPA 2012a). From 2011 through June 2012, net participation grew by 8% to 1,407 partners.

Two new large purchasers joined the EPA Green Power Partnership in 2012: Microsoft and McDonald’s USA. Microsoft is purchasing 1,120 thousand MWh of green power annually (ranked third) and McDonalds is purchasing 306 thousand MWh of green power annually (ranked thirteenth), as of July 2012.

The top purchasers in EPA’s Green Power Partnership are listed in Appendix A.

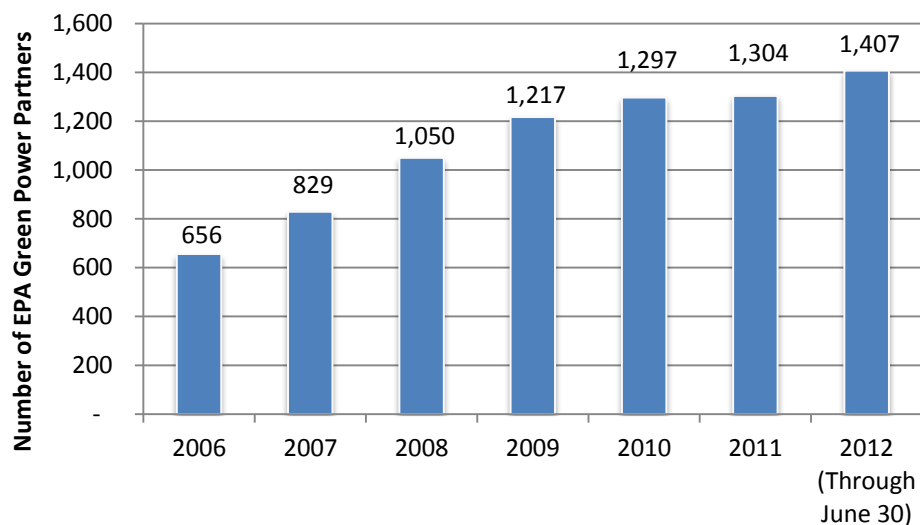


Figure 13. Number of participants in EPA's Green Power Partnership

Source: EPA 2012a

NREL has estimated that 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 3).¹⁵ This represented a 25% increase in participation from 2009. While not as strong as 2009 growth of 44%, the 2010 growth was stronger than previous years (2006-2008). Participation in competitive markets increased about 45% primarily due to substantial customer increases of 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 in 2010, due to increases in residential customer participation. However, no new figures are available for 2011.

¹⁵ There is greater uncertainty in NREL customer estimates for competitive and REC markets because of data limitations. Generally, NREL estimates are consistent with the EIA estimates when adjusted for customers in Ohio who participated in community aggregations in 2005 and earlier. NREL excluded these customers from our estimates because they purchase products with very low renewable energy content (1%–2%).

Table 3. 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
<i>Residential</i>	470,800	526,700	519,700	526,300	544,700
<i>Nonresidential</i>	15,500	20,200	26,100	26,000	22,900
<i>% Residential Growth</i>	23%	12%	-1%	1%	4%
<i>% Nonresidential Growth</i>	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
<i>% Change</i>	~ 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.

4 Community Solar Programs

Increasingly, utilities and third parties are developing community solar programs¹⁶ that allow customers to purchase a share of a renewable system developed in the local community. These types of programs represent the vast majority of new green pricing programs.

Under community solar programs,¹⁷ customers receive the benefits of the energy that is produced by their share. For example, the Holy Cross Energy solar project in El Jebel, Colorado, is an 80 kW photovoltaic system supported by 18 community participants who 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. Also, community solar may be an option for consumers who lack sufficient roof space or exposure to warrant installation of a system on their homes. For more on these issues, see Heeter and McLaren (forthcoming).

The majority of new utility programs introduced in recent years have been community solar programs. In 2011, 10 programs were introduced, and as of August 2012, an additional 8 programs had begun in 2012 (see Appendix C). U.S. community solar programs have a combined capacity of nearly 10,400 kW as of August 2012, and that capacity has been growing (Figure 14). In 2011, the Salt River Project (Arizona) began a 2,000 kW program for residential participants.¹⁸ Two additional large (>1,000 kW) programs were developed in Arizona: Tuscon Electric Power’s 1,600 kW program in 2011 and UniSource Energy Service’s 1,720 kW program in 2012. San Miguel Power Association, working with the Clean Energy Collective (Colorado) also developed a large system (1,000 kW) in 2012.

