ZERO CODE 2.0™ Technical Support Document: Off-Site Procurement

CONTENTS

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DISCLAIMER

1. INTRODUCTION

This is a technical support document (TSD) for the Architecture 2030 ZERO Code. The ZERO Code sets a minimum level of energy efficiency and then requires either on-site renewable energy or the procurement of off-site renewable energy to meet building annual operations energy consumption.

> ***Zero Carbon Building***
>
> A highly efficient building that uses no on-site fossil fuels and produces on-site, or procures, enough carbon-free renewable energy to meet building operations energy consumption annually.

On-site renewable energy systems of adequate capacity are not possible for all buildings because of limited roof space, shading or other constraints. This technical support document reviews available off-site renewable energy procurement programs in the United States and describes how these programs are credited by the ZERO Code to supplement on-site renewable energy.

Annual energy use and carbon emissions track each other quite closely; however, in areas where renewable energy, especially solar, is a significant source of electric generation, there are times during the day when carbon emissions are low per unit of electric consumption and other times when emissions are high. On sunny days with mild weather, solar energy contributes a much larger share of energy to the grid resulting in extremely low carbon emissions per unit of electric generation. At other times, the contribution of fossil fuel generators dominates, resulting in higher carbon emissions per unit of electric generation. This variability can be accounted for with hourly analysis of building energy use and renewable energy production, but for simplicity, the national and international ZERO Code assumes that carbon emissions are constant for all times of the day and for all seasons. Compliance is achieved when annual renewable energy production is equal to or greater than annual building energy consumption.

A special version of the ZERO Code has been developed for California where solar represents more than 20% of annual electricity generation, and in this case, the contribution of renewable energy and the impact of building energy use is weighted hourly for different times of the day and for different seasons. A special technical support document for California provides more information. See http://zero-code.org/zero-code/zero-code-directory/.

The ZERO Code requires the addition of on-site or off-site renewable energy systems that will generate as much energy on an annual basis as the building uses for heating, cooling ventilation and other purposes. Site energy is used as the metric for comparing renewable energy production to building energy use.[1]

The ZERO Code requires that the building achieve a minimum level of energy efficiency independent of the amount of renewable energy installed or procured, but if greater energy efficiency is achieved, less renewable energy need be installed or procured. ASHRAE Standard 90.1-2019 or other model energy standards of equal or greater stringency are used to set this minimum. These standards are designed to reduce energy use and only indirectly reduce carbon use. Some adopting jurisdictions may wish to require beyond-code energy efficiency before requiring renewable energy systems, and for this reason, optional language is provided in the ZERO Code to enable beyond-code energy efficiency. In these

[1] In mixed fuel buildings, using site energy as the metric for evaluation, results in more renewable energy offset than either source energy or carbon emissions, based on United States national average source energy use and carbon emissions associated with electricity use.

cases, the prescriptive approach to energy efficiency compliance is eliminated and all buildings would be required to use the performance approach to show that they comply with the beyond-code requirement.

In areas with clean grids, electric heat pumps for space and water heating result in significantly less carbon emissions than comparable gas-fired equipment. The ZERO Code has a separate option that prohibits the use of on-site combustion of fossil fuels. However, when on-site combustion is allowed, additional renewable energy must be procured to offset the gas or fossil fuel energy use.

On-site renewable energy systems are preferable when they are feasible because they generally have a bigger impact and result in more environmental benefit. This TSD describes criteria used to compare off-site renewable energy procurement to on-site systems, within the context of the ZERO Code, and presents a process for evaluating and assigning a weight to each procurement method. The feasibility/desirability of each option will vary with how the regional electric grid is structured and the laws and regulations applicable to each city, state, province, country or local jurisdiction that adopts the ZERO Code. It is anticipated that qualifying off-site renewable energy systems and their weightings will vary with each adoption of the ZERO Code. A key purpose of this TSD is to provide information to enable these adaptations.

2. COMPARING ON-SITE RENEWABLE ENERGY TO OFF-SITE PROCUREMENT

The benefit of on-site renewable energy systems is clear and obvious in most cases. Durable and new generation capacity is added in proportion to building energy use, usually by solar photovoltaic (PV). The system is generally a visible asset which inspires others. Marginal environmental impact is low, since the collectors take up roof space or shade parking over land that is already developed. There are other benefits as well, as summarized in Table 1. Off-site renewable energy systems and methods of procurement also have benefits, but in some cases, there are issues as summarized in Table 1.

Table 1 – Features and Benefits of On-Site Renewable Energy Systems

Criteria	*Benefits of On-Site Renewable Energy*	*Issues with Off-Site Procurement*
Generator Type	Almost all on-site renewable energy systems are solar PV.	Some off-site programs backed by biomass generators with questionable benefits with regard to carbon emissions.[2]
Renewable Energy Certificates (RECs)	For self-owned systems, the building owner is legally entitled to claim all the environmental benefits associated with the renewable energy system.[3]	With many community solar systems, the RECs are not passed on to the building that is using the electricity. In many cases, the RECs are sold to the electric distribution company to assist in meeting their Renewable Portfolio Standard (RPS) requirement, which does not achieve additionality.
Impact / Additionality	The on-site renewable energy system did not previously exist and was clearly added as part of the construction project to meet some or all of the electric loads of the new building.	Many off-site renewable energy projects do not depend on the sale of RECs to be economically viable. As result, the purchase of unbundled RECs may not result in the construction of new renewable energy capacity.

[2] The stack carbon and other emissions from biomass electric generators are excessive, even greater than many coal plants and most gas plants. – source?

[3] However, with many direct power purchase agreements and solar leases, the RECs may reside with the seller and may be sold to the electric distribution company to help them meet the requirements of their renewable portfolio standard.

Table 1 – Features and Benefits of On-Site Renewable Energy Systems

Criteria	*Benefits of On-Site Renewable Energy*	*Issues with Off-Site Procurement*
Durability	The system is installed on the roof of the building or elsewhere on the property and is a durable energy asset that will last for a long time.	A long-term commitment is not required for some methods of purchasing off-site renewable energy such as green electricity pricing or community solar. Building owners can opt out on short notice and if the building is sold, the new owner may abandon the purchase commitment.
Permanent Financing	When the renewable energy system is constructed along with the building, its cost can be included in the mortgage or other long-term financial instrument used to pay off the building.	Most off-site procurement of renewable energy is considered an operational expense as opposed to a capital cost.
Inspirational/ Educational Value	The renewable energy system is a visible asset with the potential to inspire other building owners to install their own renewable energy systems. Tours or monitoring equipment in public spaces can also have educational value.	The renewable energy system is not visible from the building site. Signage or other communication techniques are needed to document that the building is using renewable energy.
Land Use	The on-site system does not require the development of additional land that might be left in open space or wilderness.	Many off-site renewable energy systems take up land in remote or wilderness areas that reduce or modify wildlife habitat.[4]
Grid Integration	On-site PV systems produce energy in the day, but not at night. In areas with a high saturation of solar, this can be a problem but in areas with little solar, it can be a benefit since electricity is injected into the grid during typical periods of high demand.	Utility-scale wind and solar farms can be directly controlled by the balancing authority to prevent over-generation and provide other power quality functions. Many utility-scale PV systems track the sun which results in a higher capacity factor.[5]
Assignment of Benefits to a ZERO Code Building	An on-site renewable energy system is part of the ZERO Code building and all electricity production is directly associated with the ZERO Code building.	With some off-site procurement methods, the amount of renewable energy purchased is independent of the energy use of the ZERO Code building. An accounting system is needed to assign the benefits of the off-site purchase to the ZERO Code building or other properties being served.
Incremental Acquisition	On-site solar systems can be sized to meet or exceed building energy use.	Some off-site procurement programs require a minimum purchase that will often exceed the electricity consumption of the ZERO Code building, requiring an accounting system to assign the benefits.
Ability to buy more power than the building uses	On-site renewable energy systems can be net producers, although compensation for excess generation may be credited at a lower rate.	The amount of electricity that may be purchased through green electricity pricing, community solar or utility renewable energy contracts is limited to the amount of electricity consumed by the building. Using these procurement methods, additional renewable energy can't be purchased to offset possible on-site fossil fuel combustion or to accommodate a procurement factor less than one.

3. OFF-SITE RENEWABLE ENERGY PROCUREMENT METHODS

This section describes the common methods of buying off-site renewable energy and compares each to on-site renewable energy in terms of impact/additionality, durability and other criteria. On-site renewable energy system are defined as systems located on any of the following: the building, the property upon which the building is located, a property that shares a boundary with and is under the same ownership or

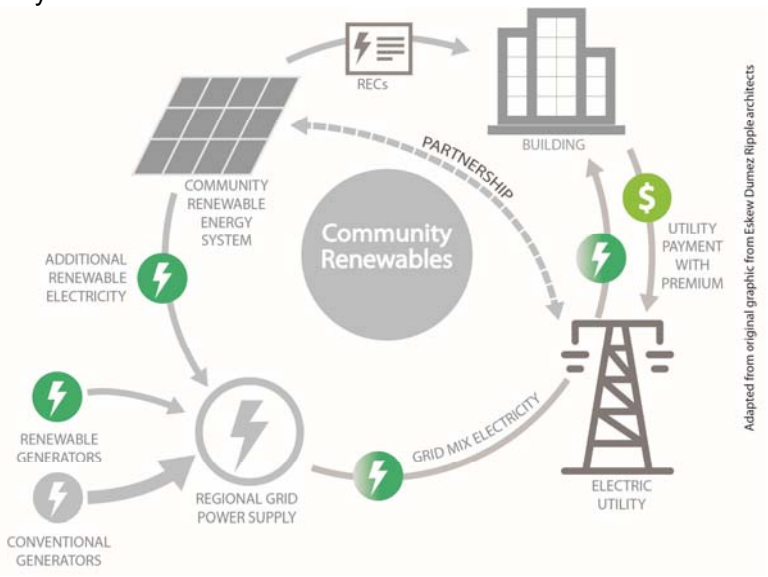
[4] However, wind turbines are typically installed over farm or grazing land and have little environmental impact.

