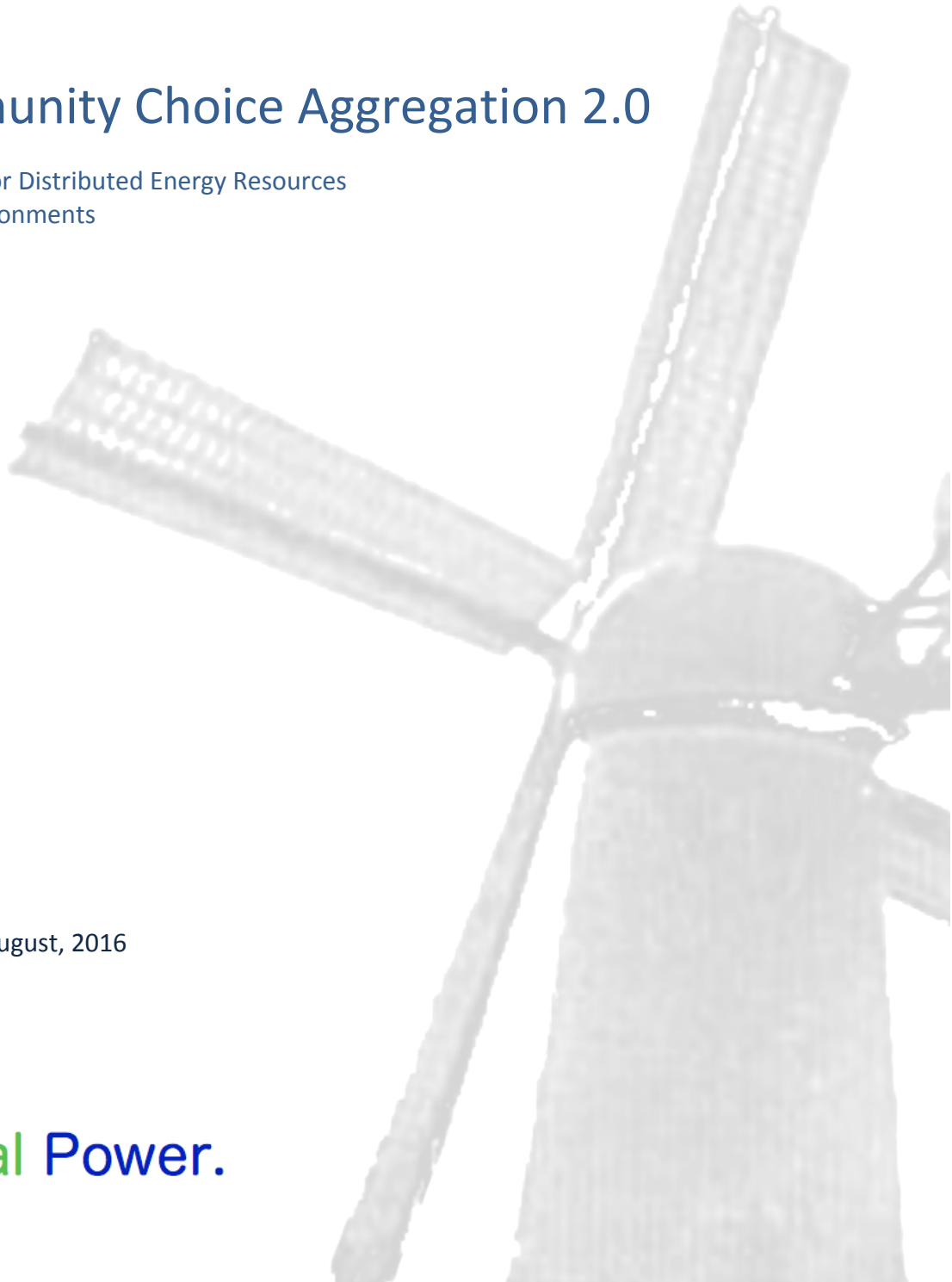
Community Choice Aggregation 2.0

Strategies for Distributed Energy Resources
in CCA Environments



Revised August, 2016

Local Power.

