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Innovations in Voluntary Renewable Energy Procurement: Methods for Expanding Access and Lowering Cost for Communities, Governments, and Businesses

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National Renewable Energy Laboratory

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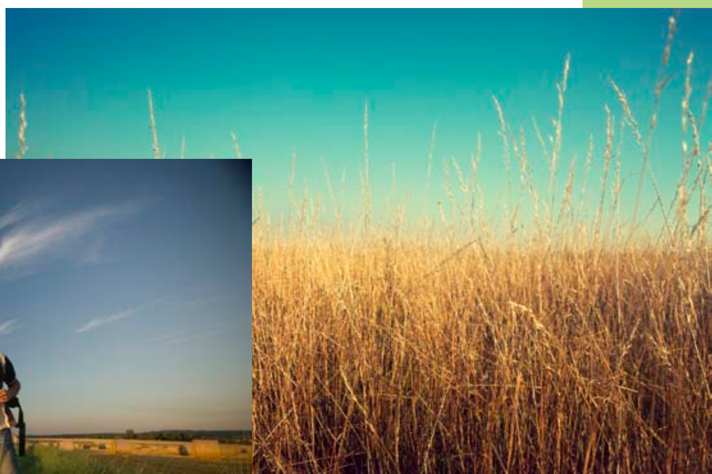

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1. INTRODUCTION

This guide explores five innovative options for voluntarily procuring renewable energy generation or systems. The options and their descriptions are shown in Table 1. These methods can be replicated by a variety of stakeholders—including local governments, not-for-profit organizations, businesses, and utilities. The three decision trees in Figure 1 indicate which method may best suit a particular stakeholder's needs.

The options described in this guide offer a variety of benefits, including lower cost, simplified transactions, expanded access to green energy, and increased impact (see Text Box 1). Each chapter describes one option, provides examples of its use, lays out design and implementation considerations, and discusses benefits and challenges.

New purchasing methods have been created by utilities, local governments, businesses, and others to expand access, lower the cost, and simplify the process of procuring voluntary renewables.

Table 1. Five Methods to Encourage Voluntary Procurement of Renewable Energy Generation or Systems

Method	Description	Examples
Community Choice Aggregation (CCA) *Section 2 (page 9)*	CCA programs allow communities to collectively choose the source of their electricity generation while maintaining transmission and distribution service from the existing provider. CCA programs may or may not select renewable energy supply; this paper focuses on such programs that do provide renewable energy.	Marin Clean Energy (CA) Oak Park Community Choice Aggregation (IL)
Community wind and solar programs *Section 3 (page 14)*	Community programs allow participants to invest in renewable energy projects; these programs include community solar and wind programs. Programs typically fund new local solar or wind capacity; each participant purchases a portion of the capacity.	Community solar: Sacramento Municipal Utility District's SolarShares Program (CA) Community wind: Huerfano River Wind Project (CO)
Green power challenges and local collaborative electricity procurement *Section 4 (page 18)*	Green power challenges are media campaigns sponsored by local governments, utilities, third-party marketers, and/or environmental organizations to encourage increased levels of voluntary green power purchasing in a community. Local collaborative electricity procurement aggregates the demand of a few organizations in deregulated electricity markets to procure renewable electricity.	Green power challenge: Lake Oswego (OR) Local collaborative electricity procurement: Groundswell's Community Power Project (D.C.)
Bulk purchasing of on-site systems *Section 5 (page 21)*	Bulk purchasing programs aggregate demand from a group of individuals or companies interested in installing on-site systems, attracting reduced prices from vendors, and simplifying the purchasing process.	Solarize Portland (OR) One Block Off the Grid (National)
Reverse auctions for renewable energy *Section 6 (page 25)*	Reverse auctions are mechanisms for one or more buyers to request a renewable energy product and have many sellers bid to provide the product; the bidder that can provide the product for the lowest price wins the auction.	World Energy Solutions (National)

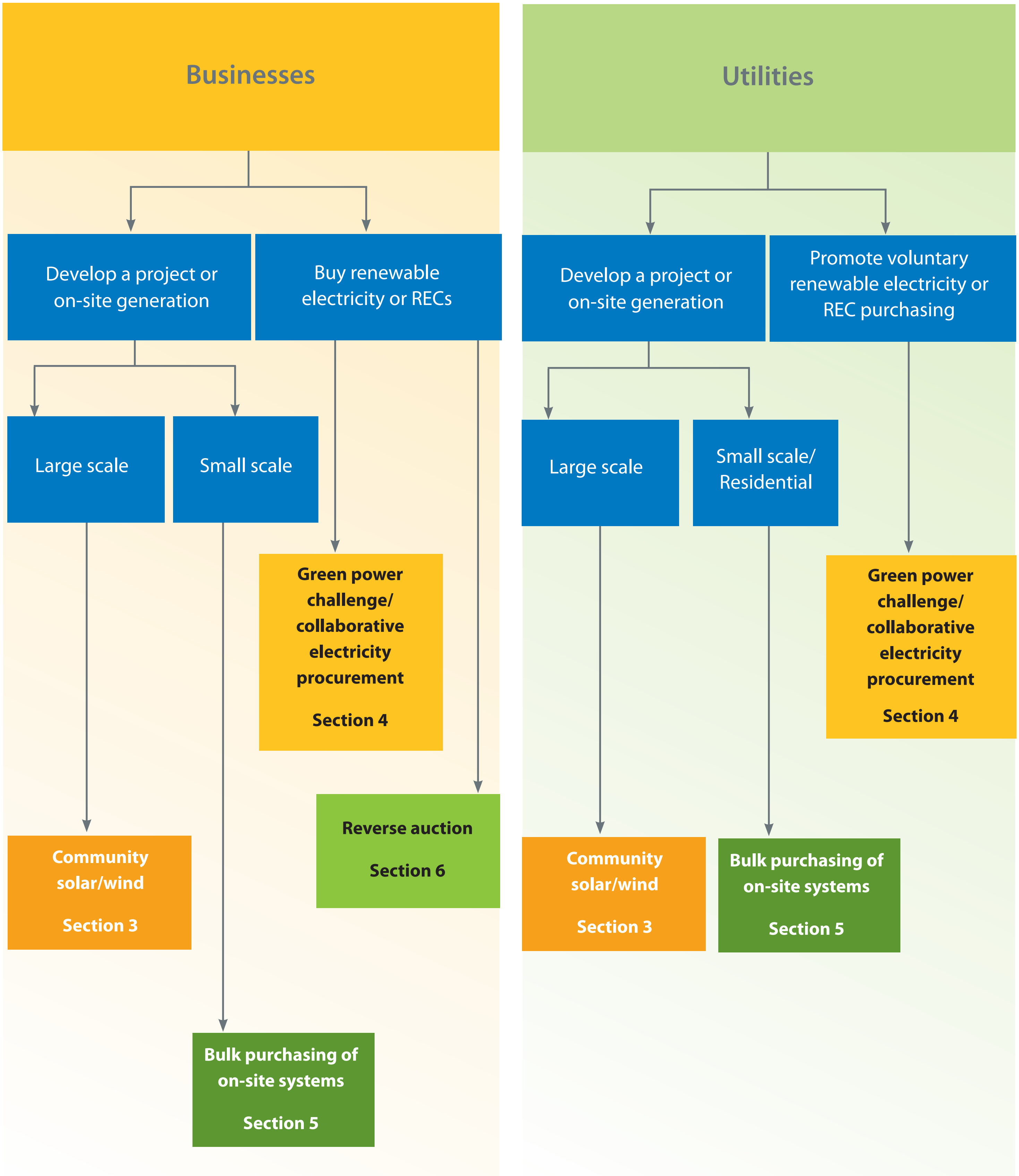
Voluntary purchasing of renewable energy—through utility green pricing programs, competitive suppliers, unbundled renewable energy certificate (REC) markets, and installation of on-site systems—is on the rise. Individual, corporate, and institutional purchasing of renewable energy has expanded rapidly in recent years, increasing from 11.9 million MWh in 2006 to 35.6 million MWh in 2010 (Heeter and Bird 2011). On-site solar photovoltaic installations have also been increasing: In 2011, the capacity of distributed grid-connected PV doubled compared to 2010, reaching 1.3 GWdc (Sherwood 2012).

Methods for voluntarily procuring renewable energy are detailed in the *Guide to Purchasing Green Power*,[1] which describes how entities can procure renewable energy from utilities or electricity suppliers and in the form of unbundled RECs.

A number of new models have emerged through which participants have been able to leverage their purchasing power or work together to lower costs and increase access to renewable energy. This guide focuses on experience with five innovative options currently being used to procure renewable electricity or on-site systems. These next-generation methods do not provide an exhaustive list. Utilities, local governments, businesses, and others are developing new models that respond to market drivers.

Photo from iStock 14461782

Figure 1. Decision trees for selecting an innovative purchasing method


Businesses
Develop a project or on-site generation
Buy renewable electricity or RECs
Large scale
Small scale
Green power challenge/ collaborative electricity procurement
Section 4
Reverse auction
Section 6
Community solar/wind
Section 3
Bulk purchasing of on-site systems
Section 5
Utilities
Develop a project or on-site generation
Promote voluntary renewable electricity or REC purchasing
Large scale
Small scale/ Residential
Green power challenge/ collaborative electricity procurement
Section 4
Community solar/wind
Section 3
Bulk purchasing of on-site systems
Section 5

Text Box 1: Benefits of Innovative Mechanisms

Decrease costs of obtaining renewable energy. Bulk purchasing of on-site systems and reverse auctions in particular are models built on the assumption of providing lower cost, but Community Choice Aggregation (CCA) programs and community solar programs may also provide renewable energy at lower cost.

Expand access to renewable energy. Innovative mechanisms work to increase access to renewable energy by making it easy to participate or by addressing common barriers. CCA programs with opt-out[1] structures ensure that a portion of a customer's electricity comes from renewable energy, unless that customer opts out. Community solar programs provide options to renters and to homeowners with shaded roofs.

Facilitate the process of buying renewables. Bulk purchasing programs relieve individuals of complex decisions that must be made when installing an on-site system. Community solar and wind programs enable participants to invest in a renewable energy project with one phone call or an online sign up. Green power challenges can also make it easier for participants by providing greater exposure to renewable options and, in some cases, providing alternative methods of signing up (e.g., at a farmers' market).