[5] Capacity factor is the annual production compared to the production assuming the systems were producing at 100% power all the time. The capacity factor for stationary solar PV systems is in the range of 30%.

control as the property on which the building is located, or a property that is under the same ownership or control as the property on which the building is located and is separated only by a public right-of-way on which the building is located.[6]

The discussion of procurement options in this section is in the context of the ZERO Code requirements which apply to a single building for which compliance is either required or implemented voluntarily. Typical discussions of these procurement options are in the context of corporate purchases that are independent of a specific building or property.

3.1 Community Renewables



When available, community solar is an attractive option for small businesses and residential customers that have a moderate load but can't install on-site renewable energy because of shading or other limitations. With this arrangement, a renewable energy developer constructs a wind or solar farm and offers capacity to individual building owners or energy users. The local utility is usually a partner with the renewable energy developer. Typically, renewable energy production is directly credited to the building owner's utility bill as if the solar panels were located on the roof or elsewhere on the property. For this reason, it is not possible to purchase more electricity from a community solar system than the building uses.

> ***Issues:***
>
> Purchase cannot exceed building electricity use.
>
> RECs are often not provided to the building owner.
>
> It's easy to opt out of the commitment.

Most community renewable energy programs generate electricity with solar photovoltaics, but other sources of renewable energy are possible, in particular, wind. An advantage of solar is that it is incremental, meaning that a portion of the production can be easily assigned to each program participant by allocating a certain number of panels to a specific building or electricity account. Similar accounting can still be done with wind, but the allocation is made in terms of units of production like MWh instead of specific equipment like a given number of solar panels. An individual building would typically need only a portion of a wind turbine's capacity.

There are two participation models for community solar: long-term and short-term. With the long-term model, the building owner/developer purchases or leases enough capacity to offset building energy and

[6] This definition is included in the ZERO Code and is adapted from ASHRAE 189.1-2020.

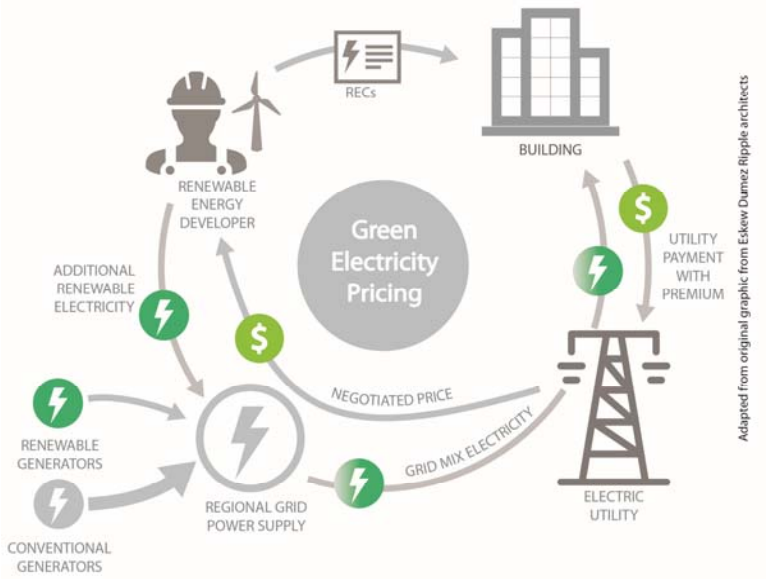
qualify for the ZERO Code. The short-term participation model is much more akin to a green tariff and typically allows the owner/developer to opt out of the agreement on short notice.[i]

Community solar programs are active in the states of Colorado, Delaware, Maine, Massachusetts, Minnesota, New York, Vermont, and Washington, but other states are in the process of implementing programs including California, Hawaii, and Maryland, as well as the District of Columbia.

In order for a specific building to claim the benefits from community renewables programs, the RECs and other environmental attributes associated with the renewable energy production of community solar must be assigned to the ZERO Code complying building. However, this essential requirement is not satisfied by most community solar programs in the United States. Most programs keep the RECs and sell them in order to improve the financial viability of the program.[8] Buying renewable energy without the RECs does not achieve the goals of a ZERO Code complying building because someone else owns the rights to the environmental benefits.

3.2 Green Electricity Pricing

Many utilities, community choice aggregators, and other retail electricity providers offer their customers the option of buying 100% renewable energy from the grid. This offering typically comes at a premium, usually in the range of about $0.02/kWh.[9]



In California and some other states, all retail electric providers must report renewable content separately for each offering, but this requirement may not apply in all jurisdictions. This prevents renewable energy sold through 100% renewable energy programs from being double counted in the standard offering.[10] If the accounting is separate for each offering, there is less chance that retail providers will blur the lines between their default portfolio and special renewable energy offerings or green tariffs.

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[i] Since solar production is seasonal, most programs require at least a year of participation to include both the cloudy and sunny months.

[ii] National Renewable Energy Laboratory document 49930 reviews a number of community solar programs in the United States and virtually all of them keep the RECs and in some cases sell them to utilities to help them comply with their renewable portfolio standards.

[iii] A typical offering is the EverGreen program offered by Sonoma Clean Power.

[43] California for instance has “buckets” of renewable energy sources. The first Bucket, and the preferred method, is renewable energy systems that sell power directly to the California ISO. At least 75% of the renewable energy must come from this bucket. The second bucket is renewable energy that is “firmed and shaped”, e.g. variable solar energy is supplemented and augmented with conventional sources to better alilgn with electricity demand. Unbundled RECs represent the third bucket and cannot exceed 10% of the renewable energy purchased to meet the RPS requirement.

Like community solar, the amount of renewable electricity that can be purchased is limited by the electricity consumption of the building. This prevents, for instance, the purchase of additional renewable electricity to make up for natural gas consumption or for any discounts that are applied to this method of off-site renewable energy procurement.

Issues:

Purchase cannot exceed building electricity use.

It's easy to opt out of the commitment.

Renewable energy generators backing the claim may not be new and not always carbon free, e.g. biomass.

Offerings are sometimes based on the purchase of unbundled RECs.

Another problem with this method of acquiring renewable energy is that almost all green electricity pricing programs are voluntary and the customer (buyer) can easily opt out of the program on short notice and revert back to the standard offering. This creates a loophole that seriously erodes the durability of this procurement option. In order to qualify for the ZERO Code, the program must be structured such that the building developer/owner makes a long-term commitment to buy 100% renewable energy, and the obligation needs to be passed on to future owners in the event that the property is sold.

To address durability, some retail providers are evaluating methods whereby customers can pre-pay for 100% renewable energy at the time of building construction.[11] This could potentially enable the premium to be financed as part of the initial construction cost. Future building owners and/or tenants would receive 100% renewable energy, but pay according to the standard (default) tariff. Deed notations and/or covenants are other possible means of structuring a long-term commitment.[12]

Another issue with green electricity pricing is the type of renewable energy that backs the offering. The types of renewable energy offered through green electricity pricing programs may not qualify for ZERO Code credit. Wind, solar, and geothermal power plants are clearly renewable energy and are recognized as such in virtually all green pricing programs. More controversial sources are biomass and large legacy hydro-electric plants. Biomass is only renewable if a long-time horizon is considered and forest growth and expansion exceed wood harvesting and clearing, which is challenging to verify.

Hydro-electric plants are renewable energy generators driven by the movement of water through turbines, but it has been decades since new large-scale dams have been constructed in the United States. The best sites are already taken, and potential new sites are likely to face significant opposition from land owners, environmentalists, and other interest groups.[13] Most states exclude large legacy hydro-electric plants from qualifying to meet the RPS requirements in order to encourage investment in new renewable energy systems.

The renewable energy portfolio that backs up green retail tariffs often includes purchases of unbundled RECs. Like biomass and hydro-electric power, each state and each RPS ruling is different in the way unbundled RECs can be counted toward meeting the RPS requirement. The issues associated with

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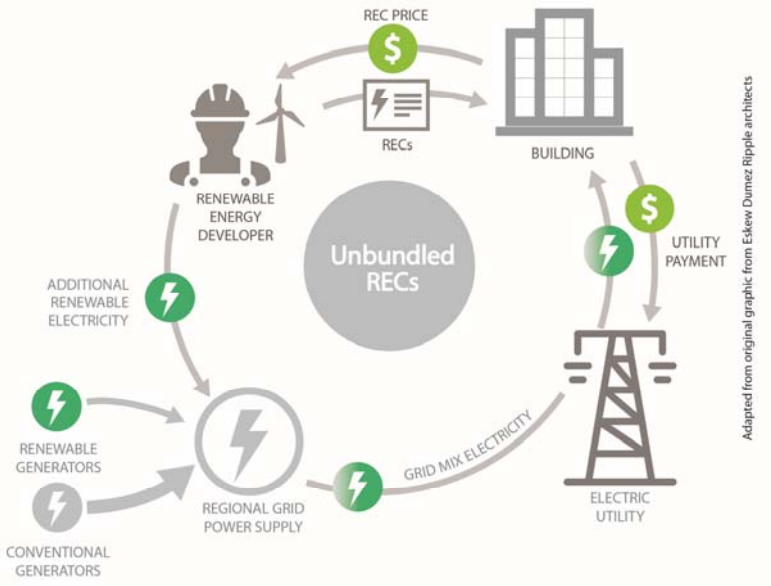
44 Sonoma Clean Power, a community choice aggregator serving Sonoma County, is exploring this option as a way to expedite building permit applications related to the reconstruction of homes destroyed by the Tubbs fire in Santa Rosa and surrounding areas.

12 The SolarShares community solar program offered by the Sacramento Municipal Utility District (SMUD) has been restructured so that the commitment to buy 100% solar energy is tied to the deed for the property. The SolarShares program qualifies as an alternative to the installation of on-site renewable energy, as required by California's Building Energy Efficiency Standards.

