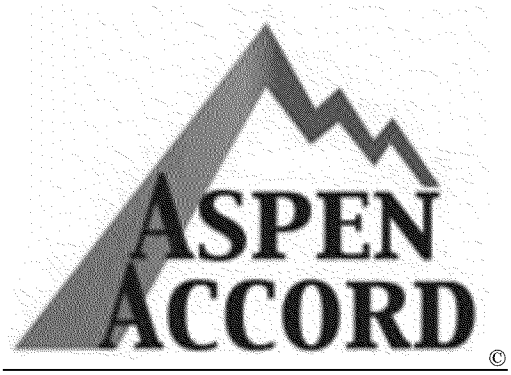

The DG Power Model

A Community-Based Distributed Generation Framework

A Concept Paper of the Aspen Accord Distributed Generation Working Group

3/29/11

Contents

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Executive Summary

This concept paper presents a new framework for making local distributed generation cost-effective for California utilities and broadly effective for California communities.

The "DG Power" model presented could revolutionize the way renewable energy is implemented throughout our society. Through utility-ownership, DG Power provides a means of retaining customers and enhancing relations, while providing new services.

The paper makes a business case for distributed generation and includes four pilot programs to test means of significantly expanding and sustaining distributed generation in California.

The Aspen Accord

The Distributed Generation Working Group of the Aspen Accord has prepared this concept paper. The Aspen Accord is a partnership of cities and their serving utilities to forge new program strategies and concepts. While the pilot programs in this document promote solar power, the paper's and pilots' findings are applicable to a variety of DG Power resources, from wind to geothermal to fuel cells and microturbines.

The Aspen Accord convened the Working Group to address the question, *"How do we overcome current limitations and create meaningful incentives and project delivery options for widespread implementation of DG, particularly for hard-to-reach low to middle-income property owners?"* Through testing, the Aspen Accord has shown that lessons can be learned and full-scale programs can be tailored for maximum benefit at the least cost.

The Rise of Distributed Generation

Distributed generation has been driven by advanced technology, ideology, and necessity. It represents a major and growing wave of activity. The California Solar Initiative has developed over 50,000 projects in the state and a solar industry of tens of thousands of workers. Distributed generation creates local jobs, and sustained careers at the local level, creating economic multipliers and sound development.

Production of local distributed generation technologies – solar, wind, geothermal, microturbines, etc. – is on the rise with competitive pressures driving down costs. For utilities, this represents lost revenues and potentially stranded generation assets, which under the current regulatory construct can place upwards pressure on rates to other customers. It also represents an equally large business opportunity. Utilities have the resources to profitably deliver clean and green DG Power in partnership with cities and counties and the growing contractor network.

Pilots for Underserved Market Segments

The DG Working Group recognizes that there are market segments that have been underserved by the State's solar initiatives. Given the tenure of the California Solar Initiative, and communities' desires for net zero carbon power production, it is timely and necessary for California's utilities to innovate and to find ways to reach into these markets.

The DG Working Group has developed a new model for distributed generation in California that relies on a partnership among utilities, cities, contractors, and customers. By working together strategically, costs can be lowered and cost-effectiveness maximized. For society, this broadens

distributed generation services to heretofore underserved customers, unlocking multiple environmental, security, and equity benefits while protecting ratepayers.

Each of the four stakeholders is essential to "drive" the model: Cities and counties work to promote the program and aggregate customers who participate as "host sites." Contractors do the same, stimulating jobs and economic development, and lowering unit costs while providing installation services and local jobs. Utilities can own and operate the systems for multiple benefits (or procure power generated by third parties). Like large power plants, they will be maintained and monitored to maximize system reliability.

The pilot projects that test this model address market segments not widely served by the existing local distributed generation approaches in California. These are:

1. **Multi-Family Solar**

The Multi-Family Solar pilot brings solar power and its benefits to apartment buildings and their tenants. To date, apartments suffer a classic "split incentive" in that renters pay electricity bills, while a building owner would own the solar system on its rooftop. This pilot employs a novel idea: Why not have the utility own the system (or the power output) and feed the power directly into the grid? By doing so, the capacity on suitable rooftops can be optimized.

In this way, instead of requiring an owner's investment, the utility makes an annual lease payment or some form of credit to the owner. One of the key tenets of this pilot is that there be a contractual arrangement with the owner assuring that a share of the benefits is passed on to tenants. This could be in the form of leveraging energy efficiency savings in apartments, or avoiding costs necessary for roof repair, or utility bill credits that could provide tenant dividends.

The pilot proposes installation of 50 solar systems on apartment buildings, testing the incentive models and finding new ways of getting solar and its multiple benefits into this tough market segment.

2. **Multi-Metered Solar**

This pilot program is for commercial spaces with multiple meters and a sole roof. It is also applicable to condominiums with similar roof-sharing issues. The goal of this pilot is to tackle the situation by circumventing complex joint ownership. This DG Power model calls for utility ownership of the system and testing the appropriate lease payment and/or utility bill credits for owners.

Everyone can benefit from the solar. As with the Multifamily Pilot, the owners of the select facilities can leverage the lease payments or utility bill credits through energy efficiency for tenants, roof repair, or even "solar bonuses" for tenants. Condominium owners will see the benefit through efficiency upgrades and avoided capital costs related to re-roofing.

3. **Single Family Solar**

Many single-family home owners have been unable to participate in the State's programs promoting solar power and sustainability for one reason or another. This pilot is novel, bringing solar to this "demographic" with a no-money down proposition. Cities and contractors aggregate home owners to trigger the 100-home program. The utility hires a contractor and installs the system on the homes. This pilot will test suitable leases/allowances/bill credits for home owners for efficiency upgrades and necessary re-roofing or repair.

Among the issues with this model identified by the Working Group is the high risk to utilities and the cost of systems. The pilot will focus its lessons learned on turn-over arrangements, roofing and structural issues, recapture provisions, and safety. A less risky model discussed by the Working Group is for utilities to partner with cities that manage and possibly finance programs in which third parties aggregate homes for DG systems.

4. Community Solar Plants

The fourth pilot will bring community solar plants to neighborhoods. Instead of utility customers owning individual systems, utilities will build (or contract for the output of) community systems and residents can buy blocks of green and local DG Power. This pilot provides access to solar for those that may not have a suitable roof or sunshine. Citizens, local businesses, corporate leaders and others can buy shares and build the community's power future. This pilot will test participant interest for widespread adoption and program design.

This pilot is different in that it does not pay allowances to the host site. Instead, participants are charged a fee to recover utility costs and eliminate cross subsidies. Utility ownership (or contract management) also provides for long-term monitoring, maintenance and upkeep as necessary to maximize production. Participants are provided a commodity credit for the value of the energy generation.

1. The Value of Distributed Generation

A. A New Wave of Power Generation

Distributed generation (DG) is power production "in the fingers of the distribution system." DG is inherently small-scale, especially compared to conventional power plants. And it is local, integrated in our communities. DG is built on homes, schools, and businesses, on churches, city facilities, and in vacant lots. It becomes the fabric in the new utility infrastructure. It is clean and green, creates jobs, protects the environment, and many believe secures the energy future.

DG covers a range of locations and technologies. It's about solar rooftops, wind turbines, geothermal systems, fuel cells, and micro turbines. DG can complement central plant power production.