Community Choice Aggregation (CCA) *gives cities and counties the authority to aggregate every customer load in their territory, and source generation on behalf of those customers. CCA is authorized in Massachusetts, Ohio, California, Rhode Island, New Jersey, Illinois, and New York, with 1300 municipalities under service in 2016.*

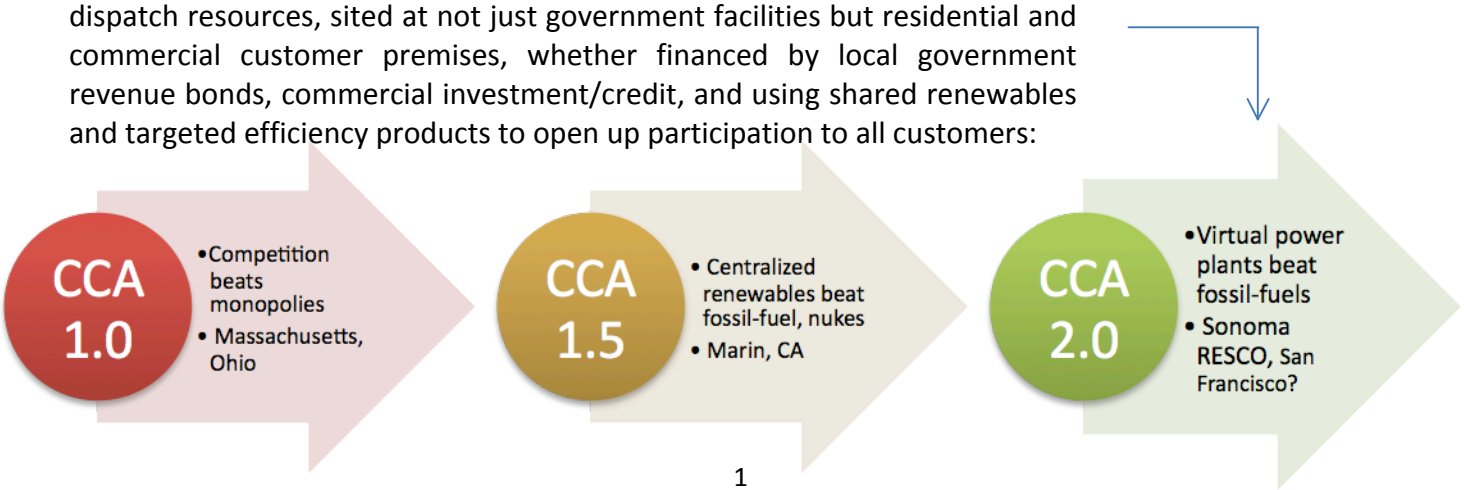
Insights for Community Choice Aggregation in a DER Environment:

The next five years will see more change in the energy industry than has occurred in the previous fifty years. As Distributed Energy Resource (DER) technologies and practices become the norm, legacy infrastructure (transmission lines and large fossil fuel burning power plants) built to serve the old centralized energy grid will become dramatically less competitive compared to local DER that is designed and operated to both reduce customer power needs and to reform the community's aggregate peak power demand– a primary cause of higher rates. The differences in reliability, power quality and local economic development are profound. Most importantly, DER provides long-term rate reduction and reduced price exposure to volatile fossil fuel prices through profound physical load reform, and can bring about greater and deeper and more enduring greenhouse gas reductions than centralized or renewable credit-based approaches to green power.

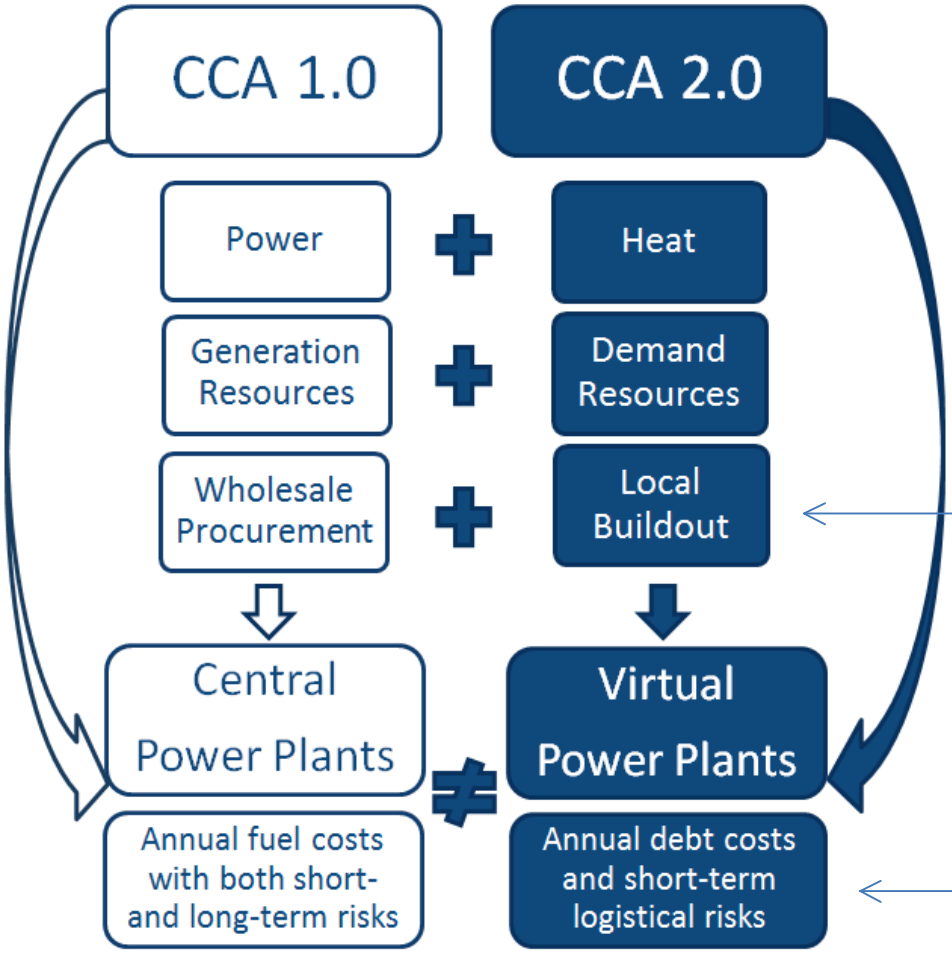
Distributed Energy Resources *(DER) are local renewable energy generators, energy efficiency measures, and conservation technologies like microgrids and electric vehicles, that are located behind the meter and/or within a substation service area, and are integrated to facilitate both customer sharing and interoperable functionality to support grid power load management in real-time energy markets.*

