Solar for Humanity: Nonprofit Solar Partnerships with Habitat for Humanity

Landscape and Financial Analysis with Applications for Minnesota

Gabriel Chan, PhD, Assistant Professor (University of Minnesota)
Jordan Morgan, Graduate Research Assistant (University of Minnesota)
Ryan Streitz, Graduate Research Assistant (University of Minnesota)

In conjunction with…
Rural Renewable Energy Alliance (RREAL),
Clean Energy Resource Teams (CERTs), and
UMN Central Regional Sustainable Development Partnership (CRSDP)

Comments welcome: gabechan@umn.edu

February 2019

Center for Science, Technology, and Environmental Policy

University of Minnesota – Twin Cities

601 19th Avenue South

Minneapolis, MN 55455

www.hhh.umn.edu/cstep

Table of Contents

Figures

Tables

Case Studies

Acknowledgements

This work has been supported by a generous grant from the University of Minnesota Extension Regional Sustainable Development Partnership.

We thank the following individuals for helpful discussions during the preparation of this work: Erica Bjelland, Art Buhs, Chad Dipman, Jason Edens, Peter Gebauer, Chuck Greenberg, Rachel Juritsch, Andrew Killeen, Matthew Grimley, Lissa Pawlisch, Rose Wirtz, and Molly Zins.

All errors are our own.

Abbreviations

CERTs	Clean Energy Resource Teams
CIP	Conservation Improvement Program
CRA	Community Reinvestment Act
DG	Distributed Generation
GRF	Green Revolving Fund
HFH	Habitat for Humanity
HFHI	Habitat for Humanity International
HUD	U.S. Department for Housing and Urban Development
ITC	Investment Tax Credit
MACRS	Modified Accelerated Cost Recovery System
NEM	Net Metering
NGO	Non-Governmental Organization
NPS	Nonprofit Solar (Organization)
OCC	Office of the Comptroller of the Currency
PACE	Property Assessed Clean Energy
PG&E	Pacific Gas & Electric
PPA	Power Purchase Agreement
PUC	Public Utilities Commission
RREAL	Rural Renewable Energy Alliance
SCREC	Solar Renewable Energy Credit
SHOP	Self-Help Homeownership Opportunity Program
SREC	Solar Renewable Energy Credit

Executive Summary

As solar energy has become increasingly affordable due to technological change and public policy, possibilities for individuals to benefit from participating in solar deployment are growing. Yet these opportunities are not equitably accessible to all. Low-income households in particular face barriers to participating in solar programs due to financing requirements arising from capital constraints and the high up-front costs of solar. These barriers are layered on top of an energy system that already places a disproportionate burden on low-income households. In this context, new initiatives have been developed to target solar deployment to low-income households to reduce energy expenditures and increase long-term wellbeing and resilience. In this report, we focus on one such possible initiative, the integration of solar deployment by a nonprofit solar organization (NPS) with affordable housing through Habitat for Humanity (HFH).

HFH is a nonprofit that has been a leader in low to medium income (LMI) housing assistance for over 40 years. Their model has created an opportunity for partnerships with NPSs looking to provide subsidized and affordable solar access to LMI homeowners. The current landscape for NPS-HFH collaboration is lacking. Within this report, 56 HFH-NPS collaboration case studies were evaluated and compiled for analysis (see Section 2). A few key lessons have emerged:

1) The current model of collaboration consists almost exclusively of an NPS solar donation to the HFH homeowner;
2) Most NPS projects are not sustainable and do not lead to future project partnerships unless they are assisted by local utilities or solar manufacturers; and
3) Creative financing structures are emerging, but there is room for growth and understanding.

Our objective in this report is to present a set of creative financing models that can enable a long-standing and sustainable platform for NPS-HFH collaboration. The models we present span the range from well-known to untested, and some may require piloting and iterative refinement before they are able to provide participants with long-term benefit. We present five financing models that range in technical complexity and in the way financial benefits are shared between a single homeowner and future homeowners. Other tradeoffs between models are discussed in the report. An outline of the five models are as follows:

1) All benefits go to the homeowner.
2) Panels are donated to the homeowner; partial benefits are recouped by the NPS through a Green Donation Fund and used to enable future solar projects.
3) Panels are donated to the Habitat affiliate and integrated in a home through a homeowner mortgage fund. Benefits are shared between the homeowner and the affiliate.
4) The NPS maintains ownership of installed panels and finances them through a Green Revolving Fund, which allows for flexible benefit adjustment and the ability to recoup on NPS investment for use in future projects.
5) The NPS maintains ownership of installed panels and finances them through a Green Revolving Fund and a Habitat affiliate receives energy-production reimbursement, which allows for flexible benefit adjustment between current and future projects. The NPS may also recoup on investment for use in future projects.

Proper communication and participation by vested actors is necessary for success. In order to optimize outcomes, each NPS and NPS-HFH partnership must find a financial model that best meets their needs. To facilitate assistance measures for these contract options, several finance tools have been evaluated and compared. These tools include: 1) internal-funds, donations, sponsors, and grants, 2) outside private investors, 3) the Community Reinvestment Act, 4) debt financing, 5) Property Assessed Clean Energy, and 6) energy conservation programs, such as the Minnesota Conservation Improvement Program. An NPS may use these options to subsidize the costs of a solar panel to the homeowner and/or the affiliate and still operate a Green Revolving Fund (GRF) with which to reinvest actualized energy production credits into additional projects.