13 The Bridge Canyon Dam in the middle of the Grand Canyon has the greatest potential for additional hydro-electric generation in the United States, but it would flood about half of a great American treasure.

unbundled RECs (see below) trickle down to the green electricity pricing programs that are based on them.

3.3 Unbundled Renewable Energy Certificates



Renewable energy certificates (RECs) represent the environmental attributes or benefits associated with renewable energy. For most off-site procurement methods, RECs are used for tracking and verification of the renewable energy purchased. However, the RECs can be separated from the underlying renewable energy they are associated with and sold separately from the electricity, typically in increments of one MWh.

The concept of RECs is international, but the term used varies in other countries. REC is used in the United States, Australia, India and other places. A variation is called an I-REC (the "I" standing for international). Europe uses the term Guarantees of Origin (GOs), Mexico uses the term Certificados de Energia Limpia (CELs), and the term Tradable Instruments for Global Renewables (TIGRs) is used in other areas. In some countries more than one designation is used.

Unbundled RECs represent the most common method of voluntary purchasing off-site renewable energy in the United States.

Issues:

Prices for RECs with no restrictions are quite inexpensive, calling to question their effectiveness in achieving impact/additionality.

Durability requires a forward contract for long-term purchase.

Renewable energy generators backing the claim may not be new and not always carbon free, e.g. biomass.

RECs can be categorized in a number of ways according to the source of renewable energy (source), when the renewable energy was generated (vintage), and where it was generated (geography). The market sets a higher price for RECs when more conditions or restrictions apply. Certificates may be purchased directly from renewable energy project owners or through third-party brokers and are verified so that the purchaser can claim sole ownership of the generated renewable energy regardless of the ultimate destination of the electrons. Unbundled RECs in the United States with no restrictions are underpriced. The average cost of a REC (with no restrictions) is less than $1, or less than 5% of its true value to society. At a price this low, it is highly unlikely that the market will respond by installing new renewable energy generating capacity. The prospect of impact/additionality is extremely low.[14]

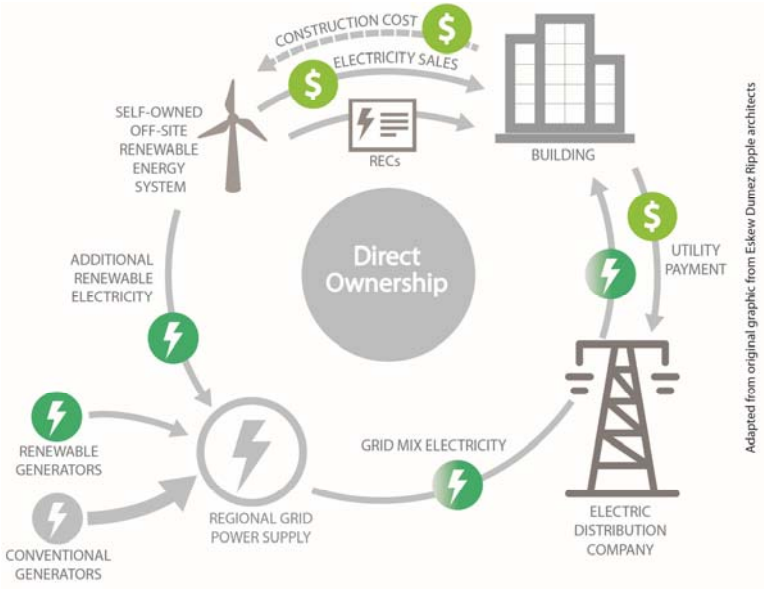
[14] However, Massachusetts Class I RECs are limited to renewable energy generators located in ISO New England and must meet other requirements established by Massachusetts DOER. These RECs are currently selling for about $20/MWh.

Even if RECs were properly valued, for the purchases to approximate the construction of on-site renewable energy, a forward contract would have to be structured such that the building owner, future building owner, and/or tenants would be required to purchase enough RECs to offset building energy for 15 years or more.

Finally, the type of renewable energy generators used to back unbundled RECs can vary considerably from wind and solar at one extreme to biomass at the other.

3.4 Direct Ownership

With direct ownership, the building developer/owner of a specific building purchases or leases a separate parcel and constructs a renewable energy system on that land to offset energy used at the building. The building draws power from the grid while the renewable energy system delivers power to the grid at a separate location. For this option to work, the building owner/developer would need to be able to sell power to the Independent System Operator (ISO), Regional Transmission Organization (RTO), or utility through a feed-in tariff or other means.



In some states, it is possible to establish a virtual net metering program whereby the remote renewable energy production is directly assigned to the electricity accounts of one or more buildings.[15] The energy produced and the environmental attributes (RECs, etc.) are automatically allocated to the referenced buildings.

Zero energy portfolios, campuses, and communities apply the principal of virtual net metering. For a zero-energy campus, the renewable energy system is located on the same property but not constructed as part of each individual building. Instead, renewable energy and the RECs are allocated as needed to separate buildings on the campus. For zero-energy portfolios and communities the arrangement is similar, except that the buildings and the renewable energy system(s) are typically located on separate sites.

Issues:

The RECs and environmental benefits need to be allocated to specific buildings in a fair and equitable manner.

A forward contract is needed to assure that the RECs will continue to accrue to the ZERO Code buildings in the event that the renewable energy system is sold to a third party.

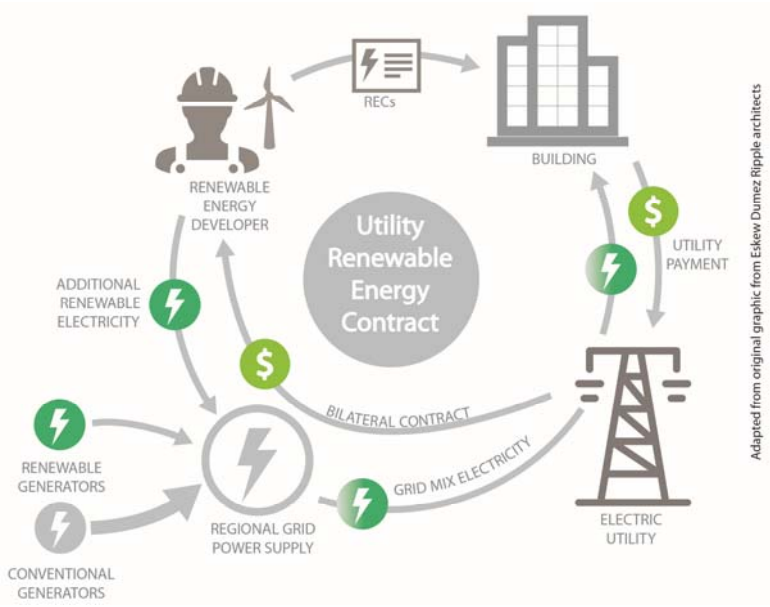
[48] In California, local governments and school districts can participate in a program called Renewable Energy Self-generation Bill Credit Transfer (RES-BCT) whereby a portion of the energy from a renewable energy system owned by the local government or school district can be credited toward the utility bills of specific buildings owned by the entity. System size is limited to 5 MW. Massachusetts has a more expansive program that is not limited to governmental entities or school districts.

There are several issues with regard to direct ownership of off-site renewable energy systems in the context of codes.

- The first is the accounting and recordkeeping involved in allocating production from the renewable energy system to the various buildings that depend on its production to comply with the ZERO Code. This needs to be done in an open and transparent manner that can be verified by third parties that are administering the ZERO Code.
- The second challenge is to assure that if the renewable energy system is sold separately from the ZERO Code building, that the RECs and other benefits would continue to accrue to the ZERO Code building.

A final consideration is that owning and operating a renewable energy plant is generally not a core competency of most businesses or institutions. For this reason, organizations often enter into agreements with energy service providers to construct and manage the off-site renewable energy system.

3.5 Utility Renewable Contract



Some electric utilities offer to procure renewable energy on behalf of large customers through a one-off bilateral contract or other arrangement. In these cases, the utility moves the customer to a custom rate structure to reflect the costs of the renewable energy project. It then buys renewable energy in the wholesale market or builds a renewable energy system and retires the RECs on behalf of the customer in proportion to their electricity consumption. The utility might fulfil its obligation by entering into a virtual power purchase agreement and aggregating several customers to meet the minimum size thresholds. Also, the long-term price predictability of utility renewable energy contracts may yield economic benefits that do not accrue through green electricity pricing programs.

Issues:

Available only to large customers.

Some programs are backed by the purchase of unbundled RECs.

The terms of the procurement contract can vary considerably and can specify the period of time and the source and location of the renewable energy generating plants.

In restructured electricity markets[16], large customers may also be able to shop for sources of electricity beyond the offerings of the local utility. Retail competition exists in some areas and electricity suppliers

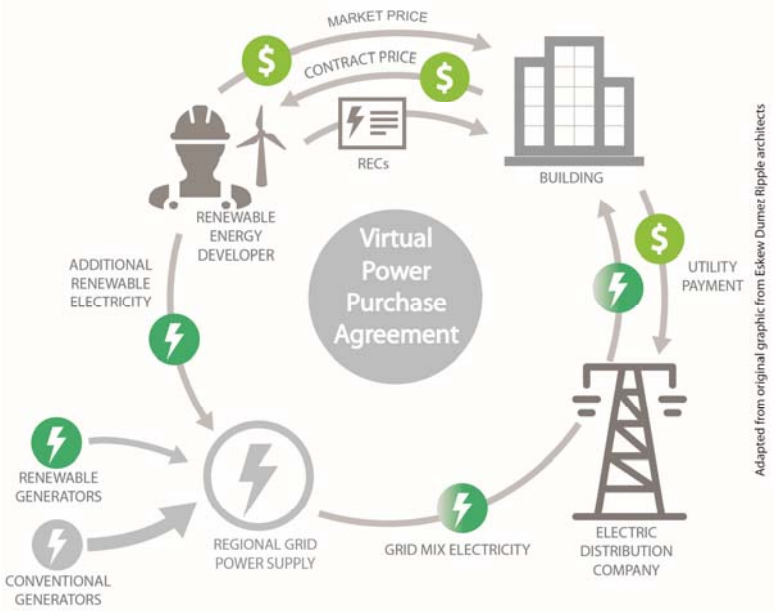
[16] Restructured electric markets are areas of the United States where there is a wholesale competitive market for electricity. These are generally areas served by Regional Transmission organizations or Independent Service Operators. About 75% of customers in the United States are served by restructured electricity markets.

compete with each other and with the default utility based on price and product differentiation. That differentiation is often renewable energy content. Suppliers can offer renewable energy products, either through direct sourcing from independent power producers or by bundling conventional electricity products with RECs. Retail competition allows large-building owners/developers to choose products that satisfy their renewable energy needs at competitive rates.