To date, DG has been promoted and developed by the free market supported by tax policies and regulated incentives. As currently structured, the Working Group believes that DG is subsidized by other ratepayers that cannot participate due to income, location, or choice. Consumer-owned systems and third party-owned systems reap the benefit of the incentives to supplant the power procurement and planning role traditionally provided by serving utilities.

Given advances in small-scale power generating systems, DG is spreading through the grid. Once relegated to a handful of "off-grid" systems and ideologists, and while still nascent in terms of penetration, it is now gaining steam toward becoming a viable generation resource.

DG costs are going down and consumers are seeking both energy independence and climate protection. There has been a marked reduction of solar module

costs in the past two years. California utilities are embracing this trend and finding ways to support this wave of green activity. So is national tax policy.

DG has many economic and environmental values. It also offers a way for consumers to take action, in their backyards and communities and rooftops without paying a premium for their power. Consumers want stable rates and to protect the environment, to protect the climate, and to secure safe and sustainable regional and national energy resources. In southern California, consumers point to the obvious: "Of course we ought to harness the power of the sun above that bathes our communities daily."

Expanding DG Locally and Globally

There is a strong impetus to expand the use of renewable energy, locally and globally. This includes both DG and centralized renewable solutions. This concept paper focuses on the former, "local DG" typically less than 1 MW, as an integral part of the solution required. The DG Working Group acknowledges the value of large, utility-scale renewable generation as a component of a robust renewable portfolio.

Governor Jerry Brown is calling on Californians to dramatically expand distributed generation within the framework of CA's ambitious climate goals. DG is the natural book-end to the State's Energy Efficiency Strategic Plan as well as the globally recognized Global Warming Solutions Act of 2006, known locally as AB 32.

Governor Brown is calling for 12,000 MW of "localized energy" by 2020, the equivalent of 3 – 4 million solar homes, 15 – 25 TWh of annual production representing 5 – 8% of current statewide consumption. The Governor's plan also sets a goal for utility-scale generation, boosting the percent of total consumption to approximately 13%.

Posting on Jobs from Governor Jerry Brown's Website

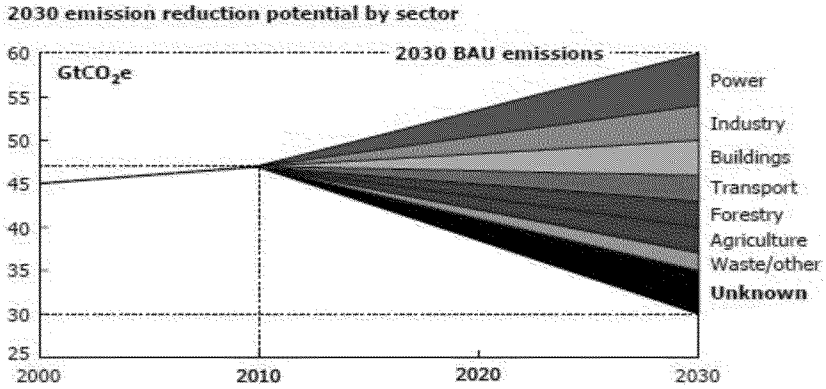
"Below is my plan to get us there..... It will produce a half a million new jobs in research, development, manufacturing, construction, installation, and maintenance over the next decade."

1. Build 12,000 MWs of Localized Electricity Generation

- *California should develop 12,000 megawatts of localized energy by 2020. Localized energy is onsite or small energy systems located close to where energy is consumed that can be constructed quickly (without new transmission lines) and typically without any environmental impact.*
- *Solar systems of up to 2 megawatts should be installed on the roofs of warehouses, parking lot structures, schools, and other commercial buildings throughout the state.*
- *Solar energy projects up to 20 megawatts in size should be built on public and private property throughout the state. For example, we should create the California Solar Highway by placing solar panels alongside our state highways.*

Nationally, the prognosis and expectation for green power is similar. In his January 26, 2011 State of the Union address, President Obama called for 80% of the nation's electricity to be from clean energy sources by 2035. He called on America to "reinvent our energy policy," and to create new jobs in the process. Large blocks of stimulus funds have been provided to clean energy providers, much of which will support the DG movement discussed herein.

Most climate scientists agree that to achieve ambitious, seemingly "stretch" climate protection goals, and to reduce worldwide atmospheric emissions of CO2 by 30 gigatons annually by 2030 to return to 1990 levels, all "wedges" shown below – a full range of climate protection actions -- will have to be used. These include mitigation policies from power, industry, buildings, transport, forestry, agriculture, and waste, etc. The numbers are large, underscoring the policy basis and rhetoric of a million solar rooftops and widespread DG adoption.

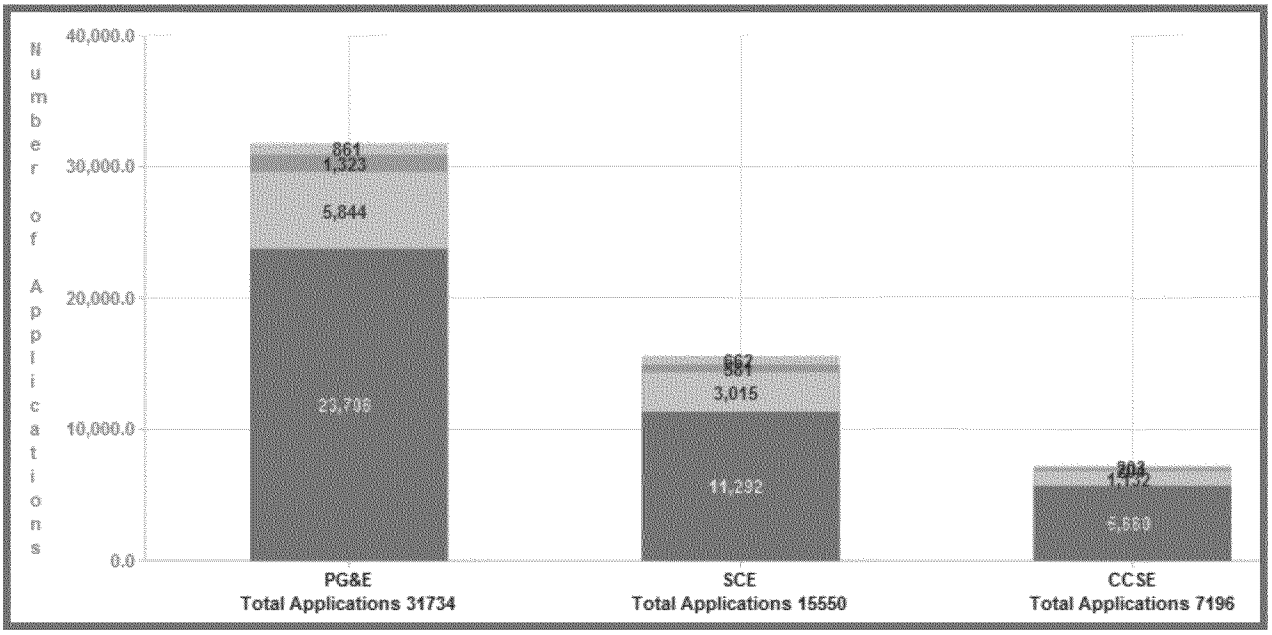


Source: Design to Win, Hal Harvey et al, San Francisco, August, 2007.