Community Choice Aggregation (CCA) is uniquely poised to augment this evolution. Unlike municipalization, CCAs do not purchase utility assets such as power plants, fuel supplies, and transmission and transportation infrastrucures. CCA is the only policy in the United States which allows a truly comprehensive approach to creating a new energy business model, by allowing an integration of energy demand and supply from an objective financial perspective unencumbered by utility legacy infrastructure considerations.

To date, CCAs have mostly pursued traditional procurement strategies: buying wholesale power and entering into power purchase agreements with large-scale remote renewable power plants, or worse, purchasing unbundled Renewable Energy Credits (RECs) from afar to "green up" their supply portfolios on a year-to-year, "rented" basis. In order to achieve more enduring results, CCAs must achieve horizontal integration of DER, by building virtual power plants composed of new local generation and demand dispatch resources, sited at not just government facilities but residential and commercial customer premises, whether financed by local government revenue bonds, commercial investment/credit, and using shared renewables and targeted efficiency products to open up participation to all customers:



The graphic below depicts how CCA 2.0 integrates six critical components of the energy business to enhance overall portfolio economics by capturing additional revenue streams, made possible through DER technologies and financing through revenue bonds and/or commercial investment:



***CCA 2.0** is characterized by the maximum localization of energy resources; Local Power Inc.'s analyses of Marin, Sonoma, and San Francisco CCAs in California 2009-2013 indicated that 60% to 80% of electricity could be provided by in-county resource at or below utility rates.*

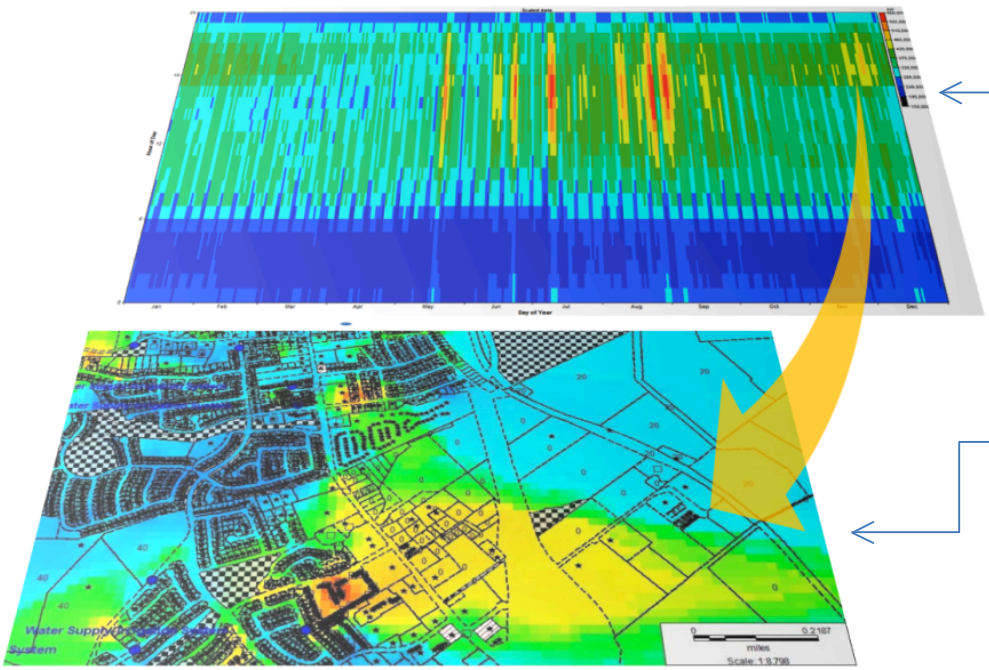
***DER Finance** is vital to CCA 2.0, enabling communities to use CCA revenues to build energy independence rather than merely procure power from wholesale suppliers. LPI developed "H Bonds" 15 years ago to allow CCAs to finance both community renewable power projects and customer-owned efficiency, solar and other DER technologies. LPI developed program designs to bring about a new, more transformative kind of CCA: achieving scaled localizations using power procurement as a revenue and ratesetting basis to finance customer-owned and community-owned DER.*