Make a larger impact. For communities looking to transition to renewable energy, many of the mechanisms discussed can provide solutions. Cincinnati recently developed a CCA program; Office of Environmental Quality Director Larry Falkin explained that CCA is one of the biggest opportunities to reduce Cincinnati's carbon footprint (Simes 2012). Green power challenges and reverse auctions also have the opportunity for a large impact.

[1] Opt-out programs are those where customers are automatically enrolled and must take action if they do not want to participate.

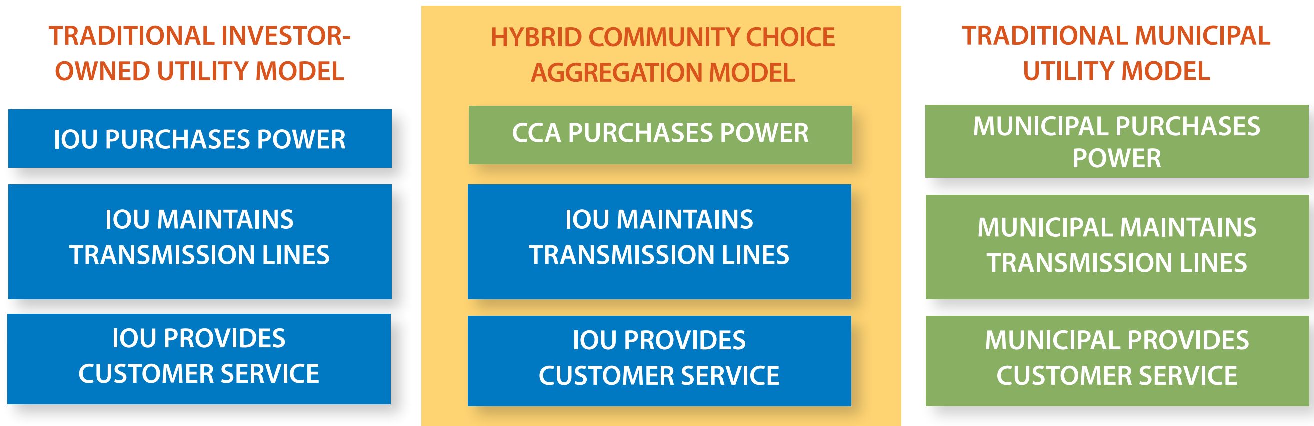
Photo by Dennis Schroeder, NREL/PIX 20373

2. COMMUNITY CHOICE AGGREGATION

CCA allows communities to determine their electricity generation sources by aggregating the community load and purchasing electricity from an alternate electricity supplier while still receiving transmission and distribution service from their existing provider. CCAs are sometimes described as a hybrid between services offered exclusively by investor-owned utilities (IOUs) and municipal utilities (see Figure 2).

CCAs allow for local control of the power source, like in the traditional municipal model, without having to manage transmission lines or provide customer service.

Figure 2. Investor-owned utility, Community Choice Aggregation, and municipal electric-sector models



Source: LEAN Energy U.S. (2012)

CCA programs can choose any type of electricity supply.[2] In the 1990s, communities in Ohio chose alternative suppliers that did not provide renewable energy. However, incorporating renewable energy has been of interest to many communities pursuing CCA in recent years. Other drivers for communities to participate in CCA programs are reduced electricity cost and increasing the percentage of electricity derived from local sources. For the most part, a CCA will purchase electricity from existing renewable energy projects; however, it can be designed to stimulate new development. Cape Light Compact helped establish the Cape & Vineyard Cooperative, which is developing 18.2 MW of new solar at up to 10 local sites. Marin Clean Energy has 31 MW of new, local solar development under contract (LEAN Energy U.S. 2012).

Importantly, implementing a CCA program requires authority from the state. Some states passed CCA-enabling legislation as part of electric restructuring in the late 1990s and early 2000s. Illinois was the state to most recently pass legislation enabling CCAs, in 2009 (see Table 2). We highlight recent experience with this model in this guide due to the resurgence of interest in the mechanism and because of its potential to enable communities to leverage their purchasing power to procure renewable energy.

Table 2. States with CCA-Enabling Legislation

State	Year CCA-enabling legislation passed
Massachusetts	1997 (HB 5117)
Ohio	1999 (SB 3)
Rhode Island	2002 (H 7786)
California	2002 (AB 117)
New Jersey	2003 (P.L. 2003, CH 24)
Illinois	2009 (HB 362)

2.1 Experience with CCA

Table 3 provides an overview of CCA programs offering or planning to offer renewable energy options as of March 2012. Illinois is currently a hotbed of CCA development, though additional communities in California and Massachusetts are also pursuing programs.

In 2002, Cape Light Compact in Massachusetts was the first CCA in the nation to offer a green option. It is currently offered at a price premium of $0.009/kWh for 50% green power and $0.016/kWh for 100% green power. The program requires customers to opt-in (i.e., customers must take action to sign up), and it had approximately 1,113 green power accounts as of March 2012 for total annual sales of 7,318 MWh of green power. Three additional Massachusetts communities have submitted CCA implementation plans. One of those, the Hampshire Council of Governments, is planning to offer a renewable energy component.

California is soon to have two CCA programs. Marin Clean Energy (MCE) began operating in 2010, offering the Light Green option (50% renewable) and the Deep Green option (100% renewable). MCE had approximately 8,000 accounts as of May 2011 and is expected to reach 100,000 accounts by the time the program is fully rolled out in July 2013. Further details are provided in Text Box 2.

CleanPowerSF is preparing to launch in 2012, providing a 100% green power option. The San Francisco Public Utilities Commission voted in December 2011 to move forward with the program, but the board of supervisors will also need to approve the plan. CleanPowerSF estimated that residential customers would pay an additional $7.00 to $54.50 per month for 100% green power, depending on electricity usage.

In "opt-out" programs, all eligible customers are enrolled automatically and it is up to the customer to contact the CCA program if they wish to be removed.

Additional communities in California are exploring CCA options. Sonoma County is moving forward with a CCA program, and the East Bay communities of Berkeley and Richmond, in conjunction with the East Bay Municipal Utility District, which is a water agency with 350,000 accounts, are exploring CCA options (Matson 2012).

While all of those communities may not adopt CCAs or select renewable energy, there is large potential in Illinois for CCA-enabled renewable energy purchasing. Potential programs in

Table 3. Overview of CCA Programs Offering Renewable Energy

Location	Program Name	Percent of Renewable Energy Content in CCA Product	Type of Renewables	Start Date	Premium	Number of Electricity Customer Accounts	Estimated Annual Sales of Renewable Energy (MWh)
Marin County, CA	Marin Clean Energy	50% or 100% green power	Wind, solar, biomass	2010	100% is $0.01/kWh extra	>8,000	291,000 MWh (2013)
San Francisco, CA	CleanPowerSF	Negotiating for 100% green power	Under negotiation	Expected in 2012	Finalizing terms, conditions, and rates	Estimated at 75,000*	Not available
Cape Cod, MA	Cape Light Compact	50% or 100% green power	Run-of-river hydro, landfill gas, wind, solar	2002	$0.009/kWh–$0.016/kWh premium	1,113**	7,318 MWh**
Cincinnati, OH	Cincinnati aggregation program	100% green power	Partially from local solar projects	2012	Average residential annual savings of $133	52,400 eligible	Not available
Oak Park, IL	Oak Park electricity aggregation program	100% green power	Wind	2012	25% discount to standard supply	~20,000	171,000 MWh

* Sabatini (2011a) **Soares (2012)

Illinois have not faced opposition from incumbent suppliers as communities in California have, perhaps because the Illinois electricity market is already deregulated.

Oak Park, Illinois, began its CCA in 2012, providing a 100% wind product sourced from within the state at a price discount of 25% to standard supply. Prices for distribution and transmission remain the same. With approximately 20,000 accounts, the CCA has total annual renewable sales of 171,000 MWh.

Evanston and Peoria, Illinois, have selected renewable energy suppliers, though program designs are being finalized. Evanston has contracted to provide a 100% renewable energy product at a rate about 38% lower than the city's current electric rate.

The future price difference between CCAs and existing supply in Illinois remains to be seen. Existing supply contracts were entered into when power prices were higher, but these are set to expire in June 2013 (Lydersen 2012).

In Ohio, Cincinnati has launched its CCA program for residents and small businesses. The city selected a supplier and is currently negotiating the contract.

2.2 Design and Implementation Considerations

CCA programs are designed by local governments (often with assistance from consultants) within any confines of CCA-enabling legislation.[3] Programs differ in terms of the type of renewable offer, price premium, eligible customer classes, opt-out provisions, and the type of renewables selected.

Opt-out provisions. CCAs can be designed either as "opt-in" or "opt-out" programs. With opt-out programs, all eligible customers are enrolled automatically, and it is up to the customer to contact the CCA program if they wish to be removed. State CCA laws may specify conditions for whether programs are opt-in or opt-out. For example, in Illinois, programs can be designed either way, but opt-out programs require approval through a referendum in a general election.

Opt-out rates (the percent of eligible customers that decide to remain with the incumbent supplier) are typically less than 20%. In Marin County, which was heavily targeted with anti-CCA messaging, the opt-out rate was around 20%. In Oak Park, the opt-out rate has been around 3% to 4%; an additional 5% to 6% of residents are not eligible to participate for a variety of reasons. The opt-in rate in Cape Light Compact has been 1,113 customers out of approximately 150,000 customers—or less than 1%.

Text Box 2: Marin Clean Energy

Using legislation passed by California in 2002 (AB 117) as a guide, residents of Marin County, California, administered a survey in 2007 in order to gauge local public interest in increasing the community's use of renewable energy. The response to that survey was overwhelmingly positive:

- 90% of residents said that reducing greenhouse gases was important to them, and 74% said they would support the local government becoming a provider of greener energy.
- 69% of residents said they would pay up to 5% more, while 58% said they would pay up to 10% more for an increase in renewable energy (MCE 2012).

The Marin Energy Authority (MEA) was established as a public agency in December 2008 with the target of "significant greenhouse gas emissions reductions" (MEA 2011). In May 2010, the MEA launched MCE.

Based on the market insight provided by the 2007 public survey, MCE developed two levels of green power procurement: Light Green, which provides 50% renewable energy at prices competitive with traditional energy generation, and Deep Green, which provides 100% renewable energy at a price increase of $0.01/kWh. MCE has retained Shell Energy North America as their renewable energy provider, and Pacific Gas & Electric will remain the transmission and distribution provider.