B. The Rise of Distributed Generation in California

Without question, solar in California has been on the rise. While some will always say, "too little, too late," and that the California Solar Initiative design is lacking in ways, and even that the CSI has contributed to California's financial crisis and driven up electric rates, the solar industry is indeed growing. According to the Solar Home & Business Journal, there are 1,400 solar companies in California now, and over 50,000 installations. The chart below, from GoSolarCalifornia, shows total applications by IOU service territory.

The California Solar Initiative Total Applications



The California Solar Initiative (CSI) was designed to provide incentives for 3,000 MW of solar capacity. This process is well underway. The CSI's ten-step system provides incentives for residential and commercial solar systems. Early uptake was spurred by the highest incentives.

Challenging Market Segments

All programs and initiatives will have varied uptake among customers. Given the track record and tenure of the CSI, the DG Working Group believes that this is an opportune time to explore next steps:

- How can California's utilities work with their constituent cities to forge programs that serve those who have not been able to participate for one reason or another?
- Can a set of pilot programs chart a course for enabling DG for market segments largely underserved to date?
- And can the next generation of DG programs be sustained by the State's electric utilities without subsidies?

In this concept paper, the Distributed Generation Working Group explores four pilot approaches to overcome market barriers that have held back participation among 1) multi-family buildings (apartments), 2) multi-metered commercial property and condo owners, 3) single-family home owners, and 4) those that don't have any or sufficient solar "real estate."

Underserved Market Segments in Focus

- Renters -- Multi-Family Buildings
- Tenants and Condo Owners -- Multi-Metered
- Single-Family Home Owners
- Citizen/Advocates: Community Solar Plant

Barriers to Widespread Adoption

There are barriers for property owners of all kinds to invest in DG. Costs and complexity are dominant. Currently there are insufficient avenues for financing DG systems, and there is a lack of understanding of the way systems work and their financial feasibility. On top of these barriers are program restrictions (such as another on-site generator), interconnection complexities, and uncertainty in securing incentive levels and rate options.

A fundamental barrier to DG – particularly solar DG -- is that its costs are currently more than conventional grid power. This is especially true when the full costs of DG are considered, including necessary back-up generation and distribution costs. While solar's "fuel costs" are fixed, and its prices will fall as technologies progress, the benefit/costs of solar DG systems are "upside down" in the initial years, meaning that the annual investment costs exceed savings offsets.

Only sophisticated property owners understand the "DG deal" since it involves at least four market forces to secure the projected investment. First is the level of incentive. Then, tax credits,

plus depreciation if commercial. Third is reduced energy required from the grid. Fourth is the value provided by retail net metering, which conveys a bill credit equal to the retail rate when the solar output exceeds the building's energy requirements.

Net Energy Metering

Before addressing the complexity of NEM, consider the limitation to the current CSI design: Given the current NEM rules, the utility effectively pays the customer for the entire retail rate for the power, while continuing to provide the customer with the benefit of the grid. The current rules compensate NEM customers for both the offset generation value, as well as the transmission and distribution fees that are not deferred by DG.

The Working Group emphasizes the reality that net energy metering is unsustainable. As currently structured in California, it cannot be scaled up, as fewer and fewer utility customers will be left paying for stranded grid assets. [D1] Feed-in tariffs can be an alternative, provided that the purchase price for the power is set at the appropriate level. Prices that substantially overcompensate solar customers for system output inflate rates by increasing costs.

Without question, net energy metering has been a useful tool to spur the DG market. NEM allows customers to link up their DG systems with utility systems. When a DG Power system has excess site power, it is fed into the grid with credit with which to draw power at night. DG systems may alleviate utility peak demands but suffer from intermittency.

Net energy metering is conceptually simple, but in practice complex. To understand a system's economics, one has to couple on-site generation values (every 15 minutes of the year), with time-of-use and seasonal rates offset. A solar system's financial return is based on both the value of the output and the rate that it is offsetting.

Some large facilities pay low rates, which from a customer standpoint is very attractive. A low rate, however, dampens interest in solar investments since paybacks are stretched longer. Introducing a DG system at a site is complex, the economics vary widely. NEM allows high-usage customers to offset the highest tiers of the rate structure. Rates are multiple and complex, especially for larger customers who pay demand charges that vary by season and time of use.

Another aspect of that accelerates the problem associated with NEM is California's tiered rate structure. This structure was set up to incentivize utility customers to consume less energy. It has been extremely effective in helping keep California's per capita consumption for residential customers relatively flat over a sustained period. However, the residential rate for usage 130% under their baseline consumption is fixed due to AB 1X legislation. Due to this legislation, utilities must recover their costs through the upper tiers.

Current DG customers can bypass the upper tiers – which makes DG most cost effective – leaving fewer customers to pay these fixed costs. Those left paying for the costs typically cannot afford DG or do not have the availability such as renters or homes that cannot accommodate solar PV. Others may simply prefer not to have DG.

One of the basic rules of the California Solar Initiative and net energy metering is that customers cannot be compensated for the value of any excess generation. An expansive roof might not be suitable if there is little power use on site. While often there is less roof "real estate" than load, in some instances NEM rules limit system size and restrict system location.

California AB 920 requires payments for excess generation, but rates are not published and will likely be insufficient to warrant "over-sizing" a DG system. AB 2466 allows local governments

and school districts to overproduce at one site and to wheel power through virtual net energy metering to other sites. Its rules limit the credit for this excess power to its generation value, reducing the offset value of the system and the efficacy of excess generation.

Another limitation of net energy metering is its disconnect with energy efficiency. DG systems are sized to maximize returns and to offset the maximum load. A solar system's economics is penalized if its output outstrips annual consumption on site. Thus, responsible solar integrators downsize the solar system to provide "headroom" for highly cost-effective efficiency retrofits, cutting the load and thus the capital requirement.

Degressive Incentives

The California Solar Initiative was designed to stimulate and transform the market, lowering costs, and in time lowering the level of incentives required to promote DG systems. On the other hand, the CSI's degressive incentive structure challenges investors analyzing solar deals and their returns. From their standpoint, the level of utility incentive shifts, enrollment is oft backlogged, all creating uncertainty.

Project delays might cause the loss of a step incentive, which in turn may require a project to go "back to the drawing board" for financial review. Reservation and application package requirements have caused projects to be slipped from the queue, impacting DG Power system economics. Solar companies in California have become very familiar with the table below that shows the CSI incentive steps and the levels remaining in each category.

The California Solar Initiative Trigger Tracker, January 25, 2011

Administrator	Customer Class *	Current Step	Initial MW in Step	Unused MW from Previous Steps	Revised Total MW in Step	Issued Conditional Reservation Letters (MW)	MW Remaining	MW Under Review
PGE	Residential	8	36.10	0.47	36.57	6.99	29.58	1.21
	Non-Residential[1]	8	73.20	3.43	76.63	40.53	36.10[1]	13.35
SCE	Residential	5	24.30	1.78	26.08	22.49	3.59	3.01
	Non-Residential	7	66.30	16.72	83.02	68.66	**14.36**	**23.38**
CCSE	Residential	8	8.50	0.05	8.55	1.27	7.29	0.33
	Non-Residential[1]	8	17.30	1.81	19.11	0.21	18.90[1]	4.12

1. Due to budgetary constraints, all un-confirmed CSI MW are not guaranteed a CSI incentive at this time. However, the Program Administrator is still accepting reservation request applications. The MW amount remaining will be incentivized as funding becomes available or as projects drop out. A waiting list for megawatts that become available can be found on the Program Administrator's website.

