

QUALIFICATIONS OF RICHARD H. BRANCH

CURRENT POSITION AT PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

Analyst, New Hampshire Revenue Requirements Department, 2012-Present
Responsibilities include supporting the company's regulatory and revenue requirements needs.

PREVIOUS POSITIONS AT PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

Analyst, Business Planning and Customer Support Services, 2008-2012

EDUCATIONAL BACKGROUND

Bachelor of Social Science Degree in Economics from the University of Ottawa, 1993
Master of Arts Degree in Economics from Boston College, 1997

PREVIOUS TESTIMONY

<u>Docket No.</u>	<u>Docket Subject</u>	<u>Subject of Testimony</u>
DE 10-314	Renewable Default Energy Service	Update of Rate
DE 11-255	Renewable Default Energy Service	Update of Rate



Green Power Marketing in the United States: A Status Report (2009 Data)

Lori Bird and Jenny Sumner

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-6A20-49403
September 2010

Contract No. DE-AC36-08G028308



Green Power Marketing in the United States: A Status Report (2009 Data)

Lori Bird and Jenny Sumner

Prepared under Task No. SA09.3102

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.

National Renewable Energy Laboratory
1617 Cole Boulevard
Golden, Colorado 80401
303-275-3000 • www.nrel.gov

Technical Report
NREL/TP-6A20-49403
September 2010

Contract No. DE-AC36-08GO28308

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 wish to thank Linda Silverman and the EERE technology programs for their support of this work. The authors also wish to thank Blaine Collison of the U.S. Environmental Protection Agency; Steve Dunn of DOE; Bridgett Neely of Green Mountain Energy; Rachael Terada and Alex Pennock of the Center for Resource Solutions; and Lynn Billman, Jim Newcomb, Robin Newmark, and Claire Kreycik of NREL for their thoughtful review of the document as well as Mary Lukkonen of NREL for her editorial support. Finally, the authors thank the many green power marketers and utility contacts who provided the information summarized in this report. Additional information on green power market trends and activities can be found on DOE's Green Power Network Web site at <http://greenpower.energy.gov>.

List of Acronyms

ACP	alternative compliance payment
aMW	average megawatt
CARB	California Air Resources Board
CCAR	California Climate Action Registry
CCX	Chicago Climate Exchange
DOE	Department of Energy
eGRID	Emissions & Generation Resource Integrated Database
EIA	Energy Information Administration
EPA	Environmental Protection Agency
ERCOT	Electric Reliability Council of Texas
FEMP	Federal Energy Management Program
FPL	Florida Power & Light
GHG	greenhouse gas
GRP	General Reporting Protocol
kWh	kilowatt-hour
MW	megawatt
MWh	megawatt-hour
NREL	National Renewable Energy Laboratory
PJM-GATS	PJM-Generation Attribute Tracking System
REC	renewable energy certificate
RES	renewable energy standard
RGGI	Regional Greenhouse Gas Initiative
RPS	renewable portfolio standard
SREC	solar renewable energy certificate
WECC	Western Electric Coordinating Council

Executive Summary

This report documents green power marketing activities and trends in the United States. Aggregate green power sales data for all voluntary purchase markets across the United States are presented for 2009. The data presented in this report are based primarily on figures provided to NREL by utilities and independent renewable energy marketers. Because data cannot be obtained from all market participants, the estimates presented here likely represent an underestimate of the market size. Key trends identified in this year's report include:

- In 2009, total retail sales of renewable energy in voluntary markets exceeded 30 million MWh, an increase of 17% from 2008. The increase was dominated by renewable energy certificate (REC) sales, primarily to nonresidential consumers, which increased by about 20% from 2008 (see Figure ES-1). REC markets now represent 62% of total voluntary green power market sales.
- Utility green pricing programs in regulated electricity markets continued to grow on a sales basis but at a slower rate than in previous years, with sales volume increasing by about 7% in 2009. A relatively small number of utility programs continued to dominate sales and customer numbers. Utility premiums for green pricing continued to fall due in part to the increased cost competitiveness of renewable with conventional generation.
- Wind energy provided 73.7% of total green power sales volume, followed by biomass energy sources including landfill gas (10.0%), hydropower (9.9%), geothermal (0.2%), and solar (0.1%), with the remainder unknown (5.9%).
- Overall, the total number of customers purchasing green power increased by 44% in 2009, which is a higher rate than in previous years and with gains coming primarily from a competitive offering in Texas introduced in 2009. Utility green pricing program participants remained essentially flat in aggregate from 2007 to 2009, with some programs continuing to report customer losses in 2009.
- In 2009, nearly 340,000 metric tons of avoided CO₂e from renewable energy facilities were marketed as offsets, an increase of approximately 39% from 2008. This is the equivalent of about 485,000 MWh of renewable energy generation.

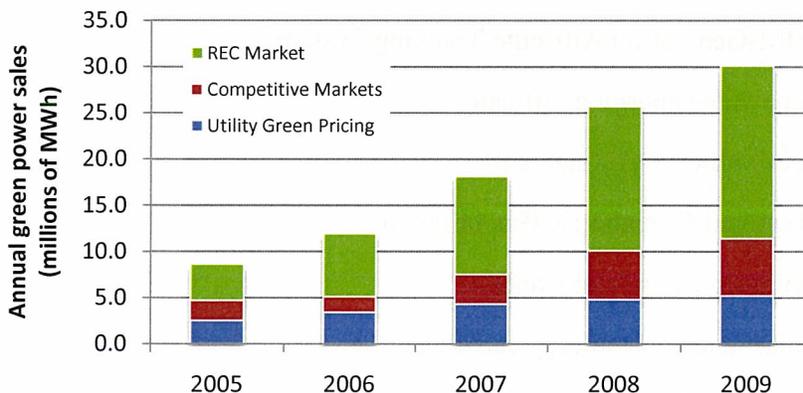


Figure ES-1. Estimated annual green power sales by market sector, 2005–2009

Table of Contents

List of Figures	vii
List of Tables	vii
Introduction	1
Green Power Market Summary and Trends	3
Green Power Sales	3
Customer Participation.....	8
Comparison of Voluntary and Compliance Markets	9
Utility Green Pricing.....	11
Green Pricing Products and Premiums	11
Green Pricing Customer Participation	13
Green Pricing Renewable Energy Sales	16
Competitive Green Power and REC Markets.....	20
REC and Competitive Market Products and Pricing	21
REC and Competitive Market Customer Participation.....	23
REC and Competitive Market Green Power Sales	26
The Voluntary Carbon Offsets Market	29
Voluntary Green Power Market Trends and Issues.....	32
REC Prices	32
REC Price Transparency and Quantity Information.....	36
Treatment of Renewable Energy Purchases in GHG Inventories.....	38
Conclusions and Observations	43
References	44
Appendix A. Leading Purchasers in the EPA Green Power Partnership	46
Appendix B. Estimated U.S. Green Pricing Customers	48
Appendix C. Utilities Offering Green Pricing Programs in Regulated Markets.....	52
Appendix D. Links to Utility Green Pricing Programs and REC and Competitive Market Green Power Offerings	54
Appendix E. Top 10 Utility Green Pricing Programs	55

List of Figures

Figure 1. Estimated green power sales by renewable energy source, 2009.....	4
Figure 2. Estimated annual green power sales by market sector, 2005–2009	5
Figure 3. Residential and nonresidential green power sales, 2005–2009	6
Figure 4. Comparison of compliance and voluntary markets for renewable energy, 2004–2009	10
Figure 5. Trends in utility green pricing premiums, 2000–2009	13
Figure 6. Annual sales of renewable energy through utility green pricing programs, 2002–2009 (regulated electricity markets only)	17
Figure 7. Texas green power product offers, 2004–2009	24
Figure 8. Changes in retail sales and customer participation for utility/marketer partnerships in competitive markets, 2005–2009	25
Figure 9. Compliance market (primary tier) REC prices, January 2007 to June 2010.....	33
Figure 10. Compliance market SREC weighted average price, November 2008 to June 2010	34
Figure 11. State percent of annual SREC trading volumes, 2009	34
Figure 12. Voluntary REC prices, January 2007 to May 2010.....	35
Figure 13. Overview of scopes and emissions.....	39

List of Tables

Table 1. Estimated Annual Green Power Sales by Market Sector, 2005–2009 (Millions of MWh)	5
Table 2. Estimated Annual Green Power Sales by Customer Segment, 2005–2009 (Millions of MWh).....	6
Table 3. Estimated Annual Green Power Sales by Customer Segment and Market Sector, 2009 (Millions of MWh).....	7
Table 4. Estimated Cumulative Renewable Energy Capacity Supplying Green Power Markets, 2006–2009 (MW).....	7
Table 5. Estimated Cumulative Green Power Customers by Market Segment, 2003–2009	9
Table 6. Residential Price Premiums of Utility Green Power Products, 2002–2009 (¢/kWh).....	12
Table 7. Estimated Cumulative Number of Customers Participating in Utility Green Pricing Programs (Regulated Electricity Markets Only), 2002–2009.....	15
Table 8. Customer Participation Rates in Utility Green Pricing Programs, 2002–2009	16

Table 9. Annual Sales of Renewable Energy through Utility Green Pricing Programs (Regulated Electricity Markets Only), 2003–2009 (Thousands of kWh)	17
Table 10. Average Purchases of Renewable Energy per Customer, 2002–2009 (kWh/year)	18
Table 11. Renewable Energy Generation and Capacity Supplying Green Pricing Programs, 2009	19
Table 12. Renewable Energy Sales as a Percent of Utility Electricity Sales, 2008–2009.....	19
Table 13. Total Retail Sales of <i>Green-e Energy</i> Certified Renewable Energy, 2008 and 2009 (Thousands of MWh).....	22
Table 14. Estimated Cumulative Number of Customers Buying RECs or Green Power from Competitive Marketers, 2003–2009.....	25
Table 15. Retail Sales of Renewable Energy in Competitive Markets and RECs, 2004–2009 (Thousands of kWh)	27
Table 16. Renewable Energy Sources Supplying Competitive and REC Markets, 2009.....	28
Table 17. GHG Offsets Sourced from U.S.-based Renewable Energy Sources, 2008–2009.....	30
Table 18. Range of Voluntary REC Prices in 2009 for Different Vintages (\$/MWh)	36
Table A-1. Top 25 Purchasers in the EPA Green Power Partnership Program, January 5, 2010	46
Table B-1. Estimated U.S. Green Pricing Customers by State and Customer Class, 2007 and 2008.....	48
Table B-2. Estimated U.S. Green Pricing Customers by Customer Class, 2002–2008.....	51
Table C-1. Utilities Offering Green Pricing Programs in Regulated Markets, 2009.....	52
Table C-2. Utility/Marketer Green Power Programs in Restructured Electricity Markets, 2009.	53
Table E-1. Top 10 Green Pricing Program Renewable Energy Sales (as of December 2009).....	55
Table E-2. Total Number of Customer Participants (as of December 2009).....	56
Table E-3. Customer Participation Rate (as of December 2009).....	57
Table E-4. Green Power Sales as a Percentage of Total Retail Electricity Sales (as of December 2009) (kWh).....	58
Table E-5. Price Premium Charged for New, Customer-driven Renewable Power (as of December 2009).....	59

Introduction

Voluntary consumer decisions to buy electricity supplied from renewable energy sources represent a powerful 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.¹ 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 renewable energy certificates (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.

Approximately 860 utilities, or more than 25% of utilities nationally, offer green power programs to customers. These programs allow customers to purchase some portion of their power supply as renewable energy—almost always at a higher price—or to contribute funds for the utility to invest in renewable energy development, such as solar installations at local schools. The term “green pricing” is typically used to refer to these utility programs offered in regulated or noncompetitive electricity 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.² A dozen states that have opened their markets to retail competition have experienced some green power marketing activity.³

Finally, regardless of whether they have access to a green power product from their retail power provider, energy consumers can purchase green power through RECs, which represent the environmental attributes of electricity generated from renewable energy-based projects. Consumers can also support renewable energy development through REC purchases without having to switch to an alternative electricity supplier. Today, several dozen companies actively market RECs to residential or business customers throughout the United States. Some REC marketers also sell greenhouse gas (GHG) emissions offsets sourced from renewable energy projects.

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

² Under these programs, consumers can buy renewable energy from independent renewable energy marketing companies without switching their electricity service from the default or standard-offer service provider.

³ States with competitive offerings include Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, Pennsylvania, Rhode Island, Texas, and Washington, D.C.

This report documents green power marketing activities and trends in the United States. First, aggregate green power sales data for all voluntary purchase markets across the United States is presented. The next three sections provide summary data on 1) utility green pricing programs offered in regulated electricity markets; 2) green power marketing activity in competitive electricity markets, as well as green power sold to voluntary purchasers in the form of RECs; and 3) renewable energy sold as GHG offsets in the United States. These sections are followed by a discussion of key market trends and issues. The final section offers conclusions and observations.

The data presented in this report are based primarily on figures provided to NREL by utilities and independent renewable energy marketers.⁴ NREL also supplements this data with information from REC certifiers, REC tracking systems (see ERCOT 2009), 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, and therefore estimates of the competitive market are more uncertain.

⁴ Green power market data for previous years are available in Bird et al. (2009), Bird et al. (2008), Bird et al. (2007), Bird and Swezey (2006).

Green Power Market Summary and Trends

Green Power Sales

Green power sales, driven by REC markets, increased by 17% to approximately 30 million MWh from 2008–2009.

Overall, retail sales of renewable energy in voluntary purchase markets exceeded 30 million MWh in 2009, or about 0.8% of total U.S. electricity sales.⁵ Estimates presented in this report are primarily based on data provided by utilities and marketers and supplemented with other available data.⁶ Because we are unable to obtain data from all market participants, the estimates presented here likely underestimate the size of the entire market. In addition to renewable energy sales, GHG offsets sourced from “new” renewable energy resources—totaling 339,200 metric tons of CO₂ equivalent (CO₂e)—were sold to U.S. voluntary purchasers in 2009. Generation from a renewable energy source can generally be sold either as a MWh or as a metric ton of CO₂e.

Wind energy represented 73.7% of total green power sales, followed by biomass energy sources including landfill gas (10.0%), hydropower (primarily low impact or small hydro; 9.9%), geothermal (0.2%), solar (0.1%), and unknown sources (5.9%) (see Figure 1). 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 2009 to be between \$136 million and \$236 million.⁷

⁵ U.S. electricity sales totaled 3,732 billion kWh in 2008 (2009 data are not yet available), according to the U.S. Energy Information Administration (EIA). See <http://www.eia.doe.gov/cneaf/electricity/epa/epat7p2.html>. The remaining renewable energy generation is rate-based by utilities or used to meet renewable portfolio standards.

⁶ Other sources include REC certifiers, REC tracking systems (see ERCOT 2009), and press releases describing large voluntary green power purchases.

⁷ Estimates of the above market value of green power sales are determined by multiplying green power sales in kWh 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.