¹⁶ For an examination of how to develop a community solar project, see DOE 2012.

¹⁷ While the term “community solar program” encompasses other business models (such as bulk purchasing of photovoltaic equipment), this report addresses only programs where participants purchase a share of the solar project and receive credit for their solar production.

¹⁸ Salt River Projects solar array includes an additional 7,840 kW reserved for local schools.

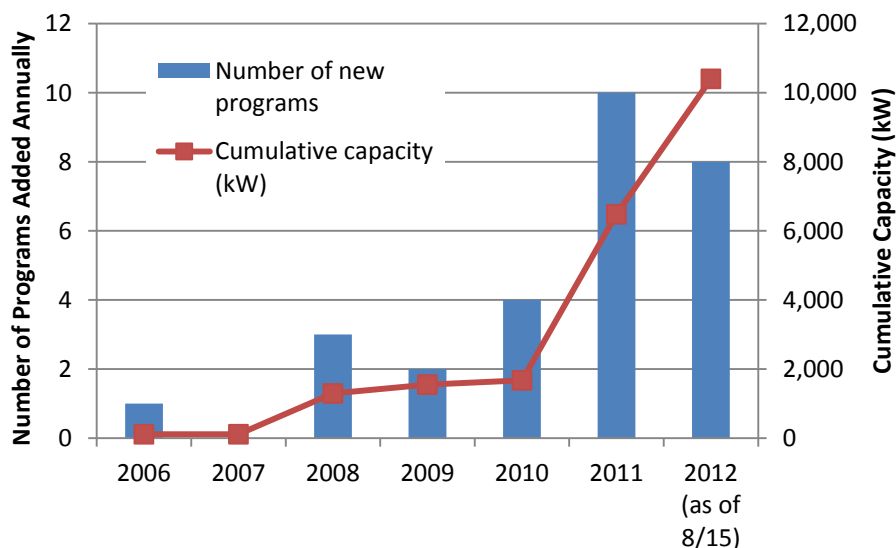


Figure 14. Number and cumulative capacity of community solar programs, January 2006–August 2012

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 2012). 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 2012).

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 incentive program. In June 2012, the Colorado PUC finalized rules pertaining to the incentive program. Under this new program Xcel will accept 4.5 MW of community solar electricity in 2012; it will pay \$0.14 per kWh for small programs (10-50 kW), and \$0.11 per kWh for medium programs (50-500 kW), then scaling down the payments over time after 3 MW of capacity has been installed. Community solar developers were invited to submit applications on August 15, 2012, and Xcel closed the application process after 30 minutes, as three times the 2012 capacity allotment had been submitted.

5 REC Pricing

In 2011, prices for voluntary RECs (both national any technology, national wind, and western wind) declined. Compliance REC pricing increased in a few states (primarily in the Northeast).

As shown in Figure 15, 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 broker data. In 2011 and early 2012, prices paid for nationally sourced voluntary RECs from any technology dropped to less than \$1/MWh. Nationally sourced voluntary wind REC prices were comparable to nationally sourced voluntary RECs for any technology. Wind from the western United States earned higher prices, though West Wind fell to less than \$2/MWh in 2012. The drop in West Wind pricing may be a result of utilities in California being on track to meet the state's RPS. Bloomberg New Energy Finance has noted that California's IOUs do not have a need for additional renewable procurement through the first compliance period (2011-2013) (BNEF 2012).