CSI Step table: CSI Rebate Levels by Incentive Step and Rebate Type

		EPBB Payments (per Watt)			PBI Payments (per kWh)		
Step	Statewide MW in Step	Residential	Non-Residential		Residential	Non-Residential	
			Commercial	Government/ Non-Profit		Commercial	Government/ Non-Profit
1	50	n/a	n/a	n/a	n/a	n/a	n/a
2	70	$2.50	$2.50	$3.25	$0.39	$0.39	$0.50
3	100	$2.20	$2.20	$2.95	$0.34	$0.34	$0.46
4	130	$1.90	$1.90	$2.65	$0.26	$0.26	$0.37
5	160	$1.55	$1.55	$2.30	$0.22	$0.22	$0.32
6	190	$1.10	$1.10	$1.85	$0.15	$0.15	$0.26
7	215	$0.65	$0.65	$1.40	$0.09	$0.09	$0.19
8	250	$0.35	$0.35	$1.10	$0.05	$0.05	$0.15
9	285	$0.25	$0.25	$0.90	$0.03	$0.03	$0.12
10	350	$0.20	$0.20	$0.70	$0.03	$0.03	$0.10

C. Ownership Models for Distributed Generation

The DG Working Group explored three forms of distributed generation ownership. Which form has the best potential to expand local distributed generation in California? In this case we are focusing on solar distributed generation.

Currently, the primary model for both the residential and commercial sectors is that the property owner owns the solar system. This has worked in large measure, with tens of thousands installed. Still, according to the New York Times, less than a single percent of California homes have solar systems.

There are secondary trends in solar system ownership, with residential and commercial solar leasing programs and power purchase agreements. A residential aggregation program can effectively drive down the equipment cost, made consumer-friendly with leasing. Aggregators can take advantage of economies of scale. For schools and government buildings, third parties can take tax credits and depreciation benefits.

The third potential owner, and one that is explored much further and then advocated in this concept paper, is that of utility ownership. The DG Working Group calls this "DG Power." Some consider this a natural evolution of utilities' product offerings. Instead of seeing distributed generation as a threat to revenues, well planned and executed DG Power project can become a new and attractive service offer for customers and a new business activity for utilities. Utility ownership provides a new product for those customers that want solar without "the hassle," or that cannot afford the investment. It's an effective means of getting solar on apartment buildings and multi-metered buildings. Customers still have the strong incentive to maximize their energy efficiency, and the DG Power systems are well maintained and therefore reliable.

Pole-Mounted Solar in New Jersey

A creative utility ownership project is in New Jersey. There, Public Service Electric & Gas will install approximately 200,000 solar units (small distributed solar systems of approximately 200 watts) on utility and street light poles located throughout the neighborhoods of its service territory.

In total, 40 MW of installed renewable energy owned by the utility will be feeding directly into the grid. This accounts for one half of PSE&G's 80 MW Solar 4 All program. It also indentifies locations for large ground-mounted solar arrays and rooftop installations throughout the territory. Project completion is slated for 2013.

San Diego Gas & Electric's Working Group representatives report that SDG&E is testing the feasibility of pole-mounted PV. This type of application may be limited in its service territory due to plans for undergrounding distribution lines, as well as system design and NYMBY issues.

Property Owner

The most basic DG ownership model is simple. The system is owned by the property owner. As such, the property owner hires a "solar integrator" or other DG provider to install the system.

The system is supported by utility rebates and self financed. Energy efficiency upgrades are not necessarily part of the installation. The owner benefits from tax credits and depreciation (if commercial or corporate) and the energy-savings offsets. The owner maintains renewable energy credits (RECs) for future benefit. The owner owns and maintains the system for 25 - 40 years. There is no buy-out or residual.

Risks are considerable for property owners and self-funding is a big barrier to widespread implementation. Then there's maintenance, and changing occupancy with its issues related to turnover of ownership. Roofing issues too can cause a project to be a "non-starter."

On a widespread basis, and from a utility standpoint, this approach results in a piece-meal distributed generation energy system. There is a distinct lack of long-term stewardship of these systems and a concern about orphan systems in time.

Generally, solar systems have been too expensive for widespread uptake. Home owners have balked at 15 – 20 year paybacks. With lower installation costs, the current incentives, NEM, tiered rate structures, now systems are in the 10 – 12 year payback range, with outliers of course. Viable commercial systems are now in the 6 – 8 year payback range.

Third Party Ownership

Given the financial hurdles to DG ownership outlined, there is a movement toward third-party ownership, both for new residential deals and for large commercial operations. Third party providers offer equipment leases and power purchase agreements, affording customers solar and its environmental and economic benefits with no money down.

In this model, the property owner engages in a long-term relationship with a third-party investor that owns and maintains the system. The property owner enters into a PPA with the system owner, purchasing power at a fixed rate for a set period. There is no upfront cost to the host site, and a correspondingly small economic gain.

There is a downside in terms of widespread DG adoption. Third party financiers and PPA providers are in business to earn returns. They are focused on investing only in the "sweet spots," those sites that are large enough (at least 250 kW in size) so the project enjoys the benefits of scale, and sites that have expensive on-site consumption. Marginal rooftops are generally not of interest, nor are apartment complexes and multi-metered buildings.

Residential leasing is also on the rise. Third parties take advantage of the tiered rate structure and target customers that can shave off their upper-tier usage. Customers must have a home that can accommodate the system and have high credit rating to participate.

Utility Ownership

The third ownership option – and perhaps most logical -- is for the utility itself to own and maintain the DG system (or to control the power generated by a third party through a firm contract). We call this "DG Power." This option has been underutilized nationally, but is now getting traction thanks to programs offered by a number of utilities including California's IOUs

as well as Arizona Public Service and Duke Power. Instead of losing market share to competitive power providers, why not secure the business?

The notion of utility ownership of DG Power is transformative: Ultimately, utilities will offer a variety of energy and power services; DG Power fulfills a market niche. As technologies advance, the niche will grow.

The DG Power model presented herein does not threaten the existing solar industry. In fact, it provides it with a bonanza of work. The utilities look to existing contractors to aggregate sites and get jobs built.