Details within AB 117 provided a key piece to the MCE program success: Customers are automatically enrolled in the CCA unless they explicitly opt out of the program during the initial 60-day period following the commencement of service. MCE achieved roughly an 80% rate of participation in the program's initial phase of implementation. In May 2011, the number of MCE accounts totaled over 8,000. MCE expects similar rates of participation going forward into Phases II and III, due to be complete in August 2012 and July 2013, respectively. MCE expects to reach a total of roughly 100,000 accounts by the end of Phase III. MCE's ultimate goal is to meet the demand of these customer accounts by acquiring 100% of their energy supply from renewable energy sources (MEA 2011).

Through a combination of demand-side efficiency incentives, a two-tiered subscription system catering to cost-sensitive and environmentally progressive customers alike, a "do nothing" program opt-in strategy, high levels of public support, and favorable net-metering conditions, the MEA expects to achieve a 33% renewable energy supply by 2015. The achievement of that goal would equal California's renewable portfolio standard (RPS) 5 years ahead of schedule.

> **A CCA "is probably the biggest opportunity we'll have over the next several years to dramatically reduce Cincinnati's carbon footprint."**
>
> — LARRY FALKIN, CINCINNATI OFFICE OF ENVIRONMENT QUALITY, DIRECTOR

Type of offer. CCA programs can be designed to offer different percentages of renewable energy. While all existing programs offer a 100% renewable energy product, some programs include other percentage offers. The MEA and Cape Light Compact both offer 50% and 100% renewable energy products. Oak Park only offers the 100% renewable product because the rate for 100% renewables was comparable to the existing utility rate for traditional power.

Price premium. The price premium indicates how much a CCA product costs relative to standard supply. Premiums in current programs vary from zero (Oak Park) to \$0.01–\$0.02/kWh (Cape Light Compact). As discussed later, some CCA programs are able to offer products at lower cost than standard supply.

Eligible customer classes. Due to differences in state regulation, not all customer classes (residential, commercial, and industrial) are eligible to participate in all CCA programs. In Illinois, industrial and large commercial classes can choose their supplier, without the existence of a CCA. Therefore, Oak Park's CCA is only open to residential and small commercial customers.

Type of renewables. CCA programs can determine the type of energy they wish to supply. Communities may want to support local resources or may favor one technology type (e.g., wind) over another. Oak Park is using 100% wind from Illinois under a 2-year contract with Integrys Energy Services. Marin County uses wind, solar, and biomass, and Cape Light Compact uses run-of-river hydro, landfill gas, wind, and solar. In Oak Park, the city is considering a longer-term (5-year) contract with a wind developer to help support the construction of new wind projects.

2.3 Benefits of CCA

CCA can provide lower-cost renewable energy products, make a large environmental impact, provide an easy way for consumers to support renewable energy, and access lower-cost, tax-exempt debt by using the borrowing capacity of the local government.

Reduced-cost renewable energy. Through aggregation, communities can solicit renewable energy supply at a potentially lower cost than individuals could solicit on their own. A main driver of CCA adoption nationally has been the reduced electricity rates resulting from competition between suppliers.

The City of Oak Park obtained rates for 100% renewable energy that were at a discount to standard electricity rates. In Illinois, communities receive renewable power for an average of 25% less than standard power. In Massachusetts, there is a small premium for 100% renewable energy, with the default supply being 6% cheaper on average. MEA offers competitive rates for partially renewable products, while there is a small premium for 100% products (Marshall 2012).

Large environmental impact at the community level. Many communities are striving to meet already established carbon reduction and/or renewable energy targets. Given that electricity consumption makes up a large part of a city's carbon footprint, developing a renewable offer can produce substantial carbon savings. According to Dawn Weisz of MEA, "When we were reviewing the GHG reductions that would come from various measures we realized that all were very small compared to a CCA, which would take over choosing power sources. With one fell swoop you could eliminate all GHG from power sources" (Braly 2011). In Cincinnati, Office of Environmental Quality Director Larry Falkin explained that approximately 85% of the city's energy currently comes from coal, and that a CCA "is probably the biggest opportunity we'll have over the next several years to dramatically reduce Cincinnati's carbon footprint" (Simes 2012).

Easy for consumers to procure renewable energy. In opt-out CCA programs, no action is required on behalf of the consumer in order to choose renewable energy. This results in larger usage of green power; opt-out CCA programs can have participation rates of more than 80%. Traditional utility green pricing programs (which are opt-in programs) have average participation rates of only around 2%, with the top programs reaching 5.3%–21.5%.

Access to low-cost, tax-exempt debt. CCAs may contract for supply or develop and own supply-side resources. MCE has contracted with Shell Energy for supply but is also developing local renewable energy projects as part of their supply mix. In order to obtain electricity supply, public entities can use low-cost, tax-exempt debt (Speer 2011), while IOUs have a higher cost of capital in order to cover debt, equity, and income taxes. In 2008, MCE estimated its cost of capital conservatively to be in the range of 5.5% to 7.0%, while noting that the incumbent supplier, Pacific Gas & Electric (PG&E), had a cost of capital between 12% and 13% (MCE 2008).

2.4 Challenges of CCA

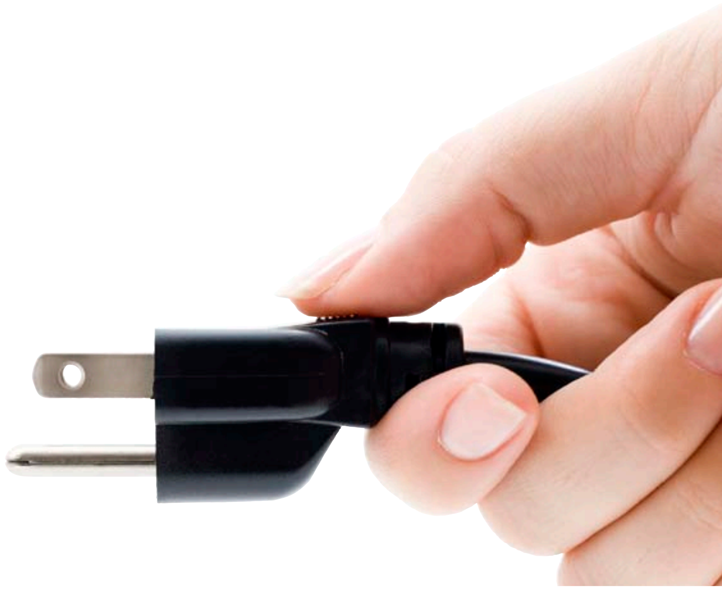
CCAs require enabling legislation, can potentially have significant start-up costs, may face resistance from the incumbent electricity supplier, and require education and outreach.

Enacting CCA-enabling legislation. In order for a community to establish a CCA, the state must have established a CCA mechanism through legislation. CCAs change the nature of the existing supplier—in regulated states, it challenges the monopoly granted to incumbent utilities, and in deregulated states, CCA changes the role of retail suppliers.

Start-up costs can be significant. Start-up activities include surveying consumers for potential interest, developing an implementation plan, educating consumers about new options, and soliciting offers for supply. Start-up costs for a CCA program can be significant, particularly for communities that are pioneering the effort in their state. In San Francisco, planning efforts for the CleanPowerSF program cost almost $3 million. Start-up costs, including a $15 million escrow account in case the CCA was terminated before contract expiration, were expected to cost $19.5 million (Sabatini 2011b). In Oak Park, the city worked with the Galvin Electricity Institute to develop a program. City staff prepared educational campaigns and relied on environmental groups to campaign for the CCA initiative passage. Costs for future CCA development should be lower than those paid by the pioneering communities.

Possible resistance from incumbent electricity supplier. In California, MCE faced strong opposition from the incumbent electricity supplier, PG&E. In May 2010, the California Public Utilities Commission (CPUC) notified PG&E to cease the use of unapproved opt-out mechanisms that were in violation of tariffs and rules (CPUC 2010a). In a separate docket, the CPUC refined marketing rules for CCA, ordering that utilities would be subject to penalties for marketing or advertising that is untrue or misleading (CPUC 2010b). In Oak Park, however, there was no opposition from the incumbent electricity supplier, likely due to the fact that retail electricity is already deregulated in Illinois.

Need for education and outreach. In Oak Park, the biggest challenge was getting people to think about where their electricity comes from. In the run-up to the city's referendum for approval to pursue a CCA, the city was limited to citizen education—it could not campaign for or against the referendum. Oak Park organized forums, created an energy committee, and partnered with environmental groups to educate local residents.



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3. COMMUNITY WIND AND SOLAR PROGRAMS

Community renewables programs provide opportunities for individuals to participate and benefit from larger-scale renewable energy projects located in their vicinity. To date the focus of community renewables has been on wind and solar projects, although the models could be used to develop other types of renewable energy technologies as well. Several ownership models have evolved for community wind projects, some of which are detailed below. While many definitions of community solar programs exist, this guide focuses on community solar programs organized or hosted by a utility company. The emerging crowdfunding model is discussed in Text Box 3.

Text Box 3: Crowdfunding Renewable Energy

Crowdfunding renewable projects differs slightly from community solar or wind projects in that crowdfunding participants provide upfront capital (as a loan) to support the development of the project rather than purchasing shares of the project. Crowdfunded programs allow anyone, regardless of utility territory, to invest in the development of a renewable project. Crowdfunding is used to finance many types of projects, not just renewable energy. Kiva and Kickstarter, for example, are two platforms through which individuals can support a wide variety of projects.

Solar Mosaic (www.solarmosaic.com) is a crowdfunding program based in California, specifically for solar development. It gives anyone (regardless of utility territory) the opportunity to invest in the development of a solar facility, which is typically hosted by a non-profit organization. To date, Solar Mosaic has financed five solar facilities totaling 73 kW by aggregating investments of over 400 people, for a total of more than $350,000. Solar Mosaic offers a full return of each individual's principal over 10 years. In April 2011, Solar Mosaic filed with the Securities and Exchange Commission (SEC) and several states to offer "Solar Power Notes" that would offer a return on investment (Revkin 2012). Details are not yet available on how the return on investment would function. The JOBS Act, signed in April 2012 by President Obama, grants crowdfunded projects raising up to $1 million annually an exemption from SEC securities regulation, allowing them to provide a return on investment, provided that they file initial and periodic disclosures to the SEC.

3.1 Experience with Community Wind and Solar Programs

Cooperative ownership schemes, in which individuals in a community own a portion of the project and receive the associated economic benefits, have been a successful development model for wind energy projects in Europe for decades. Similar models for both wind and solar are now growing in popularity across the United States.

