OPEN STANDARDS FOR SHARED RENEWABLES

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ABSTRACT

Shared renewable energy systems offer credit on customer utility bills through virtual net metering. Shared systems (also known as solar gardens) are often managed by third parties, which must communicate the proportional ownership for each account to the utility on a regular basis. Utilities use a variety of different billing software packages and billing credit methodologies. Open communication standards would allow billing software vendors to develop shared renewable APIs, and might encourage the creation of open source tools for shared system managers.

Standardized business structures and approaches to securities law such as Direct Public Offerings can reduce the startup legal costs for any community renewables project. Such tools might lower fixed costs and lower the barriers to entry for community nonprofits, solar integrators, and small utilities, thereby speeding development of shared renewable systems.

1. LEGAL NOTE

This document does not constitute legal advice of any kind, nor a recommendation to transact any type of security. When developing, investing in, or subscribing to a shared or community solar project, please consult legal professionals in the proper specialties such as securities law, tax law, or renewable energy. Securities and tax policies regarding renewable energy may change from time to time, and vary from country to country and from state to state within the United States.

2. THE SHARED SOLAR ECOSYSTEM

Solar gardens cover an enormous range of scale, from a rooftop system shared between just two participants (the famous Ben and Jerry of Vermont) (1), to the 20 MW Copper Crossing Solar Ranch operated by Salt River Project in Arizona (2). Some are owned and operated by utilities, some as entrepreneurial efforts by private corporations, and some by cooperatives seeking to fulfill the idea of shared community ownership. All of these implementations have something in common: a single renewable energy system provides power that is credited to multiple utility customers. The utility must keep track of who gets how much of the credit for the power produced by the system, and apply it to the participants' bills.

Participants, also known as subscribers, must be located within the utilities' service territory. In a few cases there are additional geographic restrictions. Under investor owned utilities in Colorado, for instance, subscribers must be located within the same county or municipality as the project (3). This gives projects a greater community feel at the cost of reducing the options available to the individual subscriber.

Shared solar legislation offers municipalities, citizens groups, homeowners associations, and affiliative groups such as houses of worship a degree of local control without having to form a separate electric utility. The geographic distribution of renewable generation also has the potential to improve community resilience during emergencies, and in aggregate to smooth the intermittency of renewables (4).

2.1 The Utility

At their best, employees of electric utilities embody a strong ethic of service, seeking to provide reliable power fairly to all of their customers. They seek to avoid shifting costs from one customer to another. They are aware that distributed renewable energy might provide a net benefit to the grid in one location, while a similar system might add cost to a separate circuit a few kilometers away.

Shared renewable systems are desirable as they make the benefits of solar energy available equally to everyone who chooses to participate, while being able to set tariffs in such a way as to avoid cost shifting. The bill credit provided to participants is generally above avoided cost, but below the full retail rate, allowing for the utility to recoup the cost of maintaining the grid (1). Utilities might also provide capacity or production-based incentives such as rebates, fixed-price renewable energy credit contracts, or a value of solar tariff such as Minnesota's (5). Utilities can work with developers to site shared systems in areas with good resource, where they can be easily interconnected and match daily load profiles to offer the most benefit and least strain to the grid. CUNY and NYSERDA have identified areas in New York State that can best benefit from solar installations (6).

For all the constant work and vigilance that it takes to keep the lights on, utilities are some of the least popular companies in the United States. The high degree of control they assert in order to provide their essential product can make them appear paternalistic. (Being some of the largest producers of greenhouse gases doesn't help either.) Employees of utilities typically live and work in their service areas, and would like to see their employer engage in activities with local benefit. Drawing on the poetic metaphor of a community garden, support of solar gardens can benefit a utility's image.

In conversation with representatives of numerous rural and municipal utilities, the author has observed that one of the main barriers small utilities face in implementing shared renewables is the matter of applying bill credits. If stakeholders can join together and standardize on data formats and communication protocols for shared renewable systems, it will be easier for billing software vendors to offer a standard "solar garden" feature.

For utilities that work with third-party community renewable developers, open standards can lower barriers to entry to providers and stimulate competition, ultimately decreasing solar subscription prices to customers (7). Utilities also already unique position to provide secured finance for renewable energy ownership (8).