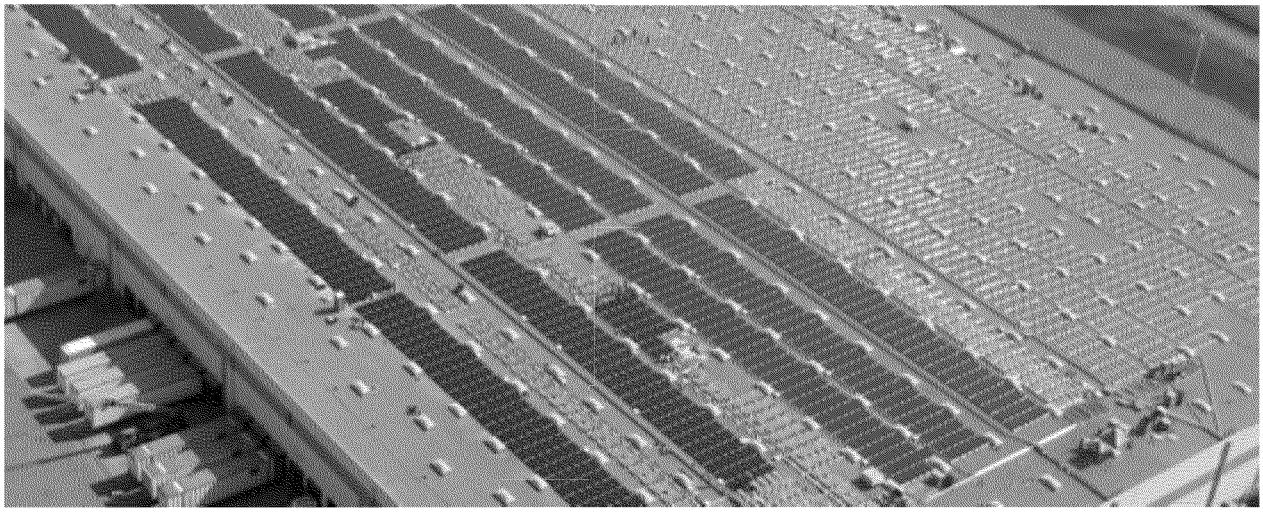
California IOU Roof Leasing Programs

Both PG&E and SCE have programs underway to install, own and operate solar PV systems. SDG&E has a smaller program called the Sustainable Communities Program. In the two larger programs, large commercial roofs and/or open space able to host 1 MW and larger systems are solicited. The utilities own and maintain the systems which feed the grid directly.

A number of PV technologies, including thin film, are being employed. Under SCE's program, the owner of the roof earns approximately $20,000 annually per MW, about $0.014 per kWh generated. The SCE program currently calls for the deployment of 250 MW through this program, though it now wants to discontinue the program in favor of lower-cost solar power production in the desert.

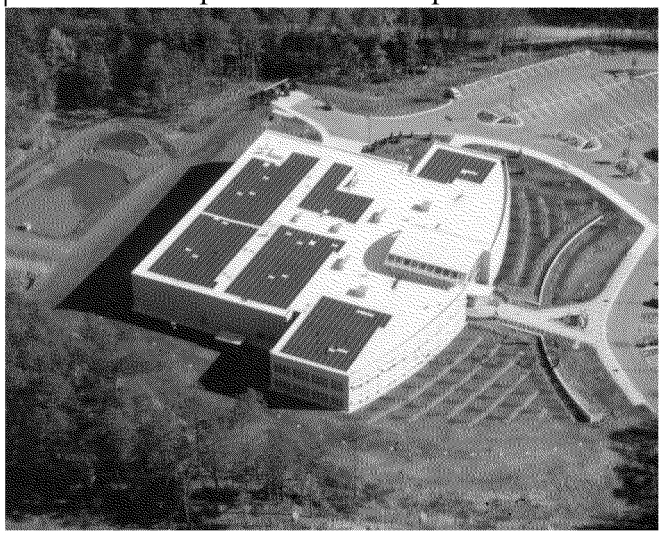
The Sustainable Communities program seeks community participants such as schools, apartment buildings, businesses, and municipal facilities. Projects typically range from 50 - 500 kW, but can be up to 1 MW. Participants must be LEED certified and greatly exceed Title 24 efficiency requirements. Compensation is based on $.01 per kWh per year.

In addition, SDG&E has a large distributed solar energy project where up to 26 MW of ground-mount, utility-owned PV will be located on utility property. Another 74 MW of PV on customer property will be secured through an RFP process and resulting PPA. This nascent program overlaps a recent CPUC decision that requires SDG&E to acquire an additional 81 MW of distributed renewable generation.



Duke Energy

Duke Energy's utility-owned 10 MW solar program is called North Carolina Solar Distributed Generation. Four large installations on commercial rooftops with a total generating capacity of 4.3 MW were completed in 2010. Another ten sites are underway and expected to generate 4.1 MW. A final phase will be completed in 2011 that will include 20 homes in the Charlotte area. All told, the program will be installing solar panels on the rooftops and grounds of homes, schools, office buildings, shopping centers and warehouses.

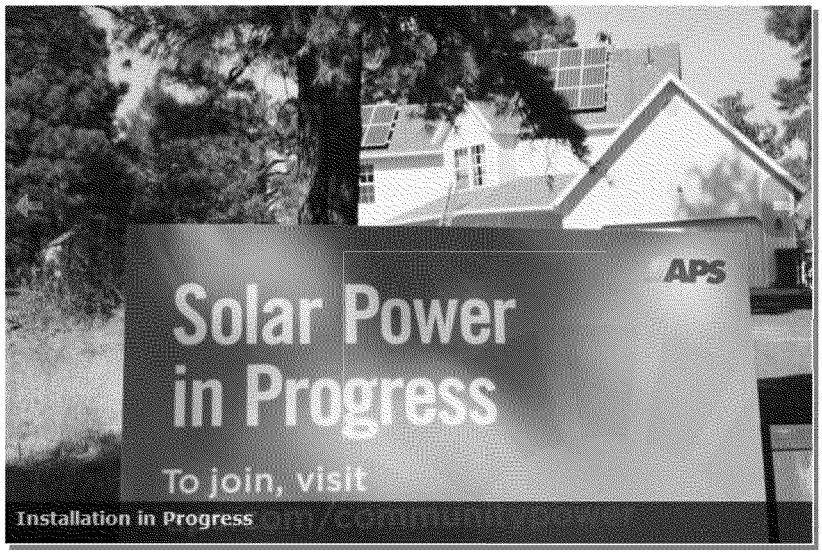


Duke Energy purchased all the modules for the program and selected private contractors to install and provide the inverters and the balance of systems. All installations will be crystalline PV, 90% of them being Yingli modules. Duke Energy owns and maintains the solar panels during their expected 25-year lifespan, as well as the electricity generated. All of the energy will be fed directly into the grid. Duke Energy pays property owners an undisclosed rental fee for the use of their roofs or land. The contracts allow for a one time removal and replacement of the PV system. The participants also have the option to buy the PV system at the end of the 25 year term.

Duke Energy is considering a similar program in South Carolina.

The Arizona Public Service Community Power Project

The APS "Community Power Project" in Flagstaff consists of three branches. One third of the 1.5 MW program will come from utility-owned solar systems placed on 200 residential rooftops. One third will come from solar or other forms of DG on commercial buildings. The remaining third will be from the Doney Park Renewable Energy Site owned and operated by the utility.



APS is supported in the project by a $3 million DOE grant to study the effects of a high-concentration of distributed energy on the electric grid. All program sites feed into the same substation. For their participation, residences and business will be virtually credited with the renewable energy production. The proportion of their bill equal to the amount of energy produced at their site will be frozen at current prices for the 20 year period. Program selection is underway now and all systems are expected to be completed by July, 2011.

The Benefits of Utility Ownership

There are at least seven discrete benefits to utility ownership of DG Power systems.

1. Getting to Scale: First and foremost, utility ownership provides a leap to far greater scale for DG Power. By putting significant resources towards this new form of power generation, just as utilities have in building power plants, DG Power can be advanced and brought to scale quickly.

2. Driving Down Costs: Getting to scale, in turn, will drive down DG Power costs. By partnering with cities and counties, and local contractors, aggregations will be developed, and unit costs will be significantly reduced.

