



Public Housing: Let Your Roof Make it Rain

A Case Study of the Housing Authority of the City and County of Denver's (DHA) Solar Power Purchase Agreement

Enfinity invested approximately **\$10 million** in the DHA solar project, so there were minimal up-front costs to DHA.

A Solar Power Purchase Agreement can enable organizations with large amounts of roof space — but limited available funding — to finance renewable energy projects and reduce utility expenses.

Summary

The Housing Authority of the City and County of Denver (DHA) had a problem: it wanted to expand its portfolio of renewable energy sources, but it had little available capital to invest in the project. In addition, DHA was also looking to decrease utility expenses and implement the project across their existing multi-family and single-family properties throughout the Denver area. The solution was an innovative Power Purchase Agreement (PPA) that enabled the installation of a 2.5 megawatt solar project across 387 different DHA buildings. Because of the structure of the PPA, the project was implemented at minimal upfront cost to DHA, and the project actually provides revenue for the housing authority from the lease agreements on its roof space. Across

the United States, there are approximately **3,300 public housing authorities**, many of which could emulate this project, not to mention the thousands of other organizations with solar-ready roof space, so this project has amazing potential for scalability and replicability.

The Housing Authority of the City and County of Denver (DHA) is a quasi-municipal corporation with a portfolio of over 12,000 units and housing choice vouchers, providing affordable housing to more than 26,000 very low, low and middle income individuals representing over 11,000 families. DHA has transformed public housing in Denver creating a vibrant, revitalized, sustainable, transit oriented and mixed-income community of choice.

Today, DHA's vision has been honed to reflect the goal that every individual or family shall have quality and affordable housing, in communities offering empowerment, economic opportunity and a vibrant living environment.

Why a Solar PPA?

- Continual expansion of DHA's renewable energy portfolio
- Long-term, predictable energy costs
- Supports HUD's interest in sustainability
- Generates payments from leased roof space
- Ample availability of sunlight and roof space
- Preserves limited capital funds for critical building improvements

Criteria for Solar-Ready Roofs

- East or South facing
- Limited obstructions from trees or other rooflines
- Estimated effective useful life of roofs
- DHA's long-range demolition and rehab plans

Project Timeline

- **2011**
Idea conceived
- **Summer of 2011**
Request for Proposals submitted
- **Spring of 2012**
Agreement signed
- **Summer of 2012**
Construction began
- **Spring 2013**
Construction was completed



The Story

In 2011, Andrea Davis from DHA's Real Estate Development Department wondered whether it might be possible for DHA to use any of the roof space on their existing building stock to generate solar power. Both the roofs and sunlight were readily available, but the funding to install and operate the solar panels would have to come from an external source.

Unlike many other large-scale solar installations, the DHA solar project would need to be installed across a wide range of existing multi-family properties and single-family homes peppered throughout the city. In comparison to projects implemented entirely on one location or during the construction of new buildings, this could lead to complications in siting, installation, maintenance and monitoring the panels once installed.

Undeterred by the uncharted nature of the project, Andrea began to explore opportunities for a comprehensive solar Power Purchase Agreement (PPA) because these require little-to-no upfront cost and can be implemented on existing buildings.

For DHA, the goals of the project were to purchase energy production from a renewable source, create green jobs, establish long-term financial sustainability and create opportunity for long-term ownership and operation of energy-efficient systems. Also, as part of the Department of Energy's Better Buildings Challenge, DHA set a goal to achieve a 20 percent reduction in its energy use intensity (EUI) within 10 years. This goal was to be achieved in part through this renewable energy PPA, and also through other energy conservation initiatives and resident engagement programs.

Environmental Defense Fund (EDF), a leading international nonprofit organization, creates transformational solutions to the most serious environmental problems. EDF links science, economics, law and innovative private-sector partnerships.

Climate Corps is EDF's innovative summer fellowship program that places specially trained graduate students within organizations as dedicated environmental problem solvers. Having worked with over 300 organizations since 2008, Climate Corps has launched a series of case studies called Scalable Solutions highlighting best practices in energy management.

In early 2012, DHA began in earnest to seek a viable PPA partnership with a Request for Proposals:

“The Housing Authority of the City and County of Denver invites responses from qualified entities to provide cost effective solar photovoltaic generating systems at multiple DHA sites by providing all design, construction, operation, application and financing services necessary to the successful installation and operation of said systems.”



DHA received a total of three responses to its Request for Proposals and after a thorough selection process selected OakLeaf Energy Partners as their partner. The proposal that was selected was a landmark renewable energy project with the installation of 666 solar electric systems on 387 DHA resident buildings, totaling 2.5 megawatts. Utilizing over 10,000 240-watt panels, these collective arrays could reduce CO₂ emissions by 3,400 tons per year.