Local Power's Infrastructure Approach to Distributed Energy Resources

Local Power has designed large-scale DER infrastructure deployments for San Marin, Sonoma, and San Francisco CCAs. Our team has combined thought-leadership over the years in renewable energy finance and local technology integration to demonstrate robust analytical database tools with which to accelerate and optimize distributed energy resources deployment at variable scales. This consists of a cost model, a financial model, and a program design under extant laws and regulations. In addition to building an aggregate cost and DER portfolio transition model, Local Power uses customized geographic information system (GIS) software to integrate multiple datasets, and also

develops a matrix of financial tools, based on outlined risk management strategies to apply to each project identified, descriptions of work required, term sheets, Requests for Proposals and Bids, and contracts for use by CCAs.

Below are some screenshots from Local Power's software platforms, arranged conceptually to show how portfolio load intensity maps can be unpacked onto maps for site-specific analysis and identification of cross-cutting opportunities (or to optimize site-specific opportunities and portfolio economics):



***On top**, LPI analyzed a county's annual electricity usage for portfolio finance calculations:*
- y axis: 0 to 24 hrs
- x axis: every day of the yr (colors denote usage intensity, hot is "high"

***On the bottom**, LPI mapped a town's load patterns for analyzing economically optimal siting of different energy efficiency and renewable technologies.*

Local Power's approach takes into account site characteristics to portfolio economics and everything in-between: this is what allows us to greatly increase the scale of distributed energy resources (DER) while also satisfying a community's cost of service, policy goals, and financial obligations. We catalogue and address local siting concerns and barriers up front, and advocate a performance-contracting approach for developers (with government assistance and financial penalties for nonperformance) to deploy and help operate renewable and demand control applications or systems. The risk of any combination of sites defaulting, or falling behind in schedule, can be managed using critical path methods across the entire portfolio. We advocate a deployment planning approach that balances risk through physical load reform: parallel and overlapping project and portfolio build-outs.

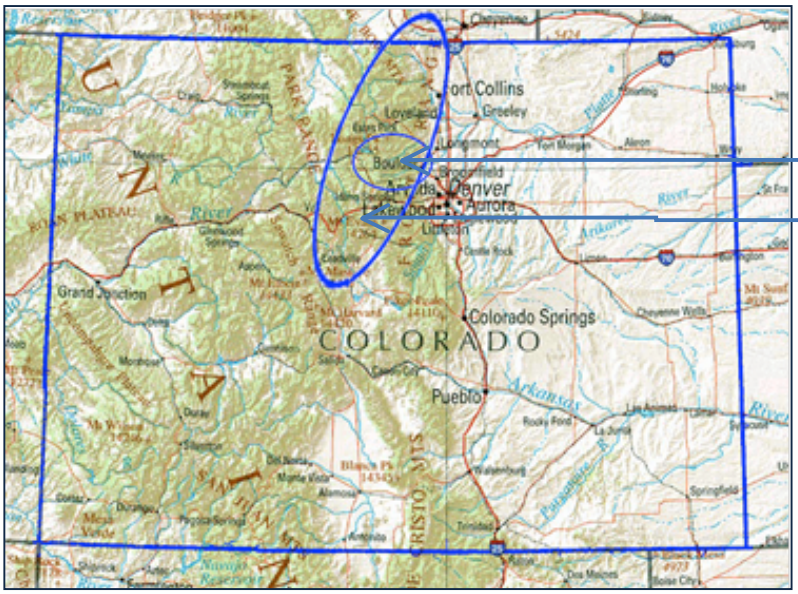
Local Power DER programs, including previous portfolio designs for formative and now-online CCAs in San Francisco, Marin County and Sonoma County and municipal utilities in Sacramento and Boulder, Colorado, have been

designed to provide competitive (meet-or-beat) costs of service, while greatly outperforming the competition in deploying distributed generation and demand-side resources. All four regional portfolio schedules mentioned above included commercial analysis of various technologies in integrated bundles under wholesale power purchase agreements and ongoing fuel related procurement obligations.