3. Serving the Hard-to-Reach: The pilot programs presented herein not only present utility ownership, but present programs that are designed to reach classically underserved market segments. The DG Power model provides attractive means of getting solar to underserved customers and assuring that a portion of the solar benefit flows to tenants.

4. Fulfilling RPS and GHG Mandates: Utilities are regulated to meet Renewable Portfolio Standards and in the near future they will have greenhouse gas reduction targets. DG Power provides means of contributing to both. Utilities' regulatory mandates are aligned with the DG Power model that provides the grid with no and low-carbon sources of power generation. Utilities keep the Renewable Energy Credits (RECs).

5. Integrating with State and National Goals: Utility ownership allows DG Power to be integrated with ongoing energy efficiency programs. By concurrently delivering DG Power, customer sites and their energy use can be optimized, using the appropriate efficiency-first mantra, with solar power for the community.

6. Assuring DG Power System Reliability: The current CSI/NEM paradigm has resulted in a dramatic uptake of solar systems in California. Each of these systems is separately owned, some are monitored, and many are completely unmaintained. As a result, and in addition to the fundamental intermittency of many renewables, utility system planners cannot rely on DG Power today. Through utility ownership, all systems will be monitored and maintained to optimize performance and provide system operator confidence.

7. Creating Local and Sustainable Green Jobs: Utility ownership will spur creation of more green jobs by working with the DG Power industry. By expanding the installation of DG Power systems, utilities can concurrently expand the jobs market for distributed generation in their service territory. This, in turn, drives economic development and its resulting economic multipliers.

Rather than lose market share to competitive pressures through net energy metering and feed-in tariffs, utilities have the opportunity to develop businesses and to offer new DG Power products that make sense. Not taking action will result in lost revenues and declining profits. Taking action will position utilities to profit and guide the expansion of DG Power.

The Business Case for DG Power

Through proactive steps, utilities can unlock DG Power benefits for society while assuring shareholder returns. In the DG Power model presented utilities provide the solar under cost-of-service ratemaking.

The risks to the utility are small, especially so when considering the downside of taking no action. Yes, utilities want to maintain a customer connection and market share. There will be perceived competition with the private market, and one could argue that the utilities already have this market, and that it is theirs to lose. The risks of DG Power are even smaller when a set of direct and indirect utility and societal benefits are factored into the equation.

Broad Values of DG Power

The list of potential DG Power values is long and multidimensional. Jobs are now high on the national agenda. Recent unrest in the Middle East and Northern Africa serves as a cold reminder of the United States' perverse dependence on foreign powers; the Japanese a potent reminder of the value of green power.

In addition to the utility perspective, the utility customer perspectives need to be considered. Through the DG Power model, both perspectives are squarely addressed, profits are generated, and customers' desires are turned into bricks and mortar at the local level.

Potential Utility Benefits / Avoided Costs

- Avoided generation
- Avoided peak power generation
- Avoided transmission and congestion pricing (depending on location and performance characteristics)
- Avoided distribution costs and upgrades (depending on location and performance characteristics)
- Avoided hedges on conventional fuels
- Value of renewable energy credits (RPS fulfillment)

Potential Environmental Benefits / Avoided Costs

- Avoided costs of greenhouse gas emissions
- Avoided costs of other air pollutants
    - SOx, NOx, mercury, particulates
- Avoided costs of thermal water pollution at power plants

Potential Economic Development Values

- Value of job creation
- Value of economic development, multipliers
- Increased property values, rooftop values

Potential National Security Values

- Avoided costs of national security
- Value of emergency preparedness
- Value of local, resilient smart grids and energy systems

On the other hand, in some cases there are additional costs to support a DG framework. For instance, integrating DG into the power grid can require costly utility infrastructure upgrades. Working Group members also point to the DG property tax exemptions as lost income for local governments.

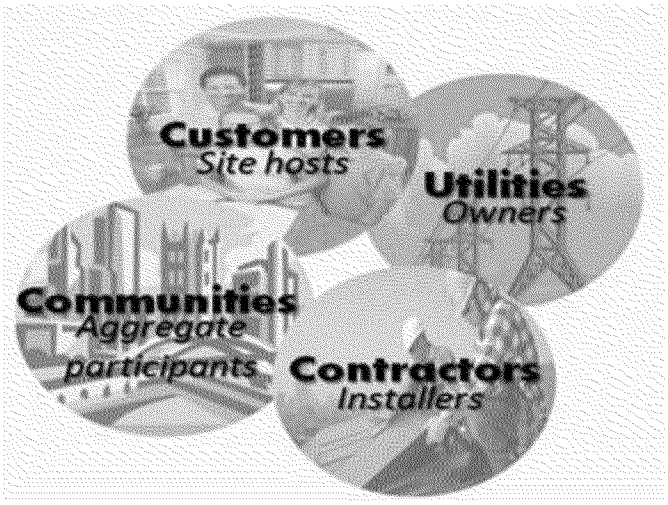
D. The Working Group's DG Power Model

The DG Working Group has been tasked with developing DG Power program approaches that are cost-effective for ratepayers and shareholders, and society, both today and tomorrow. How can long-term benefits be maximized? How can short-term marginal costs be minimized? How can cross subsidies be eliminated? What form of DG support is truly sustainable?

These challenges and parameters have caused the Working Group to develop the proposed DG Power model that drives down costs through partnering and aggregation. Through aggregation the economies of scale can be realized making the pilot programs cost effective.

The DG Power Model

A Partnership of Customers, Cities, Contractors, and Utilities



Partners launch the DG Power partnership

- **All parties** promote the partnership and its benefits

Communities engage and aggregate property owners with utility guidance

- **Contractors** identify and approach prospects
- **Cities and Counties** reach out and aggregate suitable sites

Utility negotiates contracts with owners of appropriate rooftops

- **Utility** hires contractors to install solar systems
- **Utility** owns and operates and maintains systems for 20 years

Property owner receives combination of negotiated benefits

- Comprehensive host site energy analysis
- Recommended energy efficiency measures
- Utilities provide prescriptive and custom incentives
    - Allowances for efficiency upgrades and roof repair/reroofing
    - Utility bill credits for specified contributions

Utility monitors and maintains DG Power system on property

- Utility gets energy and capacity production for 20 years

2. Four Pilot Projects

The following projects have been developed by the DG Working Group to apply the DG Power utility-ownership model to four pilot areas. San Diego Gas & Electric has chosen not to participate in one of the pilots.

The pilot projects focus on providing avenues for DG Power for hard-to-reach customer segments. One is specific for low and middle-income customers; another targets the split incentive issue; the other two provide access to DG Power for those customers without other access to clean and green renewable power. They are based on a collaboration of utilities working with cities and contractors to bring together participating customers.

The four pilot programs drive down costs in two ways: First, they aggregate systems thanks to coordinated efforts with cities and contractors. Second, they maximize rooftops and allow for bigger systems, also helping to achieve economies of scale.

Specifically, the four pilots provide solar services for a) multi-family apartment complexes, b) multi-metered commercial facilities (including condominiums), c) single-family home owners, and d) all types of utility customers that lack either property ownership or roof real estate sufficient for solar power.