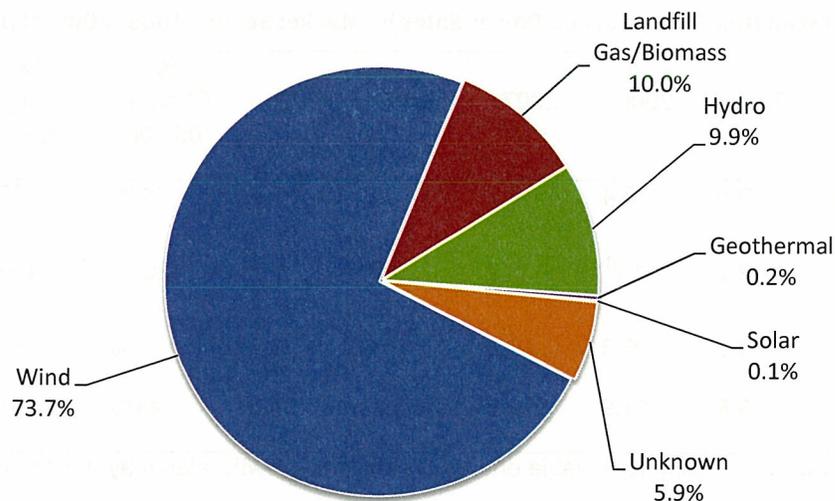


Figure 1. Estimated green power sales by renewable energy source, 2009

Green power sales (in megawatt-hours) increased by 17% in 2009 from 2008, with a compound annual growth rate of 37% since 2005 (see Table 1 and Figure 2). REC sales have been driving much of the growth, increasing 20% in 2009 from 2008. Overall, REC markets represent 62% of all green power sales.⁸ Annual growth rates in all market sectors declined in 2009 compared to 2008.

⁸ 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.

Table 1. Estimated Annual Green Power Sales by Market Sector, 2005–2009^a (Millions of MWh)

Market Sector	2005	2006	2007	2008	2009	% Change '05–'06	% Change '06–'07	% Change '07–'08	% Change '08–'09
Utility Green Pricing	2.5	3.4	4.2	4.8	5.2	39%	23%	15%	7%
Competitive Markets	2.2	1.7 ^b	3.2	5.3 ^d	6.2	-20% ^b	88% ^b	66% ^d	18%
REC Markets ^c	3.9	6.8	10.6	15.6	18.7	75%	55%	47%	20%
Retail Total	8.5	11.9	18.0	25.7^d	30.0	41%	51%	43%^d	17%

^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 Includes only RECs sold to end-use customers separate from electricity.

^d 2008 competitive market sales were revised upward in this report to reflect data on green power markets in Texas published by the Texas Public Utilities Commission in 2010.



Figure 2. Estimated annual green power sales by market sector, 2005–2009

Sales to nonresidential customers continued to outpace those to residential customers, with more than 76% of all sales by volume to the nonresidential sector in 2009, an increase from 65% in 2005 (see Table 2). Nearly all REC sales were to business and institutional customers, while

residential customers played a larger role in green pricing programs and competitive markets, where they accounted for 54% and 69%, respectively, of renewable energy sales (see Table 3).

Table 2. Estimated Annual Green Power Sales by Customer Segment, 2005–2009 (Millions of MWh)

Customer Segment	2005	2006	2007	2008	2009	% Change '05-'06	% Change '06-'07	% Change '07-'08	% Change '08-'09
Residential	3.0	3.2	4.5	6.5	7.2	8%	39%	43%	12%
Nonresidential	5.5	8.7	13.6	19.2	22.8	58%	56%	41%	19%
Total	8.5	11.9	18.1	25.7	30.0	41%	53%	42%	17%
% Nonresidential	65%	73%	75%	75%	76%	--	--	--	--

Note: Totals and growth rates may not add or calculate due to rounding.

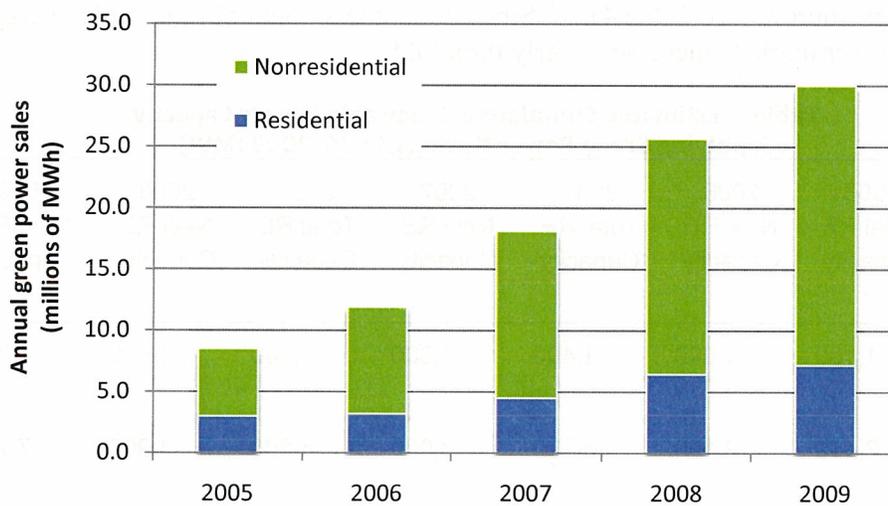


Figure 3. Residential and nonresidential green power sales, 2005–2009

Table 3. Estimated Annual Green Power Sales by Customer Segment and Market Sector, 2009 (Millions of MWh)

Customer Segment	Green Pricing	Competitive Markets	REC Markets	Total
Residential	2.8	4.3	0.04	7.2
Nonresidential	2.3	1.9	18.6	22.8
Total	5.2	6.2	18.7	30.0
% Residential	54%	69%	0.2%	24%

Note: Totals may not add due to rounding.

At the end of 2009, megawatt-hour sales of renewable energy in voluntary markets represented a generating capacity equivalent of about 9,400 MW, with about 8,000 MW of that from new renewable energy sources (see Table 4).^{9,10} Since 2006, the amount of renewable energy capacity serving green power markets increased nearly threefold.

Table 4. Estimated Cumulative Renewable Energy Capacity Supplying Green Power Markets, 2006–2009 (MW)

Market	2006	2006	2007	2007	2008	2008	2009	2009
	Total RE Capacity	New RE Capacity						
Utility Green Pricing	1,100	1,000	1,400	1,300	1,500	1,400	1,700	1,600
Competitive Markets/RECs	2,400	2,100	3,700	3,000	5,800	4,900	7,700	6,400
Total	3,500	3,100	5,100	4,300	7,300	6,300	9,400	8,000

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

⁹ Capacity estimates are calculated based on reported green power kilowatt-hours 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.

¹⁰ "New" renewable energy capacity defined here is capacity that was sourced from renewable energy systems that were built or repowered after January 1, 1997.

Customer Participation

Participation in REC markets and utility green pricing programs remained relatively flat; one competitive program pushed competitive market participation up by 110%.

Based on the information we have obtained, we estimate that approximately 1.4 million electricity customers nationwide purchased green power products in 2009 through regulated utility companies, from green power marketers in a competitive-market setting, or in the form of RECs (see Table 5).¹¹ Participation in REC markets and utility green pricing programs remained relatively flat while competitive market participation increased about 110% primarily because of substantial customer increases reported by one competitive marketer. Up until 2007, utility green pricing programs showed continued customer growth as the number of utility programs increased and as existing programs grew; however, in 2008, participation was essentially flat, largely due to the cancellation of the Florida Power and Light (FPL) Sunshine Energy Program, a large program with more than 35,000 participants prior to its termination. In 2009, customer numbers continued to remain flat—growth was 1% from 2008 to 2009.

Competitive market green power participation expanded considerably in 2009 as a result of increased participation reported by one marketer in Texas. 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.

In 2009, the number of customers buying RECs declined from 2008 but remained greater than in previous years (2003–2007). The number of customers buying RECs still represents a small fraction of the total green power market on a customer basis but not on a kilowatt-hour basis. Despite the limited number of residential customers purchasing RECs, REC sales represent 62% of green power kilowatt-hour sales (see Table 3) and have grown dramatically in recent years as a result of large purchases by nonresidential customers (see Appendix B for a list of top green power purchasers).

¹¹ 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 U.S. 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 5. Estimated Cumulative Green Power Customers by Market Segment, 2003–2009

	2003	2004	2005	2006	2007	2008	2009
Utility Green Pricing Customers	270,000	330,000	390,000	490,000	550,000	550,000	550,000
Competitive Market Customers	>170,000	>140,000	>180,000	~210,000	300,000	390,000	830,000
REC Market Customers*	< 10,000	< 10,000	< 10,000	~10,000	>10,000	30,000	< 20,000
Retail Total	~450,000	~480,000	~580,000	~710,000	~860,000	~970,000	~1,400,000
% Change	~15%	~7%	~21%	~22%	~21%	~13%	~44%

*Includes only end-use customers purchasing RECs separate from electricity.

Note: In some cases, estimates have been revised from those reported in previous NREL reports as updated data have become available.

Note: Totals may not add due to rounding.

Average participation rates among utility green pricing programs decreased slightly from 2.2% in 2008 to 2.0% in 2009, with a median value of 1.0%; top performing programs achieved rates ranging from 5.1% to 20.8%. 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 in competitive markets at the state level is much higher at more than 4.5%. Participation in competitive markets has been subject to market conditions and rules and has been more volatile than in traditionally regulated markets.

Comparison of Voluntary and Compliance Markets

Compliance demand for new renewable energy was approximately equivalent to voluntary demand.

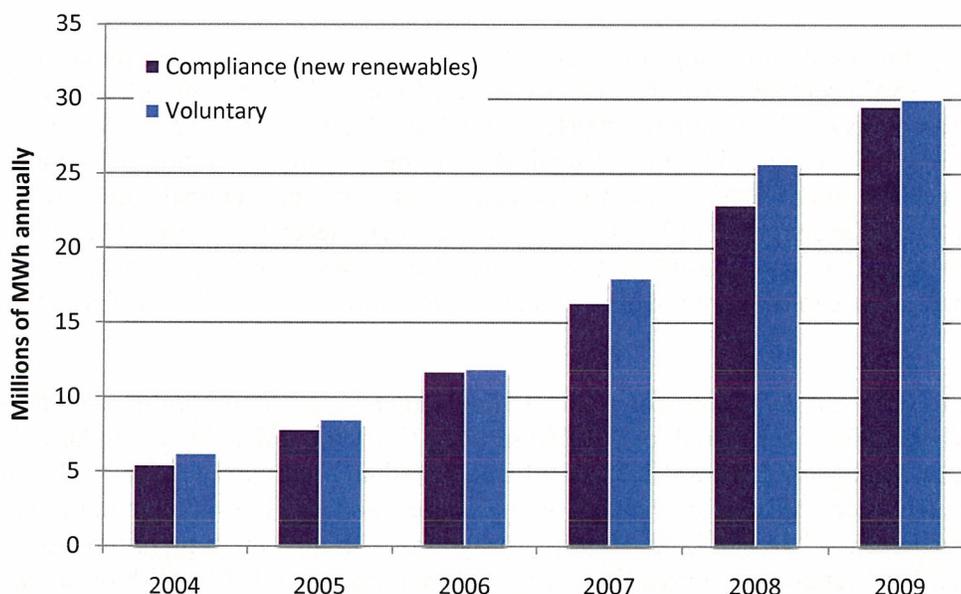
In 29 states and Washington, D.C., renewable portfolio standard (RPS) policies require that utilities or load-serving entities include a certain percentage of renewable energy within their power generation mix; the percentages required and eligibility requirements vary among the states. Voluntary purchases of renewable energy are almost always in addition to renewable energy used to meet RPS targets.¹² Green power certification programs and state RPS policies generally ensure that there is no double counting between the two markets (i.e., that the same kilowatt-hour is not used for more than one purpose).¹³ Ensuring the absence of double counting

¹² Arizona and Wisconsin are the only states that explicitly allow renewable energy purchased through voluntary programs to also count toward the RPS. (Holt and Wiser 2007) However, no utilities in these states that have reported data on voluntary programs to NREL have elected to count green power sales toward RPS compliance.

¹³ For additional details on the treatment of voluntary green power purchases in state RPS policies, see Holt and Wiser (2007).

is important to the integrity of the market because consumers who pay a premium for green power want to support renewable energy that would not have been otherwise supported through regulatory requirements.

In 2009, state RPS policies collectively called for utilities to procure about 29.5 million MWh of new renewable energy generation (Barbose 2010) compared to about 30.0 million MWh sold into the voluntary green power market.¹⁴ Figure 4 shows that between 2004 and 2008, voluntary market demand for renewable energy slightly exceeded compliance market demand for new renewable energy, while in 2009, compliance demand for new renewable energy was slightly greater than voluntary market demand. Renewable energy demand required to meet RPS policies is expected to grow rapidly in coming years. By 2010, RPS policies collectively call for utilities to obtain approximately 52 million MWh of new renewable energy, increasing to more than 100 million MWh in 2014; voluntary market growth rates would have to increase to keep pace.



Note: Compliance market data sourced from Lawrence Berkeley National Laboratory (Barbose 2010)

Figure 4. Comparison of compliance and voluntary markets for renewable energy, 2004–2009

¹⁴ 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.

Utility Green Pricing

This section provides information specific to utility green pricing programs, a subset of the market. The number of utilities offering green pricing has grown steadily in recent years—in 2009, approximately 860 investor-owned, public, and cooperative utilities in most states offered green pricing programs. Appendix D provides links to Web pages with a compilation of all green power product offerings, and Appendix E provides a list of utilities offering green pricing. Because a number of small municipal or cooperative utilities offer programs developed by their power suppliers, the number of distinct green pricing programs is about 160. Some states have adopted laws requiring utilities to offer consumers green power options, which have driven the development of new programs.¹⁵

Green Pricing Products and Premiums

Average green pricing premium continued to decrease.

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.

In 2009, the price of green power for residential customers in utility programs ranged from -0.17¢/kWh (a savings compared to standard service) to 10.00¢/kWh above standard electricity rates, with an average premium of 1.75¢/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.¹⁶ In 2009, the 10 utility programs with the lowest premiums for energy derived from new renewable sources had premiums ranging from -0.17¢/kWh (a savings) to 0.80¢/kWh. On average, consumers spend about \$5.40 per month above standard electricity rates for green power through utility programs, which is consistent with previous years.

¹⁵ These states include Colorado, Delaware, Iowa, Maine, Montana, New Mexico, Oregon, Virginia, and Washington (DSIRE 2010). Maine passed legislation in 2009 that requires the Public Utilities Commission (PUC) to develop a program offering green power; the PUC is still in the process of developing the program.

¹⁶ 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).

Table 6. Residential Price Premiums of Utility Green Power Products, 2002–2009 (¢/kWh)

	2002	2003	2004	2005	2006	2007*	2008*	2009*
Average Premium	2.82	2.62	2.45	2.36	2.12	1.85	1.80	1.75
Median Premium	2.50	2.00	2.00	2.00	1.78	1.50	1.50	1.50
Range of Premiums	0.70- 17.60	0.60- 17.60	0.33- 17.60	(0.70)- 17.60	(0.10)- 17.60	0.09- 7.50	(1.00)- 8.80	(0.17)- 10.00
10 Programs with Lowest Premiums**	0.70- 1.50	0.60- 1.30	0.33- 1.00	(0.70)- 0.90	(0.10)- 1.00	0.09- 0.80	(1.00)- 0.90	(0.17)- 0.80
Number of Programs Represented	80	91	101	104	97	71	86	92

*In later years, calculations of premiums were based on programs that responded to the questionnaire. In previous years, a larger sample of programs was used to calculate the premium, as data were available.