These lessons were accrued from a deep dive into the nonprofit solar landscape, financial assistance programs, and HFH business models. This report has been curated for the benefit of Minnesota NPS organizations, but outcomes may be applied elsewhere.

1. Integrating Solar with Habitat for Humanity

This report presents the opportunities for integrating solar energy with Habitat for Humanity (HFH) projects in Minnesota. While early experimentation with solar integration in HFH projects has been conducted in Minnesota and other states, sustainable, scalable business models have not yet been developed. We synthesize current efforts across the country for integrating solar with HFH, analyzing the relevant policy landscape in Minnesota and presenting a suite of possible design options and business models that can be considered for development in Minnesota. Our target audience for this report is non-profit solar developers seeking to work with HFH affiliates in Minnesota, but many of our findings are also more generally applicable to other low-income solar deployment efforts.

1.1. Solar and the Low-Income Energy Burden

Energy costs are one of the largest expenses that low-income families bear. In Minnesota, where home heating costs are relatively high compared to the national average, low-income households face a substantial "energy burden" ("energy burden" is defined as the percent of income a household dedicates to energy bills). Fisher, Sheehan, and Coulton, a research and consulting firm, estimates that Minnesotans with incomes 50% below the federal poverty level spent 37% of their income on energy in 2017 (Fisher, Sheehan & Colton, 2017). Notably, the energy burden increases at lower levels of poverty, suggesting that energy expenditures may create unsustainable cycles of poverty (Oxman, 2018).

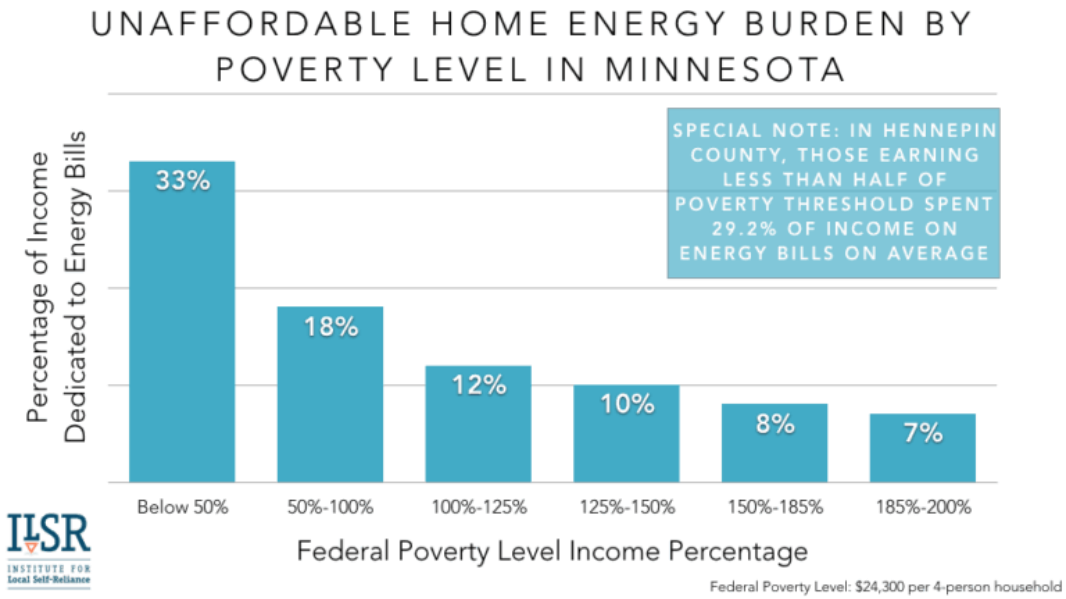

Figure 1.1. The energy burden faced by low-income households in Minnesota
Figure adopted from Farrell (2016) based on data for 2015 from Fisher, Sheehan, and Coulton.

Recognizing the disproportionate energy burden faced by low-income families, several federal programs have been developed to assist households in affording critical energy services. Most

notable is the Federal Low-Income Home Energy Assistance Program (LIHEAP). LIHEAP is primarily, although not exclusively, targeted toward meeting the immediate home energy needs of low-income households. In 2014, 49% of funds supported heating, 7% supported cooling, and 21% supported crisis assistance. Notably, $348 million, approximately 10.4% of program funds, were dedicated to weatherization ($307 million) and services to reduce reliance on home energy ($41 million) (Perl, 2018). Funding appropriated by Congress for LIHEAP has fluctuated over the past two decades. In 2000, appropriations were $1.8 billion and climbed to $2.6 billion in 2008. Following the American Recovery and Reinvestment Act, LIHEAP funding surpassed $5 billion in 2009 and 2010 before returning to a steady range of $3.3 - 3.6 billion from 2012 – 2018 (Administration for Children & Families, 2018; Perl, 2018).

At current funding levels, there remains a significant gap between the energy assistance needs of low-income households and what LIHEAP provides. Nationally, the Congressional Research Services estimates that only 16% of households eligible for LIHEAP actually received support in 2013-14 (Perl, 2018). In Minnesota, the gap between how much assistance low-income households need and how much is available averaged $1,019 per household in 2015 (Boyce and Wirfs-Brock, 2016). In the face of the persistent need to address the energy burden, measures to reduce energy expenditures for low-income families continue to be needed. Energy efficiency measures are a well-studied approach to addressing the energy burden, as many measures have short payback periods that can start saving low-income households as much as 30% of their energy bills (Drehobl and Ross, 2016). In this report, we instead focus on measures to integrate solar energy to reduce the low-income energy burden.