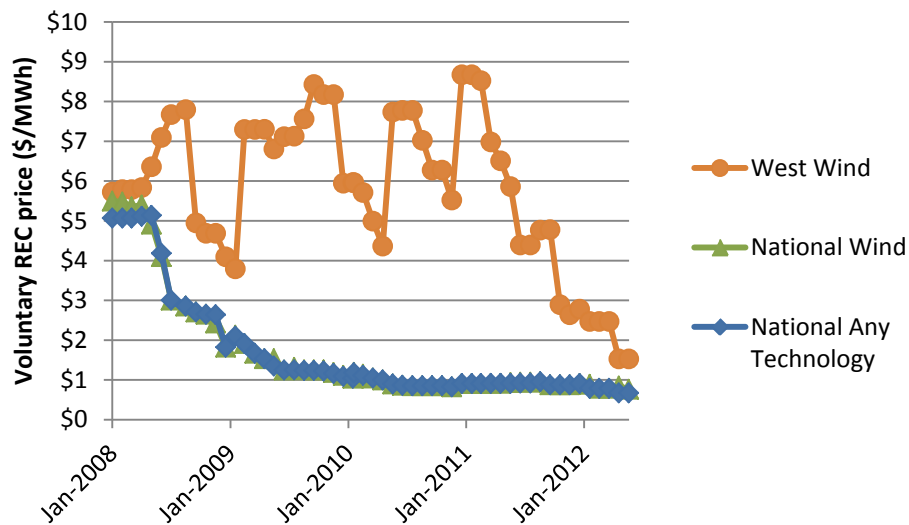


Figure 15. Voluntary REC prices, January 2008–June 2012

Sources: Spectron Group 2012

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.

Compliance REC prices differ because of regional differences in renewable energy resource quality (e.g., wind speed) and the supply and demand of RECs. In 2011, compliance REC prices began to increase in some markets, particularly in the Northeast (Figure 5). Prices for Massachusetts, Rhode Island, New Hampshire, and Connecticut RECs increased in 2011 and the beginning of 2012 to between \$50/MWh and \$60/MWh.

Other state markets have seen little to no change in REC pricing in recent years. REC prices remain under \$5/MWh in Washington, D.C., Delaware, Illinois, Maryland, New Jersey, Ohio, Pennsylvania, and Texas. Figure 16 shows the wide variation in compliance REC prices among states for which data are available.

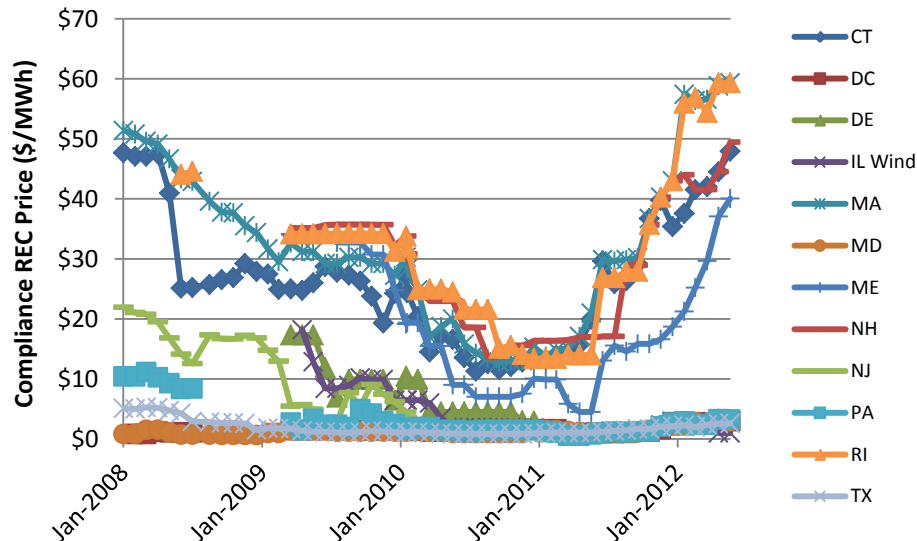


Figure 16. Compliance market (Tier 1) REC prices, January 2008–June 2012

Sources: Spectron Group 2012

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.