Community wind and solar programs (also known as "solar gardens") allow customers to invest in a wind project or a solar system and receive some of the benefits of the project's production in return, such as tax incentives, utility bill credits, and production incentive payments. A local utility, business, school, non-profit organization, or group of citizens may initiate a community renewables program.

Although community wind and solar programs often offer the project shares to residents and businesses that are close to the project site, the community model can be modified in several ways. The share offer can be initially made to those in the immediate vicinity of the project and then opened to a broader population later if all the shares are not sold. Alternatively, the "community" to which the share offer is made may not be defined by geography. For example, shares may be offered to all members of a specific environmental organization or other interest group, regardless of the members' locations.

Community renewables project ownership can be structured in a variety of ways.

- The 18 investors in the 80-kW Holy Cross Energy photovoltaic project in El Jebel, Colorado, purchased shares at an upfront cost of $3.15/W. In return, they receive $0.11/kWh, according to the system's production and the number of shares purchased. The credit appears directly on their monthly electricity bill (Green Power Network 2011a).

- New Centennial Power, LLC, a company formed and jointly owned by community members, is developing the 9-MW Huerfano River Wind Project near Walsenburg, Colorado. Joint owners receive an annual rate of return on their investment, based on the company's profits (New Centennial Power 2012).
- The "Minnesota Flip" structure helps community wind projects take full advantage of the national investment tax credit. A limited liability company (LLC) is formed to own and operate the wind project. The LLC is owned in partnership by local investors and a large equity investor that has greater tax appetite. For the initial years of the project, the equity investor owns the majority of the project, receives investment tax credits, and makes management payments to the local investors. After the project has received all the tax credits it can produce, or the equity investor has received its pre-agreed internal rate of return, the ownership flips such that local investors own the majority of the project and receive the majority of net revenue distributions over the rest of the project's remaining lifetime. The Minnesota Flip structure is a broadly replicable and increasingly popular ownership model (The Minnesota Project 2009; Windustry 2012).

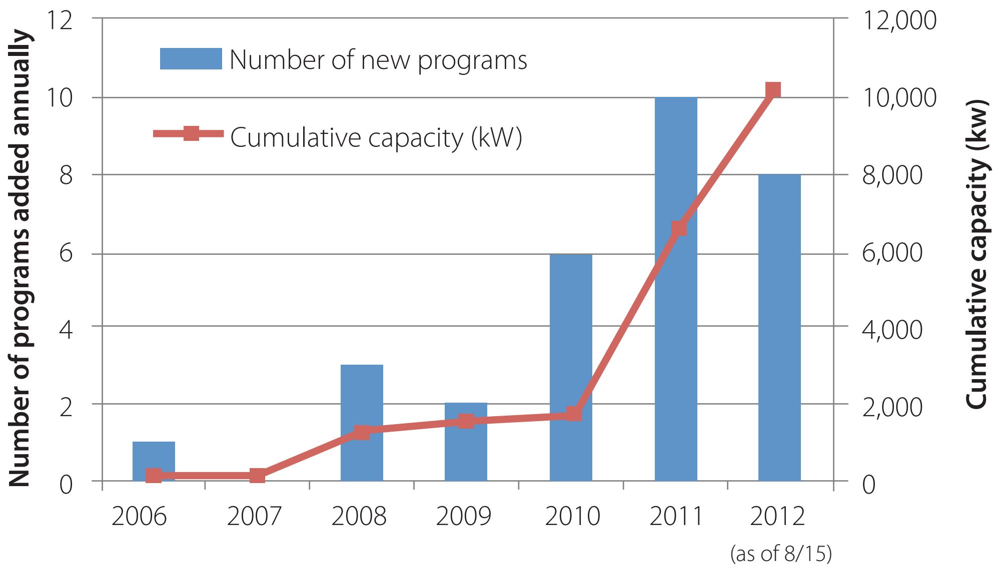
Community wind was initially spurred by the passage of Minnesota's Community Based Energy Development, or "C-BED", legislation in 2005. Other states, including Illinois, Iowa, Massachusetts, Nebraska, Oregon, Washington, and Wisconsin, have followed Minnesota's lead and adopted their own C-BED legislation.

Community wind and solar programs allow customers to invest in a wind project or a solar system and receive some of the benefits of the project's production in return.

Some key elements of the Minnesota legislation ensure that the benefits of the project are spread broadly through the community to local individuals. Each C-BED project must obtain a local resolution of support. Owners of the projects must be local, and ownership rules limit the percentage that any individual may have in the project. The power purchase agreements of C-BED projects must provide levelized cash flow to the project owners. In addition, public utilities are required to consider C-BED projects when they make new energy acquisitions and to set a special tariff for C-BED projects, based on net present value. Utilities are also encouraged to assess interconnection issues for C-BED projects.

Community solar programs appeared in the United States around the same time as community wind but were somewhat slower to take off, perhaps due to higher technology costs. In 2011 there was substantial growth in community solar projects, however, with 10 new programs developed that year alone (see Figure 3). Overall, the number of programs has increased from 3 in 2008 to nearly 30 projected by the end of 2012. The appendix provides a list of community solar programs and relevant program details.

Figure 3. Capacity and number of community solar programs



Source: NREL (2012)

Note: Only the residential portion of Salt River Project's community solar facility is included above. An additional 7.8 MW are designated for purchase by schools.

In 2011, Salt River Project, a utility in Arizona, established the largest community solar program on a capacity basis with the launch of its community solar program. Salt River Project offers blocks in a 20-MW solar facility, of which 7.8 MW are designated for purchase by schools and 2.0 MW are designated for residential purchase (Green Power Network 2011b).

> **Community members can be included in relevant siting decisions; local businesses can be used in construction and maintenance activities; and local schools may benefit from educational opportunities offered community renewables projects.**

Some community solar programs have expanded over time, indicating the popularity of the model. For example, Ellensburg, Washington, began with a 27-kW system in 2006 and expanded the program to 111 kW. In Colorado, the Clean Energy Collective, working with Holy Cross Energy, expanded its program from 80 kW in 2010 with a new 858-kW system installed in 2011.

3.2 Design and Implementation Considerations

In developing community-funded programs, the following are important design and implementation issues:

Program size. Community solar and wind programs can be developed regardless of the size of the system. Some programs are just a few kilowatts (Bainbridge Island's 5-kW program), while others are on the megawatt scale (Salt River Project's 9,840-kW program).

Upfront cost. Community solar programs typically allow customers to purchase a panel or unit upfront (sometimes referred to as a "share" or "slice"), though some programs allow customers to purchase smaller increments. Upfront costs for panels typically range from $3–$6/W for a minimum purchase of one panel (around 200 W). A few programs allow customers to purchase smaller increments. Trico Electric, a utility in Arizona, allows customers to purchase quarter panels at $230. Delta-Montrose Electric Association (Colorado) allows customers to purchase blocks of 2.67 W for $10 each. Tucson Electric Power (Arizona) bases the premium on 150-kWh blocks at $3 per block.

Bill credits. Community solar participants generally receive a bill credit per kilowatt-hour based on the electricity production of their share. Rebates per kilowatt-hour typically range from $0.07/kWh to $0.11/kWh. For example, Seattle City Light offers $0.07/kWh generated. In addition, some customers may receive upfront rebates (payments based on the kilowatt purchased) or incentive payments from the state (in Washington, up to $1.08/kWh can be obtained). Colorado Springs Utilities offers a one-time upfront rebate of $1.08/W, up to 30% of the participant's investment.

Community inclusion. For community wind projects in particular, broad community participation in the planning, implementation, and economic benefits of the project can play a role in public acceptance and the ultimate success of the project. For instance, community members can be included in relevant siting decisions; local businesses can be used in construction and maintenance activities; and local schools may benefit from educational opportunities offered by the project. In the United Kingdom, a wind turbine in the town of Swaffham was constructed with a viewing platform under the nacelle, and for a small fee tourists can climb a stairwell up the turbine's tower to get a bird's eye view of the region (EcoTech Centre 2012).

Renewable energy certificate treatment. RECs represent the environmental attributes of 1 MWh of electricity generation. RECs can be sold separately from electricity generation. Without ownership of RECs, environmental claims cannot be made. For example, if a commercial customer were to participate in a community solar program where the RECs stayed with the local utility, the commercial customer could not advertise that it was solar powered. Community solar programs generally, but not always, allocate the RECs to the utility. Similar to many utility solar incentive programs, which provide residential and commercial customers with an upfront rebate to install solar, community renewables projects often ensure that RECs stay with the utility, allowing it to meet any RPS or other environmental target. In theory, the allocation of the REC to the utility should result in a lower purchase cost to the participant, although each case may vary. Participants not receiving RECs may have other reasons for joining community programs, such as supporting local development.

3.3 Benefits of Community Wind and Solar Programs

Community wind and solar programs offer many benefits, including: expanded access to renewables, ease of participation, cost efficiencies, local connections, and local economic benefits. The program design is highly flexible and encourages innovative solutions to local challenges.

Expands access. Community programs allow renters and homeowners with poor solar resource or shading to receive the financial benefits of renewable energy.

Photo from iStock 10468794

Easy to sign up. Residents can be overwhelmed by the process of installing solar on their home. Community programs allow customers to "go solar," or participate in a wind energy project, with one phone call, although project organizers may spend years developing the project.

Cost efficiencies of a larger project or procurement. Depending on the size of the community solar project, there could be cost savings from building one large project rather than many small distributed systems, which should be reflected in the cost to purchase from a community program.

Increase connections and reduce tensions. Wind (and solar) projects that include local ownership and involvement are more likely to be publicly accepted. Community renewables programs help make local connections between the variety of stakeholders involved. Positive models encourage community discussion and involvement in the earliest stages of the project. These projects can be a source of community-building and pride within a locality, in addition to the economic and environmental benefits they provide.

Increased economic development impacts. Research has shown that community projects provide more jobs and increased economic impact over traditional energy projects. A U.S. Government Accountability Office study found that local ownership of wind systems generates an average of 2.3 times more jobs and 3.1 times more local dollar impact compared to other projects. Overall, such studies indicate that community-based wind projects provide around 1.5 to 3.4 times the economic benefit to communities during the operation of the project than projects owned by absentee companies (Lantz and Tegen 2009).