Most of the world's major electricity markets have been at least partially restructured. Retail competition is common in Europe, parts of the United States, Australia, Colombia, Japan, New Zealand, the Philippines, Russia, and Turkey. Mexico and most South American countries are moving toward retail competition.

3.6 Virtual Power Purchase Agreement

Direct (or physical) power purchase agreements (PPAs) are a common way to finance and install on-site PV systems.[17] Energy service providers install, own, and operate the PV system, which is located on a building owner's property. The building owner agrees to purchase power from the system for the term of the contract (usually 15 years) according to a schedule of prices set in the contract. The PV developer (or energy service provider) bears the cost and risks associated with construction and operation. The building owner agrees to buy the renewable power for the contract term, but often does not get to claim the environmental benefits since most contracts assign these to the seller.[18]



Virtual (or financial) power purchase agreements (PPAs) are a similar arrangement, except that the renewable energy system is not located on the building owner's property. Instead it is located in farm land, pastures, or rural land owned or leased by a renewable energy developer. While direct PPAs are almost exclusively PV systems, virtual PPAs often include wind. Virtual PPAs are the financial instrument most commonly used by large multi-national companies like Google and Amazon to acquire renewable energy to offset their operations. The buyer (customer) agrees to buy power from the system at a specified price schedule and period of time. In this way, they avoid the price fluctuations of the energy market and assume more predictable utility expenses. If prices go up, they benefit; however, if prices go down, they end up paying more. Virtual PPAs are sometimes called a "contract of differences".

[4:] The investment tax credit for solar energy in the United States has encouraged schools, local governments and other entities that do not pay federal tax to procure solar though direct PPAs. With this arrangement, the solar service provider can realize the tax advantages, which the school or government can't take advantage of.

[4;] With many, if not most, direct PPAs, the seller keeps the RECs and other environmental benefits. Sometimes these are sold to utilities to help them meet the requirements of their renewable portfolio standard. In fact, the model PPA agreement promoted by the Solar Energy Industries Association (SEIA) states that the environmental attributes are assigned to the seller. See SEIA in the Appendix.

The RECs and environmental benefits of virtual PPAs are typically assigned to the buyer. The Rocky Mountain Institute Business Renewables Center developed a Term Sheet for negotiating virtual PPAs and this document makes it clear that the RECs and environmental benefits are assigned to the buyer, in contrast to the typical direct PPA.[19] Since one of the motivations of international companies to enter into virtual PPAs is to claim the environmental benefits, having the RECs assigned to them is essential.

Issues:

Available only to large customers with an excellent credit rating.

Large purchases are required, generally at least 5 MW for solar and 10 MW for wind.

Renewable energy generators are sometimes located far from the ZERO Code building.

A tracking system is needed to allocate the RECs and environmental benefits to specific buildings.

Proximity is a potential issue with virtual PPAs. Sometimes the renewable energy system is located in a separate electric grid, thousands of miles from the electric load it is offsetting. Many buyers of virtual PPAs prefer to enter into agreements with renewable energy systems located close to their facilities, or at least in the same electric grid or market.

Another issue is that virtual PPAs are an agreement between an organization (often a corporation) and a renewable energy developer. They are not associated with a particular building that is complying with the ZERO Code. This creates an accounting and record keeping challenge similar to that discussed with the direct ownership option. Transparent documentation is needed to assure that an adequate portion of the environmental benefits from the renewable energy system are assigned to the ZERO Code complying building for a minimum period of time and are not double counted.

In traditional energy markets (no retail competition), the vertically integrated utility[20] will sometimes serve as the broker for virtual PPAs between renewable energy developers and their large customers; this is addressed here under utility renewable energy contracts.[21]

Incremental acquisition is a challenge with virtual PPAs. The minimum size for solar virtual PPAs is about 5 MW and the minimum size for wind PPAs is about 10 MW.[55] A 5 MW solar system would power approximately one million ft² of office space. Also, the counterparty to the renewable energy developer must have an excellent credit rating. The minimum renewable energy system sizes and credit requirements make virtual PPAs an unlikely option for small developers or building owners. However, governmental entities or utilities could serve as the counterparty and sell or allocate shares to individual building owners.

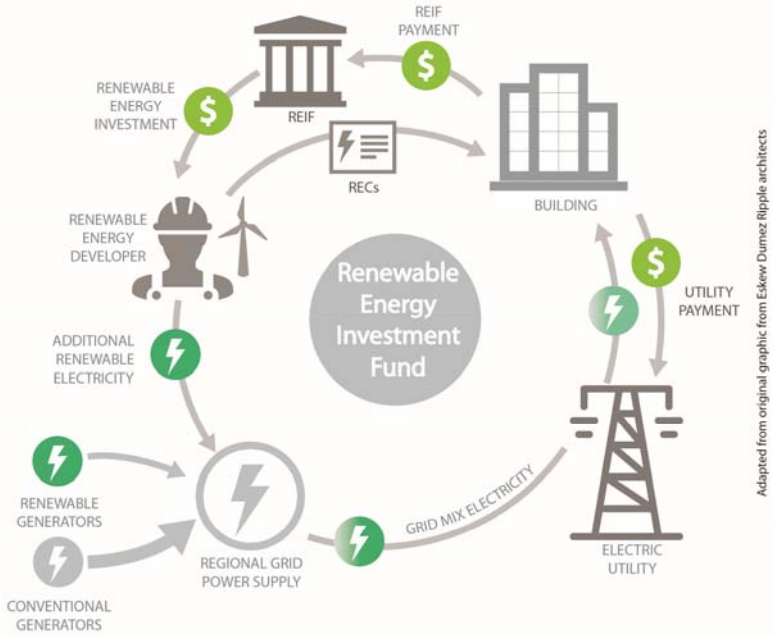
4< See Rocky Mountain Institute in the Appendix.

20 Vertically integrated utilities are common in the southeast United States and much of the northwest. In these cases, the utility owns and manages everything: the generators, transmission lines, substations, distribution lines all the way down to the building meter.

54 See Lori Bird, et. al., Policies for Enabling Corporate Sourcing of Renewable Energy Internationally, A 21st Century Power Partnership Report, NREL/TP-6A50-68149, May 2017

55 These thresholds were provided by Blaine Collison, Managing Director of Marketing & Strategic Partnerships for Altenex, a company that brokers deals between renewable energy developers and buyers of virtual PPAs and other renewable instruments.

3.7 Renewable Energy Investment Fund



A Renewable Energy Investment Fund (REIF) is a monetary account set up to accept payment from building owners or developers who are unable to install enough on-site renewable energy. Management of the fund can vary but would likely be done through a local or provincial governmental entity, although utilities may also have a role, depending on local circumstances. The managing entity would use the money to acquire or lease land and install renewable energy systems to offset the energy used by the building. The managing entity may choose to outsource development responsibility to renewable energy developers or even purchase virtual PPAs. Creating a REIF may be especially appealing in adopting jurisdictions where community solar is not available.

Payment would be made to the REIF before building occupancy. Or it could be paid over time. If paid up front, it might be included in the initial construction cost and financed through the mortgage or other long-term instruments. The payment would be proportional to the amount of renewable energy required by the ZERO Code and represent a specific amount of renewable energy capacity or production. The environmental attributes associated with the renewable energy system, including RECs and/or carbon credits, would be assigned to the building owner or developer for a minimum 15-year and live with the building in the event of a sale.

Issues:

Renewable energy generators might be located far from the building load they are offsetting.

With a subscription model, it might be easy to opt out of the program.

The type of renewable energy generator, its location and vintage may be an issue if revenue is used to purchase unbundled RECs.

Low-income housing programs provide an analogous precedent for REIFs. In communities with requirements for low-income housing, developers often have the option to either provide a certain percentage of low-income housing as part of their project or alternatively, they may contribute to a fund that the local housing authority uses to build low-income housing on another site.

If the program is set up properly and effectively managed, it should provide near equivalency to the installation of on-site renewable energy systems in terms of durability and additionality. Contributions to the REIF would result in new renewable energy generation being added to the grid and operated for the long-term. In order for the program to function, the REIF would need to sell power into the grid. This is easily accommodated in restructured electric markets, but in areas dominated by vertically integrated

utility companies, some sort of reasonable feed-in tariff[23] would need to be negotiated with the utility for a period of time that is long enough for the capital investment in the renewable energy system(s) to be financially viable.

The amount of money to be paid to the REIF should be adequate to attract renewable energy developers. The basis for the payment can be justified from a number of perspectives.

- Social Cost of Carbon – Societal Benefit. The contribution can be based on the benefit to society.[24]
- Renewable Energy Developer Pro Forma. The contribution can be set at a level necessary for investments to work out for the renewable energy developer. This amount will depend on applicable feed-in tariffs, land purchases or leases, and the cost of installing and operating the renewable energy systems.
- Building Owner/Developer Pro Forma. The contribution can be set at a level that is comparable to the cost of on-site PV.[25]

With the REIF, building developers are paying in advance for the impact their buildings will have on climate change and this money is used to construct off-site renewable energy systems to offset that impact.