The Localization Portfolio Standard

A Localization Portfolio Standard (LPS) is a kind of renewable portfolio standard that requires a majority percentage of the energy to be produced by DER within certain geographic boundaries. Local Power created the LPS concept to expedite the broader localization trend in energy, and bring the most benefit to local governments and communities, and used it in Boulder, Sonoma, and San Francisco to be implementable for CCAs or municipally-owned and operated utilities.

Conceptual Map of a Localization Portfolio Standard (LPS)



Localization Portfolio Standard (LPS): *schedules a certain percentage of power be produced from local renewable or efficiency resources within a community's geographic boundaries, defined by (1) municipality and (2) region.*

"Opting Up" to Own Your Power

Today, DERs are widely anticipated to become the preferred sources of new energy supplies. The financing of the DER will largely determine who benefits the most from this municipal Revolution in Power. Local Power created the nation's first municipal bond authority with CCA in mind precisely so that citizens and local governments could share in the financial benefits: as owners, not renters, of their power.

CCA revenue bonds are tied to revenue streams of specific renewable energy or efficiency projects, and are secured by the bill payments of CCA electricity customers. In the current environment, municipal debt analysts consider revenue bonds to be the most attractive form of public debt, in contrast to bonds secured by the general obligation of a municipality. The access to large amounts of tax free low-cost debt for revenue-generating energy projects financed by revenue bonds, combined with a lack of conflicts of interest from ownership of legacy electricity and gas infrastructure, and the ability to allow private sector innovation in both power supply and energy efficiency, are unrivaled strategic and competitive advantages to CCA, in contrast to the utility paradigm or disaggregated marketing that constrains the energy industry's ability to transition to DER on a meaningful timeline.

H Bonds *are municipal revenue bonds tied to the revenue streams of specific renewable energy or efficiency deployments, financing either tax-exempt facilities on government infrastructure, or taxable installations for residents and businesses. Local Power created the first H bond authority, San Francisco's H Bond Authority, in 2001. Since then, a variety of cost-effective DER financing products have emerged in energy markets, for both distributed renewables and demand-side measures, which may be used as alternatives or supplements to H Bonds. Solar PPAs, PACE, and third party finance and green bonds offer alternative pathways for taxable financing of DER for residents, businesses for renewables and energy efficiency/conservation.*

Financing Localization Without Bonds

Today, most California CCAs that are not issuing H Bonds say they are accumulating reserve revenue for a bond rating. Conversely, DER PPA financiers are seeking (1) long-term power contracts, and (2) creditworthy counterparties. By organizing host sites with energy demands coinciding with aggregated CCA demand curves, and subscribing Shared Renewables customers to "opt-up," CCAs can fill the market gap according to a design which reforms the CCA's particular pattern of load through planning, site selection and acquisition, while opening up an inclusive process to scale-up participation and leverage scaled DER build-outs.

On the demand side, Solar Shares installations may include microgrid extensions to neighbors and electric vehicle chargers, as well as home area networks/IP thermostats, to facilitate Demand Dispatch and Demand Response.

A CCA can provide private investors better conditions and terms than traditional IOUs or unregulated markets, and provide access to the neglected majority: medium-sized businesses that use a lot of energy, and mid-to-low income residents, particularly those in multi-family buildings. The effect is to engage the vast majority of residents and businesses as equity participants. In addition to Shared Renewables, microgrids and EVs extend this

participation to neighbors, and home area networks/ appliances/IP thermostats, as well as LED light bulbs, which represent smaller, more modular consumer credit risks available to renters, than building retrofits and building improvements, for which only building owners are eligible.

Reducing upfront development costs with on-bill financing is a power built into a CCA because it has the authority to design and set rates and offer "opt-up" products to facilitate DER development and adoption, and in some states to require the utility to transact DER ownership charges and credits on the monthly utility bill. Opting-up should include, at a minimum, Shared Renewables and home/business energy efficiency as described. Thus, for many DER products, commercial financing is a competitive cost-of-capital with less risk to achieve the same purpose, given the ability and willingness of some DER financiers to offer energy efficiency customer ownership to customers, or transfer of ownership of renewable generators to the CCA at the end of its "tax life," well short of the their functional life span. Federal tax incentives, like the Investment Tax Credit, cannot be used by public entities, but are available to private investors developing projects for CCAs and CCA customers. State programs such as Self-Generation Incentive Program or the California Solar Initiative are open to participation by CCA customers.