Flexibility. Community renewables programs may be initiated by utilities, existing groups, and/or a few local citizens. The programs may define "community" in a variety of ways and do not have to be dependent on a participant's physical location. Community solar membership is often tied to the sponsoring utility's service territory, but if participants move they typically can keep their membership (if they move within the utility service territory) or sell the membership (if they move outside of the utility service territory). A variety of mechanisms for return on investments can be used.

Encourage innovative ideas. Community projects often spawn creative solutions to challenges. Community renewables projects have been used to test innovative financing models and as a way for equipment manufacturers to enter new markets with which they have limited experience (Bolinger 2011).

3.4 Challenges of Community Wind and Solar Programs

Community programs certainly face challenges. Policy favors large-scale investors/developers, programs have long development times, there is a need to fund initial project development costs, and there are restrictions on offering a return on investment.

Policy favors large-scale investors/developers. Existing policy structures often create barriers to the development of community-owned projects. The federal production tax credit, for instance, is designed to make use of the tax appetite of large-scale investors, thus government entities and small investors often cannot take advantage of tax credits. It can also be difficult for community-owned projects to obtain loans through traditional avenues. Public entities may also not be able to make use of options like Clean Renewable Energy Bonds.

Long development times. Community renewables project leaders need to be persistent. They should be prepared for many hurdles and for long development times. David Brosch of University Park Community Solar noted, "It took us over two years to develop our project structure and only two months to find our members" (DOE 2011, p. 34). Some community wind projects have experienced development times of 5 years or more (Bolinger 2011; The Minnesota Project 2009).

Need to fund initial project development costs. Those planning community renewables projects often focus their efforts on raising funds for construction and permanent financing costs; however, many such projects will incur significant costs before even getting to the construction financing stage. Raising the seed capital needed to cover the initial costs of developing community renewables projects can be a significant hurdle for some community projects (Bolinger 2011).

Restrictions on offering a return on investment. Community renewables programs should be aware of potential securities regulation. In order to avoid any appearance of selling securities, the DOE's *A Guide to Community Solar* recommends avoiding "references to 'shares' or 'stock,' since those terms are the classic ones used to describe securities issued by a corporation and might create an expectation of profits and other rights customarily associated with stock or shares" (DOE 2011, p. 33).[4]

4. GREEN POWER CHALLENGES AND LOCAL COLLABORATIVE ELECTRICITY PROCUREMENT

Communities can encourage members to purchase voluntary green power by developing a green power challenge. In many cases, communities partner with local utilities, third-party marketers, and/or environmental organizations to raise awareness of green power purchasing options. With buy-in from a large stakeholder group, community challenges can increase participation in utility green pricing programs by providing multiple communication avenues. Short-term green power challenges set goals for having a certain fraction of their residents and businesses purchase green power within a specified time, usually around 6 months.

Local collaborative electricity procurement aggregates the demand of a few organizations in deregulated electricity markets to procure renewable electricity on a voluntary basis. This mechanism is similar to CCA but only involves a limited number of organizations, which must be located in states with retail choice. Because retail choice states allow customers to switch electricity suppliers, customers can band together to negotiate a better price or product. This type of procurement has happened in the Washington, D.C., area through the assistance of a non-profit organization, Groundswell. Groundswell does not supply electricity but rather coordinates large customer procurement in retail choice states.

Though not developed as "challenges" or campaigns, other initiatives have sought to highlight the ability to purchase renewable energy in a given state. The ChoosePAWind initiative provides links to retail electricity suppliers and REC marketers sourcing supply from Pennsylvania wind facilities. The initiative also highlights the economic benefit of purchasing from local renewable facilities. A similar service focused on New York, Green Power NYC, provides links to competitive suppliers sourcing renewable energy from New York State facilities. The effort is sponsored by the Natural Resources Defense Council and the Alliance for Clean Energy New York.

4.1 Experience with Green Power Community Challenges and Local Collaborative Electricity Procurement

Green power challenges proliferated in the late 2000s as a way to boost involvement in utility green pricing programs. More recently, local collaborative electricity procurement has emerged as a way for organizations to buy renewable electricity at lower cost.

Green Power Challenges

Challenges were particularly active in Oregon, where Portland General Electric (PGE) worked with numerous communities to develop and implement challenges. In 2006, PGE worked with the City of Salem, Oregon, which ran a challenge for 6 months with the goal of attracting upwards of 500 customers. Since then, PGE has also worked with the City of Beaverton, the City of Gresham, and the City of Lake Oswego (see Text Box 4).

Each of these cities, along with 28 others, are also part of U.S. EPA's Green Power Communities program, which provides public recognition to communities for meeting or exceeding minimum renewable energy purchase requirements. Purchase requirements vary depending on the community's annual electricity usage (Table 4).

Table 4. Green Power Community Purchase Requirements

Community Annual Electricity Usage	Minimum Green Power Community Purchase Requirements
>100,000 MWh	3%
10,001–100,000 MWh	5%
1,001–10,000 MWh	10%
≤1,000 MWh	20%

Source: U.S. EPA (2012a)

Table 5. Top EPA Green Power Communities (as of June 19, 2012)

Rank	Community	Annual Green Power Usage (MWh)
1	Washington, D.C.	752,505
2	Portland, OR	708,667
3	Hillsboro, OR	678,600
4	Philadelphia, PA	593,309
5	Aurora, IL	250,975

Rank	Community	Green Power Percent of Total Electricity Use
1	Oak Park, IL	91.9%
2	Brookeville, MD	45.7%
3	Hillsboro, OR	33.7%
4	Swarthmore, PA	27.9%
5	Corvallis, OR	21.2%

Source: U.S. EPA (2012b)

Since the program launched, the purchasing by the top community has increased from 163 million kWh in September 2010 (Santa Clara, California) to 752 million kWh in June 2012 (Washington, D.C.). Table 5 provides a list of the top five EPA Green Power Communities in terms of annual green power usage and the green power percent of total electricity use. Green power sales in these communities are heavily dominated by large purchases by non-residential participants. Communities can play a large role in the voluntary green power market; EPA's Green Power Communities are currently collectively buying more than 4.2 million MWh of green power annually, which represents 12% of all voluntary sales in 2010.

Local Collaborative Electricity Procurement Model

The local collaborative purchasing model aggregates purchasing power from existing community organizations in retail choice states to solicit competitive bids for renewable electricity generation. Instead of purchasing shares of a renewable facility or providing upfront capital, this model seeks to procure renewable electricity from one alternative supplier. By aggregating the electricity demand of multiple participants, cost savings can be achieved. Groundswell, a Washington, D.C.-based non-profit organization, operates the Community Power Project, which works with neighborhood organizations and faith institutions. For example, First Trinity Lutheran Church partnered with other Washington, D.C., churches to buy wind power and saved $6,000 annually. Groundswell estimates that since 2011 the Community Power Project has procured $5 million in renewable electricity, with participants saving up to 20% annually on energy bills (Groundswell 2012). Groundswell has organized 109 organizations to procure 56,000 MWh of renewable energy, the majority of which (98%) was Green-e Energy Certified wind (Witherbee 2012). Although the Community Power Project operates in retail choice market and procures bundled renewable electricity (energy and RECs), this model could be used for unbundled REC purchases as well.

Text Box 4. Green Power Challenge in Lake Oswego, Oregon

In 2009, Lake Oswego, Oregon, the sixth-largest city in the Portland area with a population of 36,000, launched a 2-month Green Power Challenge. Lake Oswego had been looking at sustainability issues for the past 10 years, and in 2007 adopted a sustainability plan that, among other things, examined energy use. PGE approached the city's newly formed Sustainability Advisory Board with a Green Power Challenge proposal, and the board recommended that the city council support the proposal.

Working with PGE, Lake Oswego set a goal of 300 new participants. The mayor of Lake Oswego began the Green Power Challenge by issuing a proclamation. The city promoted the challenge through its monthly newsletter, press releases, and website. Working with PGE, they conducted door-to-door outreach and tabled at the local farmers' market.

Ultimately, Lake Oswego exceeded its goal, enrolling 336 new residential and 20 new business customers in PGE's renewable programs. The community benefited by receiving national recognition. EPA staff made a presentation to the city council, street signs promoting Lake Oswego as a Green Power Community were installed, and the city received favorable local press coverage.

As of February 2010, more than 1,600 residences and businesses enrolled in one of PGE's programs and the community was collectively purchasing 9% of its power as green power, or almost 35 million kWh of renewable power.

4.2 Design and Implementation Considerations

Green power challenges and local collaborative electricity procurement programs need to set appropriate, realistic targets, decide how to distribute costs among partner organizations, and consider administrative issues.

Setting appropriate, realistic targets. With green power challenges, communities can work with their local utility to establish a target of either number of participants or percentage renewable energy purchased. Utilities can help partners understand existing participation and sales rates. Final targets for a percentage of sales from renewable energy are already established for communities seeking to join the EPA Green Power Communities program; working with the local utility company can help partners develop a plan to reach these targets.

Distributing costs among partner organizations. Organizations should determine in advance who will pay for the various components of the program.

Considering administrative issues. Consider what information is needed in order for a consumer to sign up for a green product and work with the utility to streamline the enrollment process. For example, if consumers need to provide their electric account number, this may prohibit them from signing up at community events like farmers' markets and concerts.

4.3 Benefits and Challenges of Green Power Challenges and Local Collaborative Electricity Procurement

Community green power challenges can contribute to the branding of a community, provide education and outreach to community members, and provide an easy way for community members to support green power.

Raise awareness and expand access to renewable options. A large barrier to participation in utility green power programs is lack of awareness. According to the Natural Marketing Institute, approximately one in six adults are aware of renewable power options (NMI 2011), yet more than half of consumers have the option to purchase renewable energy through their utility (Bird and Sumner 2010). Of course, all consumers have the ability to buy RECs separately from their electricity. Community challenges can help overcome the awareness barrier by targeting community residents during short, intense campaigns using multiple methods of communication. Education efforts by non-profits seeking to aggregate demand can also help organizations better understand renewable energy options.

Easy to sign up. By providing different ways of enrolling (e.g., at a farmers' market), green power challenges can make it easier for consumers to sign up.

May encourage friendly competition among suppliers. In regulated electricity markets, utilities offer green pricing programs, while in deregulated or restructured states, competitive marketers offer renewable options. In all states, renewable energy can be supplied by RECs independently from electricity. By running a campaign that includes a utility or competitive marketer in addition to a REC supplier, communities may encourage friendly competition. Boulder's Wind Power Challenge campaign worked with the local utility, Xcel Energy, and REC suppliers Clean and Green, Community Energy, and Renewable Choice Energy. Xcel Energy's green pricing program is in competition with REC suppliers for customers. Local collaborative electricity procurement also focuses on getting the lowest-cost product from suppliers.