The managing entity for the REIF could use the money in a number of ways:

- The most direct use of the funds would be to construct or expand a PV system on behalf of the participating property owner and assign RECs (and perhaps electricity as well) to the property. In this case, the REIF would own, manage and operate the system(s). With this option (and with virtual net metering if available), the REIF program could function much like a community solar program where participants pay in advance through a REIF contribution for enough capacity to offset the building's energy use.
- Rather than directly owning the renewable energy system, a second investment opportunity for the REIF is to contract with a third-party for the construction, operation and management of the renewable energy system. The third-party renewable energy developer would sell power into the grid, but the environmental attributes associated with the renewable energy, including RECs and/or carbon credits, would be assigned to REIF participants. They could also be structured to transfer to the new property owner in the event of a sale. The contract with the third-party renewable energy developer could be structured in many ways, but one option would be through a vPPA.

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[23] Feed-in tariffs are common for utility-scale renewable energy systems and are widely used in the European Union (EU). The renewable energy developer signs a contract to sell electricity into the grid. In restructured electricity markets, the price will be set by supply and demand and vary with season and time of day. Feed-in tariffs are used in the EU to encourage renewable energy investment by offering a contract price that sometimes exceeds retail rates.

[24] In the United States the Environmental Protection Agency, along with several other agencies, calculated the social cost of carbon in 2018 at about $40/tonne of CO_2e emissions. Average emissions for United States electric power production are about 0.61 tonnes/MWh. This results in a societal benefit of about $25/MWh of renewable energy production (not including the value of energy produced). The net present value of this benefit over a 30-year building life at a 3% discount rate is about $400/MWh of annual renewable energy production.

[58] The cost of installing on-site PV is in the range of $1,500 to $3,000 per kW_{stc} of capacity, but this includes the benefit of electric power as well as the environmental benefits. The fee to the REIF should only include the environmental benefit portion of the cost.

- A third option is for the REIF to purchase unbundled RECs on behalf of program participants. Small businesses or home owners may find it difficult to locate a broker and directly buy unbundled RECs, and the REIF could make the process seamless.

4. COMPARISON OF RENEWABLE ENERGY PROCUREMENT OPTIONS

Table 2 shows the advantages and disadvantages of each renewable energy procurement option from the perspective of the building owner/developer. These bullet points were taken from a National Renewable Energy Laboratory (NREL) report[59] that looks at voluntary programs at the international level. When the requirements needed to qualify for the ZERO Code are factored in, some of these advantages and/or disadvantages are negated. These are shown in italics when negated.

Table 2 – Advantages, Disadvantages, and ZERO Code Requirements for Off-Site Procurement Methods

	From NREL Report (points negated by ZERO Code requirements are italicized)		
Option	*Advantages to Owner*	*Disadvantages to Owner*	*ZERO Code Requirements*
Direct Ownership	Control over the generation asset Energy savings and potential demand charge savings Fixed electricity costs for the project lifetime Visible renewable energy project with potential local impacts Greater power reliability if used with storage in areas with weak grids Drives a new renewable energy project and new renewable energy capacity	Requires up-front capital investment or need to obtain financing Project may need to compete for internal capital and meet internal return rates Corporate owner responsible for long-term operations and maintenance Corporate owner bears risk of potential underperformance of assets On-site projects may only be able to meet a small fraction of load	Transparent accounting shall assign production to the ZERO Code complying building(s) Ownership of remote generation asset must be tied to the ZERO Code complying building so it can't be sold separately RECs and/or other environmental attributes must be allocated to the ZERO Code complying building(s) Generation source(s) shall be wind, solar, and/or geothermal Generation source(s) shall be located within the same geographic area and utility grid as the ZERO Code complying building
Community Renewables	*Flexible terms, no long-term requirements* No project-level risk Simple to align with existing electricity procurement practices	Less compelling marketing Generally, less control over resource type and project details There may be no new renewable energy capacity added to the energy system in some cases May not yield cost savings or long-term price certainty equivalent to other structures	A 15-year commitment is required RECs and other environmental attributes shall be assigned to the ZERO Code complying building(s) Generation sources shall be wind, solar, and/or geothermal Generation sources shall be located within the same geographic area and utility grid as the ZERO Code complying building

[59] Lori Bird, et. al., Policies for Enabling Corporate Sourcing of renewable energy Internationally, A 21st Century Power Partnership Report, NREL/TP-6A50-68149. Developed in cooperation with the Center for Resource Solutions, International Renewable Energy Agency and World Resources Institute.

Table 2 – Advantages, Disadvantages, and ZERO Code Requirements for Off-Site Procurement Methods

	From NREL Report (points negated by ZERO Code requirements are italicized)		
Option	*Advantages to Owner*	*Disadvantages to Owner*	*ZERO Code Requirements*
Virtual Power Purchase Agreements	No up-front capital investment for the corporate off-taker Facilitates transactions with large renewable projects with economies of scale Developer assumes project risk and handles operations and maintenance Possibility for price hedging through fixed PPA price or contract-for-differences PPA contracts may yield net savings in some markets	Some contract durations (e.g., 15 years) may be long for corporations given business strategy timeframes Typically requires approval of executives in the corporation *Power price risk and basis risk if the project is located in a region that is different from where energy is consumed* It may be more difficult for corporations to clearly communicate the value of renewable energy procurement via a financial PPA Other risks include counterparty and accounting risks	A 15-year commitment is required RECs and other environmental attributes shall be assigned to the ZERO Code complying building(s) Generation source(s) shall be wind, solar, and/or geothermal Generation source(s) shall be located within the same geographic area and grid as the ZERO Code complying building
Renewable Energy Investment Fund (REIF)	Not addressed by NREL	Not addressed by NREL	REIF must be properly and effectively managed RECs and/or carbon credits shall be assigned to the ZERO Code complying building(s) REIF shall invest in solar, wind, and/or geothermal
Utility Renewable Energy Contract	Cost savings possible—competitive supplier may offer lower rates than incumbent utility No up-front capital investment *Period of commitment may not be long (some suppliers offer near-term fixed rates)* Corporation not responsible for operations and maintenance	Corporation may have little control over project from which renewable energy is sourced Pricing can change unless locked into a long-term contract Markets can have volatility and there can be turnover in suppliers Renewable energy may be sourced from older or non-preferred renewable energy sources	A 15-year commitment is required RECs and other environmental attributes shall be assigned to the ZERO Code complying building(s) Generation source(s) shall be wind, solar, and/or geothermal Generation source(s) shall be located within the same grid and geographic area as the ZERO Code complying building The offering shall not be based on the purchase of unbundled RECs
Green Electricity Pricing	No up-front capital investment for the corporate off-taker Ability to work directly with current service provider (i.e., the vertically integrated utility) Some programs offer long-term fixed price More favorable pricing than green pricing programs Corporate purchaser not responsible for operations or maintenance	Not all utilities offer programs, so not universally available Corporations have less control over project details by working through utility rather than directly with developer Pricing and program structure can require substantial negotiations with the utility *Typically, a long-term commitment* May not yield cost savings equivalent to PPAs or other structures	A 15-year commitment is required RECs and other environmental attributes shall be assigned to the ZERO Code complying building(s) Generation source(s) shall be wind, solar and/or geothermal Generation source(s) shall be located within the same grid and geographic area as the ZERO Code complying building(s) The offering shall not be based on the purchase of unbundled RECs.

Table 2 – Advantages, Disadvantages, and ZERO Code Requirements for Off-Site Procurement Methods

	From NREL Report (points negated by ZERO Code requirements are italicized)		
Option	*Advantages to Owner*	*Disadvantages to Owner*	*ZERO Code Requirements*
Unbundled RECs	*No project-level risk* Simple to align with existing electricity procurement practices *Flexible terms, no long-term requirements*	Less compelling marketing *Generally, less control over resource type and project details* There may be no new renewable energy capacity added to the energy system in some cases May not yield cost savings or long-term price certainty equivalent to other structures	A 15-year purchase commitment is required Generation source(s) shall be wind, solar, and/or geothermal Generation source(s) shall be located within the same grid and geographic area as the ZERO Code complying building The vintage of the RECs shall align with building energy use

5. MINIMUM REQUIREMENTS FOR OFF-SITE PROCUREMENT METHODS

Not all off-site procurement options are equal in terms of their environmental and carbon reducing impact. The best option if it is available and feasible is to install on-site renewable energy. In this case, you know that the generation source is solar, that the commitment is durable, will be a part of the building for a long time, and that the RECs are not being sold separately. The following three minimum requirements should apply to any and all off-site procurement options:

- *Generation Source*. The renewable energy generating source should be photovoltaic systems, solar thermal power plants, geothermal power plants, or wind turbines and located reasonably close to the building. Biomass power plants do not qualify unless they are powered from captured methane that would otherwise escape into the atmosphere.
- *Durability*. The procurement should represent a long-term commitment, similar to building your own solar system. The commitment should survive the sale of the property.
- *Renewable Energy Certificates*. RECs and other environmental attributes associated with the renewable energy are not sold off to a third party but become part of the property or are retired on behalf of the property owner.

Table 3 summarizes how each of the procurement options described in the previous section satisfy the minimum requirements.

Table 3 – Minimum Requirements for Off-Site Renewable Energy Procurement Options

	Issues Meeting the Minimum Requirements		
Procurement Option	*Generation Source*	*Durability*	*Renewable Energy Certificates*
On-Site (Off-site options are compared to this)	Will be solar PV in almost all cases.	The system is on-site but can be self-owned or installed through a solar lease or direct PPA.	Some owners have been known to sell the RECs, and direct PPA contracts often assign the RECs to the seller.
Community Renewables	Usually solar but could be another type of generator.	It's easy to opt out of most programs.	Most existing community renewables programs do not provide RECs to the participant.
Green Electricity Pricing (includes competitive suppliers and Community Choice Aggregators (CCAs))	Some are backed by wind RECs from Texas or the Great Plains.	Generally, a problem, but forward contracts may be used to establish a long-term commitment.	RECs are provided with most green pricing programs.