Nationally, despite dramatic declines in the cost of solar (Barbose and Darghouth, 2018), most homeowners with appropriate roof space cannot deploy solar without access to capital or credit. And while the financial payback period of solar continues to decrease, solar is not an obvious first step for addressing the low-income energy burden. However, there is an increasingly important set of opportunities where the conditions for solar integration can deliver meaningful benefits for low-income households. **First**, many solar companies and industry players are adopting social responsibility programs that result in low-cost and no-cost solar equipment earmarked for integration with low-income housing. How to integrate this equipment most effectively to deliver the greatest benefits to low-income households remains a challenge. **Second**, federal, state, and utility policy has created incentives to make solar a financially attractive investment in some places; zero-upfront-payment finance is even available in some communities (Tarbi, 2017). However, low-cost finance is typically not available to low-income households and in some cases, finance programs transfer financial risk to homeowners. Whether or not these programs create benefits for low-income homeowners is important to evaluate. **Third**, an increasing number of states are adopting specific incentives and requirements to make solar accessible to low-income homeowners and it remains a challenge to determine how to best design these programs (Low Income Solar Policy Guide, 2018).

1.2. Habitat for Humanity

In this report, we are focused specifically on how solar can be integrated with Habitat for Humanity (HFH) home builds. Incorporating solar into HFH builds can be a transformative development because it can relieve the energy burden felt by homeowners. This transformative

development concurrently provides the families HFH serves with homeownership and electrical generation ownership.

Habitat for Humanity is a natural partner for low-income solar work due to their extensive history creating new homeownership opportunities for low-income families. Since 1976, HFH has made over 13 million American families home owners across all 50 states and abroad (Habitat for Humanity, 2018a). Habitat for Humanity's vision statement is "a world where everyone has a decent place to live," and one of HFH's guiding principles is to "support sustainable and transformative development" (Habitat for Humanity, 2018b). As part of their mission, HFH develops strategies for increasing home affordability, often working with a diverse set of international, national, and local partners to develop creative new approaches to enable long-term homeownership.

The main structure of HFH is a decentralized network of local affiliates. Affiliates have a large level of autonomy to develop and construct projects, and as such, affiliates within and across states vary dramatically. Habitat for Humanity revenues in 2012 topped $1.35 billion across 2,100 affiliates, 1,500 of which are in the USA (Smith, 2013). Habitat affiliates are independent and encouraged to be self-supporting. However, Habitat for Humanity International (HFHI), the parent organization, will solicit contributions on behalf of its affiliates and distribute federal funds to them on a competitive basis and Habitat affiliates are expected to direct ten percent of unrestricted cash contributions to support HFHI (Smith, 2013). Generally, HFH affiliates rely on relationships with local contractors and community members to provide reduced-cost and free equipment and labor. Further in this report, we explore the typical financing structure of HFH projects and opportunities for solar integration in this structure.

2. Landscape of Habitat for Humanity Solar Projects

Habitat for Humanity affiliates have begun to develop approaches for integrating solar into home builds. In this project, we searched for HFH affiliates who had integrated solar into builds using web searches and outreach. Appendix A summarizes the cases we identified along with key project characteristics that were publicly reported. Figure 2 displays our identified cases organized by number of HFH affiliates (not projects) who have integrated solar in builds by state. Reflecting the organization's decentralized network of affiliates, there is no national clearinghouse of home builds or solar-integration projects. Therefore, our survey of existing projects should not be taken as a comprehensive or even representative summary of HFH projects. Instead, this survey demonstrates that HFH affiliates in every region of the country have begun to integrate solar into projects.

In our national survey of affiliates, we also found that many HFH builds also focus on energy efficiency. There are many examples of HFH homes that were "eco-homes" or "energy efficient," but did not include solar. Further, most of the HFH home builds that included solar also included various energy efficiency measures. We used our national survey to identify a number of notable case studies for further investigation, detailed in the section below. These cases summarize our

research based on third-party sources as well as semi-structured interviews conducted in Fall 2018.