6 Conclusions and Observations

Voluntary REC markets continue to exhibit growth and provide a 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, NREL has identified the following market trends:

- In 2011, several available data sources show that voluntary sales of renewable energy continued to increase. Both EPA's Green Power Partnership and CRS' Green-e Energy program experienced growth rates of around 20%. The EPA's Green Power Partnership grew to 21.7 million MWh in 2011, a 22% increase over 2010. The CRS' Green-e Energy program grew to an estimated 27.9 million MWh in 2011 for retail sales, an increase of 21% over 2010.
- Data from REC tracking systems, which is the most comprehensive data source, but excludes transactions that occur outside of these systems, show about 40 million MWh of renewable energy in voluntary markets in 2011, up from 20.8 million MWh in 2010, a growth rate of 90%. In 2010, tracking systems represented about 60% of the NREL estimated total market volume of about 35 million MWh. Growth in this sector is likely partially a result of increased use of tracking systems for voluntary market transactions. ERCOT and WREGIS saw the largest growth on a MWh basis in 2011; and ERCOT represents roughly half of all reported volumes.
- Based on data from EIA on a sample of utility programs, the largest 20 programs that report in the EIA 826 recorded a mix of green power sales increases and declines from 2010 to 2011. A few programs saw sales growth greater than 35%, while others saw losses of similar proportion; the median growth for the sample of programs was 1%.
- The majority of new utility programs introduced in recent years have been community solar programs that enable utility customers to purchase a share of a solar system and receive the benefits of the energy produced by their share. Since 2011, 18 new programs were introduced. Today, nearly 30 community solar programs have a combined capacity of more than 10 MW.
- Voluntary REC pricing fell to less than \$1/MWh in 2011. Pricing has remained under \$1/MWh through August 2012.

References

- Bird, L., C. Kreycik, and B. Friedman. (September 2009). *Green Power Marketing in the United States: A Status Report (2008 Data)*. NREL/TP-6A2-46581. Golden, CO: National Renewable Energy Laboratory, September.
<http://www.nrel.gov/docs/fy09osti/46581.pdf>. Accessed October 4, 2011.
- Bird, L.; Sumner, J. (September 2010). *Green Power Marketing in the United States: A Status Report (2009 Data)*. NREL/TP-6A20-4940. Golden, CO: National Renewable Energy Laboratory. <http://www.nrel.gov/docs/fy11osti/49403.pdf>. Accessed September 2011.
- Bloomberg New Energy Finance (BNEF). (2012). U.S. Renewable Energy – Research Note: California renewable compliance: up to the brim. 22 June.
- Clean Energy Collective (CEC). (2012). “Bringing down the cost of solar through community shared solar.” Webinar presentation. <http://www.icleiusa.org/action-center/learn-from-others/bringing-down-the-cost-of-solar-through-community-shared-solar-programs>. Accessed August 14, 2012.
- Coon, A. (17 August 2012). E-mail. Western Electricity Coordinating Council. Salt Lake City, Utah.
- Database of State Incentives for Renewables & Efficiency (DSIRE). (2012). www.dsireusa.org. Accessed August 17, 2012.
- Department of Energy (DOE). (2012). “Guide to Community Shared Solar: Utility, Private, and Non-profit Project Development.” <http://www1.eere.energy.gov/solar/pdfs/54570.pdf>. Accessed August 14, 2012.
- Electricity Information Agency (EIA). (2012). “Monthly Electric Utility Sales and Revenue Data.” <http://www.eia.gov/cneaf/electricity/page/eia826.html>. Accessed September 4, 2012.
- EIA. (2011). “Annual Electric Utility Data File – EIA-861.” <http://www.eia.gov/electricity/data/eia861/index.html>. Accessed September 4, 2012.
- Electric Reliability Council of Texas, Inc. (ERCOT). (2012). *ERCOT’s 2011 Annual Report on the Texas Renewable Energy Credit Trading Program*. Project No. 27706. Texas Public Utilities Commission. <https://www.texasrenewables.com/reports.asp>. Accessed September 4, 2012.
- ERCOT. (2011). *ERCOT’s 2010 Annual Report on the Texas Renewable Energy Credit Trading Program*. Project No. 27706. Texas Public Utilities Commission. <https://www.texasrenewables.com/reports.asp>. Accessed September 4, 2012.

ERCOT. (2010). *ERCOT's 2009 Annual Report on the Texas Renewable Energy Credit Trading Program*. Project No. 27706. Texas Public Utilities Commission.
<https://www.texasrenewables.com/reports.asp>. Accessed September 4, 2012.