Energy efficiency and conservation are at center of the logistical mission of DER, due to the fact that generators are concentrated at high energy demand sites while energy efficiency and conservation are more ubiquitously deployed. Furthermore, true DER renewables are functionally incomplete without microgrids, power storage and IP thermostats/home area networks, and are thus part and parcel of the definition of DER as not merely a bunch of small renewable generators spread randomly around a region, but a real-time management system that is configured to capture the many efficiencies of onsite capacity.

In California, CCAs can apply to directly administer Public Purpose Program funds set aside by state regulators for deployment of locally-tailored energy efficiency technologies, and can design their own programs for the use of those funds with regulatory approval from the California Public Utilities Commission. Similar opportunities exist in other CCA states like Massachusetts.

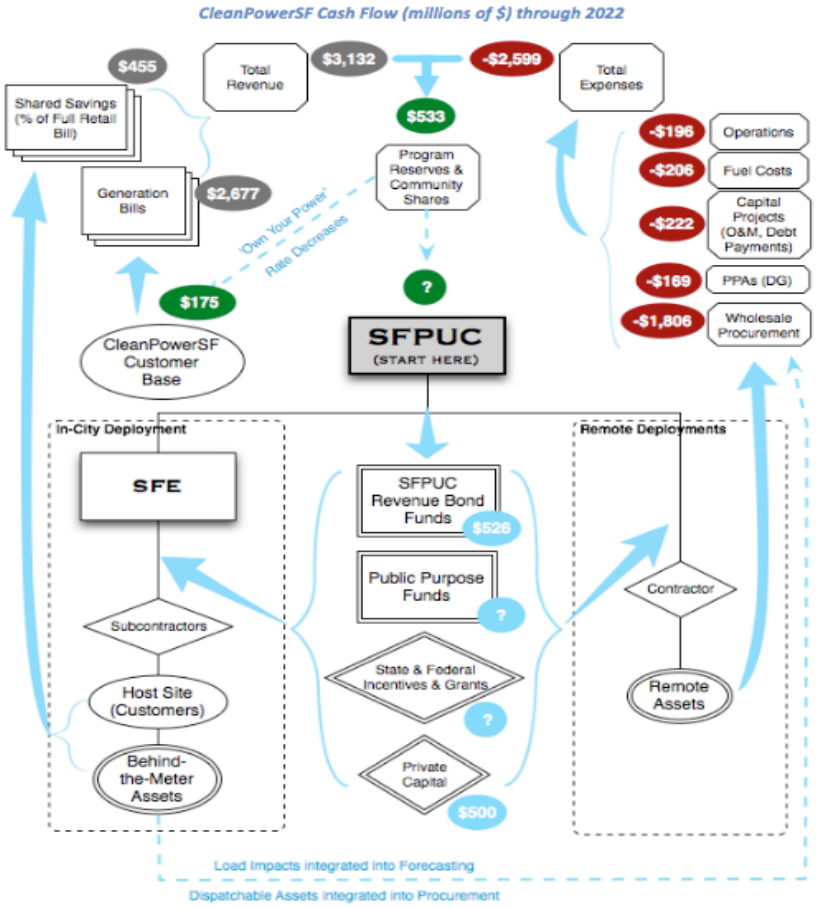
Because energy efficiency is inexpensive compared to the average cost of gas-fired power or heating gas, and creates immediate savings for customers, shorter-term financing may be obtained for certain energy efficiency products from private sources. Local Power proposed for San Francisco that it offer special tariffs to customers who subscribe financed energy efficiency products that share the resulting savings with the CCA program. Proceeds from these "Shared Savings" arrangements can then be used to subsidize more local DER investment.

Local Power Inc. designed California's first Shared Renewables program *for the Sacramento Municipal Utility District (SMUD) in 2006.*

Financed Targeted Energy efficiency and Community Renewable Shares *programs based on commercial investment are ideal program designs to use during the early launch phase of CCA service, to achieve substantial DER build-outs while awaiting a credit rating or reserves for issuance of H Bonds. Short payback efficiency measures and off-site "virtual" ownership facilitate customer ownership benefits at low financial risk and may be offered to both renters and owners, residents and business customers of all sizes. Local government buildings can be used as an early phase renewable siting platform.*

Another way in which a CCA can attract private investment is to identify optimal locations to develop distributed renewable generation from the point of view of financial return and financial security, through its access to individual meter data, as well its ability to solicit participation from willing Shared Renewables facility site hosts, including privately- and publicly-owned buildings. A CCA, as a program of the local municipal government, can give its support to and engage its community in any needed planning and permitting processes to facilitate DER development. Finally, the CCA is also the buyer of the power produced by new generation projects, and can enter into long-term contracts to allow investments with longer paybacks. These advantages make investments more secure and increase the likelihood of participation from the private sector.