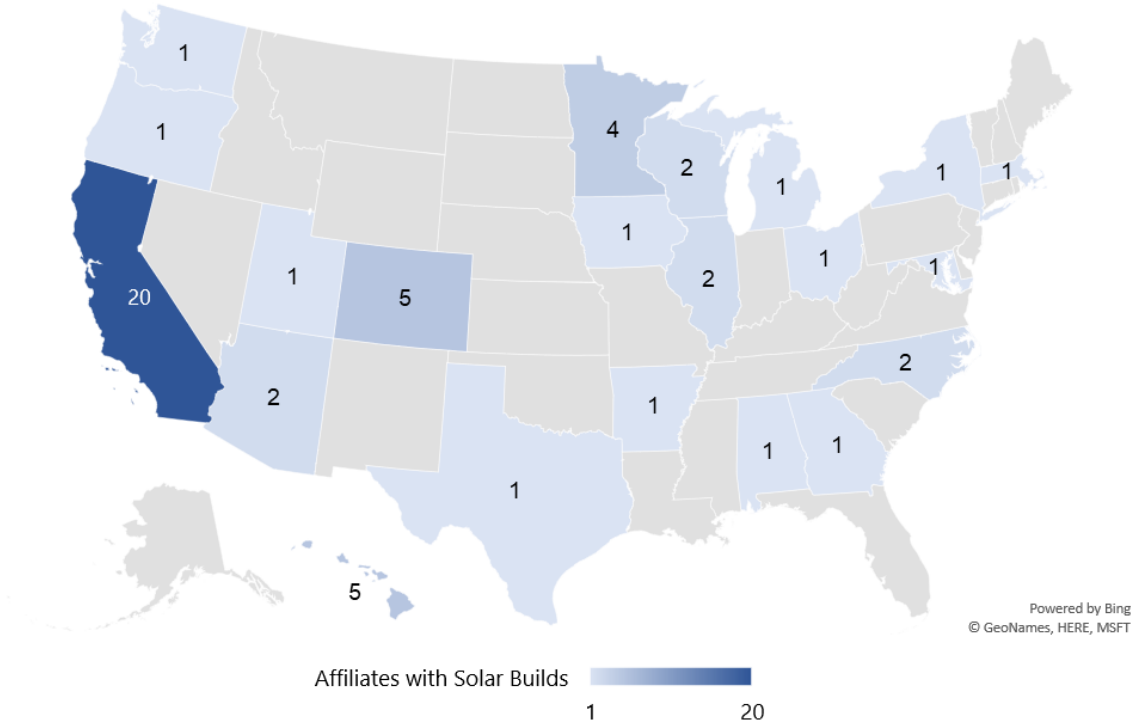

Figure 2.1. Landscape of Identified Habitat for Humanity Affiliates with Solar Builds
Displayed projects are based on affiliates identified via web search and are not necessarily representative of the national landscape, as many projects are not widely reported (see Appendix A for underlying data and links to specific affiliates and solar builds). Washington D.C. also has an affiliate with solar builds.

2.1. Minnesota and Nonprofit Leadership

From pioneering state net-metering policy, to having the nation's largest community solar program, Minnesota has historically been a leader in photovoltaic solar panel policy. Additionally, Minnesota has a thriving HFH network, with over 2,000 HFH homes in the state and over 100 homes built in 2018 alone. Yet pairing solar panels with HFH builds, is still a relatively recent development in Minnesota. While at least four Minnesota HFH affiliates have experimented with incorporating solar onto a home build, these projects have required individually renewed financing efforts.

While HFH affiliates have shown a willingness to accept donated solar panels, their top priority is reducing cost burdens of the families they serve. The nonprofit solar developer, Rural Renewable Energy Alliance (RREAL) based in Backus, Minnesota, has pioneered partnerships with Minnesota HFH affiliates to install solar panels onto home builds. In these partnerships, solar equipment is typically donated to an affiliate or RREAL and RREAL leads the installation of the panels. Once installed, the homeowner owns the solar array (without any impact on the home mortgage) and receives financial benefits from the associated net-metered electrical generation. However, there is no sustainable or reliable funding source for these projects and affiliates do not

generally have the capacity or incentive to seek out partnerships for solar integration. Instead, partnerships between affiliates and solar developers like RREAL have been important for these projects to succeed.

One barrier to solar integration in Minnesota HFH projects is the legal requirement that mandates no more than three construction workers/volunteers per certified electrician for solar-related construction. This restriction is higher than those in other states and has been criticized for increasing the labor cost of solar development (Bures, 2018). This requirement may create specific barriers for HFH solar projects that rely on substantial labor of many uncertified volunteers.

Advantages

- Homeowner owns the solar panel array
- Homeowner doesn't pay a monthly payment for solar panel array
- There are no costs to the Habitat for Humanity affiliate

Disadvantages

- Relies on donated solar panels
- 3:1 builder to electrician ratio (state statute)

Case A. Twin Cities Zero-Energy Home Partnership with the University of Minnesota

In 2013, the Twin Cities HFH partnered with the University of Minnesota's Cold Climate Housing Program and its Center for Sustainable Building Research department to include a solar array on a "zero energy home." During this project, the solar panel array was counted as capital to be included in the mortgage the home recipient paid to HFH. In an interview, a representative of the Twin Cities affiliate stated that they would do solar again if it was donated, but only if it was in the best financial interest of the affiliate and the homeowner. (Engen, 2017)

Case B. North St. Louis County HFH Partnership with the Rural Renewable Energy Alliance

In 2011, the North St. Louis County HFH partnered with the Rural Renewable Energy Alliance to bring a solar array onto a Hibbing HFH home. This build was the 1800th HFH home in Minnesota. The home was built "green," according to the Minnesota Green Community Guidelines to compliment the "green" solar panel installation. (North St. Louis County Habitat for Humanity, 2011)

Case C. Lakes Area HFH Partnership with the Rural Renewable Energy Alliance

In 2018, the Lakes Area HFH partnered with the Rural Renewable Energy Alliance to bring a solar array onto a Brainerd HFH home. The homeowner is a special education professional who lost her home in a fire. The homeowner says this build will life changing stating that when she was approved to receive a

HFH home, “I sat there and cried. I was so relieved. We moved here in November of 2008. So it took a little while, but it happened." (Rural Renewable Energy Alliance, 2017)

Case D. Central Minnesota HFH Partnership with the Rural Renewable Energy Alliance

In 2018, the Central Minnesota HFH partnered with the Rural Renewable Energy Alliance to include a solar array on a HFH home in Brainerd. The 3.9 kilowatt array is projected to generate $600 worth of electricity each year. At first the homeowner didn’t want the solar stating that “At first, we did not want solar panels installed onto our house; we thought they would look ugly, but then we realized the economic benefit they would bring us.” After learning more about the benefits of solar they hope more HFH homes receive solar stating that “If Habitat and RREAL can learn from us for future projects and help another Habitat family, I will be forever grateful.” (Brainerd Dispatch, 2018)