**Represents the 10 utility programs with the lowest price premiums for new, customer-driven renewable energy. This includes only programs that have installed—or announced firm plans to install or purchase power from—new renewable energy sources.

Since 2000, the average price premium has dropped at a compound annual rate of 7% (Figure 3). 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 (and national demand if a federal standard is adopted), will affect premiums in coming years.

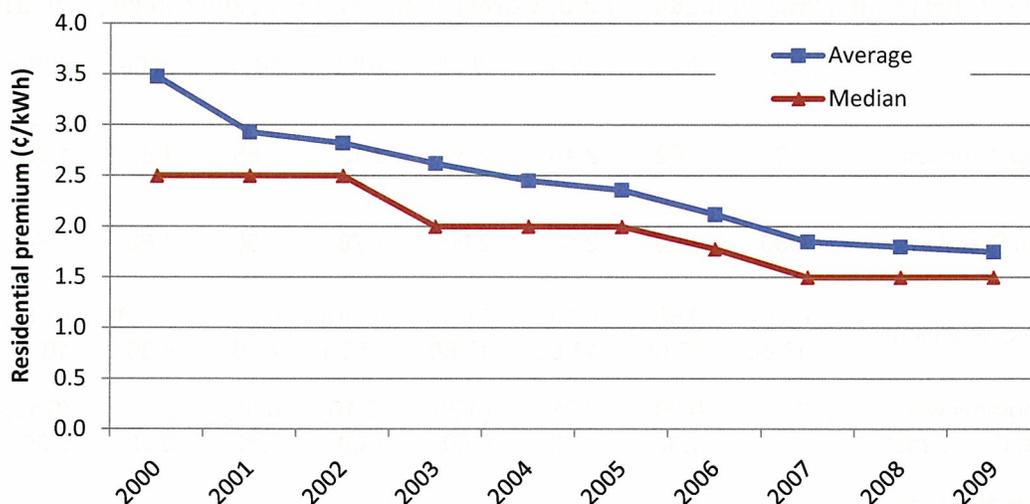


Figure 5. Trends in utility green pricing premiums, 2000–2009

Green Pricing Customer Participation

Aggregate green pricing participation was largely flat; average program participation rates decreased slightly.

At the end of 2009, about 552,200 customers were participating in utility green pricing programs in regulated electricity markets (see Table 7).¹⁷ As in the past, a relatively small number of green power programs account for the majority of customers, with just 10 programs accounting for 75% of all participants (see Appendix E).¹⁸ From 2001 to 2007, the number of customer participants increased more than threefold, but this trend reversed in 2008. With the cancellation of the large FPL program, nearly 40,000 customers left the market,¹⁹ and total participants in

¹⁷ 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.

¹⁸ 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 E or at <http://apps3.eere.energy.gov/greenpower/markets/pricing.shtml?page=3>.

¹⁹ The Florida Public Service Commission initially acted to discontinue the program as a result of concerns over the amount of program revenues spent on marketing compared to expenditures on the renewable energy resources used to supply the program, as well as its support for out-of-state resources. However, the final basis for the decision to terminate the program, after a subsequent program audit, was related to the commission's assessment that a voluntary program was not needed after the Florida Legislature mandated an RPS. By Order No. PSC-08-0600-PAA-EI, issued September 16, 2008, in Docket No. 070626-EI, the commission terminated the program. <http://www.floridapsc.com/library/filings/08/08720-08/08-0600.ord.doc>.

utility programs nationwide fell slightly. Without the loss of the FPL program, the number of participants in utility green power programs would have grown modestly in 2008, by about 6%. In 2009, customer participation remained relatively unchanged from 2008, growing just 1% (see Table 7).

The decline in the economy in the second half of 2008 and in 2009 likely contributed to smaller gains in participants relative to previous years, and a number of programs reported losses in the total number of participants. In 2009, residential participation increased by 1%, while nonresidential participation declined by 1%, whereas in previous years, total participation increased at a greater rate (see Table 7). Of the 62 utility programs that reported participation data in both 2008 and 2009, 32 utilities (52%) saw net declines in participation, 28 utilities (45%) saw net gains in participation, and 2 utilities (3%) had the same number of participants.

Table 7. Estimated Cumulative Number of Customers Participating in Utility Green Pricing Programs (Regulated Electricity Markets Only), 2002–2009

Customer Segment	2002	2003	2004	2005	2006	2007	2008	2009
Residential	224,500	258,700	323,700	383,400	470,800	526,700	519,700	526,300
Nonresidential	3,900	6,500	8,100	11,300	15,500	20,200	26,100	26,000
Total	228,400	265,200	331,800	394,700	486,300	546,900	545,800	552,200
% Total Annual Growth	35%	16%	25%	19%	23%	12%	0%	1%
% Residential Growth	35%	15%	25%	18%	23%	12%	-1%	1%
% Nonresidential Growth	56%	67%	25%	40%	37%	30%	29%	-1%

Note: Totals may not add due to rounding.

Table 7 delineates residential and nonresidential customer participation in utility green pricing programs over time. The vast majority of participants are residential customers, with nonresidential customers accounting for only 4.7% of all participants. From 2002 to 2008, nonresidential participation was growing at a faster rate than residential participation; however, in 2009, this trend reversed, with nonresidential customers declining by 1% and residential customers increasing by 1%.

At the end of 2009, the average participation rate in utility green pricing programs among eligible utility customers was 2% with a median of 1% (Table 8). These industry-wide rates have shown little change in recent years, though 2009 did see a decrease in participation rates, likely a result of the economic recession. Top-performing programs have demonstrated improvement, with participation rates ranging from about 5% to 21% in 2009, compared to a range of 3% to 6% in 2002, though participation rates in top performing programs have remained relatively unchanged since 2007. The 20% participation threshold was exceeded for the first time in 2007.

Table 8. Customer Participation Rates in Utility Green Pricing Programs, 2002–2009

Participation Rate	2002	2003	2004	2005	2006	2007	2008	2009
Average	1.2%	1.2%	1.3%	1.5%	1.8%	2.0%	2.2%	2.0%
Median	0.8%	0.9%	1.0%	1.0%	1.0%	1.3%	1.2%	1.0%
Top 10 Programs	3.0%– 5.8%	3.9%– 11.1%	3.8%– 14.5%	4.6%– 13.6%	5.1%– 16.9%	5.2%– 20.4%	5.0%– 21.0%	5.1%– 20.8%

In 2009, utilities reported that an average of 7.8% and a median of 6.3% of customers dropped out of green pricing programs, an increase from 2008 when utilities reported that an average of 5.5% and a median of 2.5% of customers dropped out. Although the average and median drop-out rates are higher than in previous years, likely due to the economic recession, retention rates are still relatively high. This finding suggests that customers tend to be “sticky” and maintain participation in green power programs. While data on the reason for dropouts is not available, anecdotal evidence from some utilities suggests that customer moves can be a significant source of dropouts. Most utilities (about 66%) do not impose minimum periods for which customers must subscribe to the green power program. If a minimum term is imposed, it is most commonly one year—although there are several programs that offer fixed-price green power for contracts of longer durations, particularly to nonresidential customers.

Green Pricing Renewable Energy Sales

Green pricing sales increase modestly in 2009; average purchase size increased.

Utility green pricing sales continue to exhibit some growth, but growth has slowed in the past three years. Collectively, utilities in regulated electricity markets sold about 5.2 billion kWh of green power to customers in 2009 (Table 9). Green pricing program sales to all customer classes grew by 7% in 2009, compared to rates ranging from 15% to 43% in recent years (Table 9 and Figure 4).

Table 9. Annual Sales of Renewable Energy through Utility Green Pricing Programs (Regulated Electricity Markets Only), 2003–2009 (Thousands of kWh)

	2003	2004	2005	2006	2007	2008	2009
Residential	870	1,300	1,610	2,100	2,550	2,660	2,820
Nonresidential	410	540	840	1,300	1,630	2,150	2,320
Total Sales	1,280	1,840	2,450	3,400	4,190	4,810	5,150
% Annual Growth in Total Sales	43%	43%	33%	39%	23%	15%	7%
% Nonresidential of Total Sales	32%	30%	34%	38%	39%	45%	45%

Note: Totals may not add due to rounding.

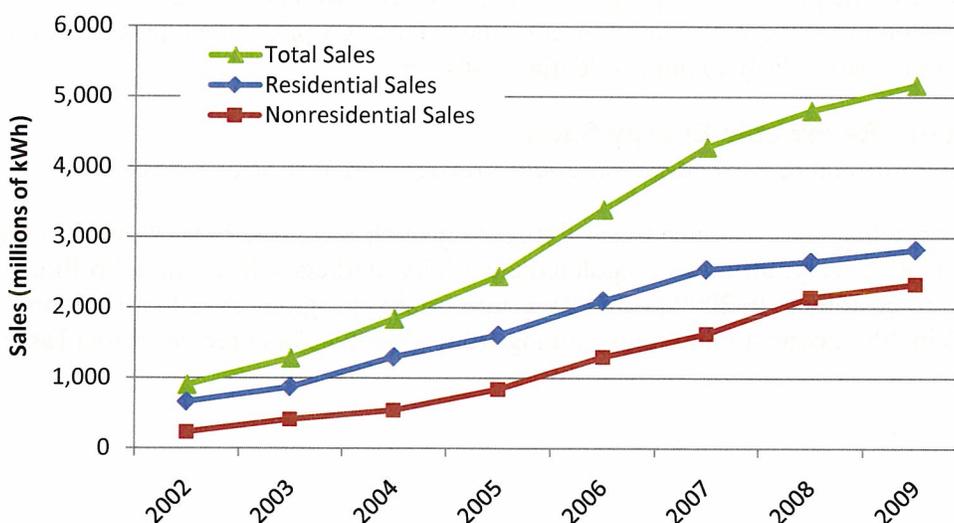


Figure 6. Annual sales of renewable energy through utility green pricing programs, 2002–2009 (regulated electricity markets only)

In 2009, the average residential purchase decreased slightly, while the average nonresidential purchase increased slightly after nearly doubling from 2007 to 2008 (Table 10). Although the reason for increased purchases by nonresidential customers is not known, it could be attributed to a decline in green power prices for nonresidential retail customers or enrollment of larger commercial and industrial customers. Some programs may have also placed greater emphasis on marketing to the commercial sector to make up for residential customer losses.

Table 10. Average Purchases of Renewable Energy per Customer, 2002-2009 (kWh/year)

	2002	2003	2004	2005	2006	2007	2008	2009
Residential	2,900	3,400	4,000	4,200	4,400	4,900	5,500	5,100
Nonresidential	60,000	63,100	67,200	74,500	85,700	77,400	141,300	146,300
All Customers	3,900	4,800	5,500	6,200	6,700	7,400	20,800	26,300

The vast majority (about 96%) of the renewable energy sold to consumers through green pricing programs was supplied from projects meeting the generally accepted industry definition of “new.” Renewable energy sold through green pricing programs in 2009 represents an equivalent renewable energy capacity of 1,645 MW, with 1,585 MW of this represented by new renewable energy resources (Table 11).²⁰ In 2008, sales of renewable energy through green pricing programs represented more than 1,500 MW of renewable energy capacity, with about 1,400 MW of that from new renewable energy sources. Wind, solar, landfill gas, and other biomass are the renewable resources most commonly included in utility programs; although solar in particular may be used to supply a small fraction of MWh sales. Wind energy represents the largest portion of the total capacity. Table 4 presents estimates of new capacity-serving green pricing programs in earlier years.

²⁰ Capacity estimates in 2008 and 2009 are calculated based on reported green power kilowatt-hours 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. Estimates of megawatts prior to 2008 were higher on a relative basis due to the capacity factor assumed for wind. In prior years, a 30% capacity factor was assumed, but in 2008, estimates of megawatts were based on a 33% capacity factor to reflect improvements in capacity factors as a result of the movement toward larger turbines as well as greater reliance on projects in areas with strong wind resources. For every 1 million MWh, this accounts for a discrepancy of 35 MW of capacity in the estimates.

Table 11. Renewable Energy Generation and Capacity Supplying Green Pricing Programs, 2009

	Landfill Gas	Other Biomass	Geo-thermal	Hydro	Solar	Wind	Unknown	Total
Sales (MWh)	353,400	248,600	45,000	63,100	18,875	4,434,400	1,700	5,165,000
% of Total Sales	7%	5%	1%	1%	0.4%	86%	0.03%	100%
Total Sales (MW)	45	35	5	18	14	1,534	1	1,652
Total New Sales (MW)	42	35	5	17	13	1,472	-	1,585

Note: Totals may not add due to rounding.

In 2009, green power sales represented a small proportion of a utility company’s overall energy sales. Table 12 shows that, on average, renewable energy sold through green pricing programs in 2009 represented 1.0% of total utility electricity sales (on a MWh basis). The average percentage of green power sold compared to total utility electricity sales in 2009 remained unchanged from 2008, while the median percentage dropped slightly. A few utilities reported fractions as high as 8% of total retail electricity sales, and, due to a large nonresidential purchase, one small utility reported 21.4% of total retail electricity sales (see Table E-4 in Appendix E). On a residential basis, green power sales represented a higher fraction of total utility electricity sales, with one utility reporting a fraction as high as 24.9%.

Table 12. Renewable Energy Sales as a Percent of Utility Electricity Sales, 2008–2009

Customer Class	2008			2009		
	Avg.	Med.	Range	Avg.	Med.	Range
Residential	1.5%	0.5%	0%–23.4%	1.4%	0.4%	0%–24.9%
Nonresidential	0.8%	0.2%	0%–12.0%	1.2%	0.2%	0%–21.6%
All Customers	1.0%	0.4%	0%– 6.4%	1.0%	0.3%	0%–21.4%

Competitive Green Power and REC Markets

This section provides greater detail on green power sold in competitive (or restructured) retail electricity markets as well as in the form of RECs—subsets of the entire green power market. About one-quarter of U.S. states have restructured their electricity markets for retail service competition. Currently, electricity consumers in the following states can purchase competitively marketed green power: Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, Pennsylvania, Rhode Island, Texas, and D.C.^{21,22} Competitively marketed green power offerings are also available to nonresidential consumers in a few other states.

Initially, buying green power in competitive retail markets entailed switching electricity service from the incumbent utility to a green power supplier. In some markets, there was limited switching, and as a remedy, a number of states now require default suppliers (which are often the incumbent distribution utilities) to offer green power options to their customers. These load-serving entities typically provide customers with underlying electricity generation, combined with a choice of several green products offered by competing green power marketers. In addition, several utility suppliers have voluntarily teamed with a single green power marketer to offer a green power option to their customers. Such programs are now offered in Connecticut, Massachusetts, New Jersey, New York, Pennsylvania, and Rhode Island.