2.2 Shared System Managers

A third-party shared solar system is often managed under contract by a specialized service provider that handles subscriber sales, customer service, and coordinates billing with the utility (1). Today, these providers use proprietary software, and bundle their service with the development and finance of solar projects and (in the United States) access to tax equity. Sometimes they offer "white label" services, allowing a utility or subscriber organization to carry their own brand on the project.

This integrated model has both advantages and disadvantages. Advantages include smooth, user-friendly service, and allowing multiple projects to be aggregated for lower cost installation and finance. Well-funded corporations can pay the large teams that are necessary to bring large numbers of projects under development. Access to tax equity might not otherwise be available to community projects.

The tax equity model has fixed per-project costs and a high demand on return for investment that discourage the development of smaller projects (9). Existing service providers may be venture funded startups, which require a high overall return on investment and could be subject to acquisition by less socially motivated companies when seeking an exit. A service provider might simply fail. Providers may rely on strategic investment by panel manufacturers and large developers that may require exclusive single source contracts.

If a for-profit shared system manager is operating under the above constraints, and also signs a single source contract with the utility or operates the only franchise within a given geographic area, it can achieve a local monopoly without the constraints typically placed on traditional utilities. Competition within local markets might allow participants to enjoy a cost savings over traditional grid electricity, and vastly expand the market for solar energy.

The PC, Linux, and HTML opened the computer industry, creating enormous business opportunities. Open standards and open-source tools for shared renewables could lower the barriers to entry for additional developers to also be shared renewable service providers. A consortium of stakeholders might also be able to form a nonprofit entity in the spirit of the Wikimedia Foundation or the Mozilla Foundation that could provide a low-cost or even free service to manage shared renewables for utilities and subscriber organizations. Developers could have the option of placing projects into nonprofit trust after the five-year Investment Tax Credit recapture period is completed (but for tax reasons may not commit to this transfer until the period is completed).

2.3 Solar Gardeners and Subscriber Organizations

The push for community solar starts at the grassroots: renters and condominium owners who can't go solar, members of local nonprofits, environmental activists, municipal sustainability coordinators, state assembly members, visionary board members of cooperative utilities, and solar installers, to name just a few. These are the solar gardeners, the local champions who provide the impetus for shared renewable policy and projects. Organizations such as Vote Solar, the Interstate Renewable Energy Council (IREC) (10), and the Solar Gardens Institute support the efforts of these pioneers.

It can take years to jump through all the hoops to get a project up and running. Many proposals have yet to make it: small competitive utility pilot programs, difficulties in obtaining finance and tax equity, and utility opposition in state legislatures are only some of the hurdles these projects face. Solar gardeners need to be supported and nurtured in every way possible, with training programs, open source tools, and low-cost public finance.

Solar gardeners build local stakeholder groups which can become subscriber organizations when projects are brought into development. Subscriber organizations serve as the legal container for a community owned project's participants. Colorado's Community Solar Gardens Act allows a wide variety of structures for subscriber organizations, including municipalities, nonprofits, cooperatives, and for-profit corporations. Some subscriber organizations might have the necessary resources to manage projects themselves if the necessary tools are available. Smaller groups will likely need the continued assistance of service providers.

2.4 Participants (Subscribers)

The customers receiving bill credits under a shared renewables program are called "subscribers" under Colorado's Community Solar Gardens Act (3) and "participants" under California's Green Tariff Shared Renewables Program (11). Participants can range from residential customers purchasing a $10 share to municipalities and businesses subscribing to a significant fraction of the output of a shared array. Motivations for participation include a desire to support solar power within the local community, lack of a good site to install solar, a socially responsible investment philosophy, green energy goals, and establishing a predictable electricity cost. Other potential participants are only interested if they can realize a short-term or long-term power cost savings.

The development of open standards and open source tools could benefit participants by increasing the availability of shared renewables to more utilities, increasing competition and thereby lowering prices within service territories, and allowing the development of smaller more localized systems.

2.5 Billing Software Providers

Utility billing and customer information systems (CIS) is a lucrative, competitive, and growing market. Navigant Research forecasts that worldwide revenue from billing and CIS software and services will grow from $2.5 billion in 2013 to $5.5 billion in 2020 (12). Providers include some of the largest names in the software industry: Accenture, Hewlett Packard, IBM, Infosys, Oracle, and SAS.