2.2. California and the Innovative PG&E Policy

California is leading the nation in total solar development. Similarly, California HFH have incorporated solar into more builds than any other state in the United States. This expansive incorporation of solar panels onto HFH projects is supported by strong state policies and utility leadership. Early in 2018, California announced legislation that starting in 2020, California would require all new homes built to have solar panels (Guerin, 2018). Many California HFH affiliates assert that “we will be in compliance with this new policy, but that isn’t why we are putting solar on all of our new home builds.” Rather, the California Habitat for Humanity affiliates cited an innovative solar panel grant they receive from their local electrical utility, Pacific Gas and Electric (PG&E).

During July of 2015, PG&E announced that they would financially support 18 HFH affiliates with solar panel technology. These individual affiliates apply for these funds by submitting their annual project build plans to PG&E. PG&E awards roughly $12,000 per household. This money goes towards purchasing the physical solar panel capital from a solar installer contractor. In many instances the developer will donate their labor, but a portion of the $12,000 may go towards labor costs if labor is not donated. The HFH will cover any additional costs of the solar panel array, but that is rarely necessary.

The goal of HFH is to provide affordable mortgages that are below market rates. True to this mission the physical capital of the solar panel array is not included in the mortgage paid by the family living in the Habitat home. Despite this, the homeowner owns the solar panel array and receives the financial benefit associated with the electrical generation from the solar panel system. In addition to solar panel arrays, the homes also receive energy efficient building materials and appliances to minimize the amount of electricity required per household.

While generally the families in their Habitat homes are simply net-metering their solar panel’s electrical generation, there are two unique home owning models. The first type of home owning model is the standard one-home-one-family arrangement. This model is simple because the family owns the home and the solar panel array. The second type of home owning model is a

Homeowner Association. Under this arrangement there are multiple home units in a building and many times multiple buildings per Homeowner Association. While the individuals in the Homeowner Association will own a panel of the roof mounted solar array, the Homeowner Association will hold additional solar panels in common to offset the remaining electrical costs. The value of the solar panel is not included on the mortgage price of the home despite the homeowners owning the solar panels (or a share of the solar panel in the Homeowner Association model)

In 2016, the California Energy Commission conducted a study on expanding low-income access to solar technologies. In this study, HFH urged programs to reach out to targeted low-income communities "through public relations channels and networks such as community agencies, churches, and faith-based and community-based organizations" (California Energy Commission, 2016).

Advantages

- Homeowner owns the solar panel array
- Homeowner doesn't pay monthly payment for solar panel array
- There are no costs to the Habitat for Humanity affiliate
- Solar is the default options for Habitat for Humanity builds given reliable financing

Disadvantages

- Contingent on PG&E donating the funds
- Unique solar policy mandates

2.3. Washington D.C. and Solar on Renovation Projects

The HFH chapter in Washington D. C. has completed two solar projects as of 2018. The solar panels were fully donated by the organization Grid Alternatives. As a result, the homeowner owns the solar panel array and the associated Solar Renewable Energy Credits (SRECs). The homeowner receives financial benefit from selling the SRECs and from net-metering their solar panel array's electrical generation. SRECs are sold to the city of Washington D.C. While the SREC market provide an additional financial benefit to homeowners, this benefit is relatively negligible due to the low value of SRECs on the market.

Given the density of Washington D.C., the HFH affiliate there is disproportionately focused on home repair instead of home builds. This unique situation is a contributing factor that led to issues for both solar projects that were incorporated onto the HFH home post construction. Subsequently, the solar panels have been removed due to roof integrity damages associated with the solar panels. Due to their negative experience and lack of new home builds, the HFH affiliate does not plan to include solar panels into future projects.

Despite the relatively unsuccessful inclusion of solar in Washington D.C., there are some important takeaways. To make a solar panel inclusion project successful, it is better to incorporate planning for solar apart of the pre-build process. This pre-planning ensures that the roof structure

can support a solar panel build. While this ultimately became a major barrier for the Washington D. C. HFH affiliate due to their uniquely low amount of new builds, other affiliates who are more focused on new builds, this is less of a barrier.

Advantages

- Utilizes Renewable Energy Credits
- Allows for home retrofits to utilize solar panels

Disadvantages

- Old roofs may incur damage when not designed for solar panels
- Relies on donated panels from Nonprofits
- Homeowner is responsible for maintenance costs

2.4. Hawaii and a Seven-Year Power Purchase Agreement

Hawaii has a unique economic and geographical considerations which make solar a very attractive option for their state. This fact is capsulized by Hawaii's aggressive Renewable Energy Portfolio Standard of being 100% renewable energy by 2050. These factors have led to the Hawaii Habitat for Humanity Association having arguably the strongest Habitat Renewable Energy Program in the nation.

Hawaii HFH aggressively helps the families they serve to go solar with their new home builds. To accomplish this, Hawaii HFH partners with the solar panel developer, Mercury Solar. Mercury Solar is the largest solar developer on the Hawaii islands and has been operating since 1979. Mercury Solar acts as a "utility" and enters a power purchase agreement (PPA) with the new HFH homeowners. The homeowner then enters a seven-year agreement to pay a monthly payment to Mercury Solar that is a fixed rate throughout the PPA. While the solar panel array is on the roof of the homeowner, the homeowner does not own the solar panel array. At the end of the seven years the homeowner can either buy the solar panels at their market value, renew into another seven-year contract, or have the solar panels removed. The Habitat affiliate also receives a small percent of this payment to help fund future builds.