In addition to competitive offerings, RECs provide another alternative to switching electricity suppliers. Also known as green certificates, green tags, or tradable renewable certificates, RECs represent the “green” attributes of renewable energy generation and can be sold separately from commodity electricity. REC-based products may be supplied from a variety of renewable energy sources throughout the country and sold to customers nationally, or they may be supplied from renewable energy sources in a particular region or locality and marketed as such to local customers. More than 25 companies offer certificate-based green power products to retail customers via the Internet, and a number of other companies market RECs solely to commercial and industrial customers.²³

²¹ For an up-to-date list of products offered by competitive green power marketers, see the U.S. Department of Energy’s Green Power Network Web site at:

<http://apps3.eere.energy.gov/greenpower/markets/marketing.shtml?page=1>.

²² We do not include Oregon and Virginia in this list. In Oregon, only large commercial and industrial customers are able to switch to competitive green power providers; residential and small commercial customers have access to green power options offered by the incumbent utilities, which we categorize as green pricing. In Virginia, at least one retail electricity provider provided green power options in 2007 and earlier but does not do so currently.

²³ For an up-to-date list of companies offering REC-based green power products, see the U.S. Department of Energy’s Green Power Network Web site at: <http://apps3.eere.energy.gov/greenpower/markets/certificates.shtml?page=1>.

For a list of REC suppliers serving commercial or wholesale customers, see: <http://apps3.eere.energy.gov/greenpower/markets/certificates.shtml?page=4>.

RECs are also sold in the wholesale market and are frequently used by utilities and marketers who bundle RECs with commodity electricity to sell green power to retail customers. In fact, RECs are used to supply most of the programs where default suppliers have teamed with green power marketers. Therefore, it can be difficult to distinguish REC products from other green power offerings. This is particularly true when REC products are supplied from renewable sources located in the same region where they are marketed.

REC and Competitive Market Products and Pricing

On the whole, retail REC products continued to be less expensive than competitive market products; 73% of the total kilowatt-hours sold in the retail voluntary market in 2009 were involved in a Green-e Energy certified transaction at some point in their chain of custody.

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 2009, about 81% 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. Beginning January 1, 2007, the *Green-e Energy*²⁴ certification program began requiring that all certified products be supplied exclusively from new renewable energy projects. The U.S. Environmental Protection Agency's (EPA) Green Power Partnership requires its partners to purchase new renewable energy to meet its purchase criteria.²⁵ Currently, both the *Green-e Energy* National Standard and EPA define new as those facilities put into service on or after January 1, 1997, which is generally considered to be the inception of the voluntary green power market. Beginning on July 15, 2011, the *Green-e Energy* National Standard will have 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.

The price premium charged for competitive-market products depends on several factors including the price of standard offer or default service, the availability of incentives to green power marketers or suppliers, and the cost of renewable energy generation available in the regional market. Some marketers have charged prices close to or even below the default market price in recent years (e.g., in Texas); others have offered fixed-price products, providing

²⁴ Administered by the San Francisco-based Center for Resource Solutions, the *Green-e Energy* program certifies retail and wholesale green power products that meet its environmental, product content, and marketing standards. For details on the *Green-e Energy* National Standard, see the *Green-e* Web site at: <http://www.green-e.org/>.

²⁵ See the EPA's Green Power Web site at: <http://www.epa.gov/greenpower>.

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 1.3¢/kWh and 3.7¢/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 2.2¢/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 1¢/kWh to 2.5¢/kWh for residential and small commercial customers, although some are priced as high as 10–20¢/kWh for some products, such as solar RECs. 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. Table 13 shows *Green-e Energy* certified retail transactions in 2008 and 2009. *Green-e Energy* certified more than 18.6 million MWh of retail transactions in 2009 (Terada 2010). Compared to NREL’s total voluntary market retail sales figure of 30.0 million MWh, *Green-e Energy* certified 62% of voluntary market retail sales.

Table 13. Total Retail Sales of *Green-e Energy* Certified Renewable Energy, 2008 and 2009 (Thousands of MWh)

Year	Residential		Commercial		Total Retail	
	2008	2009	2008	2009	2008	2009
RECs	50	40	10,490	15,653	10,540	15,693
Green Pricing	1,413	1,552	753	1,003	2,166	2,555
Competitive Electricity	171	224	170	188	341	411
Total	1,634	1,816	11,413	16,843	13,047	18,659

Note: Totals may not add due to rounding.

Source: Terada 2010

The *Green-e Energy* program also certifies wholesale renewable energy transactions, which exceeded 8.9 million MWh in 2009. It is important to note that 5.7 million MWh sold in certified wholesale transactions were resold in *Green-e Energy* certified retail transactions. The remaining

3.2 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 21.9 million unique MWh in 2009. This is an increase of 26% from 2008. Assuming that all kilowatt-hours certified at the wholesale level were ultimately sold in retail voluntary sales, 73% of the total megawatt-hours sold in the retail voluntary market in 2009 were involved in a *Green-e Energy* certified transaction at some point in their chain of custody.

REC and Competitive Market Customer Participation

Participation in REC and competitive market programs nearly doubled, primarily due to new competitive offerings in Texas.

Based on data received from green power marketers, we estimate that more than 840,000 retail customers were buying green power from competitive suppliers or as unbundled RECs at the end of 2009 (see Table 14). This number includes about 130,000 participants in utility/marketer programs available in competitive markets. 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.

The Texas market has seen dramatic growth in the number of green power offerings and participants in recent years. The number of green power offerings in Texas has increased from 4 in November 2005 to 50 as of February 2010 (see Figure 7) (Power to Choose 2010). Texas saw the number of green power customers increase by 45%, from 142,000 customers in 2007 to 206,000 customers in 2008 (see Appendix B).²⁶ In 2009, participation in the Texas competitive market was likely more than 500,000; because NREL does not collect marketer data on a state-by-state level, the exact number of participants in the Texas market cannot be determined until EIA releases its customer data for 2009.

Gains in participation in Texas have been tempered by losses in some states, where marketers have struggled to provide electricity service to consumers amidst adverse market conditions and increasing costs. During 2008, EIA data show a slight decline in the number of green power customers in Pennsylvania and Virginia but slight gains in Maryland and D.C. (see Appendix B).

²⁶ The EIA figures include customers in both utility green pricing programs and competitive market programs.

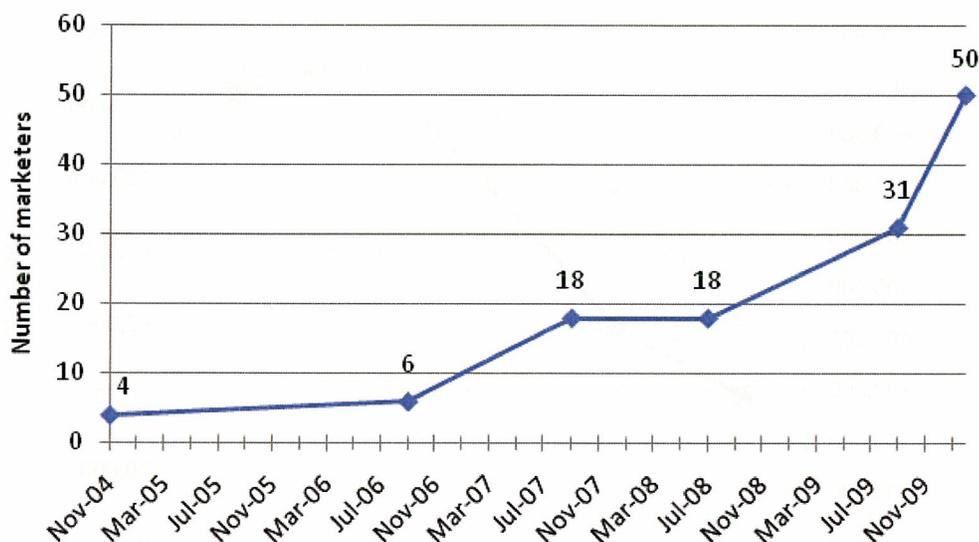


Figure 7. Texas green power product offers, 2004–2009

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, including those by competitive marketers and utility green power programs, increased by 22.7% between 2008 and 2009, from 7.3 million MWh to 8.9 million MWh (ERCOT 2009).²⁷ A voluntary retirement occurs when a REC is used for voluntary purposes and will no longer be traded or claimed.

Nationally, participation in utility/marketer partnership programs in competitive markets doubled between 2005 and 2008, although growth has slowed in the last two years. In 2009, customer growth was similar to that of 2008, at 6%, while total sales declined by 7% from 2008 to 2009 in this sector. The decline in sales was prominent in two utility/marketer programs, which saw declines ranging from 21% to 47%. Figure 8 shows changes in both sales and customer participation in utility/marketer programs in competitive markets.

²⁷ The data is published annually in a report by ERCOT to the Texas PUC. Retirements from the most current year (2009) are reported in aggregate, while retirements from the previous year (2008) 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 2008 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 2009, data are not yet available by marketer; in order to provide a conservative estimate of the competitive marketer, the same amount of sales added in 2008 were also added to 2009 figures. 2009 data may need to be modified if individual marketer data for 2009, due to be released in May 2011, are different from our current estimate.

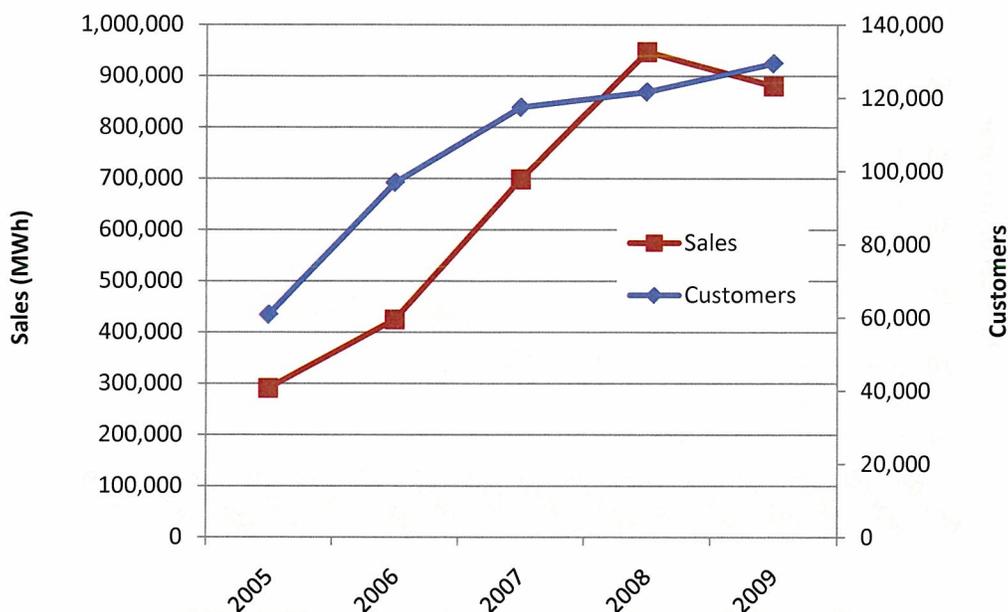


Figure 8. Changes in retail sales and customer participation for utility/marketer partnerships in competitive markets, 2005–2009

In competitive markets, the vast majority of customers buying green power are residential customers. Of the approximately 840,000 retail green power customers in competitive markets, less than 2% purchase REC-only products. The number of REC-only buyers increased from approximately 13,000 to 30,000 customers in 2008, showing some increase in traction with residential consumers—however, this trend reversed in 2009, when fewer than 20,000 customers purchased RECs. While most of the REC buyers are residential customers, the majority of REC sales on a kilowatt-hour basis are made to nonresidential customers due to the much larger purchase sizes.

Table 14. Estimated Cumulative Number of Customers Buying RECs or Green Power from Competitive Marketers, 2003–2009

	2003	2004	2005	2006	2007	2008	2009
Competitive Markets	~ 170,000	< 140,000	> 180,000	~ 210,000	~ 300,000	~ 390,000	~ 830,000
RECs*	< 10,000	< 10,000	< 10,000	~ 10,000	~ 13,000	~ 30,000	< 20,000
Total	~ 180,000	< 150,000	~ 190,000	~ 220,000	> 310,000	~ 425,000	< 850,000
% Change	13%	-17%	27%	16%	37%	37%	98%

*Includes only end-use customers purchasing RECs separate from electricity.

Note: Totals may not add due to rounding.

REC and Competitive Market Green Power Sales

Retail REC sales increased by 20% to 18.6 million MWh; competitive market sales increased 18% to 6.2 million MWh.

An estimated 24.8 million MWh of renewable energy was sold to retail customers by competitive green power and REC marketers in 2009 (Table 15). This figure includes renewable energy from both pre-existing and new sources. Due to the challenges of obtaining data from competitive marketers, it is likely that the sales figures for the competitive market are underestimated.

Retail REC sales increased by 20%, reaching 18.6 million MWh in 2009. Most of the growth in REC-only sales is attributable to the nonresidential sector. An estimated 6.1 million MWh were sold as a bundled green power product in competitive electricity markets—an 18% increase from 2008. While there was a large increase in participation in competitive market programs, there was not a similarly sized increase in sales due to the fact that most of the growth in participation came from one marketer offering a product that was 25% green power. 2009 was 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 2008.

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 880 thousand MWh in 2009, a 7% decrease from 2008 (see Figure 8). The losses came primarily from two programs in the Northeast.

Table 15. Retail Sales of Renewable Energy in Competitive Markets and RECs, 2004–2009 (Thousands of kWh)

	2004	2005	2006	2007	2008	2009
Competitive Markets						
Residential	2,140	1,330	1,000	1,800	3,591	4,307
Nonresidential	510	820	710	1,400	1,669	1,879
Subtotal	2,650	2,150	1,720 ^a	3,200	5,260 ^c	6,186
% Change	40%	-19%	-20% ^a	88% ^a	64% ^c	18%
% Residential	81%	62%	59%	56%	68%	70%
Unbundled RECs ^b						
Residential	40	40	110	60	200	41
Nonresidential	1,690	3,840	6,700	10,500	15,400	18,619
Subtotal	1,720	3,890	6,810	10,500	15,600	18,660
% Change	160%	126%	75%	55%	49%	20%
% Residential	2%	1%	2%	1%	1%	0.2%
Total Sales	4,370	6,040	8,530	13,800	20,860	24,846
% Change	71%	38%	41%	62%	51%	19%

^a 2006 are likely underestimated because of data gaps.

^b Includes only RECs sold to end-use customers separate from electricity.

^c 2008 competitive market sales were revised in this report to reflect data published in 2010

Note: Totals may not add due to rounding.

Table 15 also delineates green power sales by customer segment. In 2009, residential customers represented 70% of green power sales in competitive markets. In contrast, nonresidential customers represented nearly all unbundled REC sales. 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.²⁸ On the other hand, residential customers may not be aware that RECs are available or may not understand what they convey.

In 2009, renewable energy sold in competitive markets or as unbundled RECs represented an equivalent renewable energy capacity of about 7,710 MW, with more than 6,390 MW of this total coming from new renewable energy resources (see Table 16).^{29,30} This is up from 5,800 MW of equivalent capacity and 4,900 MW of new capacity in 2008. Equivalent figures for 2007 are 3,700 MW and 3,000 MW, respectively.