XCEL Energy built custom extensions to its billing system to support solar gardens programs in Colorado and Minnesota. Small utilities rely on commercially available billing software, and are beginning to demand the functionality needed to implement virtual net metering. If open standards are available, software providers will be more easily able to add this functionality, just as the availability of the HTML open standard encouraged the development of web browsers. Software providers can gain a potential competitive advantage by implementing standard interfaces for virtual net metering.

3. A SAMPLE COMMUNICATION PROTOCOL

This paper does not define a final standard for shared renewable communication, but attempts to define the features that such a standard might need to include. To see the beginnings of how this might work, let's step back to one of the very first solar gardens located in the small rural community of Ellensburg Washington (13). The year is 2006.

Every three months, the resource manager of this small municipal utility would drive out to the solar arrays and physically read the production meter. He would subtract his previous reading to get the production for the last three months. The kWh's produced would be entered into a simple excel spreadsheet to calculated the billing credit for each subscriber. The credited amount was based on the subscriber's fractional interest (the amount of money they contributed divided by the total cost of the solar array). The resource manager knew how much the array was earning based on the power sales at avoided cost and the state production incentives. He would then provide the Excel spreadsheet to the utility billing department staff and they would manually credit each subscriber account by the calculated amount.

This is easy enough to do for Ellensburg's 90+ participants, but when thousands become involved, a simpler process will be required. A next step could be to write a script to transfer the data into the billing system automatically.

In 2010 Colorado Assemblymember Claire Levy introduced a bill called the Community Solar Gardens Act (3) that allowed third parties to manage the systems. The bill passed. Within a year, several startups and some established solar developers were actively chasing a few Megawatts of capacity in XCEL's pilot program. Nine states and the District of Columbia now have their own flavors of community solar, each with important differences (14).

There is the possibility that one or more utilities, billing software providers, or service providers might propose their current practices as a standard. This might occur for philosophical reasons, to promote an individual provider's product, or in an attempt to rescue a flailing company. These situations have happened many times in the software industry. We should both welcome and carefully examine any such proposals. On the positive side, we could see proven practices become standard. On the negative, if it gives an advantage to one player or another, we run the risk of a fragmented standard.

There are several things the utility billing software needs to know in order to issue a bill credit. These sample commands are provided for illustration purposes only, and are not intended to be adopted as a standard without discussion within the industry.

SYSTEM record for the shared renewable system:

- System ID
- Production in kWh (real time, daily, monthly)
- Bill credit rates for each rate class (this may depend on the size of the solar garden)
- The total amount of unsubscribed capacity, if any (this may be credited to the subscriber organization at a different rate)
- List of SUBSCRIBER records

SUBSCRIBER record for each subscriber:

- Subscriber ID
- Name and address
- Account number
- Meter number
- Rate class
- Size of subscription in kilowatts

Subscriptions may be portable — they can be changed to a different address if the subscriber moves. They are generally also transferrable - they can be sold, given away, donated, or passed on to a subscriber's heirs. If a subscriber's account is closed the capacity can become unsubscribed. New subscribers can be added if capacity is available. A subscriber might change rate classes, or change the capacity of their subscription. Depending on the utility, changes might only be allowed at certain time intervals.

This paper recommends that the system manager transmit the complete database at specified intervals for synchronization purposes, along with any changes using one of the following commands, prefixed with M_ (for system manager). This provides a useful check; the total number of kilowatts in the system will not usually increase nor decrease, nor will large numbers of subscribers usually change their subscription, such conditions would be an indication of potential error or fraud and would be flagged by the utility software.

M_SYSTEM(SYSTEM record)
- Transmits entire system database.

.
M_NEW(SUBSCRIBER record)
- Adds a subscriber with the given record.

.
M_CANCEL(Subscriber ID)
- Cancels a subscriber.

.
M_CHANGE(Subscriber ID, subscription size)
- Changes size of subscription.

The utility is responsible for informing the system manager of changes in the other subscriber fields besides subscription size (name, address, account number, and rate class). The utility will keep the system manager informed of the system's production and any changes in bill credit rates. The utility can also transmit the entire system database if a discrepancy is detected. Commands are prefixed with U_ to show that they originate from the utility.

U_SYSTEM(SYSTEM record)
- Transmits entire system database.

U_PRODUCTION(System ID, Production in kWh)
-Updates system production to the system manager.