This a unique financing model because all parties involved receive financial benefit. Additionally, this financing model does not require any donations of labor or capital. The homeowners benefit because they receive fixed electricity costs that are lower than utility rates. Considering the homeowner can buy the panel after seven years, there is an established path to solar panel ownership. While there are high upfront costs to buy solar panels, the homeowner has no limit to how many seven-year leases they can enter to avoid the upfront costs from solar. Another unique financial component of the Hawaii model is that the HFH affiliate receives minor financial benefit from the solar build to leverage towards future builds. While the affiliate financially benefits, this still fits the non-profit model because the financial benefit the Habitat affiliate receives is funneled towards future Homeowners.

Advantages

- No upfront cost to homeowners
- Solar panels are available to all Habitat for Humanity homeowners
- Monthly payments are fixed and lower than utility bills
- The Habitat for Humanity affiliate receives a small amount of money to support future builds
- Homeowner may choose to buy the solar panels after seven years or renew their PPA
- All solar panel system maintenance costs are covered by Mercury Solar

Disadvantages

- Solar panels are not free to homeowners
- Relies on the solar panel company to obtain "utility" designation as defined by a PPA

2.5. Summary of Cases

In this section we provide two synthesis tables of the four case studies presented in this section. Table 2.1 summarizes the financing and ownership models developed to support solar in the four cases. Table 2.2 presents our subjective assessment of the benefits that these models create for homeowners, HFH affiliates, and solar developers.

Table 2.1. Summary of solar financing and ownership models in case studies

State	Financing Source	Solar Panel Array Ownership	Financial Flow
Minnesota	Nonprofit Donation	Homeowner	Net-metering
Washington DC	Nonprofit Donation	Homeowner	Net-metering
California	Electric Utility (PG&E) Grant	Homeowner/Homeowner Association	Net-metering
Hawaii	Solar Developer & Homeowner Enter Seven Year PPA	Solar Developer (seven-year contracts)	PPA

Table 2.2. Summary of assessed benefits to actors in case studies
We make qualitative judgments about the relative benefits to homeowners, HFH affiliates, and solar developers in the four case study states.

State	Homeowner	Habitat for Humanity Affiliate	Solar Developer
Minnesota	High	None	Low
Washington DC	Medium	None	Low
California	High	None	Low
Hawaii	Low	Low	High

3. Nonprofit Solar Financing Models

This section details a high-level overview of the many inputs to finance projects, increase homeowner agency, and creatively utilize federal and state assistance programs for solar integration with HFH projects. HFH 's financial success is also important to evaluate within the scope of nonprofit solar financing models, as any successful partnership that can attract HFH interest will also require financial viability for HFH affiliates.

3.1. Habitat for Humanity Financial Model

HFH financing and cash flow is built upon "secondary" mortgage payments from homeowners to an HFH affiliate who bears the primary mortgage on the home. While there is some variation in mortgage terms, an example HFH mortgage has a 30-year term, a 3% fixed interest rate, a borrower up-front contribution of $3,000, and a stipulation that monthly payments will not exceed 30% of a homeowner's gross income (T. C. H. for Habitat for Humanity, 2018). This stipulation limits the debt-to-income ratio of homeowners, increases mortgage affordability, and decreases default risk. During a homeowner's mortgage repayment period, mortgage payments to the affiliate, coupled with donations, sponsorships, and partnerships, are used to finance additional home builds.

This brief overview serves as an introduction into the existing nonprofit strategies leveraged by HFH affiliates. The following section lists mechanisms utilized by local affiliates to harness benefits for project funding, particularly at the state and federal level, without additional private and internal financing options.

3.1.1. Self-Help Homeownership Opportunity Program (SHOP)

The Self-Help Homeownership Opportunity Program (SHOP) is a program seemingly designed for Habitat for Humanity, exhibiting the power and influence that HFH has at the federal level to harness support for further developments. SHOP is funded by Congress and administered by the

U.S. Department for Housing and Urban Development (HUD). Financing is awarded competitively to nonprofits that utilize "sweat equity" in home construction. Many HFH homesites use SHOP grants to buy large tracts of vacant and inexpensive land in repossession or foreclosure often located on the edge of towns/cities, brownfield sites, or in the "decaying inner-suburbs" (Smith, 2013).

HFH has been awarded over half of the $373 million dollars given out in grants since 1996 under SHOP. HFH has in turn leveraged private investment equivalent to 500% of SHOP funding, totaling over $1 billion for community development. Of the $9.9 million SHOP budget in 2015, HFH was awarded over $6 million, equivalent to 63.3% of the program (Habitat for Humanity, 2016). This suggests Habitat for Humanity is a critical piece of SHOP implementation and speaks to HFH's traction at the federal level to secure consistent streams of federal support for projects.