Contribute to branding of a community. Green power challenges generate publicity for the local government and any other co-sponsors, such as large institutional purchasers and the local electric utility. In Oregon, communities looking to attract high-tech businesses were interested in promoting their community's green image (Hinckley 2010).

Green power challenges and local collaborative electricity procurement programs need to set appropriate, realistic targets, decide how to distribute costs among partner organizations, and consider administrative issues.

Lower cost. By aggregating demand and soliciting renewable electricity bids for multiple organizations, local collaborative electricity purchasing through Groundswell achieved up to 20% annual savings on energy bills for participants (Groundswell 2012).

Green power challenges are fairly straightforward to implement. The primary implementation activities may include scheduling the challenge with the city council, determining the timing, and getting space at the local farmers' market. Because many organizations might be involved with a green power challenge, it is important to clarify funding needs upfront and determine which organizations will cover which costs. Local collaborative electricity procurement requires a lead organization to educate potential partners and develop the actual procurement.

5. BULK PURCHASING OF DISTRIBUTED ENERGY SYSTEMS

Bulk purchasing programs are an increasingly common mechanism to encourage solar installations, in particular, but could also be used for other distributed energy technologies (U.S. Department of Energy 2011a). These programs identify a group of individuals or companies interested in installing solar systems and aggregate their demand. By buying the systems in bulk, group purchasing attracts reduced prices from vendors. The programs also save buyers the time and effort that would be required to navigate the purchasing process individually.

A bulk purchasing program requires a clear leader to organize the process. The leader may be a local government agency, interest group, cooperative, private enterprise, or a partnership between these. The organizer plays a variety of important roles throughout the process, including:

- Defining the potential participant base
- Seeking out participants
- Providing information and education on renewable energy options
- Assessing the possible sites and types of demand and conducting resource assessments
- Issuing a request for proposals (RFP) to potential vendors
- Selecting the winning vendor(s)
- Overseeing the signing of standard contracts between participants and vendors
- Assisting with coordination during the installation phase.

5.1 Experience with Bulk Purchasing of Distributed Energy Systems

The group purchasing model began in the United States with the Solarize Portland initiative, which functions as partnerships between the city and neighborhood associations. The model has since grown to include a wide variety of programs that are organized by not-for-profits, private enterprises, public utility commissions, and governmental agencies at various levels. Examples of several of these models are provided below.

City Government Model

Portland, Oregon

Neighborhood associations in the City of Portland can obtain technical and programmatic assistance from the city to offer group solar purchasing programs to their residents. The city assists the associations in program design, provides outreach and educational materials, and aids in the selection of solar contractors. It also helps coordinate and deliver educational workshops about the volume purchasing concepts and the benefits of solar energy. The Energy Trust of Oregon, Solar Oregon, and local solar contractors also played key roles in the program's success. Since its beginning in 2009, the program has resulted in over 600 solar installations and cost savings of up to 35% (U.S. Department of Energy 2011a). Additional programs have been developed in Pendleton, Beaverton, and Salem, Oregon.

Los Angeles, California

Other cities across the nation have followed Portland's lead. In 2009, a group of citizens in Los Angeles County, California, came together to form the Open Neighborhoods community solar program. Solar panels were installed on 32 homes in the first round. Another round of installations was organized in 2011, which brought the cost of solar close to that of electricity from the grid. The price of around $4.40/W was reported to be the lowest cost for residential solar systems in California. The Open Neighborhoods program encourages broader participation by making donations to schools and non-profits

Photo by Dennis Schroeder, NREL/PIX 21499

when community members participate in the group-buy program (Farrell 2011).

Santa Barbara, California

The Community Environmental Council of Santa Barbara, California, initiated a pilot group purchasing program in 2011, installing 49 systems in 3 months. The program began its second phase in August 2012, offering both solar system purchasing and lease options to satisfy a variety of financing needs. The council selected two solar contractors to provide the systems, obtaining a bulk price for program participants. A one-time fee of $0.15 per installed watt is paid by the contractors to fund the council's continued efforts.

Madison, Wisconsin

The City of Madison, Wisconsin, helped facilitate the first residential group solar purchasing effort in Wisconsin. The 22 participants in the first round of the MadiSUN program obtained solar systems for an average of $5,320/kW, a discount of 20% (MadiSUN 2012). Marshfield, Wisconsin, has also started a group-buy program, Solarize Marshfield, funded by a DOE SunShot grant (Midwest Renewable Energy Association 2011).

Private Enterprise Model

One Block Off the Grid

One Block Off the Grid (1BOG) is a for-profit enterprise that acts as an intermediary between potential customers and solar installers. The company identifies potential solar system customers, provides information on solar options, and finds and vets installers on behalf of the customers, obtaining bulk pricing for the systems. The service of amassing the demand within a region is valuable to system providers as well, who pay a fee to 1BOG for each watt they install for customers through 1BOG. The fee is built into the price of the installed solar systems but is more than offset by the price savings obtained from buying in volume. 1BOG's success began when they assisted the San Francisco Department of the Environment in conducting aggregated solar purchases at the request of several neighborhoods in the city (U.S. Department of Energy 2011b).

Utility Model

Orlando Utilities Commission

In 2011, the Orlando Utilities Commission (OUC), a municipal utility company, carried out the pilot Commercial Customer Solar Aggregation program to assist its large commercial customers with installation of solar technologies. OUC identified nine large commercial customers interested in installing solar systems. OUC issued an RFP for this aggregate demand, which totaled an estimated 1,237 kW of solar electric and 77 kW of solar thermal capacity. Developers were allowed to bid on solar thermal, solar electric, or both. The chosen developer will construct, own, and finance the solar projects through a power purchase agreement (PPA), with OUC acting as the billing agent. OUC purchases the RECs and excess electricity generated at the facilities under a long-term fixed-price PPA of at least 25 years (OUC 2011).

Collaborative Partnership

City of San Jose, Bay Area Climate Collaborative, and San Jose Credit Union

The City of San Jose, the Bay Area Climate Collaborative,[5] and the San Jose Credit Union partnered to form a solar group-buy program called SunShares, supported by a federal Solar America Cities grant. The program offers employees and retirees of the over 360 Silicon Valley Leadership Group member companies the opportunity to purchase solar thermal and photovolatic systems at discounted rates and take advantage of financing options as low as 3.99%. The program is administered with assistance from GroupEnergy, a company specializing in collaborative purchasing programs (BACC 2012).

> **Successful bulk purchasing programs explore creative financing options to enhance customer participation and encourage competition between many vendors through effective outreach.**

Silicon Valley Collaborative Renewable Energy Procurement Project

Another collaborative, the Silicon Valley Collaborative Renewable Energy Procurement Project, was formed through a partnership between the City of Santa Clara, Joint Venture: Silicon Valley Network, and the Public Sector Climate Task Force.[6] The program facilitates public agencies in the installation of renewable energy systems. Nine public agencies are participating in the first phase to develop 70 sites on 43 locations, for a total capacity of 14.4 MW. As such, the effort represents the largest multi-agency procurement of renewable energy in the United States at this time. The agencies sign a Memorandum of Understanding in the initial stages to express their intent to carry through the entire development process.

Types of sites identified for development include office rooftops, carports, water storage tanks, ground-mounted systems, bus depots, senior centers, parking garages, and health centers. Site assessments were contracted prior to the release of the RFP, both to ensure site feasibility and to provide bidders with accurate site information on which to base their bids. These technical and economic assessments were undertaken by Optony, Inc. for all of the sites, on behalf of the participating agencies. This relieved the agencies of the need to conduct individual analyses, for which they may not have resources or expertise. While this process reduced the number of sites considerably, it ensured that only sites that met technical and economic feasibility were included in the bidding process.

Because the systems were of a broad range of sizes, the project team grouped the installations into strategic bundles of 6–15 locations each, based on system size and across different owners. The team allowed developers to bid on one or more bundles. This encouraged participation by bidders who specialize in a subset of system sizes or who would be deterred if the entire contract were offered to a single bidder. A point system in the selection process gave preference to local vendors.

Participating agencies buy the power generated by the systems from the developer but have the option to purchase the system at several stages in the contract period. This arrangement means that agencies that cannot afford the high upfront cost of going solar can still participate.

According to the Solar Labor Force Impact Model, approximately 200 jobs will be created by the program, with one-third of those being permanent positions in fields such as contract management and system maintenance (U.S. EPA 2010; Joint Venture: Silicon Valley Network 2011).

As a result of the success of the program, the EPA is implementing a similar effort called the Clean Energy Collaborative Procurement Initiative, which targets federal, military, and higher education facilities in the Washington, D.C., metro area (U.S. EPA 2011).

5.2 Design and Implementation Considerations

General

General design and implementation considerations include:

- Consider local resource availability and likely participant base
- Leverage an existing group or organization to serve as the program leader; look for strategic partnerships and make use of available expertise in outreach, financing, site assessment, and contracting
- Identify the state and federal incentives; keep an eye on them and meet the deadlines
- Use independent experts to assess and refine your program plan and to carry out site assessments
- Explore creative financing options to enhance participation
- Identify program goals and metrics of success early in the process.

Communication and Participant Outreach

Communication and participant outreach considerations include:

- Use a variety of communication methods with program participants; avoid a one-size-fits-all method
- Provide contact options that suit a variety of communication styles
- Maintain participant satisfaction with as much personal communication as feasible
- Hold informational meetings to encourage broad participation and to answer participant questions throughout the process
- Create an online forum to inform interested communities, connect participants, and solicit program feedback.

Bidding Process

Program success depends on both buyers and sellers benefiting from participation. In order to accomplish this, programs could:

- Provide information to vendors on the benefits of aggregated demand
- Encourage competition between many vendors through effective outreach
- Bundle sites by installation type, host facility, size, and other attributes
- Allow vendors to bid on one or more of the bundles.

Vendor Selection

The strength of a vendor can impact the success of a program. In selecting a vendor, programs could:

- Consider a variety of factors when selecting winning bidders, such as cost, system design, quality assurance, and ability to provide long-term maintenance and support

- Select one or more reputable vendors with a track record of high-quality installations and be very clear about the terms of the contract.