This proposal stood out above the rest due to the revenue DHA could make from leasing its roof space for the solar panels. On top of being able to purchase the electricity generated by the panels for a slight per kilowatt hour discount, this proposal enabled DHA to receive payments for leasing the

roof space the solar panels occupy. Because of the environmental benefits, revenue generation opportunity and discounted long-term energy pricing included in the PPA, in June of 2012, DHA signed the contract, and installation of the panels began.

Implementation

A number of partners were engaged in the implementation of the DHA solar project. While Chris Jedd, the DHA Portfolio Energy Manager, acted as the project manager, the PPA project was a major cross-functional project that was catalyzed by the real estate department, and involved the finance and maintenance departments, amongst others.

Outside of DHA, Oak Leaf Energy Partners served as the project’s developer, providing site planning, interconnection analysis, tax and financial structuring, and negotiating financing. The project was designed to be a minimum of 2.5 Megawatts, as that would ensure financial viability. Based on Google Earth imagery, a portfolio of over 4,000 potential sites was identified. This pool was narrowed down by eliminating properties with less favorable roofs.

Enfinity, the project’s financier, owns and operates the photovoltaic arrays, selling the electricity it generates from the solar electric systems to DHA at a discount. Enfinity invested approximately \$10 million in the DHA solar project, so there were minimal upfront costs to DHA. Under this 20 year contract, DHA receives payment for leasing the roof space and has the option to purchase the panels at a significant discount in six years.

For the engineering and installation of the solar electric systems, DHA turned to Namaste Solar. Over a period of 11 months, nine crews installed the over 10,000 solar panels included in the project. The typical installation period for any one building lasted just two days.

Results

Now installed, the systems are anticipated to collectively generate an average of 3.4 million kilowatt hours of electricity per year, which is an annual reduction of around 3,400 tons of carbon dioxide. Outside of reduced carbon emissions, the project resulted in several benefits. This project spurred the generation of **40+ green jobs** in the Denver area for workers hired to install the panels. Also, this PPA supports commitments by HUD to sustainability, including clean renewable energy.

For DHA there are a number of resulting benefits. This project enabled the housing authority to expand its portfolio of renewable energy sources without dedicating funding. Also, DHA actually receives revenue from leasing its roof space and is able to purchase this renewable energy at a slight per kilowatt hour discount. Both of these aspects of the PPA provide DHA with additional revenue streams that can be used for other improvements. These energy costs are also long-term and predictable, which is something HUD encourages. Lastly, through an accompanying resident engagement program, DHA has been able to communicate about the solar project, which provides residents with an additional reason to take pride in their homes.

Challenges

DHA has encountered one main challenge through the implementation of its solar project: collecting data and monitoring production from such a disparate system of panels. Unlike many other solar projects consisting of large systems located on a single site, this project was implemented as 666 separate systems on 387 different residences across the city of Denver. With all of these separate systems, determining the output and ensuring productivity of the panels in real time, or close to real time, has proven difficult. Currently, DHA is only able to receive data on the system's production on a monthly basis.

Moving Forward

In the United States, there are an untold number of housing authorities and other types of organizations with rooftops ready for solar power. Through PPAs, organizations can overcome the financial barriers often associated with these renewable energy projects. If all 3,300 housing authorities in the US were able to establish solar installations similar to this

A Scalable Solution

This solar project could be replicated at thousands of other housing authorities resulting in:



11 billion kwh of clean electricity generated annually



1 million homes powered by solar energy



11 million tons of CO2 emissions reduced annually

DHA project, the rooftops of public housing authorities could produce enough solar energy to power over 1 million homes.

While DHA was able to secure a slight per kilowatt hour discount on electricity prices, it is important to note the additional revenue it generates by leasing its roof space. Future solar installations could be structured such that the traditional utility buys the electricity directly, and the only financial exchange between the owner/ operator of the solar panels and the building owner is regarding the roof lease. This alternative model eliminates the concerns of a volatile energy market and the need for organizations to sign long-term energy contracts.

Thinking Big

Housing authorities such as DHA could set up microgrids with their renewable energy projects that could be separated from the traditional grid. In this way, they would increase their resilience to storms and grid disruptions caused by increased demand. Additionally, although utility policy currently prevents it, if housing authorities were able to use these microgrids to supply their surrounding communities with electricity in times of need, it might change the dynamic of how public housing is viewed in the United States. Instead of being viewed as detracting from or dependent on the rest of the community, housing authorities would be able to provide a much needed service for their surrounding neighborhoods.