3.1.2. Capacity Building for Community Development and Affordable Housing Grant

The Capacity Building for Community Development and Affordable Housing grant was implemented as a tool to enable HUD, through cooperative efforts with other levels of government and the private sector (including non-profit organizations, foundations and communities), to demonstrate methods with a variety of activities to fill gaps in available services and resources (*HUD Demonstration Act of 1993*). This grant program has a focus on equitable outcomes for disadvantaged communities and individuals. HFH remains a notable recipient for this funding due to the close alignment of HFH's target demographic and the grant program's mission to benefit low-income families. As noted in Section 4 of the HUD Demonstration Act of 1993, Capacity Building for Community Development and Affordable Housing grants can be awarded for:

1. technical assistance, training support, and advice to affiliates
2. loans or grants to affiliates to carry out community development for low-moderate income housing
3. economic development activities that create jobs for low-income persons.

While this grant program (as well as SHOP) may not be directly applicable to other nonprofits, particularly those facilitating energy assistance, their interactions with Habitat affiliates may still provide a relevant possible mechanism to support project financing.

3.1.3. Financing Experimentation and Solar Inclusion

On average, a HFH home will cost a homeowner $75,000. Additional costs may be added for efficiency measures, e.g. EnergyStar appliances and LEED certification, in excess of up to $5,000. When such installations are integrated into a mortgage, they are designed to have a payback value equal to or greater than that of the added cost of the mortgage (Solaripedia, 2010).

As seen in Section 2, it is rare to have solar be considered as an efficiency upgrade, and panels are most typically donated post-construction. HFH has a set protocol for affiliates to use when considering solar for its projects, detailed in 0, and summarized below:

1. Donations may be a key factor to determining if PV can meet affordability requirements;
2. Maintenance cost will be borne by the homeowner, so proper roof mounting and installation is pertinent;
3. Strategic placing of an array to meet peak hours will be most financially beneficial;
4. It is important to realize who receives credit for distributed generation;
5. Designing a house with solar in mind is preferred rather than introducing solar post-construction; and
6. Rebates may be available and could generate cost savings.

Considering the takeaways listed above, it may be in the affiliate's interest to install solar for the homeowner, but it may also be a burden to the homeowner if it raises mortgage costs and hinders payback periods that the affiliate depends on for further project investment. Further, while solar may be designed to benefit the homeowner, it seems unlikely that the affiliate would pursue solar independent of a third-party mediator initiating the integration. Solar integration and environmental sustainability are not explicit aspects of HFH's mission. Nevertheless, most affiliates appear happy to accept donated panels and pass energy savings on to homeowners but would not otherwise offer additional financial support to integrate solar unprompted.

This dynamic offers a window of opportunity for nonprofits and other third-parties to intervene and offer assistance. It is unlikely that an affiliate would turn down a partnership with a third-party solar organization, so long as its financing is designed for the homeowner at an affordable rate that does not increase monthly payments. It is even more unlikely that an affiliate would turn down a solar donation for a homeowner that offered a free solar system that reduces energy payments. In these instances, the affiliate is less of a partner and more of a pathway towards homeownership assistance. The affiliate may act as a facilitator or an intermediary of sorts. Options may also be designed which make the affiliate the owner of a solar installation, assisted by a third party, to then be distributed and financed to a homeowner. The challenge in coordinating these options is in designing a sustainable model for long-term success that balances financial benefits/risks for all parties, organizational complexity, and potential for replication and scalability.

3.2. Nonprofit Solar Financial Design Options

The following lists potential financing options available to non-profit solar organizations (NPS), such as the Rural Renewable Energy Alliance (RREAL), to aid in project siting, installation, and maintenance. Many alternatives exist and may be considered independently or in combination. Solutions we highlight have the potential to create sustainable measures to ensure long-term successes for nonprofits, to either guarantee funding/assistance or capitalize upon existing legislation and utility rate structures.

3.2.1. Debt Financing

Debt financing is a conventional agreement that involves a project developer pursuing a construction loan, a term loan, or both. Factors to consider include the term of a loan, the interest rate, whether the interest rate is variable or fixed, the amortization period, and whether the loan is recourse or nonrecourse (Smith, 2016). Exclusive debt financing is not frequently used for residential solar projects because of advantages retained by tax equity (particularly federal tax credits for solar); however, most projects are financed at least in part, by some type of debt.

There are three general types of debt to consider for a debt financing model (Stoel Rivers LLP, 2017):

1. **Development**: This includes upfront interconnection deposits, PPA deposits, solar resource studies, permitting, and site control costs. This often involves collateral security and operational covenants securing a future payment.
2. **Construction**: Highest capital portion of an installation. This includes equipment, component parts, contractors, subcontractors, etc. Tax equity investors generally do not take construction risk with funds, and financing typically falls to lenders and sponsors.
3. **Permanent** (post-construction "long-term debt"): Often reworked from construction debt, allowing recoupment of invested capital; often less intensive than construction loans.

Considerations under debt financing (Smith, 2016):

1. Transaction, legal, and closing costs of solar projects;
2. Fixed cost assurances (or lack thereof); and
3. Refinancing costs if loan is not amortizing as scheduled.

Many of the financial design options included in this report are consistent with debt financing with additional incentives. But while debt financing is a more conventional model, it does not necessarily leverage the most attractive program/grant options (such as the federal investment tax credit). For this reason, it will not be explored further, but may be referred to through other financing techniques.

3.2.2. Solar Power Purchase Agreement (PPA)

PPAs are financial agreements where a developer (or nonprofit installer) arranges and implements a solar panel system on a customer's property but ownership is retained by a third party, not the homeowner. Arrangements are then made via long-term contracts that allow for full or partial payback on the solar system in the form of energy usage payments. In many circumstances, PPAs can reduce the upfront cost of solar installations for the homeowner/offtaker—sometimes to zero. The third-party owner of the solar installation acts as a utility of sorts to the homeowner; the homeowner may then sell excess generation to the regional utility for credits, typically at the retail rate in states with net-metering policy. Traditional PPAs are often offered by for-profit and investor driven companies. More creative and adaptable PPAs may be offered by nonprofits and be designed to underwrite contracts to benefit the homeowner.