Table 3 – Minimum Requirements for Off-Site Renewable Energy Procurement Options

	Issues Meeting the Minimum Requirements		
Procurement Option	*Generation Source*	*Durability*	*Renewable Energy Certificates*
Unbundled RECs	Can be any type of generator, but mostly wind with some solar.	Forward contracts can be used to establish a long-term commitment.	RECs are the asset being purchased.
Direct Ownership	Will typically be wind or solar.	Forward contracts for RECs can provide durability in the event that the system is sold separately.	Forward contracts can assure that RECs are passed on to the ZERO Code complying building.
Utility Renewable Contracts	Wind and solar are most typical.	Contracts are for the long-term.	Customers contract for RECs and energy.
Virtual PPA (limited to large credit-worthy organizations)	Wind and solar are the most common, but other renewable generator types are possible.	Long-term contracts are a requirement.	RECs are provided; this is the essence of the deal.
Renewable Energy Investment Fund (REIF) (three investment options)	REIF management establishes criteria.	Contribution can be an up-front payment or a subscription.	RECs would be assigned to ZERO Code complying buildings.

The three minimum requirements detailed above are mandatory. In addition, there are other factors to consider in evaluating off-site procurement methods relative to on-site construction. These are more subjective and require a qualitative evaluation.

- **Impact/Additionality**. The likelihood that additional renewable energy generating capacity will be added to the grid in proportion to the building's energy use.
- **Electricity Credit**. Electricity production from the renewable energy system is directly credited to the building's account and is visible on each month's bill.
- **Inspiration/Education Value**. The renewable energy system is a visible asset and has the potential to inspire and educate others on the benefits of renewable energy.
- **Land Use**. The renewable energy system has minimal impact on natural resources and habitat.
- **Grid Integration**: The renewable energy system can be managed to supply the grid when power is needed but to avoid over-generation for low-load conditions.
- **Incremental Acquisition**. The renewable energy can be procured or installed in increments to match the exact loads of the ZERO Code complying building (some procurement options require a minimum contract that exceeds the needs of the building).
- **Permanent Financing**. The cost of the renewable energy system or procurement is known at the time the building is constructed and can be included in the permanent financing for the project.

To address these differences, the ZERO Code applies a procurement factor to off-site procurement options when they are not deemed to be equivalent to on-site renewable energy. The procurement factor considers how well each option meets the minimum requirements and the additional considerations discussed above. If a procurement option is considered to be only 80% effective as on-site solar because it is less durable and is expected to have less impact, then the procurement factor is 0.80. This means that if you need to offset 100 MWh of electricity consumption, you would need to buy 125 MWh (100/0.80)

of electricity through that procurement option as opposed to generating 100 MWh of renewable energy on-site.

The procurement factors are quite sensitive to local conditions and the availability of various off-site renewable energy procurement options. Architecture 2030 recommends that the procurement factors be adjusted by each adopting jurisdiction.

6. ADJUSTED OFF-SITE RENEWABLE ENERGY

Some methods of off-site renewable energy procurement are preferred over others, depending on local factors, considerations, and priorities. For instance, methods with a greater probability of impact/additionality (the likelihood that new renewable energy generating capacity will be installed) or that involve a solid commitment to purchase or acquire renewable energy for the long term (durability) are favored over procurement methods that do not have these characteristics.

The method used in the ZERO Code to encourage one procurement method over another is to apply a multiplier to each procurement option. On-site renewable energy is normalized with a multiplier of 1.0 and each off-site procurement method has a multiplier relative to on-site renewable energy. The adjusted renewable energy is calculated as the amount procured times the multiplier. If an off-site procurement option has a multiplier greater than one (not common, but possible), the option would be favored over on-site renewable energy and the adjusted renewable energy for that option would be greater than the amount procured. High multipliers apply to the more favorable procurement options while low multipliers apply to less favorable options. The process for calculating the adjusted off-site renewable energy is shown in the following equation:

$$RE_{offsite} = \sum_{i=1}^{n} PF_i \cdot RE_i$$

where

$RE_{offsite}$ Adjusted off-site renewable energy (MWh)

PF_i Procurement factor for the i^{th} renewable energy procurement method (unitless)

RE_i Electricity purchase for the i^{th} renewable energy procurement method (MWh)

n The number of renewable energy procurement methods considered

With many procurement options, the amount of renewable energy procured must match the building net electricity use. This is the case for green electricity pricing, community solar and utility renewable energy contracts. When a minimum amount of on-site renewable energy is installed and the building is all-electric, the ZERO Code allows a procurement factor of one for these options.

The procurement factors are determined by judging how well each off-site procurement option meets the evaluation criteria. Each criterion is given a weight to represent its relative importance. Each procurement option is then judged relative to each criterion on a subjective scale, e.g. the inspirational/educational value of an option is judged to be high, medium, low, or zero. The subjective scores are then translated into simple numerical scores and an overall multiplier is calculated for each procurement option.

Considerable judgment is involved in weighting the criteria, scoring each procurement option, assigning procurement options to a class, and choosing how much to mark down the off-site procurement method.

The risks associated with each procurement method are mitigated to some extent by the minimum requirements. Additional locality-specific mitigating requirements can be added when the ZERO Code is adapted for specific cities, states, provinces, or countries. This may further reduce risk and result in higher multipliers. When the ZERO Code is adapted for other locations, one or more of the procurement methods may be unavailable, or other procurement methods specific to the jurisdiction may be available and preferred. Appendix A provides an example of how the weighting process has been completed for United States conditions.

APPENDICES

APPENDIX A: CALCULATION ZERO CODE 2.0 PROCUREMENT FACTORS

This appendix documents the procedure used to calculate the default procurement factors published in the ZERO Code Version 2.0. This procedure is implemented in a spreadsheet that is available to adopting jurisdictions. Architecture 2030 recommends that the default procurement factors be modified for local conditions. The ZERO Code 2.0 default procurement methods and variations are described in Table 5

Each of the renewable energy procurement methods and variations are scored in terms of seven criteria listed in Table 4. Each of these criteria are given a weight to indicate their importance. The minimum criteria listed in Table 3 are given a weight of zero since they are mandatory.

Table 4 – Scales and Weight for each Evaluation Criterion – United States

Criteria	*Weight*	*Scales*			
Impact / Additionality	37%	High	Medium	Low	Zero
Electricity Credit	15%	Yes	Possible	Difficult	No
Inspirational/Educational Value	15%	High	Medium	Low	Zero
Land Use	11%	Low	Depends	High	
Grid Integration	11%	Yes	Possible	Difficult	No
Incremental Acquisition	7%	Yes	Possible	Difficult	No
Permanent Financing	4%	Yes	Possible	Unlikely	No
	100%	3	2	1	0
		Good			Bad

Table 6 is a qualitative comparison of each of the off-site procurement options and variations listed in Table 5. Each is scored using the scales and weights in Table 4. These scores are based on the conditions of the United States and will likely vary for other countries or for the specific conditions of each state or local jurisdiction. Each of the procurement methods are assumed to meet the minimum requirements from Table 3. The first column in Table 6 lists the evaluation criteria and each procurement option is scored relative to these criteria in a qualitative way, using the scales shown in Table 4.

Table 5 – Default Off-Site Renewable Energy Procurement Methods and Variation

Source: ZERO Code 2.0

Procurement Method	*Description*	*Variation*	*Description*
Community Solar	A common and local renewable energy system (usually solar) is constructed in the community to serve multiple customers. The electric distribution company is usually a partner with the renewable energy developer and renewable electricity production is directly credited to the building owner's utility bill as if the renewable energy system were located on-site.	Up-Front Payment	The building owner pays an up-front fee for program participation.
		Subscription	The building owner subscribes to the program and pays for renewable energy through a premium on the monthly utility bill.
Renewable Energy Investment Fund	A monetary account is set up to accept payment from building owners or developers. The managing entity would install renewable energy systems on behalf of the building owner or otherwise invest the proceeds in renewable energy projects with a similar impact.	Up-Front Payment	The building owner pays an up-front fee for program participation.
		Subscription	The building owner contributes to the program with monthly or annual payments.
Virtual PPA	The buyer (building owner) guarantees a minimum price for electricity produced by a renewable energy project, enabling the renewable energy developer to secure funding for construction and operation.	Within the Balancing Authority	The renewable energy project is located within the electricity balancing authority or a neighboring balancing authority that has a formal exchange program.
		Out of Region	The renewable energy project is located outside the electricity balancing authority.
Self-Owned Off-Site	A renewable energy system is constructed on separate property owned or managed by the building owner	n. a.	n. a.
Green Electricity Pricing	A special tariff offered by electric distribution companies or community choice aggregators whereby 100% renewable energy is purchased on behalf of participating customers.	Energy Bundled with RECs	The renewable electricity is purchased from a specific renewable energy generator along with the renewable energy certificates.
		Unbundled RPS Qualifying RECs	The obligation is met through the purchase of unbundled RECs that meet the requirements of the state's renewable portfolio standards. Not applicable in states without RPS requirements.
		Unbundled Other RECs	The obligation is met through the purchase of non-qualifying RPS RECs
Utility Renewable Energy Contract	A special bilateral contract with the local electric distribution company to purchase 100% renewable energy or RECs on behalf of the building owner.	Energy Bundled with RECs	The renewable electricity is purchased from a specific renewable energy generator along with the renewable energy certificates.
		Unbundled RPS Qualifying RECs	The obligation is met through the purchase of unbundled RECs that meet the requirements of the state's renewable portfolio standards. Not applicable in states without RPS requirements.
		Unbundled Other RECs	The obligation is met through the purchase of non-qualifying RPS RECs
Direct Purchase of RECs	The building owner directly purchases unbundled RECs.	Unbundled RPS Qualifying RECs	The RECs meet the requirements of the state's renewable portfolio standards. Not applicable in states without RPS requirements.
		Unbundled Other RECs	Other unbundled RECs.