CCAs can design and implement their own Shared Renewables programs, which diversify and dramatically increase the numbers of eligible customers of shares in new distributed renewable generation assets. For instance, Shared Solar, in which customers in a given area can buy shares in a project sited at CCA-identified locations in their community/neighborhood, is a way to allow the majority of customers not owning a rooftop suitable for solar, as well as renters, to participate in renewables ownership, receiving economic benefits in the form of monthly bill credits.



Flow of Investment *this chart shows LPI's draft program design for CleanPowerSF as it relates to the movement of revenues, investment, repayment of financed DER projects, costs and surpluses in a CCA 2.0 program. The many moving parts make it more complex than 1.0, but are essential to real build-out for GHG reduction goals and local job creation and economic benefits for the community.*

Shared renewables and financed efficiency offer immediate pathways for a CCA to develop DER at scale using private investment while awaiting a credit rating for solar bonds or "H Bonds," which can provide tax-exempt financing and thus less dependency on federal subsidies. The flow chart above demonstrates how money moves through CCA 2.0 including very significant investment from the private sector for new assets that create local benefits.

Energy Localization

The paradigm of centralized generation is rapidly waning as distributed generation is becoming price-competitive. This transition is happening because the manufacture, deployment, and operation of distributed energy resources have inherent and increasing advantages compared to large-scale energy resources.

In order to realize this potential, Local Power has designed a transition to local renewables that functions within the traditional energy framework. The new energy system will be built by adapting the old economic realities to serve contemporary needs. To this end, the financing structure of an H Bond backed CCA mimics the annual fuel outlays for a traditional utility, creating a price-parity for a profoundly modernized energy infrastructure.

***Under CCA 2.0, annual grid power and fossil fuel-related expenses** are replaced by payments to service the debt accrued for local energy deployments. Exposure to fuel price volatility and the associated risk premiums in the cost of power are eliminated.*

While power costs from renewables are becoming competitive, the key barrier to an even playing field is financial. Because the cost of power from a fossil fuel plant is 70% to 90% fuel and only 10% to 30% the plant itself, the upfront cost to start generating power is much less than for a renewable plant. This is because with renewables, there is no ongoing fuel cost, so the down payment on an investment is not 10% but 100%. H Bonds are important because they offer secure, low-interest financing to imitate, in effect, the characteristics of fuel, spreading payments over time on a fixed 100% down investment, and minimizing capital costs, to make possible a low-cost transition to DER.

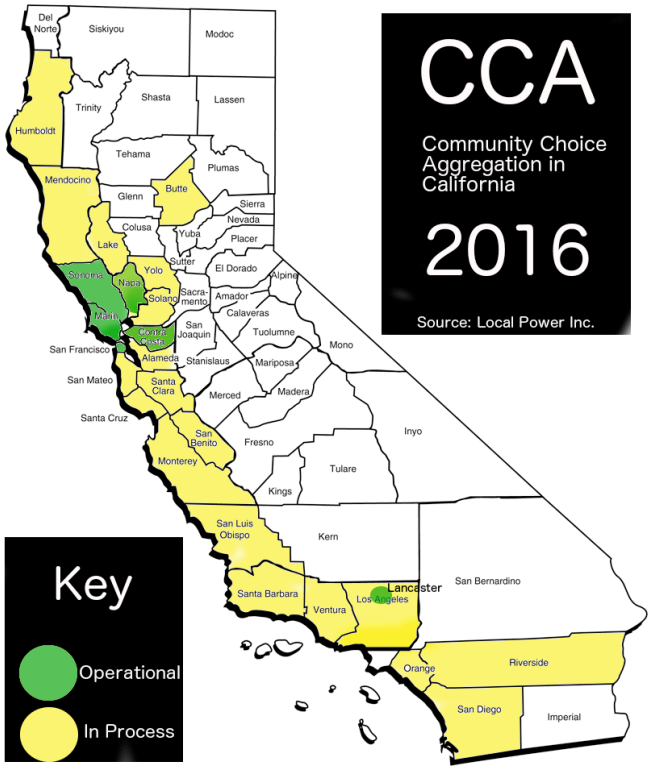
In the big picture, CCA 2.0 divests from the massive fuel price risk now defining the price of our power, and embraces the logistical risk of energy decentralization – the cost of capital and construction timelines involved in building many small installations in a community, rather than a single power plant on one location. Understanding and managing the logistical risk inherent in a transition from fuel to renewables, critical path methodology is at the center of CCA 2.0 approach to building our new energy future.