A. Multi-Family Buildings Pilot

Pilot #1	Multi-Family
Target	Apartment Building Owners
Number of Projects	50
Average Size (kW)	50
Estimated Price/kW	$6,000
Cost of System	$15,000,000
Total Cost w/ Admin	$18,000,000
Test Areas	
Benefits/Cost Offsets	
Policy Challenges/ Issues	

Issue

Apartment dwellers have not been able to participate in the State's solar programs. While they usually pay their electric bills, they are normally short term in any one location, and thus they have no incentive to invest in a solar system, even if they could use a roof shared by all tenants.

Target group

- Apartment building owners
- 50 buildings in the pilot program; 20:20:10 utility split

Goals

- To provide solar power to apartment buildings in test cities
- To stimulate activity on rooftops that would not otherwise participate
- To test means of contractually requiring owners to pass a share of the benefits to their tenants.

Approach

- Cities and contractors to promote program
- Owners commit to passing a share of the benefits to renters (benefits could included implementation of energy efficiency measure resulting in lower energy bills for tenants)
- Utilities qualify sites, select requisite number for pilot program
- Select sites have efficiency assessments provided by the utility
- Contractors install systems; monitor output and maintain
- Building owners get allowances for efficiency upgrades, roof repair, credits
- Continuous monitoring, measurement and maintenance as needed

System Size

- Apartment building systems will generally be 20 – 100 kW in size.

Approximate Project Cost

- $300,000 per site based on average 50 kW size and $6/kW AC
- $18,000,000 based on 50, 50 kW projects and 20% project management and administration fee.

Policy Challenges/Issues

- Working with multiple constituents
- Competing for time and attention
- Preparing a win-win mix of allowances, credits, pass-through provisions
- Proposing a long-term business proposition

Test Areas

- One city in each service territory

Evaluation Criteria

- Willingness of building owners to participate
- Enthusiasm of renters
- Value of the discounted power they receive

B. Multi-Tenant and Multi-Metered Facilities Pilot

Pilot #2	Multi-Metered
Targets	Commercial Property & Condo Owners
Number of Projects	10
Average Size (kW)	250
Estimated Price/kWh	$6,000
Cost of System	$15,000,000
Total Cost w/ Admin	$18,000,000
Test Area	
Benefits/Cost Offsets	
Policy Challenges/ Issues	

Issue

The issue is a classic split incentive: the renter and business owner who pays his or her electricity bill. The owner of the building and thus the rooftop, but with no need for power, has no incentive to go solar. An additional factor adding complexity: one roof owned by the property owner, and many renters with variable leases.

Target group
- Commercial property owners who want to go solar and are willing to negotiate benefits.

Goal
- 10 commercial properties

Approach
- Select city identifies properties for inclusion with utilities
- City and contractor approach property owners
- Select sites have efficiency assessments provided by utility
- Utility provides allowance/bill credit for efficiency upgrades, roofing, solar bonuses
- Tenants receive lower energy bills due to implementation of energy efficiency measures
- Solar system installation
- Continuous monitoring, measurement and maintenance as needed

System Size
- 100 – 500 kW

Approximate project investment
- Average investment cost of $1.5 million (based on 250 kW avg. @ $6/watt AC)
- $18 million program with 20% project management and administration fee

Policy Challenges/Issues
- Assuring that solar payments leverage energy efficiency gains
- Assuring that a portion of solar allowance benefit flows to tenants

Test Areas
- One city per utility territory, 4:4:2 utility split

Evaluation Criteria

- Willingness of property owners to encumber their roofs with solar systems
- Determination of the share of benefits that ultimately flow to tenants

C. Single Family DG Power Pilot

Pilot #3	Single-Family
Target	Single-Family Home Owners
Number of Projects	100
Average Size (kW)	3.5
Estimated Price/kWh	$7,500
Cost of System	$2,625,000
Total Cost w/ Admin	$3,150,000
Test Areas	
Benefits/Cost Offsets	
Policy Challenges/Issues	

Issue

This pilot promotes utility ownership of solar systems on a limited number of single- family homes. What barriers have customers had in going solar? Can utility residential solar services be an attractive product in the market? Will utility ownership be more attractive to homeowners than third party ownership?

Target group

- Single-family home owners

Goal

- To provide single-family home owners with DG Power
- 100 homes total
- 50:50 split between PG&E and SCE (SDG&E elects not to participate in this pilot.)

Approximate Project Investment

- Approximate cost of $26,250 per home or $2,625,000; $3,150,000 with 20% project management and administration fee

Approach

- Offer customers in select areas solar systems for their homes
- Site checks to assure veracity of structure and its roof; checklist for screening
- Select sites have efficiency assessments provided by utility
- Utility provides allowance/bill credits for customer to leverage efficiency gains, cover roofing repairs, and provide bonuses
- Solar system installation
- Continuous monitoring, measurement and maintenance as needed

System Size

- 2 – 5 kW per home (approximate pilot program size of 350 kW)

Policy Challenges/Issues

- How to handle turnover of property
- Option to recover? Transfer?
- Theft and vandalism

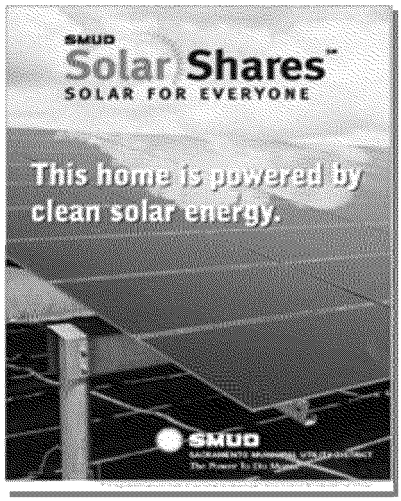
Test Areas

- One city in each service territory
- Need to have ample single-family housing

Evaluation Criteria

- Willingness of customers to participate
- Cost of monitoring and maintaining systems

D. Community Solar Plant Pilot



One of the most interesting local solar developments in the United States is that of Community Solar Plants. They are both experimental and attractive in that they open up a solar pathway for all manner of participants. Sacramento Municipal Utility District's 1 MW plant is underway, with some 700 shareholders.

Community solar plants achieve an economy of scale by linking together dozens of customers. This leads to a host of benefits:

Benefits of Community Solar Plants

- Lower Unit costs
- Routine maintenance
- Regular monitoring
- Reliability for utility system planners
- Help communities reach their climate protection goals

Furthermore, and depending on the structure used, the community solar plant can currently result in attractive commercial system tax benefits. In some cases the plants will support the utility RPS standards; in other cases, the RECs (environmental attributes) will be owned by the customer/investors.

The following table presents two community solar plant programs, highlighting a set of terms and conditions for comparative purposes. Note that in the SMUD case, the utility does not own the plant. Instead it buys its output from a developer and then buys-down its costs for consumers. Utility-owned and "utility-arranged" community solar will be explored in the pilot.

Administered by	SMUD SolarShares	United Power Sol Partners , CO
Hosted by	1 MW central array	United Power
Host site type	Ground mount	Ground mount
Program cap (MW or sites)	Expanding from1MW to 25MW	10kW in Phase I, more planned
Who can participate	700 SMUD Customers in first MW	United Power customers (25)
Participant system cap	0.5 kW to 4 kW shares	Each 210 module is leased
Program length	20 years	25 years
Cost to participate	0.5 kW share $129/yr	One-time fee of $1,050
Compensation	SMUD bill credited with kWh production from shares	Value of kWh credits (about $900 over 25 years in 2010 dollars, but will likely rise)
Installed by	PPA (enXco)	
RECS	To the utility	To the utility
Notes	12 month participation is minimum	

Source: DOE Community Solar Plant Guide November 2010.