Table 16. Renewable Energy Sources Supplying Competitive and REC Markets, 2009

	Biomass/ Landfill Gas	Geo- thermal	Hydro	Solar	Wind	Unknown	Total
Sales (thousands of MWh)	2,391	48	2,912	28	17,683	1,783	24,846
% of Total Sales	10%	0.19%	12%	0.11%	71%	7%	100%
Total MW	320	10	830	20	6,120	410	7,710
MW New Renewable Energy	260	10	420	20	5,680	--	6,390

Note: Information on new content is unavailable in some instances.

Note: Totals may not add due to rounding.

²⁸ For example, the EPA Green Power Partnership reports that the majority of its Top 25 partners purchases RECs (see Appendix A). For more information, see <http://www.epa.gov/greenpower/>. In addition, the Green Power Market Development Group promotes the purchase of RECs among its members. For more information, see the organization's Web site at: <http://www.thegreenpowergroup.org/>.

²⁹ Capacity estimates are calculated based on reported green power kilowatt-hours 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.

³⁰ "New" renewable energy capacity defined here is capacity that was sourced from renewable energy systems that were built or repowered after January 1, 1997.

The Voluntary Carbon Offsets Market

Green power markets are affected by other related markets, such as the emerging U.S. market for GHG offsets. Since green power and GHG offset offerings have converged in recent years, this section addresses GHG offsets sourced from renewable energy supplies. A 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 CO₂e. Corporations and individuals are buying these products to “offset” their own emissions, such as those associated with energy used for heating, product manufacturing processes, automobile use, and air travel.

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. Examples of GHG reduction projects include renewable electricity generation, energy efficiency measures, methane capture at landfill sites, soil carbon sequestration, and forestry projects. Developers of these project types can sell GHG offsets to consumers or businesses to help finance their projects. 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.³¹

Offsets sourced from renewable energy differ from green power in that they are sold in metric tons of CO₂e, while RECs and other forms of green power are sold in megawatt-hours. In addition, certification standards for offsets differ from those for renewable energy sold as green power. Generally, offsets must demonstrate additionality, meaning that the emissions reductions are additional to what would have occurred anyway (or under business-as-usual). Retail customers typically purchase green power or RECs equivalent to a portion or all of their electricity consumption. In contrast, retail customers buying GHG offsets generally purchase metric tons of CO₂e to match their carbon emissions. There is overlap in the sense that many green power purchasers are motivated to buy green power for their electricity consumption out of concern about climate change and to address their electricity-related GHG emissions. Currently, renewable energy generators can provide either a GHG offset (metric tons of CO₂) or a megawatt-hour of green power—however; there are double-counting concerns if the same kilowatt-hour is sold as both an offset and a REC. Certifiers generally do not allow this type of double counting.

Eight out of approximately 25 GHG offset providers that offer products at least partially sourced from U.S.-based renewable generation reported 2009 offset sales to NREL. Additional data on

³¹ 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.

offset sales were obtained from the Center for Resource Solutions' Green-e Climate program.³² The carbon offsets sourced from renewable energy totaled more than 339,000 metric tons of CO₂e, which is equivalent to about 486,000 MWh of renewable energy generation.³³ This represents an increase of approximately 39% from 2008 when carbon offsets sources from renewable energy totaled nearly 246,000 metric tons of CO₂e, or about 343,000 MWh of renewable energy generation.

Table 17. GHG Offsets Sourced from U.S.-based Renewable Energy Sources, 2008–2009

	Carbon Offset Sales (Metric Tons CO ₂ e)		Carbon Offset Sales (MWh equivalent)	
	2008	2009	2008	2009
Residential	31,200	45,400	43,500	67,800
Nonresidential	214,700	293,800	299,000	417,900
Total	245,900	339,200	342,500	485,700

Several independent certifiers have created standards for verifying GHG reductions to ensure that they are real, measurable, and beyond business-as-usual and any regulatory requirement. They also establish ownership of the actual emission reductions so that multiple parties do not claim the carbon reduction. GHG offset providers responding to the NREL questionnaire reported that some, if not all, of their offsets were verified by the following organizations:

³² In February 2008, the Center for Resource Solutions certified its first retail offset products under Green-e® Climate, a consumer-protection program requiring verification of GHG reductions based on product-level certification that ensures that emissions reductions come from projects verified and certified under project standards that meet a high standard of quality, that the emissions reductions are not being double-sold, and that consumers are being given full and accurate information. Sellers must undergo a yearly audit to ensure their supply of offsets matches their sales, and a twice annual review of website and marketing materials to ensure compliance with Green-e Climate's consumer disclosure and truth in advertising requirements. The Green-e Climate Protocol for Renewable Energy is a project standard that establishes the eligibility requirements for renewable energy projects in the United States that wish to supply Green-e Climate certified offsets, including methodologies used to assess additionality and calculate the emission reductions, and other requirements related to tracking, prevention of double counting and double claiming, and verification. The Protocol requires that the RECs associated with the renewable energy generation producing the emissions reductions that are certified under Green-e Climate be retired as part of the substantiation for any carbon offset claim and not resold in the voluntary green power markets or used for compliance with renewable energy standards. The seller must verify that the attributes are only sold once and not double counted. For more information, see the Protocol at <http://www.green-e.org/docs/climate/Green-eClimateProtocolforRenewableEnergy.pdf>.

³³ The EPA's national average electricity emissions factor for non-baseload generation (eGRID 2010) was used to estimate the equivalent in MWh for companies that did not report their sales in MWh.

Center for Resource Solutions, Environmental Resources Trust,³⁴ or the Chicago Climate Exchange (CCX).³⁵

³⁴ The Environmental Resource Trust/Winrock International verifies carbon offsets in partnership with the American Carbon Registry. The American Carbon Registry allows flexibility for members to choose among methodologies set out by the Clean Development Mechanism and the Voluntary Carbon Standard. A carbon offset is considered an emissions reduction ton (ERT) if it is real, additional, permanent, and that ownership is incontestable. After verification, the Registry assigns each offset a unique serial number. For more information on the ERT certification, see http://www.winrock.org/common/files/Solution_Stories/acr_capabilities.pdf.

³⁵ The CCX guidelines for carbon offsets sourced from renewable energy generation were established in 2006. To qualify, renewable energy systems must have been activated on or after January 1, 2005. Project proponents must demonstrate ownership rights associated with the environmental attributes (i.e., they must not have sold the RECs or used them for compliance purposes). Under the verification process, for CCX offsets to be issued, the RECs are surrendered to and retired by CCX. For more information on the CCX guidelines, see http://www.chicagoclimatex.com/news/publications/pdf/CCX_Renewable_Offsets.pdf

Voluntary Green Power Market Trends and Issues

As the voluntary green power market continues to grow, a few trends and issues have surfaced. This section highlights trends in REC prices in both the compliance and voluntary markets and discusses the current availability of data on REC prices and quantities transacted in the market and the general lack of price transparency. The section concludes with a description of the treatment of renewable energy purchases in GHG inventories.

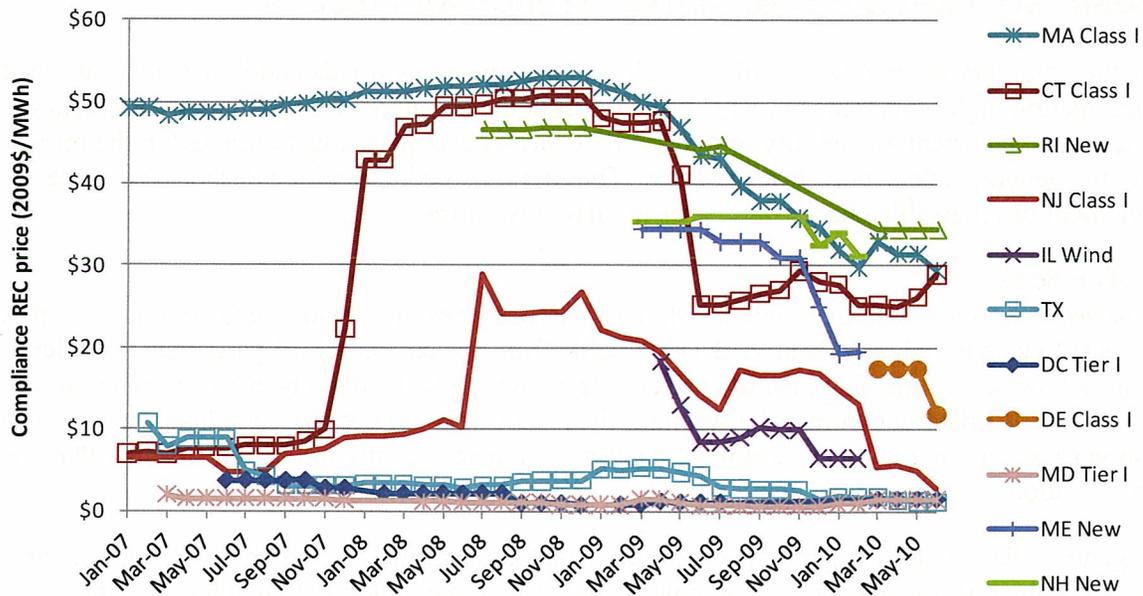
REC Prices

This section provides an overview of wholesale REC prices in voluntary and 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, the region in which the generator is located, whether they are eligible for certification, and whether the RECs are bought to meet compliance obligations or serve voluntary retail consumers. Natural gas prices can also affect the cost competitiveness of renewable energy generation, which is reflected in REC prices.

Compliance Markets for RECs

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 regions where there have been shortages of renewable energy to meet RPS requirements, compliance REC prices have reached or come close to levels for alternative compliance payment (ACP) of \$50–\$55/MWh; whereas, in other states or regions, compliance RECs have sold for less than \$5/MWh. Figure 9 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.

Figure 9. Compliance market (primary tier) REC prices, January 2007 to June 2010

Sources: Evolution Markets (2007) and Spectron Group (2010).

Solar RECs (SRECs) have higher value than RECs from other resource types in both compliance and voluntary markets. This is true for a number of reasons: 1) 16 states and D.C. have specific provisions to encourage solar or customer-sited generation (DSIRE 2010); 2) the penalty price for non-compliance is often set higher for solar/distributed generation tiers than for standard RPS compliance; and 3) SRECs can be desirable in the voluntary market where customers may be willing to pay more for solar, which costs more than other types of renewable energy.

Recently, PJM-GATS, the REC tracking system that covers the PJM regional transmission organization territory, began publishing the solar weighted average price for SRECs. The data date back to November 2008 and are updated on a monthly basis for SRECs traded in New Jersey, D.C., Ohio, Pennsylvania, Maryland, Delaware, and Virginia.³⁶ SRECs in New Jersey continue to trade at the highest levels, in the \$400–\$650 range, while SRECs from other regions trade in the \$200–\$500 range. While historic data availability is limited, several price points are indicative of the higher market price for SRECs in compliance markets in 2009 (see Figure 10).

³⁶ The data can be queried online at: <https://gats.pjm-eis.com/myModule/rpt/myrpt.asp?r=230>.

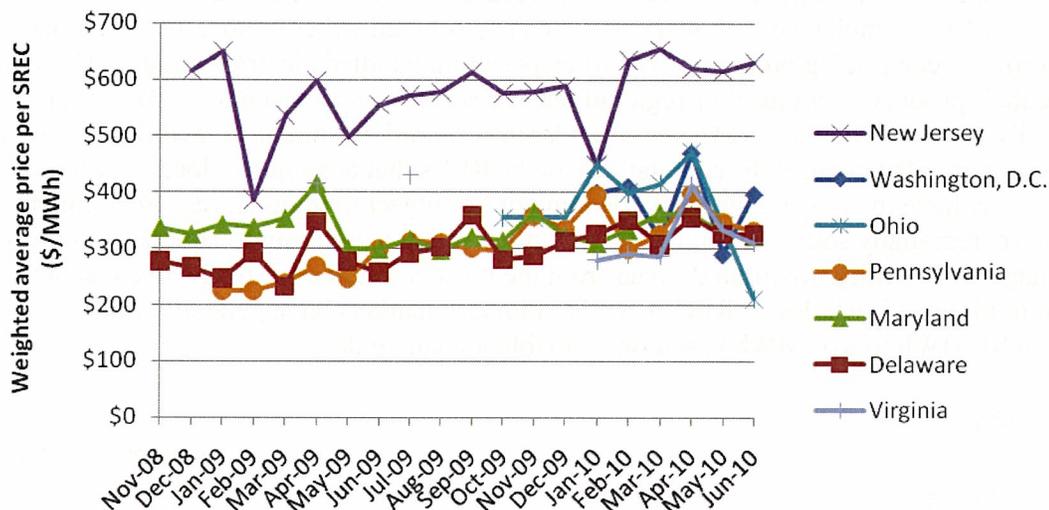


Figure 10. Compliance market SREC weighted average price, November 2008 to June 2010

Source: PJM-GATS

In 2009, New Jersey also saw most of the SREC trading volume, at 85%, while Delaware, Maryland, and Pennsylvania saw smaller volumes, and Ohio, Virginia, and D.C., saw little to no volume (see Figure 11).

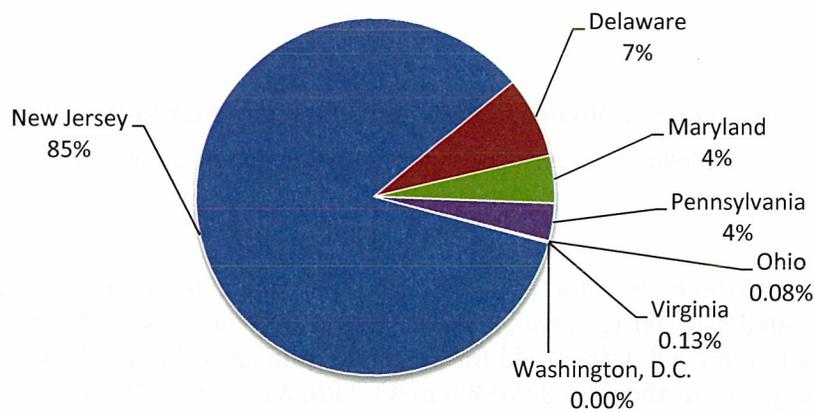


Figure 11. State percent of annual SREC trading volumes, 2009

Source: PJM GATS

Voluntary Markets for RECs

While compliance RECs generally must be sourced from within some geographic region to be eligible for RPS compliance, voluntary RECs can be sourced either regionally or nationally. 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. As shown in Figure 12, wholesale RECs used in voluntary markets have generally traded in the range of \$1/MWh to \$10/MWh based on available indicative data.