U_CREDITS(System ID, Bill Credit rates)
- Updates bill credit rates.

U_CHANGE(Subscriber ID, SUBSCRIBER record)
- Changes subscriber name, address, rate class, etc.

U_CANCEL(Subscriber ID)
- Notifies system manager that a subscriber's account has been closed

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All commands should be timestamped to a sure the credits are assigned accurately.

An open standard for shared renewables could be used anywhere in the world where the model is allowed.

3.1 Security and Privacy Considerations

In conversations with utility employees, it is quite clear that they do not want solar garden system managers connecting directly to their billing systems. This is to avoid the risk of someone stealing money, or worse, penetrating systems that control the grid. It's useful to have the file transmitted in a human readable ASCII form to reduce the risk of malware. The information should be encrypted in transit to prevent loss of privacy or spoofing.

It's important in the light of recent SSL vulnerabilities to carefully examine the means by which the data are transmitted, whether in an encrypted e-mail or by other means. This e-mail is used, no attachments should be allowed. Transmitting the data to a physically isolated machine and using sneakernet to move the text data to the utility's billing system is also an option. What's important is the practices that become standard are no weaker than, and preferably stronger than current best practices.

3.2 Real-time production monitoring

The production meters of shared renewable systems over a certain size (say 10kW) should report their production in real-time to the utility via a bankable production meter. The system can also report directly to the system manager to alert to any problems and to allow production data to be reported to participants via a cell phone app or the Web.

3.3 Complicating Factors and Questions

Now things get really fun. These are the kind of questions that get asked during Public Utilities Commission rulemakings and rate cases. Any attempt at standardization must take into account the reality that these questions are answered in different ways by different utilities and in different jurisdictions. Achieving standards and best practices for shared renewables will, however, gently guide these decisions towards proven solutions. Some of these questions are addressed in IREC's Model Program Rules (10). For the moment, we are left with more questions than answers.

- For subscribers with multiple meters, how best can different implementations of meter aggregation be addressed?
- How should a single customer subscribing to multiple systems be handled?
- How should credits to subscribers with staggered billing cycles be handled?
- Can credits be offered either as kilowatt hours or amounts expressed in national currency?
- For subscribers with inverted block rates, should credit be taken against the lower rate of the first kilowatt hour or the higher rate of the last one?
- For customers with time of use (TOU) rates, should the power produced by a community renewable system be credited depending on the time that it was produced?
- For customers with demand charges, how should the credit be calculated?

4. STANDARDIZED BUSINESS STRUCTURES AND FINANCE

In the United States since the expiration of the 1603 Payments for Specified Energy Property in Lieu of Tax Credits, community owned solar systems have faced a double burden, forced to steer between the Scylla of tax law and the Charybdis of securities law. Standardized business structures and finance could lower transaction costs and barriers to entry and promote a secondary market in the bundling of solar projects.

New opportunities have been appearing in both the realms of tax and securities law in the United States. Standardized structures could vary from country to country, and potentially from state to state within the United States.

4.1 Tax Law

4.1.1 2017 Investment Tax Credit Step-Down

The Federal 30% solar Investment Tax Credit (ITC) is set to step down to 10% at the end of 2016. Tax equity investors can be difficult to find since the ITC can only be claimed against passive income such as real estate and not an individual's salary. Since community solar projects can easily take two years or more to come to fruition, and the process of adopting standards even longer, it seems to make sense to design standard structures for the post-ITC era.

There's some good news to be found here. GTM research finds that in many states commercial projects will be able to produce power for less than grid pricing even after the step-down. Even smaller projects will be close to grid parity (15).

Being free of the need for tax equity investors greatly simplifies both the business structures needed to projects and the ability to locate finance. This is already happening - at a cost of less than $3/W, Re-Volv's 22 kW crowdfunded PV project on the Kehilla Synagogue in Piedmont, CA was successfully financed and installed without requiring tax equity, and was still able to offer energy cost savings to this house of worship (16).