Table 6 – Qualitative Comparison of On-Site and Off-Site Procurement Methods – United States

		Community Solar		Renewable Energy Investment Fund		Virtual PPA			Green Electricity Pricing			Utility Renewable Energy Contract			Direct Purchase of RECs	
Considerations	On-Site	Up-Front Payment	Subscription	Up-Front Payment	Subscription	Within ISO/RTO	Out of Region	Self-Owned Off-Site	Energy Bundled with RECs	Unbundled RPS RECs	Unbundled Other RECs	Energy Bundled with RECs	Unbundled RPS RECs	Unbundled Other RECs	Unbundled RPS RECs	Unbundled Other RECs
Impact / Additionality	High	High	Medium	High	Medium	High	Medium	High	High	Medium	Low	High	Medium	Low	Medium	Low
Electricity Credit	Yes	Yes	Yes	Yes	Yes	Difficult	Difficult	Possible	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Possible
Inspirational/Educational Value	High	Medium	Medium	Medium	Medium	Low	Low	Medium	Low	Low	Low	Low	Low	Low	Low	Low
Land Use	Low	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends	Depends
Grid Integration	Difficult	Possible	Possible	Possible	Possible	Yes	Yes	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible
Incremental Acquisition	Yes	Yes	Yes	Yes	Yes	Difficult	Difficult	Possible	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Permanent Financing	Possible	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	No	No	No	No	No	No	No	No
Calculation of Procurement Factors																
Impact / Additionality	3	3	2	3	2	3	2	3	3	2	1	3	2	1	2	1
Electricity Credit	3	3	3	3	3	1	1	2	3	3	3	3	3	3	3	2
Inspirational/Educational Value	3	2	2	2	2	1	1	2	1	1	1	1	1	1	1	1
Land Use	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Grid Integration	1	2	2	2	2	3	3	2	2	2	2	2	2	2	2	2
Incremental Acquisition	3	3	3	3	3	1	1	2	3	3	3	3	3	3	3	3
Permanent Financing	2	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Sumproduct	2.74	2.56	2.19	2.56	2.19	2.07	1.70	2.33	2.37	2.00	1.63	2.37	2.00	1.63	2.00	1.48
Unrounded Procurement Factor	1.00	0.93	0.80	0.93	0.80	0.76	0.62	0.85	0.86	0.73	0.59	0.86	0.73	0.59	0.73	0.54
Round to Nearest 0.10	1.00	0.90	0.80	0.90	0.80	0.80	0.60	0.90	0.90	0.70	0.60	0.90	0.70	0.60	0.70	0.50
Round to Nearest 0.05	1.00	0.95	0.80	0.95	0.80	0.75	0.60	0.85	0.85	0.75	0.60	0.85	0.75	0.60	0.75	0.55

APPENDIX B: RESOURCES ON OFF-SITE RENEWABLE ENERGY PROCUREMENT

A series of resources about off-site procurement of renewable energy in the US are cited below. These procurement mechanisms are mostly voluntary and are not tailored to mandatory code compliance. Nevertheless, they provide some very useful lessons and information.

Solar Energy Industries Association – Direct PPAs and Solar Leases

The Solar Energy Industries Association has endorsed model agreements for both direct PPAs and solar leases. See https://www.seia.org/research-resources/model-leases-and-ppas. With direct PPAs and solar leases, the renewable energy system is installed on-site, but the terms of the lease set a precedent for off-site procurement.

The SEIA website has six agreements: three for solar leases and three for PPAs. For both PPAs and solar leases, there is a commercial building version as well as two residential versions: aggregated vs. disaggregated. The aggregated version is for vertically integrated companies who finance and install systems. This disaggregated version is for companies that work with a network of third-party installation partners or financiers.

The commercial PPA has restrictions on assigning the agreement in the event of a real estate transaction, which should commit the new owner to honoring the agreement. However, with regard to environmental attributes (RECs), the model agreement says that the environmental attributes and tax credits accrue to the seller and there are no exceptions in the standard agreement. This sets a bad precedent; the building owner who installs solar using the standard agreement can't claim to be a ZNC building since someone else owns and is taking credit for these benefits. The commercial model solar lease has similar language with regard to assignment, but the agreement has a check box where the environmental attributes can be assigned to the lessee. The default, however, is that the environmental attributes accrue to the lessor.

Table 7 – Treatment of RECs and Property Sale in SEIA Model Agreements

	Direct PPAs	Direct Solar Leases
Environmental Attributes	The **environmental attributes** and tax credits **accrue to the seller**. There are no standard exceptions to this in the standard agreement.	The environmental attributes accrue to the lessor by default, but a clause in Exhibit 1 allows the attributes to be assigned to the lessee.
Sale of Property	There are restrictions on assigning the agreement in the event of a real estate transaction. Basically, the new owner of the building has to honor the agreement.	Similar restrictions apply, but the language is not as clear.

Rocky Mountain Institute, Business Renewables Center

The RMI Business Renewables Center works with businesses to help them procure renewable energy. The virtual PPA (otherwise known as a financial PPA) is the main tool they recommend. They have developed two tools to assist businesses. The first is a model term sheet for virtual PPAs. Unlike the SEIA model agreement, the RMI term sheet makes it clear that the environmental attributes accrue to the business, e.g. they are not retained by the renewable energy developer. The second tool is a request for proposals (RFP) template that businesses can use to shop for renewable energy purchasing opportunities. The term sheet can be downloaded from the RMI website. The RFP template is available

only to members of the Business Renewables Center. For more information go to https://www.rmi.org/our-work/electricity/brc-business-renewables-center/.

Sullivan & Worcester

Elilas Hinckley[27] is an attorney that advises corporate clients on the procurement of clean energy. His former firm is Sullivan & Worcester and the firm has published an excellent piece on procurement of off-site renewable energy called Edge Advisory: Focus on Corporate Renewables. The document can be downloaded at http://cdn2.hubspot.net/hubfs/878449/Edge-Advisory-September-2016-FINAL.pdf?t=1511197049837. It contains seven articles by a variety of authors. The titles of these articles are:

- Energy Transition Driving Corporate Participation in Renewable Energy Purchasing
- Keys to Success for Corporate Procurement Transactions
- Market Outlook: Corporate Clean Energy Purchasing
- Unlocking Clean Energy Value in Dormant Corporate Properties
- Interview Q&As with Sector Leaders
- State Policy Developments and Prospects
- Financing International Projects

Stoel Rives LLP

The Stoel Rives law firm publishes a blog titled “Renewable + Law” with contributions that address a number of issues related to off-site procurement of renewable energy. From the website: “First published in early 2008, Renewable + Law blog is dedicated to tracking all major policy and legal developments impacting the U.S. renewable energy industry. Whether your interest involves solar energy, wind energy, biomass, ocean and hydrokinetic energy, biofuels, waste-to-energy, geothermal, electric energy storage or other clean technologies, we blog about it.” See also footnote 4.

National Renewable Energy Laboratory

The National Renewable Energy Laboratory (NREL) has released several publications on corporate procurement of renewable energy:

- O’Shaughnessy, Erik, et. al., Status and Trends in the U. S. Voluntary Green Power Market (2014 Data), NREL/TP-6A20-65252.
- Lori Bird, et. al., Policies for Enabling Corporate Sourcing of renewable energy Internationally, A 21st Century Power Partnership Report, NREL/TP-6A50-68149. Developed in cooperation with the Center for Resource Solutions, International Renewable Energy Agency and World Resources Institute.
- Renewable electricity: How do you know you are using it? (two-page flyer)

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[5] Mr. Hinckley is now a partner in the K&L Gates law firm in Washington DC.

- Jenny Heeter, Renewable Energy Certificate (REC) Tracking Systems: Costs & Verification Issues, slide presentation, October 11, 2013.
- "A Guide to Community Solar: Utility, Private, and Non-profit Project Development", November 2010. The guide was developed for the National Renewable Energy Lab by Northwest Sustainable Energy for Economic Development, Keyes and Fox, Stoel Rives, and the Bonneville Environmental Foundation. See NREL document 49930. This document provides guidance to organizations that want to set up community solar systems, and has examples of programs circa 2010.

U. S. Environmental Protection Agency – Social Cost of Carbon

The United States Environmental Protection Agency, along with 11 other federal agencies[28], calculated the social cost of carbon for use in cost effectiveness analysis of federal programs. Two reports have been issued:

- Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Interagency Working Group on Social Cost of Carbon, February 2010
- Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 Interagency, Working Group on Social Cost of Greenhouse Gases, August 2016

The social cost of carbon (SC-CO2) "is the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change."[29] The SC-CO2 was calculated through multiple simulations using three integrated assessment models and three different discount rates for future costs: 5%, 3%, and 2.5%. Figure 1 shows the results for one calendar year (2020). In addition to the average values for these discount rates, the study also looked at a high value representing the 95th percentile.[30] The SC-CO2 values for all years through 2050 are shown in **Error! Reference source not found.**.

[5;] The following agencies were part of the working group: Council of Economic Advisers, Council on Environmental Quality, Department of Agriculture, Department of Commerce, Department of Energy, Department of Transportation, Environmental Protection Agency, National Economic Council, Office of Energy and Climate Change, Office of Management and Budget, Office of Science and Technology Policy, and Department of the Treasury.

[5<] Executive Summary of the 2016 update.

[63] See the 2016 update, page 20.