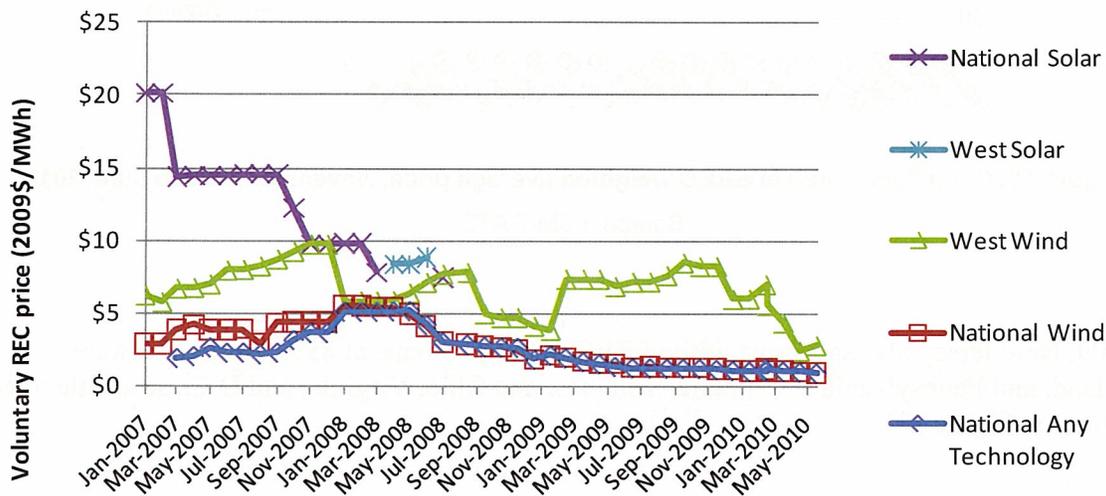


Figure 12. Voluntary REC prices, January 2007 to May 2010

Sources: Evolution Markets (2007), Spectron Group (2010)

Table 18 presents wholesale voluntary REC prices for wind and for any renewable energy technology located nationally, as well as wind from within the Western Electric Coordinating Council (WECC). In 2009, prices paid for nationally sourced voluntary RECs from any technology ranged from about \$0.88/MWh to \$3.00/MWh. Nationally sourced voluntary wind REC prices were comparable to nationally sourced voluntary RECs for any technology, while wind from WECC netted higher prices on average. 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 in which the product is sold, the first three months of the following calendar year, or the last six months of the prior calendar year (CRS 2008). Table 18 shows price ranges for different vintages based on bids and offers in 2009 (ranges are based on the midpoint between

bid and offer prices). In 2009, voluntary RECs from the 2008 vintage year were cheaper than current vintage RECs. In 2010, vintage year voluntary RECs were slightly more expensive than 2009 RECs, with the exception of WECC Wind.

Table 18. Range of Voluntary REC Prices in 2009 for Different Vintages (\$/MWh)

Technology Type	2008	2009	2010
National Any Technology	\$0.88–\$1.35	\$1.00–\$2.75	\$1.35–\$3.00
National Wind	\$0.88–\$1.40	\$1.03–\$2.75	\$1.35–\$3.00
WECC Wind	\$1.15–\$5.25	\$5.50–\$8.75	\$1.53–\$2.08

Source: Spectron Group

REC Price Transparency and Quantity Information

Many renewable energy projects sell power and RECs bundled together in a single product. In such transactions, usually in the form of power purchase agreements (PPAs), there are no explicit REC prices. REC price information, therefore, is available only for RECs that are transacted separately, or unbundled, from the underlying power. REC prices, in both the voluntary and compliance markets, can be difficult to determine without the assistance of a broker, and even then, available information only indicates the transactions made by one broker. A few sources offer publicly available data on SREC pricing. PJM-GATS, the state of New Jersey, and brokers at SRECTrade, Flett Exchange, and PJM EnviroTrade all provide various forms of SREC pricing publicly. In addition to these sources, a few jurisdictions (Maryland, Pennsylvania, and D.C.) require that REC prices be disclosed.

In recent years, more SREC pricing data has become publicly available. SRECTrade, Flett Exchange, and PJM EnviroTrade post SREC data on their Web sites. SRECTrade³⁷ was founded in 2007 and launched its online platform in August 2008. The founders developed the platform because of the “lack of a transparent, fair and public marketplace that facilitated the sale of SRECs in a cost effective way” (SRECTrade 2010). SRECTrade runs auctions for SRECs from Delaware, Massachusetts, Maryland, New Jersey, Ohio, Pennsylvania, and D.C. Price information is available on a monthly basis for each state. Historical price information dates back to September 2009 when the exchange began auctioning New Jersey SRECs.

Flett Exchange³⁸ was also founded on the principle that markets should be more transparent. The exchange began in 2006. Flett Exchange posts results from its REC auctions on its Web site and

³⁷ <http://www.srectrade.com/>.

³⁸ <http://www.flettexchange.com/>.

in a monthly newsletter. In addition to compliance SRECs, Flett Exchange brokers voluntary RECs and also posts price and volume information on its voluntary transactions.

PJM EnviroTrade³⁹ is a subsidiary of PJM Interconnection, the regional transmission organization that coordinates electricity markets in all or parts of 13 states in the mid-Atlantic and Midwest.⁴⁰ PJM EnviroTrade began a monthly auction of SRECs in the summer of 2010. In June 2010, PJM EnviroTrade began posting monthly updates of its auction results, listed in volume, offer price range, and bid price range, by state.

In New Jersey, SREC data is posted on the NJ Clean Energy⁴¹ Web site on a monthly basis, with a delay of one to two months. The data show low and high SREC prices and the weighted average cost. Historical data are available dating back to August 2004. In the current reporting year (June 1, 2009–May 31, 2010), the New Jersey SREC pricing data is sourced from trades on the PJM-GATS trading platform.

PJM-GATS, the generation attribute tracking system for PJM, provides the high, low, and weighted average SREC price by state, dating back to November 2008. Data is available from Delaware, Maryland, North Carolina, New Jersey, Ohio, Pennsylvania, Virginia, and D.C. Data is posted on a monthly basis and can be queried by state. In addition to posting SREC prices, PJM-GATS provides data to Pennsylvania, New Jersey, Maryland, and D.C., on the price paid for RECs that are retired for RPS compliance.

While there have been some emerging data sources for SREC prices, REC price transparency remains limited. Pennsylvania posts annual REC (“Alternative Energy Credit”) pricing online⁴², including the weighted average price and price range for each tier of resources. However, because pricing is delayed and only reported on an annual basis, it provides only an historic price perspective. In the 2008–2009 compliance year, pricing for solar PV ranged from \$225 to \$690, with a weighted average price of \$260, while Tier I pricing ranged from \$0.50 to \$23.00, with a weighted average price of \$3.65.

Washington, D.C., requires utilities to submit price information in their RPS filings; however, the information is not aggregated and published in any form. While this compliance information is still helpful to the PUC, it does not do much to foster greater market price transparency because it is unlikely that individuals looking for REC price information would spend the time to search through individual case filings on the PUC Web site for price information.

³⁹ <http://www.pjmenvirotrade.com>.

⁴⁰ PJM Interconnection covers all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Washington, D.C.

⁴¹ www.njcep.com/srec.

⁴² <http://paaeps.com/credit/pricing.do>.

REC Quantity Information

While there are sensitivities around the price paid for RECs, there are few concerns about increasing the transparency of the quantity of RECs retired for compliance or voluntary purposes. The Texas PUC has encouraged public access to REC market data by requiring ERCOT to annually report 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 and/or voluntary RECs, but after one year, confidentiality is expired, and ERCOT documents how many RECs were retired by each account holder.⁴³

WREGIS, PJM-GATS, MRETS, and NC-RETS all track voluntary retirements, but none of them currently make the information publicly available. Several REC tracking systems have indicated that they are willing to share or make public the quantity of RECs retired in a given year, subject to approval by their respective governing boards. PJM-GATS and MRETS are moving forward with providing data publicly (Schuyler 2010; Gower 2010).

Treatment of Renewable Energy Purchases in GHG Inventories

Because many organizations are purchasing renewable energy or RECs as part of their comprehensive GHG strategies, questions have arisen regarding how best to treat RECs and green power purchases under carbon accounting methodologies. Leading GHG inventories allow participants to account for renewable energy purchases, although there are some differences in methods used, particularly with respect to calculating and crediting the emissions benefits.

Renewable energy purchases are generally matched with purchased electricity (i.e., Scope 2 emissions), which are considered indirect emissions because they are not under the direct control of the facility (see Figure 13). However, there are some differences in the methods in which they are reported and how the adjustment to Scope 2 emissions is calculated. To give an indication of the differences of methodologies in use, we briefly summarize the methods that leading public GHG inventories use to account for renewable energy purchases.

⁴³ ERCOT's Annual Report on the Texas Renewable Energy Credit Trading Program is available for download here: https://www.texasrenewables.com/staticReports/Annual%20Report/2009_Report.doc.

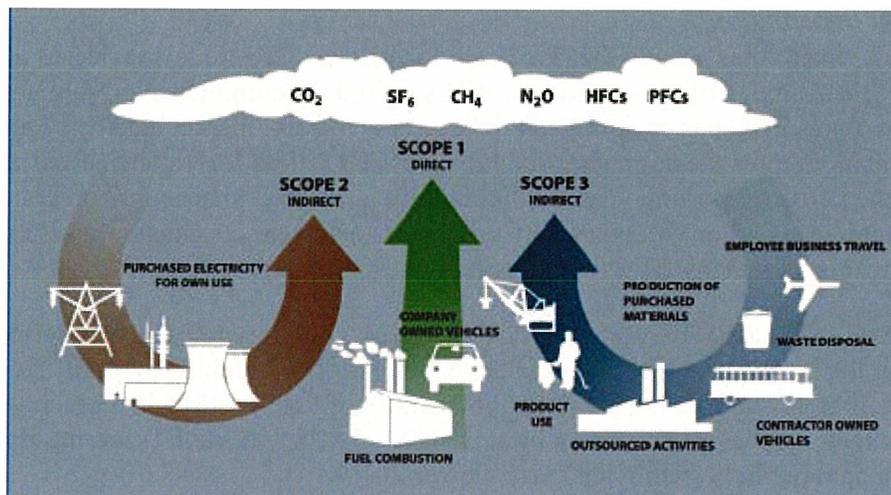


Figure 13. Overview of scopes and emissions

Source: WRI and WBCSD (2004)

EPA Climate Leaders Program

The U.S. EPA Climate Leaders Program⁴⁴ is a voluntary program under which companies develop long-term climate change goals and develop a corporate-wide GHG inventory to track progress. The program uses an inventory protocol developed by the World Resource Institute and the World Business Council for Sustainable Development. The EPA Climate Leaders Program recognizes internal reductions including efficiency, on-site renewable energy, project-based offsets, and green power purchases (including bundled renewable electricity as well as unbundled RECs).⁴⁵ In September, 2010, EPA announced that it would be phasing out the Climate Leaders Program over the next year, and encouraged its participating companies to join another state or non-governmental program. However, it is still useful to examine how the program has addressed GHG accounting of green power, as it provides perspective on how U.S. EPA has addressed these issues to date.

For on-site renewable generation, no adjustment to the GHG inventory is required as it will already be reflected in GHG inventory. Yet if the partner sells RECs from an on-site power generation facility, then the renewable energy generation cannot be counted toward GHG reductions; instead, the indirect emissions associated with the electricity equivalent to the RECs sold from the on-site facility must be reported.

Renewable energy purchases and RECs can be used to adjust GHG inventory emissions if the RECs meet all the resource eligibility and additionality requirements specified by EPA, including being additional to regulatory mandates. Partners are able to use green power purchases to reduce GHG emissions associated with their purchased power (Scope 2 emissions).

⁴⁴ For further information, see <http://www.epa.gov/climateleaders/index.html>. Accessed July 6, 2010.

⁴⁵ For additional information on Climate Leaders protocols for offsets and green power, see <http://www.epa.gov/climateleaders/resources/optional-module.html>. Accessed July 6, 2010.

Scope 2 emissions can be reduced by the product of the avoided emission rate of the renewable energy generator and the amount of green power purchased.⁴⁶

The Climate Registry

The Climate Registry⁴⁷ is a nonprofit organization that provides standards for businesses and governments to calculate, verify, and publicly report their North American carbon footprints in a single, unified registry. The Climate Registry supports both mandatory and voluntary reporting programs and is guided by a Board of Directors comprised of 41 U.S. states and Washington, D.C., 13 Canadian provinces and territories, 6 Mexican states, and 4 Native Sovereign Nations. The Climate Registry was established in 2007 as an extension of the California Climate Action Registry (CCAR), which has been helping companies in California voluntarily report direct and indirect emissions from their operations in California since 2001.

The Climate Registry's General Reporting Protocol (GRP) gives entities the option to report renewable energy purchases as supplemental information to their Scope 2 emissions data. The GRP called for entities to report their Scope 2 emissions based on the system average emissions mix (without a direct adjustment for renewable energy purchases, as in the Climate Leaders program), but entities could calculate the benefits of green power purchases and provide that as supplemental information.⁴⁸

The Climate Registry is currently conducting a pilot program in which renewable energy purchases (including RECs) can be used to adjust Scope 2 emissions (Foran 2010). The program, called the Climate Registered Program, was announced in December 2009 and is designed to recognize leading organizations that meet GHG emissions reductions goals consistent with the program's silver, gold, and platinum leadership levels. Under the program, participating organizations can use renewable energy purchases (including RECs) or offsets to meet a portion of their GHG reduction goals. The green power purchases can be reported as an adjustment to Scope 2 (purchased electricity) emissions by matching the megawatt-hours of green power or RECs with the megawatt-hours of electricity purchases, starting with the electricity purchases in the cleanest region to yield a conservative estimate of emissions benefits. For example, a company that purchases electricity for facilities in California and Illinois would first credit the green power purchases against the California electricity consumption, which has a lower regional GHG emissions rate.

In contrast to the Climate Leader's methodology, this method does not rely on estimating the avoided emissions based on the location of the renewable energy generator supplying the green power (which in some cases is not known) but rather applying the zero-emissions benefits of the renewable energy to the organization's purchased electricity, whose estimated emissions are based on the regional grid mix. Participating organizations will report two Scope 2 emissions

⁴⁶ For further information on Climate Leaders guidance on GHG accounting for green power and RECs, see http://www.epa.gov/climateleaders/documents/greenpower_guidance.pdf.

⁴⁷ For further information, see <http://www.theclimateregistry.org>.

⁴⁸ For further information, see page 101. <http://www.theclimateregistry.org/downloads/GRP.pdf>.

levels: a) an unadjusted estimate of emissions based on the local emissions of the purchased electricity (using EPA eGRID regional emissions factors) and b) an adjusted estimate of emissions including any Registry-accepted utility-specific emission factors and any renewable energy purchases or offsets (Foran 2010).

The Climate Registry plans to evaluate the pilot program after about six months and anticipates receiving public comments on the program and adjustment methods employed. Thus, the calculation methodologies and program structure could be modified going forward based on stakeholder input.

The Climate Registry has also developed an industry-specific protocol for the power sector that incorporates a framework to deal with RECs sold by power companies that own renewable energy facilities or procure RECs for their portfolio.⁴⁹ Under the Climate Registry's electric sector protocol, utilities have the option to report sales and purchases of RECs sold from renewable energy facilities that they own. Utilities following the optional protocol are required to estimate system average emissions for those renewable energy facilities in which RECs are not retained. This ensures that the emissions benefits are not double counted by the utility and the renewable energy purchaser.

Local Government Operations Protocol

ICLEI – Local Governments for Sustainability (ICLEI) is an association of city and county governments interested in making their communities more sustainable. ICLEI assists local governments in their efforts to reduce GHG emissions, providing tools and methods to measure emissions. ICLEI developed the Local Government Operations Protocol⁵⁰ (“Protocol”) in partnership with the California Air Resources Board (CARB) and CCAR and in collaboration with The Climate Registry. The Protocol is designed specifically for use by local governments throughout the United States. CARB encourages California's local governments to use the Protocol to annually inventory and report their GHG emissions so that reductions made by local governments are transparent, consistent, and accurate.