Issue

There are a number of utility customers that are "boxed out" of the California Solar Initiative for one reason or another. Imagine an apartment renter facing the classic split incentive of wanting rooftop solar, but without owning the roof to be able to do so. This same situation could apply to a retailer that rents. Community Solar plants provide an opportunity for these customers and others to invest in clean power, in DG Power.

Pilot #4	Community Solar
Target	**Open to all existing customers**
Number of Plants	**3**
Average size (MW)	**1**
Estimated Price/kWh	**$5,000**
Cost of Systems	**$15,000,000**
Total Cost w/ Admin	**$18,000,000**
Potential Site	
Benefits/Cost Offsets	
Policy Challenges/Issues	

Target Groups

- Renters
- Those without good solar access
- Those with rooftops that cannot accommodate solar
- Those that do not want to physically own a PV system
- Corporate citizens joining fellows to build community

Community solar plants provide a means – a new product -- to engage all interested customers, from homeowners without ample roof space, to renters, to corporate and industrial citizens keen on supporting the local community plant.

Approach

- Cities and utilities determine appropriate locations
- Cities and utilities promote solar plants
- Utilities invest to meet customer commitment
- Contractors build plants
- Utilities compensate owners with bill credits for the commodity
- Utilities experiment with using "efficiency points"

Payment Options

Research to date shows Securities and Exchange Commission challenges to the solar plants paying dividends to shareholders. Thus utility bill credits are a preferred option. Additionally, the DG Working Group supports the concept of "efficiency points" to cause homeowners to continue to invest in efficiency measures, leveraging the value of community solar plant investments.

Returns for Customers

- Utility bill credits for the value of the energy generated
- Efficiency upgrades through point system

Goals

- To provide a new green product for interested customers
- To test customer uptake at different sizes and price points

Sizing Notes

- 1 MW solar plant in each utility service territory
- 3 MW total pilot project size

Approximate Pilot Investment

- Approximate $15 million system cost ($5/AC watt); $18,000,000 with 20% project management and administration fee

Policy Challenges and Program Issues

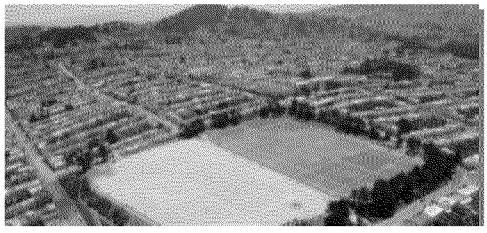
- Locating systems
- Ownership versus Arranged (PPA)
- Potential use of non-profit LLC for deduction

Test Areas

- One Community Solar Plant for each service territory

Locations, sites

- Ground mount



- "Floatovoltaics" over reservoirs, as in the photo – cuts evaporation and reduces the need for expensive replacement bladders
- Municipal sites, parks, parking lots, road sides
- Leased commercial space

Evaluation Criteria

- Ability to secure locations with long-term leases/agreements
- Participants interest in terms of number of signups: residential, commercial, industrial
- Efficacy of the value proposition of utility bill credits and efficiency points

FOUR PILOT PROJECTS AT A GLANCE

	Pilot #1 Multi-Family	Pilot #2 Multi-Metered	Pilot #3 Single-Family	Pilot #4 Community Solar
Target	Apartment Building Owners	Commercial Property & Condo Owners	Single-Family Home Owners	Open to all customers
# Projects	50	10	100	3
Size (avg kW)	50	250	3.5	1,000
Estimated Price/kWh	$6,000	$6,000	$7,500	$5,000
Cost of System	$15,000,000	$15,000,000	$2,625,000	$15,000,000
Total Cost w/ Admin	$18,000,000	$18,000,000	$3,150,000	$18,000,000
Test Areas				
Benefits/Cost Offsets				
Policy Challenges/ Issues				

Conclusion

This paper presents a transformative model for utilities, a new product offering and a countermeasure to free-market solar that is stripping revenues from electric utilities.

Significant Benefits

The benefits of the utility-owned DG power are numerous.

Maintaining the Connection to Customers. The primary benefit to utilities is maintaining customers and the customer connection. Current distributed generation programs are based on a lesser relationship. DG Power provides utilities with a means of continuing to serve all customers with a new, win-win business model through enhanced service.

Driving Down Costs and Increasing Reliability: Through the collaborative DG Power model presented herein, utilities can help drive down costs expeditiously to make renewables more affordable. Through utility ownership, system planners can rely on DG Power systems. These attributes beget more DG Power.

Harnessing the Power of Communities: To replicate success, DG Power projects must be affordable. This model outlines an affordable approach to DG Power because it relies on aggregation and taps into the power of cities and counties and contractors to play a significant role in this effort. This collaborative alliance harnesses the power of local governments to aggregate customers, providing substantial economic benefits and energy savings to communities while achieving climate protection and national security.

Boosting Green Jobs and Local Economic Development: Finally, and in today's economy of utmost importance, is that DG Power expands job creation. By putting greater muscle into the DG Power arena, utilities will leverage greater amounts of DG Power, and in turn there will be more work, building and sustaining the green workforce.

Policy Implications

Net energy metering has been a valuable policy instrument to catalyze a new market. It is, however, unsustainable. As it grows there will inherently be fewer and fewer ratepayers – those without their own solar power and DG systems – shouldering utilities' sunk costs.

DG Power provides a sustainable means for utilities to retain customers, and to build more stable revenues. As it spreads throughout our society, much like cell phones did with telecomm, utilities can be in the forefront of the transformation.

In addition, there are benefits of DG that have here-to-date not been factored into the benefit-cost analysis of DG. These are qualified, but similarly not factored into the benefits of the pilot designs. The DG Working Group is charged with finding cost-effective DG solutions using today's rules and rates. During the pilot programs, these "un-factored" or indirect benefits of DG will be evaluated.

DG Power Services

This concept paper introduces a growing industry, and one evolving to address market segments not fully served with the benefits of distributed generation. It presents market barriers and solutions in the form of four pilot programs that will allow utilities to take the next steps in owning and operating DG Power systems as a new product for untapped markets.

By taking ownership positions, utilities can monitor and maintain their investments to maximize production and system reliability. They can also profit from DG Power instead of seeing it as a threat to their sales and livelihoods.

The four pilot programs delve head-long into areas that have been hard to reach, and for good reason. Apartment buildings have been off the map; the pilot herein gives benefits to both property owners and tenants for going solar. Multi-metered buildings have been off limits for net energy metering and now too can join the solar revolution for good value and credit.

The third pilot allows utilities to once again take the reins installing and owning DG Power on single-family homes. Community solar plants provide a pathway for community involvement in solar, driving down costs and building spirit and community energy resilience.

Each of these pilots is based on a partnership between customers, the utility, contractors and their cities. Together, projects are promoted and aggregated, costs are made reasonable, and a net is cast around distributed generation with its shared benefits.

Next Steps

This paper will be presented by the Working Group at the Spring 2011 Aspen Accord Conference in San Francisco, CA on March 31, 2011. Subsequent work will include developing the detailed pilot approaches, locations, scale, budgets and implementation plans.