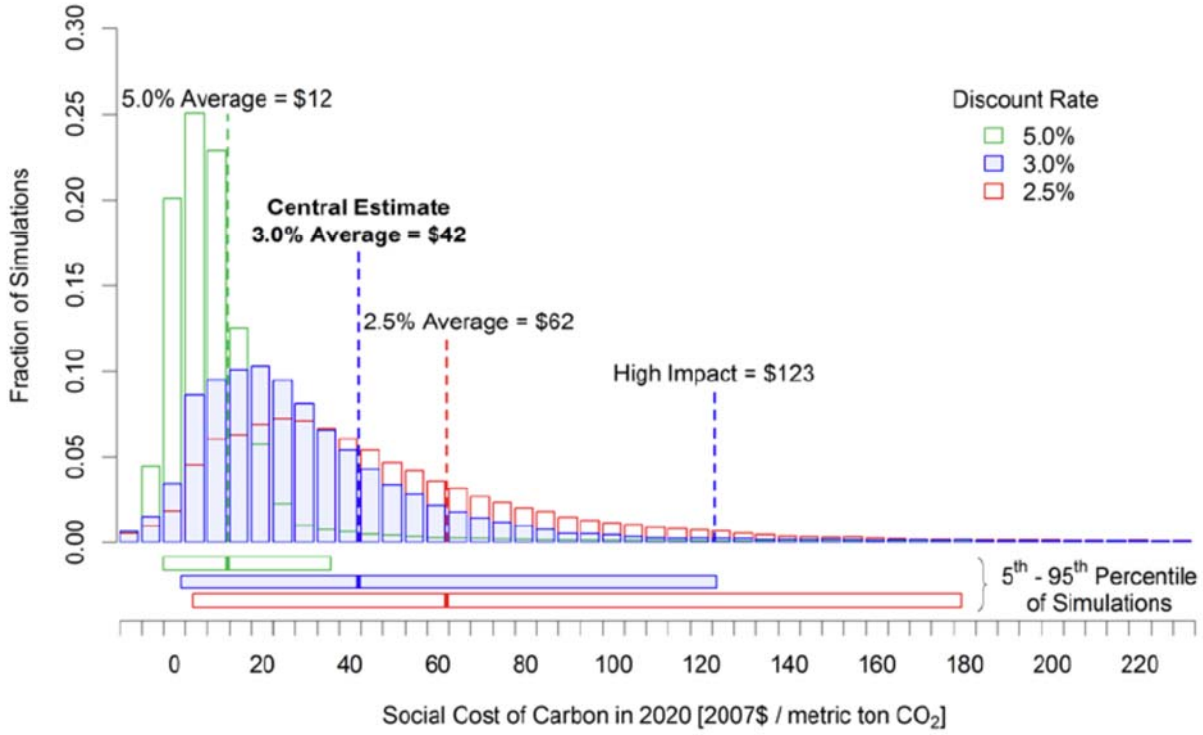

Figure 1 – Frequency Distribution of SC-CO2 Estimates for 2020

Source: Figure ES-1 of 2016 Report

Table 8 – Social Cost of Carbon

Source: 2016 Update, Table A1

Year	5% Average	3% Average	2.5% Average	Average (95th PCT at 3%)
2010	10	31	50	86
2011	11	32	51	90
2012	11	33	53	93
2013	11	34	54	97
2014	11	35	55	101
2015	11	36	56	105
2016	11	38	57	108
2017	11	39	59	112
2018	12	40	60	116
2019	12	41	61	120
2020	12	42	62	123
2021	12	42	63	126
2022	13	43	64	129
2023	13	44	65	132
2024	13	45	66	135
2025	14	46	68	138
2026	14	47	69	141
2027	15	48	70	143

Table 8 – Social Cost of Carbon

Source: 2016 Update, Table A1

2028	15	49	71	146
2029	15	49	72	149
2030	16	50	73	152
2031	16	51	74	155
2032	17	52	75	158
2033	17	53	76	161
2034	18	54	77	164
2035	18	55	78	168
2036	19	56	79	171
2037	19	57	81	174
2038	20	58	82	177
2039	20	59	83	180
2040	21	60	84	183
2041	21	61	85	186
2042	22	61	86	189
2043	22	62	87	192
2044	23	63	88	194
2045	23	64	89	197
2046	24	65	90	200
2047	24	66	92	203
2048	25	67	93	206
2049	25	68	94	209
2050	26	69	95	212

From these values, the economic benefit of reducing building energy use or producing renewable energy can be calculated. At present, each MWh of electricity produced in the United States results in 1,348 lb (0.61 tonnes) of CO2e. If this is assumed to decline at a rate of 3% due to improvements in our grid, the net present value of the benefits of saving one MWh for thirty years is $404.31

If the social cost of carbon is assumed to be $40/tonne for a single year (this is the average value for 2018 at 3%), the net present value of the benefits of saving one MWh of electricity is approximately $25. This calculation is shown below:

$$\frac{\$40}{tonne} \times \frac{1348\ lb}{MWh} \times \frac{tonne}{2205\ lb} \approx \$25/MWh$$

California Energy Commission – Required Renewable Energy and Off-Site Options

Beginning in January 2020, the California Energy Commission begin requiring that low-rise residential buildings include on-site renewable energy. The On-site renewable energy shall be installed to offset the electricity of the dwelling unit (gas use for space and water heating is not offset). The prescriptive PV requirement is fixed according to the climate zone, the number of dwelling units, and the conditioned floor

[64] These calculations are documented in a supplementary spreadsheet.

area. The required PV system capacity (DC) in Watts is given by following equation. The coefficients A and B for the various California climate zones are given in Table 9.

$$PV\_system\_capacity = A \times Conditioned\_Floor\_Area + B \times NmbrDU\#$$

Table 9 – Proposed California PV Requirement for Low-Rise Residential Buildings

Climate Zone	A = Watts per Conditioned Floor Area	B = Watts per Dwelling Unit
1	0.793	1,270
2	0.621	1,220
3	0.628	1,120
4	0.586	1,210
5	0.585	1,060
6	0.594	1,230
7	0.572	1,150
8	0.586	1,370
9	0.613	1,360
10	0.627	1,410
11	0.836	1,440
12	0.613	1,400
13	0.894	1,510
14	0.741	1,260
15	1.560	1,470
16	0.590	1,220

Of interest to the ZERO Code is language that would allow buildings to comply with the PV requirement through what the CEC calls a “Community Shared Solar Electric Generation System or Community Shared Battery Storage System”. Qualifying community systems would be eligible to partially or totally substitute for the on-site renewable energy system that would otherwise be required. To qualify, the community system shall meet the following requirements:

- The renewable energy or battery storage system must be installed and available for inspection prior to the final inspection of the building that depends on the system for compliance.
- The enforcement agency must have access to inspect the renewable energy or battery storage system.
- Documentation that creates development entitlements for the building shall be completed prior to filing the building permit application.
- The off-site system shall provide the same or better energy performance than the on-site system it is offsetting. Software approved by the CEC must be used to show equivalency.
- The benefits from the off-site system shall be in the form of dedicated power utility energy reduction credits or payment for energy bill reductions. Most community solar legislation in the United States requires this.
- The off-site system shall have a useful life of at least 20 years.
- The energy saving benefits (RECs) of the off-site system shall accrue exclusively to the dedicated building.

- The entity managing the community system shall maintain records and be accountable for a period of at least 20 years. The records shall be available for audit by the CEC or its assignees.
- Community system providers shall be approved by the CEC.

Sonoma Clean Power (SCP) – Green Tariffs

Sonoma Clean Power is a California Community Choice Aggregator (CCA) that buys power for residences and businesses in Sonoma County. SCP offers a voluntary tariff called EverGreen that includes electric power from 100% renewable sources. Customers that opt for EverGreen pay a little more per kWh and the electricity they use comes entirely from local renewable energy sources. In the SCP case, geothermal is the source of the renewable energy.

Green tariffs are voluntary and the customer can opt out on short notice. This makes the typical green tariff unacceptable as an alternative to on-site renewable energy for both the ZERO Code and California code compliance. To address this issue and to provide an alternative to on-site renewable energy for the thousands of residents that lost their homes as part of the Tubbs fire of 2017, SCP is considering a program that would meet the CEC requirements through pre-payment of the increment between the default and EverGreen tariffs.

Since all retail electric providers in California have to report renewable content and portfolio emissions factors separately for each offering, SCP cannot blur the lines between the default portfolio (called CleanStart) and the EverGreen portfolio. As more customers sign on to EverGreen, SCP will have to acquire more renewable energy. The renewable energy credited toward EverGreen cannot be double counted in CleanStart. Furthermore, the state has an aggressive policy to increase the renewable energy requirements for default offerings, preventing renewable energy counted toward CleanStart to be moved over to EverGreen. SCP points out that a person pre-paying for twenty years of EverGreen would cause a net increase of renewable energy to be produced quickly (and certainly within the next RPS compliance period).

Non-Profit Initiatives – RE100.org, CDP.net and wemeanbusinesscoalition.org

In addition to the RMI Business Renewables Center, several other organizations promote the procurement of renewable energy by businesses.

- CDP.net, formerly the Carbon Disclosure Project, “is a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. Over the past 15 years we have created a system that has resulted in unparalleled engagement on environmental issues worldwide.”[32]
- “RE100 is a collaborative, global initiative uniting more than 100 influential businesses committed to 100% renewable electricity”[33] More than 100 international corporations have made the commitment.

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- "The We Mean Business coalition is catalyzing business action and driving policy ambition to accelerate the low-carbon transition."[34]

Brokers

Several organizations have emerged to help corporations acquire renewable energy by brokering the deals.

- 3Degrees is located in San Francisco and offers "comprehensive clean energy services that enable organizations, utilities and individuals to transition towards a low-carbon economy." They work with corporations to broker deals with renewable energy developers. They also have a consulting practice that works with utilities and others to set up community solar or shared renewable energy projects. Details can be found at https://3degreesinc.com/about/.
- Altenex is a subsidiary of Edison Energy, the parent company of Southern California Edison. Altenex works with companies "interested in purchasing renewable energy as a way of helping them control energy costs and improve the environmental performance of their operations." Details can be found at http://www.altenex.com/about.html.

Renewable Energy Certificate Tracking Organizations

The Center for Resource Solutions operates the Green-e program, which tracks RECs in the United States and other countries. The organization works with other organizations and publishes research documents on voluntary procurement of renewable energy. Details can be found at https://resource-solutions.org/.

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