For local governments that purchase renewable energy, either through their electric utility or an independent power provider, the Protocol does not allow deductions from Scope 2 emissions. The Protocol made this determination because it considers this purchase to be already accounted for in the region's emissions rate, or eGRID factor.⁵¹ However, local governments are encouraged to report renewable energy purchases as supplemental information in their GHG inventories.

⁴⁹ For more information on the electric sector protocol, see <http://www.theclimateregistry.org/resources/protocols/electric-power-sector-protocol/>. Accessed July 6, 2010.

⁵⁰ For further information, see The Local Government Operations Protocol: <http://www.icleiusa.org/programs/climate/ghg-protocol/local-government-operations-protocol>. Accessed August 9, 2010.

⁵¹ It should be noted that currently, voluntary purchases have minimal impact on overall emissions rates.

For local governments generating on-site renewable energy, the Protocol does not require any adjustment because the generation will decrease the grid electricity that is purchased, therefore decreasing Scope 2 emissions.

Draft Federal Guidance on Executive Order 13514

Executive Order 13514 was signed on October 5, 2009, requiring the federal government to make reductions of GHG emissions a priority for federal agencies. Each federal agency is directed to establish a percentage reduction target relative to a fiscal year 2008 baseline and complete a GHG inventory of fiscal year 2010 emissions by January 31, 2011. The Federal GHG Accounting and Reporting Guidance (“Guidance”) is being developed by the Department of Energy’s Federal Energy Management Program (FEMP), in coordination with other federal agencies. The draft Guidance was released for public comment on July 14, 2010.⁵²

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

On-site renewable generation, when the associated RECs are owned by the agency, will reduce Scope 1 emissions if the renewable generation is displacing on-site non-renewable generation. If the on-site renewable generation is displacing purchased electricity, Scope 2 emissions will be reduced due to the decreased use of purchased electricity. If an agency does not own the RECs from their on-site renewable generation, the agency must adjust its Scope 1 and Scope 2 emissions by reporting emissions for the electricity associated with the REC as if it were conventional electricity by using the non-baseload emissions factor for the eGRID sub-region of the on-site renewable generation system.

⁵² For further information, see “Draft Guidance for Federal Greenhouse Gas Accounting and Reporting,” <http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg>. Accessed August 9, 2010.

Conclusions and Observations

The green power market continues to exhibit strong growth and provide an important demand-driven 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 2009, total retail sales of renewable energy in voluntary-purchase markets exceeded 30 billion kWh, representing a capacity equivalent of 9,500 MW of renewable energy, including 8,300 MW from “new” renewable energy sources.
- Wind energy provided 73.7% of total green power sales, followed by biomass energy sources including landfill gas (10.0%), hydropower (9.9%), geothermal (0.2%), solar (0.1%), and the remainder unknown (5.9%).
- Total market sales increased by 17% in 2009, dominated by REC sales, which are primarily to nonresidential consumers and increased by about 20% from 2008. REC markets now represent 62% of green power market sales, surpassing sales in competitive electricity markets and utility green pricing programs.
- Overall, the total number of customers purchasing green power increased by 44% in 2009, a higher rate than in previous years, with gains coming primarily from one competitive offering in Texas. Utility green pricing program participants remained essentially flat in aggregate from 2007 to 2009, with some programs continuing to report customer losses in 2009, presumably due to the economic downturn.
- Utility green pricing programs in regulated electricity markets continued to grow on a sales basis but at a slower rate than in previous years, with sales increasing by about 7% in 2009. A relatively small number of utility programs continued to dominate sales and customer results. Utility premiums for green pricing have continued to fall due in part to the increased cost competitiveness of renewable energy with conventional generation.
- In 2009, nearly 340,000 metric tons of CO₂e avoided due to renewable energy facilities were marketed as offsets, an increase of approximately 39% from 2008. This is the equivalent of about 485,000 MWh of renewable energy generation.
- In 2009, sales to nonresidential customers continued to outpace those to residential customers, bringing the fraction of nonresidential sales to 76% of all green power sales on a kilowatt-hour basis. The continuing dominance of nonresidential sales is a departure from the early history of green power markets when most products and programs were oriented toward residential customers.
- REC prices vary considerably, depending on a number of factors. In compliance regions where there have been shortages of renewable energy to meet RPS requirements, REC prices have reached or come close to levels for ACP of \$50–\$55/MWh; whereas, in other states or regions, compliance RECs have sold for less than \$5/MWh. Wholesale RECs used in voluntary markets have generally traded in the range of \$1–\$10/MWh.

References

- Barbose, G. (8 October 2010). E-mail. Lawrence Berkeley National Laboratory, Berkeley, CA.
- Bird, L.; Dagher, L.; Swezey, B. (December 2007). *Green Power Marketing in the United States: A Status Report (Tenth Edition)*. NREL/TP-670-42502. Golden, CO: National Renewable Energy Laboratory. <http://apps3.eere.energy.gov/greenpower/resources/pdfs/42502.pdf>. Accessed September 2010.
- Bird, L.; Hurlbut, D.; Donohoo, P.; Cory, K.; Kreycik, C. (March 2009). *An Examination of the Regional Supply and Demand Balance for Renewable Electricity in the United States through 2015*. NREL/TP-6A2-45041. Golden, CO: National Renewable Energy Laboratory. <http://www.nrel.gov/docs/fy09osti/45041.pdf>. Accessed September 2010.
- Bird, L.; Kreycik, C.; Friedman, B. (October 2008). *Green Power Marketing in the United States: A Status Report (Eleventh Edition)*. NREL/TP-6A2-44094. Golden, CO: National Renewable Energy Laboratory. <http://www.nrel.gov/docs/fy09osti/44094.pdf>. Accessed September 2010.
- Bird, L.; Swezey, B. (November 2006). *Green Power Marketing in the United States: A Status Report (Ninth Edition)*. NREL/TP-620-40904. Golden, CO: National Renewable Energy Laboratory. <http://www.eere.energy.gov/greenpower/resources/pdfs/40904.pdf>. Accessed September 2010.
- Bird, L.; Swezey, B. (2005). *Green Power Marketing in the United States: A Status Report (Eighth Edition)*. NREL/TP-620-38994. Golden, CO: National Renewable Energy Laboratory. <http://www.eere.energy.gov/greenpower/resources/pdfs/38994.pdf>. Accessed September 2010.
- Bird, L.; Swezey, B. (September 2004). *Green Power Marketing in the United States: A Status Report (Seventh Edition)*. NREL/TP-620-36823. Golden, CO: National Renewable Energy Laboratory. <http://www.eere.energy.gov/greenpower/pdfs/36823.pdf>. Accessed September 2010.
- Bird, L.; Swezey, B. (October 2003). *Green Power Marketing in the United States: A Status Report (6th Edition)*. NREL/TP-620-35119. Golden, CO: National Renewable Energy Laboratory. <http://www.eere.energy.gov/greenpower/resources/pdfs/35119.pdf>. Accessed September 2010.
- Bird, L.; Swezey, B.; Cory, K. (August 2008). *Renewable Energy Price-Stability Benefits in Utility Green Power Programs*. NREL/TP-670-43532. Golden, CO: National Renewable Energy Laboratory. <http://apps3.eere.energy.gov/greenpower/resources/pdfs/43532.pdf>. Accessed September 2010.
- CRS (December 2008). *National Standard Version 1.6*. San Francisco, CA. http://www.green-e.org/docs/energy/Appendix%20D_Green-e%20Energy%20National%20Standard.pdf. Accessed September 2010.
- Database of State Incentives for Renewables & Efficiency (DSIRE) (2010). www.dsireusa.org. Accessed August 30, 2010.

Electric Reliability Council of Texas, Inc. (ERCOT) (2009). *ERCOT's 2009 Annual Report On The Texas Renewable Energy Credit Trading Program*. PROJECT NO. 27706. Texas Public Utilities Commission.

https://www.texasrenewables.com/staticReports/Annual%20Report/2009_Report.doc. Accessed September 2010.

Emissions & Generation Resource Integrated Database (eGRID) (2010).

<http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>. Accessed September 23, 2010.

Evolution Markets (2007). www.evomarkets.com Accessed December 2007.

Foran, P. (6 July 2010). Personal Communication. The Climate Registry, Los Angeles, CA.

Gower, B. (23 August 2010). Personal communication. APX, Inc., San Jose, CA, .

Holt, E.A.; Wiser, R.H. (April 2007). *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards*. LBNL-62574. Lawrence Berkeley National Laboratory, Berkeley, CA.

<http://eetd.lbl.gov/ea/ems/reports/62574.pdf>. Accessed September 2010.

PJM-GATS (2010). Solar Weighted Average Price. <https://gats.pjm-eis.com/myModule/rpt/myrpt.asp?r=230>. Accessed September 23, 2010.

Power to Choose (2010). www.powertochoose.org. Accessed September 23, 2010.

Schuyler, K. (7 July 2010). Personal communication. PJM Environmental Information Services, Inc., Norristown, PA.

Spectron Group (2010). Data provided by Christian Thalacker. London, UK.
www.spectrongroup.com

SRECTrade (2010). <http://www.srectrade.com/about.php>. Accessed September 23, 2010.

Swezey, B.; Bird, L. (August 2000). *Green Power Marketing in the United States: A Status Report (5th Edition)*. NREL/TP-620-28738. Golden, CO: National Renewable Energy Laboratory. <http://www.eere.energy.gov/greenpower/resources/pdfs/28738.pdf>. Accessed September 2010.

Swezey, B.; Bird, L. (August 1999). *Information Brief on Green Power Marketing (4th Edition)*. NREL/TP-620-26901. Golden: CO: National Renewable Energy Laboratory.
<http://www.eere.energy.gov/greenpower/resources/pdfs/26901.pdf>. Accessed September 2010.

Terada, R. (9 October 2010). Personal communication. Center for Resource Solutions, San Francisco, CA.

World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) (2004). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)*. <http://www.wri.org/publication/greenhouse-gas-protocol-corporate-accounting-and-reporting-standard-revised-edition>. Accessed September 2010.

Appendix A. Leading Purchasers in the EPA Green Power Partnership

Table A-1. Top 25 Purchasers in the EPA Green Power Partnership Program, January 5, 2010

Rank	Company	Annual Green Power Usage (kWh)	GP % of Total Electricity Use	Green Power Resources
1	Intel Corporation	1,433,200,000	51%	Biogas, Biomass, Geothermal, Small Hydro, Solar, Wind
2	Kohl's Department Stores	1,367,376,000	100%	Biogas, Biomass, Small Hydro, Solar, Wind
3	PepsiCo	1,226,403,121	100%	Various
4	Whole Foods Market	790,459,000	105%	Solar, Wind
5	City of Houston, TX	438,000,000	34%	Wind
6	Dell, Inc.	431,058,000	129%	Biogas, Solar, Wind
7	The Pepsi Bottling Group, Inc.	426,239,848	100%	Various
8	Cisco Systems, Inc.	400,996,000	46%	Wind
9	Commonwealth of Pennsylvania	400,000,000	40%	Biomass, Wind
10	Johnson & Johnson	386,455,711	34%	Biogas, Biomass, Small Hydro, Solar, Wind
11	U.S. Air Force	339,660,392	4%	Biogas, Biomass, Solar, Wind
12	City of Dallas, TX	333,659,840	40%	Wind
13	HSBC North America	314,013,000	98%	Wind
14	U.S. Environmental Protection Agency	262,262,425	101%	Biogas, Biomass, Solar, Wind
15	Wal-Mart Stores, Inc./California and Texas Facilities	243,328,000	8%	Solar, Wind
16	Starbucks	237,000,000	25%	Wind

17	BNY Mellon	229,500,000	77%	Wind
18	City of Chicago, IL	214,635,000	20%	Biomass, Wind
19	Kimberly-Clark Corporation	192,730,000	7%	Biomass
20	University of Pennsylvania	192,727,000	46%	Wind
21	U.S. Department of Energy	188,599,600	4%	Various
22	Los Angeles County Sanitation Districts	181,624,000	55%	Biogas
23	DuPont Company	180,075,000	4%	Biomass, Solar, Wind
24	Wells Fargo & Company	175,000,000	14%	Wind
25	Deutsche Bank	160,000,000	100%	Wind

Source: EPA Green Power Partnership, <http://www.epa.gov/greenpower/toplists/top50.htm>

Appendix B. Estimated U.S. Green Pricing Customers

Table B-1. Estimated U.S. Green Pricing Customers by State and Customer Class, 2007 and 2008

State	Electric Industry Participants 2008 ^a	Participating Customers			
		2008			2007
		Residential	Nonresidential	Total	Total
Alabama	25	1,786	30	1,816	585
Alaska	1	440	20	460	530
Arizona	6	4,222	123	4,345	9,285
Arkansas	2	25	0	25	-
California	13	80,178	3,432	83,610	58,676
Colorado	26	56,270	1,966	58,236	57,501
Connecticut	3	122	24	146	96
Delaware	9	11,193	1,260	12,453	8,914
D.C.	3	1,590	3,925	5,515	4,854
Florida	5	38,099	385	38,484	37,833
Georgia	24	9,170	186	9,356	8,308
Hawaii	-	-	-	-	4,738
Idaho	6	4,935	192	5,127	4,817
Illinois	4	4,225	40	4,265	3,892
Indiana	14	6,111	97	6,208	4,299
Iowa	40	8,522	743	9,265	9,193
Kansas	1	1	-	1	1
Kentucky	24	3,026	32	3,058	1,338
Louisiana	2	357	38	395	-
Maine	2	2,003	218	2,221	2,494
Maryland	4	42,690	16,337	59,027	55,954
Massachusetts	8	9,738	474	10,212	6,155

State	Electric Industry Participants 2008 ^a	Participating Customers			
		2008		2007	
		Residential	Nonresidential	Total	Total
Michigan	11	27,843	285	28,128	13,196
Minnesota	98	43,879	554	44,433	44,034
Mississippi	12	249	9	258	3
Missouri	20	4,283	55	4,338	1,439
Montana	11	538	26	564	995
Nebraska	4	7,585	61	7,646	6,891
Nevada	2	30	1	31	514
New Hampshire	1	0	1	1	1
New Jersey	4	1,945	323	2,268	441
New Mexico	11	3,129	300	3,429	21,273
New York	9	27,310	1,225	28,535	21,857
North Carolina	23	13,936	287	14,223	12,386
North Dakota	7	3,095	14	3,109	5,086
Ohio	13	3,625	130	3,755	1,789
Oklahoma	8	9,882	539	10,421	11,287
Oregon	24	109,656	3,442	113,098	100,595
Pennsylvania	5	36,742	812	37,554	39,099
Rhode Island	2	5,086	120	5,206	4,887
South Carolina	21	9,895	485	10,380	4,766
South Dakota	7	596	16	612	632
Tennessee	64	11,712	987	12,699	-
Texas	18	184,994	20,731	205,725	142,334
Utah	8	25,291	607	25,898	23,406
Vermont	2	4,535	257	4,792	4,517

State	Electric Industry Participants 2008 ^a	Participating Customers			
		2008			2007
		Residential	Nonresidential	Total	Total
Virginia	2	1,062	0	1,062	1,306
Washington	25	46,516	1,391	47,907	43,885
West Virginia	2	72	2	74	-
Wisconsin	60	45,889	2,229	48,118	36,344
Wyoming	8	4,206	300	4,506	13,225
Total	643	918,284	64,711	982,995	835,651

^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: Energy Information Administration, "Green Pricing and Net Metering Programs, 2008."
<http://www.eia.gov/cneaf/solar.renewables/page/greenprice/netmetering08.pdf>. Accessed August 2010.