4.1.2 IRS Tax Credits for Subscribers

Rather than seeking a tax equity provider for an entire project, the tax code may allow certain subscribers/ participants that qualify to claim a credit on their own taxes. The IRS tax code allows a 30% tax credit for residential customers. In late 2013 the IRS issued Notice 2013-70 (17) which appears to open the door to this. (This would only apply to projects completed before the end of 2016.) The relevant text is included below:

Q-26: A taxpayer purchases solar panels that are placed on an off-site solar array and connected to the local public utility's electrical grid that supplies electricity to the taxpayer's residence. The taxpayer enters into a direct contractual arrangement with the local public utility that supplies electricity to the taxpayer's residence to allow the taxpayer to provide electricity to the grid using a net metering system that measures the amount of electricity produced by the taxpayer's solar panels and transmitted to the grid and the amount of electricity used by the taxpayer's residence and drawn from the grid. The contract states that the taxpayer owns the energy transmitted by the solar panels to the utility grid until drawn from the grid at his [sic] *residence. Absent unusual circumstances, the panels will not generate electricity for a specified period in excess of the amount expected to be consumed at the taxpayer's residence during that specified period. Can the taxpayer claim the § 25D credit?*

A-26: Yes. Section 25D(d)(2) defines a qualified solar electric property expenditure, in part, as an expenditure for property that uses solar energy to generate electricity for use in a dwelling unit used as a residence by the taxpayer. The taxpayer's expenditure for off-site solar panels under this type of contractual arrangement with a local public utility that supplies electricity to the taxpayer's residence meets the definition of qualified solar electric property expenditure.

4.2 Securities Law

Again, your friendly author is not a lawyer, so consult one if you want to do anything even remotely like issuing a security.

Standardized business structures for community solar might take multiple forms in the United States. Here are a few possibilities that seem worthy of discussion.

4.2.1 Exemptions From Securities Registration

Colorado and Maryland allow an unlimited securities exemption for cooperatives (18). In California, the exemption is capped at $300 (19). In 2014 Oregon passed a law exempting renewable energy cooperatives from securities registration (20).

Under the uniform securities act, there are several other important securities exceptions (21):

1. Government Securities
2. Financial Institution Securities
3. Public Utility and Common Carrier Securities
4. Insurance Company Securities
5. Securities Listed on Stock Exchanges
6. Not-for-Profit Enterprise Securities
7. Commercial Paper
8. Options or Warrants

Government, public utility, and not-for-profit exemptions might be useful in constructing a nationwide common business structure for community solar.

4.2.2 Direct Public Offerings

Federal securities law also offers an exemption for an intrastate Direct Public Offering (DPO) of up to $5 million from non-accredited investors (those with incomes less than $200,000 or net worth less then $1 million). The cost to register a DPO is typically in the high four figures to low five figures.

Cutting Edge Capital in Oakland, California specializes in DPOs and is working with the Solar Gardens Institute to establish a "boot camp" program specifically for renewable energy (22).

4.2.3 JOBS Act

The Jumpstart Our Business Startups Act (JOBS Act) was signed into law by President Obama on April 5, 2012. It allows crowdfunded equity for up to $1 million. This is enough to support a solar project of 250 kW or more at today's prices. Proposed rules were issued by the Federal Securities and Exchange Commission in October 2013.

When final rules are issued, offerings can be made through brokers and a new entity called a funding portal (23).

4.2.4 Avoiding Securities Entirely

A number of solar developers that also function as shared system managers have developed ownership models that they claim do not require securities registration. These models generally involve subscribers owning their panels directly, and therefore satisfying the "Howey test" (24) for whether a particular offering is to be defined as an investment contract and therefore subject to potential securities registration.

The "Howey Test"

1. investment of money due to
2. an expectation of profits arising from
3. a common enterprise
4. which depends solely on the efforts of a promoter or third party

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It might be possible, with proper legal counsel, to develop open source ownership models that do not require securities registration. Alternatively, as often happens within the software industry, an existing service provider might offer an open source version of their business model for a perceived business advantage.

5. NOMENCLATURE

Community renewables (or for solar energy *community solar*) refers to the broad class of renewable energy models used by people with a common interest. This includes crowdfunded, bulk purchased, and shared renewables.

Shared renewables (or for solar energy *shared solar*) refers to projects where multiple users are given credit on their electric bills.

Solar garden or *community solar garden* is a synonym for shared solar evoking the metaphor of a community garden where each participant has his or her own garden plot.

Subscriber and *participant* are synonyms, referring to a utility customer receiving bill credits from a shared renewable project. The terms are used interchangeably in this paper.

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