5.3 Benefits of Bulk Purchasing Programs

Bulk purchasing programs provide a variety of benefits, ranging from lower costs to broader adoption of solar energy.

Lower costs. Aggregating demand unlocks volume discounts from local solar installers.

Reduced transaction costs. Administrative costs are spread amongst a large group of customers.

Reduced risk perception/ease of decision making. As a member of a group, participants have reduced risk perception. The leadership of the organizing group relieves individuals of complex decision-making processes.

Company reputation/employee satisfaction. Companies and agencies can offer group-buy programs as part of their employee or membership benefit packages. The unique offer can increase employee satisfaction, attract new members, and enhance the company's overall reputation for sustainability.

Encourage broader use of solar energy. Because group-buy campaigns can be made available to employees, neighborhoods, and other broad bases of individuals, they encourage people who would not have otherwise considered or investigated the option to install solar energy. Peer pressure to participate may work to increase solar deployment.

Public education. Through workshops and participant outreach, group-purchasing campaigns enhance overall public education about solar energy.

Solar providers. Vendors of solar systems receive substantial new business with reduced sales expenditures.

Competitive contract terms. Developers are more likely to agree to competitive contract terms (e.g., buyout options, performance guarantees, and termination options) when making bulk deals.

Flexibility of design. Group-buy programs can be designed to suit a wide variety of goals and needs. They can incorporate direct purchases, leases, or unique financing and ownership models. They can target a variety of participant types, system sizes, and technologies.

Quality assurance. Thorough vendor-selection processes ensure system quality, which improves buyer satisfaction as well as the overall reputation of solar energy.

5.4 Challenges of Bulk Purchasing Programs

Bulk purchasing programs require a champion and provide less flexibility than an individually designed procurement process.

Requires a champion. One or more organizations must be willing to take the lead and have the resources to carry out the program.

Less flexibility. Individual buyers may have less flexibility to select vendors, customize systems, or specify contract terms.

Scheduling challenges. Participating installers may be pressed to complete many installations in a short time frame. The individual participant is subject to program schedules and deadlines. If individuals are required to wait too long for the installation of their system, they may be tempted to withdraw from the program and accept bids from vendors that are not a part of the program.

Photo by Dennis Schroeder, NREL/PIX 20689

6. REVERSE AUCTIONS FOR VOLUNTARY PURCHASES

A reverse auction is an auction in which the roles of the buyer and seller are switched. In a traditional auction, a seller puts a product up for sale, which is bid on by many potential buyers. The buyer willing to pay the highest price wins the auction. In a reverse auction, a buyer requests a product, and many sellers bid to provide that product. The bidder that can provide the product at the lowest price wins the auction.

A few elements are essential to the functioning of a reverse auction:

- The product to be supplied must be a standardized product of known quality
- There must be multiple sellers of the same product
- There must be a range of prices at which the product can be produced and sold.

Energy production is a natural fit for a reverse auction because it meets all three of the above criteria. The standardized product to be supplied is electricity. There are many energy developers who can compete to provide this product, and the price at which power can be provided is variable.

Reverse auctions provide a flexible method to purchase renewable energy generation in deregulated electricity markets. In addition, reverse auctions can be used to purchase RECs or to contract for the construction of a renewable energy system in all electricity markets. Private companies, government agencies, and non-profit groups can all use a reverse auction.[7] These buyers can either organize and hold their own reverse auctions or use an independent auction manager to coordinate auctions on their behalf. Using an auction manager avoids the need for buyers to go through the learning process needed to organize a successful auction. World Energy Solutions is one company that offers reverse auction services for clients in deregulated electricity markets.

Well-designed auctions create an open, market-driven process that draws in a variety of potential product suppliers. Pre-auction planning and analysis helps buyers and sellers make informed decisions on auction day. Thorough pre-auction documents ensure that all bidders are clear about the product and terms of provision on which they will bid. Once the auction opens, all bidders see the prices their competitors are willing to contract for. In the moments prior to auction closure, the opportunity to make a final blind bid encourages bidders to submit their lowest possible final offer. The transparency of the process ensures equality and enhances participant trust while creating a highly competitive environment that drives down prices.

Reverse auctions can be used for entities that aggregate their demand to increase their purchasing power. Reverse auctions in which buyers are requesting bids to provide large quantities of electricity draw more bidders and typically result in lower prices per kilowatt-hour than smaller auctions. World Energy Solutions runs auctions for clients with demand levels of 4+ million kWh/year (roughly the demand of 350 American households) (Joyce 2010). Aggregating demand can allow buyers to take advantage of this leveraging effect. Aggregating the demand of several buyers within the same power service area allows those with smaller demands to participate in the reverse auction process. Even aggregating accounts that are already large may provide further price benefits. Combining the purchase of traditional electricity with that of green energy, such that total demand is supplied through a single auction, is another form of aggregation.

6.1 Experience with Reverse Auctions

The Healthcare Clean Energy Exchange (HCEE) provides an example of how buyers with limited demand can be aggregated to allow for broader participation in reverse auctions. The HCEE is a reverse auction service offered to its members by Practice Greenhealth, a non-profit organization for healthcare facilities. Through HCEE, member facilities can participate in custom-tailored, online reverse auctions to procure renewable energy or the development of hospital-sited renewable energy systems. The exchange makes use of the World Energy platform described above. In 2009, Mercy Hospital and Medical Center participated in their first reverse auction with the goal of reducing their annual electricity expenditures, which totaled about $2.5 million. The facility procured 10% green electricity and saved more than $190,000/year compared to their previous utility contracts (Pizzi 2009). Multiple hospitals in the same distribution area may also choose to aggregate their renewable energy demand in order to reach the capacity minimums required for auction participation and further drive down prices (Practice Greenhealth 2012).

Well-designed auctions create an open, market-driven process that draws in a variety of potential product suppliers.

The General Services Administration (GSA) provides another example of how a reverse auction can be used to procure power for multiple loads with notable price benefits. The GSA is an independent agency of the U.S. government that supports federal agencies by managing assets, such as office buildings and transportation fleets, and leveraging the government's buying power through bulk acquisition of products and services. Since 2001, GSA has used the World Energy Solutions services to procure electricity for government facilities across the country. More recently, GSA has used in-house expertise to hold reverse auctions themselves (Shah 2011).

Through a reverse auction, GSA has obtained electricity for federal agencies at significantly lower prices than existing contracts. Through a round of auctions organized by World Energy in 2008, GSA purchased 100% wind power for the Statue of Liberty and Ellis Island at prices under the current standard offer contract rate. Through a round of auctions in January 2012, new contracts were signed to provide electricity to New York federal facilities for 35% lower cost than previous utility contracts (World Energy 2012).

6.2 Design and Implementation Considerations

A reverse auction can be used to procure renewable energy in deregulated (competitive) electricity markets and can be used to procure RECs in all electricity markets.

Clearly written and thorough pre-auction announcements are an important feature of a successful reverse auction process. These documents specify the amount of electricity to be purchased, any technology or location restrictions, and all contract terms that would be offered to a winning bidder. These documents ensure that bidders understand exactly what they will be bidding on.

A reverse auction can be used to influence the market in a number of ways, including:

- Encouraging the development of new renewable energy facilities by specifying that the generation to be purchased must come from a new facility
- Encouraging local development by specifying that the generation to be purchased must come from within a particular region
- Encouraging a particular technology (e.g., solar) by specifying that the generation to be purchased (or a portion thereof) must come from a certain technology.

Ongoing verification and auditing requirements ensure that the renewable power being procured through the reverse auction is not also being used to satisfy a state RPS or other renewable energy targets.

In a reverse auction, each bidder aims to bid lower than all other bidders. Bidders will only bid as low as necessary to beat the most recent bid. If the auction time runs out before a bidder reaches their lowest possible offer, the buyer could pay more than necessary for the product requested. Thus, a pure reverse auction may not result in the lowest possible price for the buyer. This drawback can at least partially be addressed by switching the reverse auction to a blind auction for the final seconds of bidding. All bidders place their best and final offer at the end of the auction, without seeing their competitors' final bids. This increased uncertainty during the final seconds of the process encourages bidders to place their best offer on the table.

Today's reverse auction platforms are high-speed, time sensitive, and dependent on the Internet. If a bidder has technological difficulties at the time of the auction, their bids will not be available for consideration. The technology requirements may also inhibit some buyers from holding their own reverse auctions and necessitate going through an auction coordinator at additional cost. Some auction platforms require bidders to register for a fee, which could discourage potential providers.

6.3 Benefits of Reverse Auctions

Reverse auctions are not entirely a new concept in the electricity supply realm. Many of the same elements are present in the traditional methods for acquiring electricity supply contracts, such as RFPs or requests for bids. Several benefits, however, set the reverse auction process apart from traditional methods of acquiring electricity service contracts. The benefits of using a reverse auction include:

Increased transparency. Favoritism between bidders is impossible during the auction process, and all bidders have an equal opportunity to win. There is also price transparency with all parties able to see the lowest bid. The impartiality and transparency of the auction process increases confidence amongst bidders and encourages broad participation.

Increased competition. Today's online reverse auctions are fast-paced. The details of the product being requested and the contract terms that will be offered are announced well in advance so that bidders can prepare. The actual bidding process typically lasts for only a few minutes. While the auction is open, bidders receive instant feedback on the prices their competitors are offering. They know that if they do not respond with a lower bid quickly, they will lose the contract. This environment taps the competitive nature of bidders and drives down prices.

> **Using a reverse auction process, Mercy Hospital and Medical Center procured 10% green electricity and saved more than $190,000 per year, compared to its previous utility contracts.**

Price discovery and consumer education for buyers. Reverse auctions allow buyers to quickly test the current market and easily compare prices between products before making a purchase decision. Buyers become more educated consumers as they learn about their electricity usage, product options, and prices as a result of participating in the auction process.

Reduced administrative burden. Participating in reverse auctions is faster and less burdensome for bidders than responding to RFPs. Buyers avoid lengthy proposal review processes.

Fast award and contract times. Contract terms and other details are set by buyers and announced to bidders ahead of auction day. Contract negotiations are limited and contracts can be signed quickly. Often, contracts between buyers and the winning bidder can be signed on the same day as the auction.

Photo from iStock 20787546

6.4 Challenges of Reverse Auctions

Due to the cost and logistics of implementing a reverse auction, this mechanism is generally available only to customers with high electricity demand or customers who are able to aggregate their demand with others, which limits its applicability.