ERCOT. (2009). *ERCOT's 2008 Annual Report on the Texas Renewable Energy Credit Trading Program*. Project No. 27706. Texas Public Utilities Commission.
<https://www.texasrenewables.com/reports.asp>. Accessed September 4, 2012.

ERCOT. (2008). *ERCOT's 2007 Annual Report on the Texas Renewable Energy Credit Trading Program*. Project No. 27706. Texas Public Utilities Commission.
<https://www.texasrenewables.com/reports.asp>. Accessed September 4, 2012.

Environmental Protection Agency (EPA). (2012a). E-mail. Data on Green Power Partnership.

EPA. (2012b). Green Power Partnership – National Top 50.
<http://www.epa.gov/greenpower/toplists/top50.htm>. Accessed April 2011.

Green Power Network. (2010). “Holy Cross Energy Launches 80 kW Community Solar Program.” http://apps3.eere.energy.gov/greenpower/news/news_template.shtml?id=1564. Accessed October 3, 2011.

Green Power Network. (2011). “Delta-Montrose Electric Association (Colo.) Launches Community Solar.”
http://apps3.eere.energy.gov/greenpower/news/news_template.shtml?id=1620. Accessed October 3, 2011.

Heeter, J.; Bird, L. (October 2011). Status and Trends in U.S. Compliance and Voluntary Renewable Energy Certificate Markets (2010 Data). NREL/TP-6A20-52925. Golden, Colorado: National Renewable Energy Laboratory.
<http://apps3.eere.energy.gov/greenpower/pdfs/52925.pdf>. Accessed August 17, 2012.

Heeter, J.; McLaren, J. (forthcoming). Innovations in Voluntary Renewable Energy Procurement: Methods for Expanding Access and Lowering Cost for Communities, Governments, and Businesses. Golden, Colorado: National Renewable Energy Laboratory.

Spectron Group. (2012). Data accessed through Vantage database. London, UK.
www.spectrongroup.com. Accessed August 15, 2012.

Terada, R. (14 September 2012). Email. Center for Resource Solutions, San Francisco, CA.

Appendix A. Leading Purchasers in the EPA Green Power Partnership

Table A-1. Top 25 Purchasers in the EPA Green Power Partnership Program, as of July 5, 2012

Company & Rank	Annual Green Power Usage (kWh)	GP % of Total Electricity Use - 2012	Green Power Resources
1. Intel Corporation	2,798,660,169	89%	Biogas, Biomass, Small-hydro, Solar, Wind
2. Kohl's Department Stores	1,528,378,000	101%	Solar, Wind
3. Microsoft Corporation	1,120,000,000	46%	Biomass, Small-hydro, Wind
4. Wal-Mart Stores, Inc. / California and Texas Facilities	872,382,088	28%	Biogas, Solar, Wind
5. Whole Foods Market	800,257,623	107%	Solar, Wind
6. Lockheed Martin Corporation	546,399,457	30%	Biogas, Small-hydro, Solar, Wind
7. Staples	516,713,408	78%	Biogas, Solar, Wind
8. City of Houston, TX	438,000,000	35%	Wind
9. Starbucks	414,560,000	46%	Biogas, Geothermal, Small-hydro, Wind
10. City of Austin, TX	370,464,066	100%	Wind
11. BD	317,276,000	60%	Solar, Wind
12. Hilton Worldwide	315,000,000	94%	Small-hydro, Wind
13. McDonald's USA LLC	306,000,000	30%	Wind
14. U.S. Department of Energy	295,974,615	6%	Geothermal, Solar, Wind
15. City of Dallas, TX	295,883,744	40%	Wind
16. Cisco Systems, Inc.	268,644,637	27%	Wind
17. District of Columbia	267,042,489	50%	Wind
18. U.S. Air Force	265,777,826	3%	Biogas, Biomass, Solar, Wind
19. TD Bank, N.A.	261,827,000	100%	Wind
20. U.S. Environmental Protection Agency	261,056,565	101%	Biogas, Biomass, Solar, Wind

Source: EPA 2012b.