Table B-2. Estimated U.S. Green Pricing Customers by Customer Class, 2002–2008

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

^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: Energy Information Administration, "Net Metering and Green Pricing Customers by End Use Sector, 2002 - 2008," http://www.eia.doe.gov/cneaf/electricity/epa/epaxfile7_5.pdf. Accessed January 2010.

Appendix C. Utilities Offering Green Pricing Programs in Regulated Markets

Table C-1. Utilities Offering Green Pricing Programs in Regulated Markets, 2009

Investor-Owned Utilities	Electric Cooperatives	Municipal/Public Utilities	
AEP Appalachian Power	Alabama Electric Cooperative	City of Alameda	Muscatine Power and Water
Alliant Energy	Associated Electric Cooperative, Inc.	American Municipal Power-Ohio	City of Naperville
AmerenUE	Bandera Electric Cooperative	Anaheim Public Utilities	City of New Smyrna Beach
Arizona Public Service	Basin Electric Power Cooperative	City of Ashland	Northern Wasco County PUD
Avista Utilities	Boone Electric Cooperative	Austin Energy	Oklahoma Municipal Power Authority
Central Vermont Public Service	Buckeye Power	Austin Utilities (MN)	Omaha Public Power District
Cheyenne Light, Fuel and Power Co.	Central Electric Cooperative	Benton County Public Utility District	Owatonna Public Utilities
Connecticut Light and Power	Central Iowa Power Cooperative	City of Bowling Green	Pacific County PUD
Consumers Energy	Connexus Energy	Braintree Electric Light Department	City of Palo Alto Utilities
Dayton Power and Light	Corn Belt Power Cooperatives	Burbank Water and Power	Pasadena Water & Power
Dominion North Carolina Power	Dairyland Power Cooperative	CPS Energy (San Antonio)	Platte River Power Authority
Dominion Virginia Power	Dakota Electric Association	Cedar Falls Utilities	Roseville Electric
DTE Energy	Delaware Electric Cooperative	Central MN Municipal Power Agency	Sacramento Municipal Utility District
Duke Energy	Deseret Power	Chelan County Public Utility District	Salt River Project
El Paso Electric Company	Deseret Power/Mt. Wheeler Power Cooperative	Clallam County PUD	San Francisco Public Utilities Commission
Entergy Gulf States	East Kentucky Power Cooperative	Clark Public Utilities	Santee Cooper
E.ON U.S.	Electric Cooperatives of Arkansas	College Station Utilities (TX)	Seattle City Light
FirstEnergy	Farmers Electric Cooperative	Colorado Springs Utilities	Shrewsbury Electric and Cable Operations
Georgia Power	Flathead Electric Cooperative	Columbia River PUD	Silicon Valley Power
Green Mountain Power	Georgia Electric Membership Corporation	Concord Municipal Light Plant	Snohomish County Public Utility District
Gulf Power Company	Golden Valley Electric Association	Cowlitz PUD	Southern Minnesota Municipal Power Agency
Hawaiian Electric Company	Great River Energy	Edmond Electric	City Utilities of Springfield (MO)
Idaho Power Company	Gunnison County Electric Association	City of Eldridge (IA)	Springfield Utility Board
Indianapolis Power & Light Company	Holy Cross Energy	ElectricCities	City of St. Charles
Kansas City Power & Light	Hoosier Energy	Emerald People's Utility District	City of St. George
Kentucky Power Co.	Intermountain Rural Electric Association	Estes Park Light and Power	Tacoma Power
Kentucky Utilities Company	KAMO Electric Cooperative	Eugene Water & Electric Board	City of Tallahassee
Louisville Gas and Electric Company	Kauai Island Utility Cooperative (KIUC)	Fort Collins Utilities	Truckee Donner Public Utility District
Madison Gas and Electric	La Plata Electric Association	Gainesville Regional Utilities	Waverly Light and Power
MidAmerican Energy	Lower Colorado River Authority	Grant County PUD	WPPI Energy
Minnesota Power	Lower Valley Energy	Grays Harbor PUD	
NSTAR Electric	Midstate Electric Cooperative	Heartland Consumers Power District	Federal
Nevada Power	Minnkota Power Cooperative	Iowa Association of Municipal Utilities	Tennessee Valley Authority
NorthWestern Energy	New-Mac Electric Cooperative	Keys Energy Services	
OG&E Electric Services	Orcas Power & Light	Lakeland Electric	
Otter Tail Power Company	Oregon Trail Electric Cooperative	Lansing Board of Water and Light	
PacifiCorp	Palmetto Electric Cooperative	Lenox Municipal Utilities	
Portland General Electric Company	Park Electric Cooperative	Lewis County PUD	
Progress Energy	Pedernales Electric Cooperative	Lincoln Electric System	
Public Service Company of NM	Peninsula Light Company	Lodi Utilities	
Puget Sound Energy	Power South Energy Cooperative	Longmont Power & Communications	
SCE&G	PNGC Power	Los Alamos County (NM)	
Tampa Electric Company	Rappahannock Electric Cooperative	Los Angeles Dept. of Water and Power	
Tucson Electric Power Company	Southern Montana Electric G&T Cooperative	Loveland Water & Power	
UniSource Energy Services	Tri-State Generation and Transmission Ass	Mason County PUD No. 3	
United Illuminating	Vigilante Electric Cooperative	Missouri Joint Municipal Electric Utility	
Upper Peninsula Power Company	Wabash Valley Power Association	Missouri River Energy Services	
We Energies	Western Farmers Electric Cooperative	Moorhead Public Service	
Wisconsin Public Service Corporation	Yampa Valley Electric Association		
Xcel Energy			

Table C-2. Utility/Marketer Green Power Programs in Restructured Electricity Markets, 2009

State	Utility
Connecticut	Connecticut Light & Power
	United Illuminating
Maine	Kennebunk Light and Power District
Massachusetts	Massachusetts Electric (National Grid)
	Nantucket Electric (National Grid)
Michigan	Consumers Energy
New Jersey	Atlantic City Electric
	Public Service Electric & Gas
	Rockland Electric
	Jersey Central Power & Light
	Orange and Rockland Utilities
New York	Long Island Power Authority
	Energy East/NYSEG
	Niagara Mohawk (National Grid)
Pennsylvania	PECO Energy
Rhode Island	Narragansett Electric (National Grid)

Appendix D. Links to Utility Green Pricing Programs and REC and Competitive Market Green Power Offerings

Table of Utility Green Pricing Programs by State:

<http://www.eere.energy.gov/greenpower/markets/pricing.shtml?page=1>

REC Retail Products:

<http://www.eere.energy.gov/greenpower/markets/certificates.shtml?page=1>

Retail Green Power Product Offerings in States with Retail Competition:

<http://www.eere.energy.gov/greenpower/markets/marketing.shtml?page=1>

Appendix E. Top 10 Utility Green Pricing Programs

Table E-1. Top 10 Green Pricing Program Renewable Energy Sales (as of December 2009)

Rank	Utility	Resources Used	Sales (kWh/year)	Sales (aMW) ^a
1	Austin Energy	Wind, Landfill Gas	764,895,830	87.3
2	Portland General Electric ^b	Wind, Biomass, Geothermal	740,880,487	84.6
3	PacifiCorp ^{cde}	Wind, Biomass, Landfill Gas, Solar	578,744,080	66.1
4	Sacramento Municipal Utility District ^c	Wind, Hydro, Biomass, Solar	377,535,530	43.1
5	Xcel Energy ^{cf}	Wind, Solar	374,296,375	42.7
6	Puget Sound Energy ^{cg}	Wind, Landfill Gas, Biomass, Small Hydro, Solar	303,046,167	34.6
7	Connecticut Light and Power/ United Illuminating	Wind, Hydro	197,458,734	22.5
8	National Grid ^h	Biomass, Wind, Small Hydro, Solar	174,536,130	19.9
9	Public Service Company of New Mexico	Wind	173,863,751	19.8
10	We Energies ^c	Wind, Landfill Gas, Solar	173,217,802	19.8

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

^b Marketed in partnership with Green Mountain Energy Company.

^c Product is Green-e Energy (www.green-e.org) certified.

^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 Includes Niagara Mohawk, Massachusetts Electric, Narragansett Electric, and Nantucket Electric.

Table E-2. Total Number of Customer Participants (as of December 2009)

Rank	Utility	Program(s)	Participants
1	Portland General Electric ^a	Clean Wind, Green Source, Renewable Future	72,812
2	PacifiCorp ^{bc}	Blue Sky Block ^d , Blue Sky Usage ^d , Blue Sky Habitat ^d	71,165
3	Xcel Energy ^e	WindSource ^d , Renewable Energy Trust	70,393
4	Sacramento Municipal Utility District	Greenergy ^d	50,250
5	PECO ^f	PECO WIND	34,491
6	Puget Sound Energy ^{cg}	Green Power Program ^d	25,789
7	National Grid ^h	GreenUp	22,888
8	Connecticut Light and Power/ United Illuminating	CTCleanEnergyOptions	22,336
9	We Energies	Energy for Tomorrow ^d	20,927
10	Iberdrola USA: NYSEG and RG&E ^f	Catch the Wind	20,386

^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 E-3. Customer Participation Rate (as of December 2009)

Rank	Utility	Program(s)	Customer Participation Rate	Program Start Year
1	City of Palo Alto Utilities ^a	Palo Alto Green ^b	20.8%	2003
2	Portland General Electric ^c	Clean Wind, Green Source, Renewable Future	10.2%	2002
3	Madison Gas and Electric	Green Power Tomorrow	9.6%	1999
4	Sacramento Municipal Utility District	Greenergy ^b	8.5%	1997
5	City of Naperville, IL ^d	Renewable Energy Program	8.4%	2005
6	Silicon Valley Power ^a	Santa Clara Green Power ^b	8.1%	2004
7	Pacific Power - Oregon Only ^a	Blue Sky Block ^b , Blue Sky Usage ^b , Blue Sky Habitat ^b	6.5%	2002
8	River Falls Municipal Utilities ^e	Renewable Energy Program ^b	5.8%	2001
9	Stoughton Utilities ^e	Renewable Energy Program ^b	5.2%	2002
10	Lake Mills Light & Water ^e	Renewable Energy Program ^b	5.1%	2002
10	Pacific County PUD	Green Power Tomorrow	5.1%	2002

^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.

Table E-4. Green Power Sales as a Percentage of Total Retail Electricity Sales (as of December 2009) (kWh)

Rank	Utility	Program(s)	% of Load
1	Waterloo Utilities ^a	Renewable Energy Program ^b	21.4%
2	Edmond Electric ^c	Pure and Simple	8.1%
3	Portland General Electric ^d	Clean Wind, Green Source, Renewable Future	7.9%
4	City of Palo Alto Utilities ^e	Palo Alto Green ^b	6.9%
5	Austin Energy	Green Choice	6.4%
6	River Falls Municipal Utilities ^a	Renewable Energy Program ^b	6.2%
7	Madison Gas and Electric	Green Power Tomorrow	4.9%
8	Sacramento Municipal Utility District	Greenergy ^b	3.6%
9	Park Electric Cooperative ^f	Green Power Program	3.4%
10	PacifiCorp (Oregon only) ^{be}	Blue Sky Block ^b , Blue Sky Usage ^b , Blue Sky Habitat ^b	2.8%

^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 Power supplied by Basin Electric Power Cooperative.

Table E-5. Price Premium Charged for New, Customer-driven Renewable Power^a (as of December 2009)

Rank	Utility	Resources Used	Premium (¢/kWh)
1	Edmond Electric ^{bc}	Wind	-0.17
2	OG&E Company ^{bd}	Wind	0.28
3	Avista Utilities	Wind, Landfill Gas, Hydro	0.33
4	Park Electric Cooperative	Wind	0.39
5	Arizona Public Service Company ^f	Wind, Geothermal, Biomass, Landfill Gas, Solar	0.40
6	Indianapolis Power & Light Company	Wind	0.42
7	Flathead Electric Cooperative ^e	Wind	0.50
7	Sacramento Municipal Utility District ^f	Wind, Hydro, Biomass, Solar	0.50
9	Xcel Energy (New Mexico) ^{bf}	Wind, Solar	0.75
10	Emerald People's Utility District	Landfill Gas, Wind, Biomass	0.80

^a Includes only programs that have installed or announced firm plans to install or purchase power from 100% new renewable resources.

^b Premium is variable; customers in these programs are exempt or otherwise protected from changes in utility fuel charges.

^c Power supplied by Oklahoma Municipal Power Authority.

^d OG&E Company offers two rate structures for its Wind Power program; the lowest premium is for the rate which exempts customers from the fuel charge.

^e Power is supplied by Basin Electric Power Cooperative.

^f Product is Green-e Energy certified.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188		
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Executive Services and Communications Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.</p>					
1. REPORT DATE (DD-MM-YYYY) September 2010		2. REPORT TYPE Technical Report		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE Green Power Marketing in the United States: A Status Report (2009 Data)			5a. CONTRACT NUMBER DE-AC36-08-GO28308		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Lori Bird and Jenny Sumner			5d. PROJECT NUMBER NREL/TP-6A20-49403		
			5e. TASK NUMBER SA09.3102		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) National Renewable Energy Laboratory 1617 Cole Blvd. Golden, CO 80401-3393			8. PERFORMING ORGANIZATION REPORT NUMBER NREL/TP-6A20-49403		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S) NREL		
			11. SPONSORING/MONITORING AGENCY REPORT NUMBER		
12. DISTRIBUTION AVAILABILITY STATEMENT National Technical Information Service U.S. Department of Commerce 5285 Port Royal Road Springfield, VA 22161					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT (Maximum 200 Words) This report documents green power marketing activities and trends in the United States. First, aggregate green power sales data for all voluntary purchase markets across the United States are presented. Next, we summarize data on utility green pricing programs offered in regulated electricity markets; green power marketing activity in competitive electricity markets, as well as green power sold to voluntary purchasers in the form of RECs; and renewable energy sold as greenhouse gas offsets in the United States. Finally, this is followed by a discussion of key market trends and issues. The data presented in this report are based primarily on figures provided to NREL by utilities and independent renewable energy marketers.					
15. SUBJECT TERMS green power; marketing trends; renewable energy certificates; REC; utility green pricing programs; voluntary markets; sales; renewable energy					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UL	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (Include area code)

Renewable Default Energy Service Options
 Monthly Bill Impacts Based on the Current Price Estimates

		1.3895 cents/kwh	2.779 cents/kwh	5.558 cents/kwh
	Monthly	25% Option	50% Option	100% Option
	KWH	Monthly Bill Impact	Monthly Bill Impact	Monthly Bill Impact
Residential	500 \$	6.95 \$	13.90 \$	27.79
Small Business	10,000 \$	138.95 \$	277.90 \$	555.80