Energy localization also involves energy intermittency management, underscoring the importance of coordinated DER technologies. Renewables

are by nature intermittent generators like wind and solar. Matching generation to demand, and maximizing the efficiency of onsite power use is critical for achieving price parity. Demand Response and Demand Dispatch technologies open the functionality door for renewable distributed generation. Non-exporting systems are preferred. Data analysis can identify low-hanging fruit like cogeneration, efficiency retrofits, onsite renewable development and innovative islanding, storage, and microgrid applications occurring in numerous discrete geographic areas in a city or county.

A final, potentially radical advantage which DER technologies enjoy over centralized power plants lies in their manufacture, which is subject to ever-increasing economies of scale, efficiency, innovation, and price competition. Integrated localizations are competitive with fossil fuels today, and in the likely scenario of increasing and volatile fossil prices and lower solar prices, the investment is sound.

Community Choice Aggregation enjoys a key competitive advantage in this framework: the ability to embrace these new economies of production and deployment of distributed energy resources, without suffering from the financial conflicts that come with ownership of the old fossil fuel-based centralized legacy infrastructure, and that have delayed technological innovation in the utility industry for so many decades.



CCA is expected to serve 60% of Californians under IOU service by 2018, *and already covers the majority of Ohio and Illinois, and is rapidly expanding into major regions of Massachusetts, New Jersey and New York, with increasing interest in the benefits of CCA 2.0.*

Sources for this document are contained within Local Power Inc. diverse and widely shared work products. The documents linked below are available for free download at localpower.com:

CCA Program Design & Engineering

--City of San Francisco - San Francisco Public Utilities Commission CleanPowerSF In-City Buildout of Renewables and Energy Efficiency - SFPUC-Released Documents (2013)

--*San Francisco's CCA Program Design, Draft Implementation Plan and H Bond Action Plan* (2007) Appendices

Energy Resilience & Carbon Planning

--*SonomaCleanPower-Related Documents*

--*Sonoma County Renewable Energy Secure Communities (RESCO) - Final Report (2013)*

--*Sonoma RESCO Data Collection Report*

--*Sonoma County (California) 2008 Climate Action Plan*

--*Appendices*

Community Renewable Resource Survey

--*San Luis Obispo Renewable Energy Secure Community (2013)*

--*San Francisco CCA Program Report (2009)*

--Attachments

Energy Localization Feasibility Studies

--*Boulder Localization Standard Electricity and Natural Gas (2011)*

CCA Wholesale Power RFP Drafting and Negotiation

--*San Francisco Community Choice Aggregation Second Request for Proposals (2010)*

--*San Francisco Community Choice Aggregation First Request for Proposals (2009)*

Community Choice Aggregation Policy Analysis

--*Sonoma County Alternatives Analysis: Electricity from Renewable Sources for Sonoma County (2013)*

--*San Francisco CCA Best Practices and Lessons Learned Report (2009)*

--*Appendices*

Power Plant Replacement / Environmental Impact Report Analysis

--*San Diego County "Green Energy Options" Report (2007)*

--*Green Energy Options Report Appendices*

--*Green Energy Options Press Release*

--Los Angeles Communities for a Better Environment Power Plant Assessment (2008)

Renewables and Energy Efficiency Finance Authority and Implementation Ordinance
--San Francisco "Solar Bond" or H Bond Charter Authority - Proposition H, City Charter Section 9.107.8 (2001)
--San Francisco Community Choice Aggregation Ordinance 86-04 (2004)

Community Choice Aggregation Laws and Rules

--New York Public Service Commission Community Choice Order (2016)
--California's Community Choice Law, Assembly Bill 117 (2002)
--Massachusetts "Community Choice" Law, Senate 447 (1995)
--Original Testimony to Massachusetts Regulators Regarding Original "Community Choice" Bill, Senate 447 (1995)

Local Power Inc. assisted in drafting CCA legislation for the State of New York in 2014, participated in the State's Reforming the Energy Vision (REV) at the New York Public Service Commission ((14-M-0101, 14-M-0224), and is an advisor to New York State Energy Research and Development Authority on the implementation of CCA 2.0 (2016). The order instituting CCA in New York can be found here.

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