Appendix B. EIA Estimated U.S. Green Pricing Sales by State

Table B-1. EIA Estimated U.S. Green Pricing Sales by State (MWh), 2010

State	2009 Green Pricing Sales (MWh)	2010 Green Pricing Sales (MWh)
AK	-	-
AL	7,659	12,915
AZ	104,548	130,494
AR	18,497	21,797
CA	809,262	640,910
CO	345,377	344,256
CT	192,971	235,413
DC	29,612	554,524
DE	90,160	178,343
FL	14,983	13,716
GA	56,306	60,536
HI	-	-
ID	48,820	44,711
IL	25,181	916,181
IN	112,885	140,329
IA	34,458	111,365
KS	73,435	1,020
KY	42,685	19,734
LA	3,350	1,948
ME	17,862	15,787
MD	171,138	525,206
MA	83,746	93,863
MI	172,649	174,820
MN	276,516	238,770
MS	1,113	5,315
MO	58,890	77,542
MT	6,308	5,484
NE	15,067	209
NV	81	69
NH	-	308
NJ	18,369	29,312
NM	219,210	190,673
NY	358,271	785,378
NC	12,898	24,424
ND	34,761	7,387
OH	24,468	18,033
OK	231,508	302,669
OR	1,130,908	1,145,227
PA	300,515	196,510
RI	33,150	32,998
SC	28,351	25,836
SD	263	1,925
TN	73,160	63,870
TX	5,102,146	6,920,311
UT	180,173	186,522
VT	16,674	20,666
VA	23,584	85,313
WA	579,015	555,440
WV	855	177
WI	449,843	136,060
WY	42,935	37,537

Source: EIA 861

Appendix C. Community Solar Offers

Table C-1. Historical Development of Community Solar Offers

Utility/Provider	Program Name	Program Size (kW)	Program Start Year
Ellensburg (WA)	Community Solar Project	111	2006
Sacramento Municipal Utility District (CA)	SolarShares	1,000	2008
Florida Keys Electric Cooperative (FL)	Simple Solar	117	2008
Ashland (OR)	Solar Pioneers II	64	2008
St. George (UT)	SunSmart	250	2009
Bainbridge Island (WA)	Solar for Sakai	5	2009
Holy Cross Energy/Clean Energy Collective (CO)	Mid Valley Solar Array (El Jebel)	80	2010
University Park Community Solar LLC (MD)	University Park Solar	23	2010
Corvallis (OR)	Corvallis OR, SunSlice Deal	2	2010
Okanogan County Elec. Coop. (WA)	OCEC Community Solar	20.2	2010
Salt River Project (AZ)	SRP EarthWise & Copper Crossing Solar Ranch	2,000	2011
Trico Electric (AZ)	Trico SunWatts Sun Farm	193	2011
Delta-Montrose Electric Association (CO)	Community Solar Array	20	2011
Holy Cross Energy/Clean Energy Collective (CO)	Garfield County Array	858	2011
Berea Utilities (KY)	Berea Solar Farm	14	2011
Edmonds (WA)	Edmonds Community Solar Cooperative	4	2011
Okanogan County Elec. Coop. (WA)	Winthrop Community Solar	23	2011
Poulsbo Project (WA)	Poulsbo Middle School	75	2011
Seattle City Light (WA)	Community Solar	24	2011
Tucson Electric Power (AZ)	Bright Tucson Community Solar Program	1,600	2011
UniSource Energy Services (AZ)	Bright Arizona Community Solar	1,720	2012
Colorado Springs (CO)	Community Solar Garden Facility Incentive Program	500	2012
Poudre Valley REA/Clean Energy Collective (CO)	Community Solar	115	2012
Brewster Community Solar Garden Coop. Inc. (MA)	Brewster Community Solar Garden	345.6	2012
Olympia (WA)	Olympia WA, SunSlice Deal	75	2012
Acorn Energy Coop. (VT)	Acorn Energy Solar One	150	2012
United Power (CO)	Sol Partners Coop. Solar Farm	10	2012
San Miguel Power Association/Clean Energy Collective (CO)	SMPA Community Solar	1,000	2012