Reverse auctions must be carefully designed in order to ensure fairness amongst bidders and in order to encourage the lowest possible price for customers. Thus, reverse auctions are often coordinated by third parties for a fee.

7. SUMMARY AND CONCLUSIONS

Increasingly, communities, businesses, non-profits, and utilities are partnering to provide a wider variety of options for procuring renewable energy. CCA programs, community wind and solar programs, green power community challenges, local collaborative electricity purchasing, bulk purchasing of on-site renewables, and reverse auctions provide unique methods, often resulting in cost savings and expanded access for consumers. The mechanisms are summarized below, as well as in Table 6.

Community choice aggregation programs, though not available in every state, allow communities to select an alternative energy supplier while continuing to receive transmission and distribution service from their existing supplier. While not all CCAs select renewable resources, programs such as MCE in California, Cape Light Compact in Massachusetts, and Oak Park in Illinois all offer renewable options. San Francisco is preparing to launch a renewable offer in 2012, and 242 communities in Illinois have voted to move forward with a CCA, though whether they will offer renewable energy is yet to be determined. CCAs can provide a lower-cost electricity product, large environmental impact, an easy way for consumers to support renewables, and access to lower-cost, tax-exempt debt. CCAs can be challenging to implement because they require state legislation, can have significant start-up costs, face possible resistance from the incumbent electricity supplier, and because residents may be unaccustomed to thinking about their electricity use.

Community programs allow customers to invest collaboratively in renewable energy. In community solar programs, all participants purchase a share of a solar system and receive the financial benefits of the energy produced by their share. While few programs existed as late as 2008, by 2012, nearly 30 programs were identified. Community wind programs are emerging in the United States and are more common in Europe. Community programs expand access to renewable energy, provide an easy way to sign up, take advantage of cost efficiencies from larger projects or procurements, may offer a unique, local product, and may be more flexible, allowing participants to keep their investment, even if they move. However, programs can be challenging to establish, due to tax, finance, and legal concerns; developing the program structure can be more challenging than finding subscribers.

Green power challenges and local collaborative electricity purchasing programs expand access to utility green pricing and competitive supplier programs. Local governments often partner with local utilities, third-party marketers, and/or environmental organizations to increase awareness of green pricing options through a green power challenge. EPA's Green Power Communities are collectively buying more than 3.3 million MWh of green power annually, representing 9% of all voluntary sales in 2010. Groundswell's Community Power Project is a local collaborative electricity purchasing program that has facilitated procurement of 56,000 MWh of renewable energy for 109 organizations in the Washington, D.C., area. Green power challenges and local collaborative electricity purchasing programs raise awareness and expand access to renewable options, provide alternative ways to sign up for renewable energy, may encourage friendly competition among suppliers, and can contribute to branding of a community. Challenges and procurement programs are fairly easy and straightforward to implement. One barrier may be organizing the timing of the challenge and clarifying funding responsibilities between organizations. Local collaborative electricity procurement programs require a lead organization to educate potential partners and develop the actual procurement.

Group on-site purchasing programs identify a group of individuals or companies that are interested in installing solar systems and aggregate their demand for the equipment and installation services. This can result in attractive bulk pricing from vendors. In addition, the programs save buyers the time and effort that would be required to navigate the purchasing process individually, which may encourage more customers to install renewable energy systems. The program may also include a financing aspect, which can further ease the process for customers and help expand the market.

A group purchasing program requires a clear leader to organize the process. Successful programs have been organized and offered by a variety of leader organizations representing the private and public sectors, including the cities of Portland and San Jose, a citizen group in Los Angeles, a nation-wide enterprise called One Block Off the Grid, and the Orlando Utilities Commission.

Reverse auctions provide a flexible method for organizations and companies in restructured electricity environments to contract for electricity provision, including electricity from renewable energy sources. Customers in any electricity market can purchase RECs or contract for the construction of a renewable energy system using the reverse auction mechanism. Although many customers make use of paid auction organizers (e.g., World Energy Solutions), buyers with significant demand may choose to organize their own auctions, as the GSA has recently done. The transparency of the online bidding process often draws in a variety of potential bidders. The competitive environment created by reverse auctions has yielded significantly reduced prices for renewable energy, compared to traditional contracting processes. Careful pre-auction analysis and planning pays off in the increased confidence of buyers and bidders, as well as rapid post-auction contract signing.

Table 6. Overview of Innovative Renewable Energy Procurement Mechanisms

Innovative Mechanism	Sector Developing the Method	Procuring Sector	Benefits of Approach	Challenges to Approach
Community Choice Aggregation	Local governments	Utility consumers	-Potential lower cost -Large impact -Easy for consumers -Access to lower-cost, tax-exempt debt	-Need enabling legislation -Start-up costs can be significant -Possible resistance from incumbent electricity supplier -Need for education and outreach
Community wind and solar programs	Typically municipal or cooperative utilities and/or third-party project developers	Utility consumers, local residents, residents from anywhere	-Expanded access -Easy to sign up -Cost efficiencies of larger project or procurement -May offer a unique, local product -Can move subscription within service territory	-Tax and financial issues -Concerns over potential securities regulation
Green power challenges and local collaborative electricity procurement	Partnership between utility, local government, and/or large institutional purchasers	Utility consumers	-Contributes to branding of community -Provide education and outreach to community members -Easy to sign up -May encourage supplier competition -May lower cost	-Setting appropriate, realistic targets -Distributing costs among partner organizations -Administrative issues
Bulk purchasing of distributed energy systems	Government agencies, businesses, non-profit organizations	Local residents, government agencies, schools, businesses	-Lower-cost solar -Reduced administrative effort for buyers -Improved company reputation for sponsors -Flexibility of program design and implementation -Quality assurance	-Requires a champion to coordinate -Potentially reduced flexibility for individuals in project design or contract terms
Reverse auctions	Businesses, governments, non-governmental organizations	Businesses, government agencies, non-profit organizations	-Increased price transparency and competition -Price discovery and buyer education -Reduced administrative burden -Fast award and contract times	-Pure reverse auction may not allow sufficient time to generate lowest bid -Relies on auction software technology

8. ENDNOTES

[1] The guide was produced by a collaborative effort between the U.S. EPA, the U.S. Department of Energy, the World Resources Institute, and the Center for Resource Solutions. http://www1.eere.energy.gov/femp/pdfs/purchase_green_power.pdf.

[2] Though not discussed in this paper, CCAs exist in Rhode Island and Ohio, but they do not offer substantial renewable energy products. The Northeast Ohio Public Energy Council (NOPEC) aggregates natural gas and electricity consumer load, and the Rhode Island Energy Aggregation Program (RIEAP) aggregates load of local governments in the state. RIEAP renewable percentages have ranged from 5% to 10% (LEAN Energy U.S. 2012).

[3] For example, in Illinois, opt-out programs can be implemented but must be approved through a referendum question at a general election.

[4] For more on securities issues, see Coughlin et al 2012.

[5] The Bay Area Climate Collaborative is a public-private initiative developed by the Silicon Valley Leadership Group to encourage a clean-energy economy. See http://www.baclimate.org.

[6] The Public Sector Climate Task Force is made up of sustainability officers from across the region.

[7] While the focus here is the use of reverse auctions in voluntary renewable energy markets, the mechanism is also being used in compliance markets. For example, the State of Connecticut's Public Utilities Regulatory Authority approved the ZREC (zero-emissions) and LREC (low-emission) renewable energy program. Through the program, state utility companies will hold a series of reverse auctions that will result in long-term contracts to purchase the RECs associated with electricity generated by customers of the state's distribution companies. The program was mandated by the state Energy Act of 2011. See http://www.ct.gov/pura/cwp/view.asp?A=4144&Q=502078 and http://energy.aol.com/2012/04/30/connecticut-focuses-on-unique-reverse-auctions-to-drive-green/.

9. RESOURCES AND REFERENCES

Resources

Community Choice Aggregation

Illinois Community Choice Aggregation Network: http://www.ippconnect.com/CCA.php.

Local Energy Aggregation Network (LEAN Energy U.S.): www.leanenergyus.org.

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10. APPENDIX

Table A-1. Overview of Community Solar Programs

Utility/Provider	Program Name	Program Size (kW)	Program Start Year
Ellensburg (WA)	Community Solar Project	111	2006
Sacramento Municipal Utility District (CA)	SolarShares	1,000	2008
Florida Keys Electric Cooperative (FL)	Simple Solar	117	2008
Ashland (OR)	Solar Pioneers II	64	2008
St. George (UT)	SunSmart	250	2009
Bainbridge Island (WA)	Solar for Sakai	5	2009
Holy Cross Energy/Clean Energy Collective (CO)	Mid Valley Solar Array (El Jebel)	80	2010
University Park Community Solar LLC (MD)	University Park Solar	23	2010
Corvallis (OR)	Corvallis OR, SunSlice Deal	2	2010
Okanogan County Electric Cooperative (WA)	OCEC Community Solar	20	2010
Salt River Project (AZ)	SRP EarthWise & Copper Crossing Solar Ranch	2,000	2011
Trico Electric (AZ)	Trico SunWatts Sun Farm	193	2011
Delta-Montrose Electric Association (CO)	Community Solar Array	20	2011
Holy Cross Energy/Clean Energy Collective (CO)	Garfield County Array	858	2011
Berea Utilities (KY)	Berea Solar Farm	14	2011
Edmonds (WA)	Edmonds Community Solar Cooperative	4	2011
Okanogan County Electric Cooperative (WA)	Winthrop Community Solar	23	2011
Poulsbo Project (WA)	Poulsbo Middle School	75	2011
Seattle City Light (WA)	Community Solar	24	2011
Tuscon Electric Power (AZ)	Bright Tucson Community Solar Program	1,600	2011
UniSource Energy Services (AZ)	Bright Arizona Community Solar	1,720	2012
Colorado Springs (CO)	Community Solar Garden Facility Incentive Program	500	2012
Poudre Valley REA/Clean Energy Collective (CO)	Community Solar	115	2012
Brewster Community Solar Garden Cooperative Inc. (MA)	Brewster Community Solar Garden	346	2012
Olympia (WA)	Olympia WA, SunSlice Deal	75	2012
Acorn Energy Cooperative (VT)	Acorn Energy Solar One	150	2012
United Power (CO)	Sol Partners Cooperative Solar Farm	10	2012
San Miguel Power Association/Clean Energy Collective (CO)	SMPA Community Solar	1,000	2012

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