Because a PPA is independent of the regional utility, an NPS may have leeway to develop an extremely adaptable and customizable model for creating contracts with homeowners.

PPAs allow nonprofits to advantage the Investment Tax Credit (ITC) and the Modified Accelerated Cost Recovery System (MACRS) to lower cost and utilize investor's upfront capital to minimize short-term risk. The MACRS allows the non-profit to take advantage of the modified accelerated cost recovery system, accelerated depreciation (26 U.S.C. 168). This allows the taxpayer to recover investment on an accelerated schedule by frontloading the depreciated deductions with larger deductions in the early years of the recovery period (Burke and Friel, 2016). In Minnesota, the law requires strict regulation of public utilities (stat 216B.01), but also states that "no person shall be deemed to be a public utility if it produces or furnishes service to less than 25 persons (Stat 216b.02 subdiv. 4)," as of 2015.

PPAs typically structure buyouts after 6 years to fully advantage tax incentives and structure the length of a contract to be between 10-25 years. If, by the end of the contract, the panels are not bought out, the host may 1) extend the agreement 2) have the host remove the panels, or 3) buy the system from the developer.

PPA Mandates

1. The service recipient cannot operate the facility that will be providing the service;
2. The service recipient cannot bear "any significant financial burden if there is nonperformance under the contract or arrangement;"
3. The service recipient cannot join in any potential financial upside if the operating costs of the project are less than expected; and
4. The service recipient can only have a purchase option in the contract to buy the facility at fair market value.

For a PPA to conjoin with a nonprofit and advantage federal tax benefits, it must be structured as a "service contract," rather than a lease (under the Internal Revenue Code) (Source: 26 U.S.C. 7701 (e)(4)(A)).

Third-party PPAs are allowed in 25 states. Most recently was the Solar Power Free-market Financing Act of 2015 in Georgia. In other states, such as Minnesota, it is less clear. However, a study from the University of Minnesota Energy Transition Lab indicates that it appears that third-party PPAs would not need to be regulated as a public utility. The study argues that "if the reason that electricity markets are regulated is to protect the consumer, then it makes no sense to regulate third-party PPAs as utilities because doing so would protect the monopoly the utilities maintain, not the consumers" (Berger, 2016). This should work to avoid loopholes considered by the Minnesota Supreme Court to determine if a case has the necessary "public character" to be considered a public utility. Third-party mediators, namely those supporting HFH homes, would likely be exempt because they only serve the signing entity. Therefore, PPAs are merely incidental to the system design, construction, operations, maintenance, and financing services provided by third-party owners in a competitive market (Environmental Law & Policy Center, 2015). This would allow for nonprofits such as RREAL to hold a PPA with a homeowner, credited through a second mortgage, and separate from the affiliate. Before pursuing this option further, we would recommend further analysis by legal scholars.

The Minnesota Department of Commerce Office of Energy Security prepared a report in 2010 assessing the feasibility of third-party owned solar on schools (MN DOC Office of Energy Security, 2010), which has some analogous features to solar integration with HFH. We extract the advantages and disadvantages of this model from the report below:

Advantages

- ***No or low up-front costs****: The initial investment costs for PV systems can be substantial. In third party ownership models, the system owner is responsible for these investments. As a result, the host has no upfront capital cost (although other transaction costs such as legal fees must be taken into account).*
- ***Predictable electricity prices for 20 to 25 years****: Under the PPA, the host knows at the outset of the transaction the price it will pay for electricity over the life of the contract. The price may escalate at a specified rate or may be fixed for the life of the contract.*
- ***Operation and maintenance responsibility is handled by the system owner****: The system owner operates and maintains the PV system, removing this burden from the host.*
- ***Buyout option provides ownership potential****: In the PPA, there will likely be the option for the host to purchase the system either after some fixed period of time (6 years) as well as at the end of the transaction.*
- ***Production Risk****: The host only pays for the electricity that is generated by the PV system. It is common to have minimum production guarantees in a PPA.*

Disadvantages

- ***Ownership of the "clean" energy attributes****: In that the host is not the owner of the PV system, it must expressly agree to purchase the Solar Renewable Energy Certificate Credits (SRECs) from the system owner if it wishes to make certain claims about the system such as being "solar powered" or using "clean energy". If the host chooses against purchasing the SRECs, the appropriate language to use is that the school is "hosting a PV system."*
- ***Granting ongoing access to site****: Ongoing site access is necessary to maintain the installed solar panels. In some cases, maintenance staff may not be comfortable with a third party accessing the facility.*
- ***Transaction costs****: There are transaction costs associated with drafting the PPA and associated documents which are borne by the host. The time commitment is significant during the negotiation phase of the project.*
- ***Contractual issues****: Contractual issues can occur since most local and state governments approve funding for operating obligations on a yearly basis rather than for the full duration of the long-term PPA. The discussion of whether or not signing a PPA constitutes a long term debt obligation is common. However, those concerns can often be addressed through specific contractual clauses (e.g. non-appropriation and non-substitution clauses.)*

There has been some concern over the legality of PPAs to directly service residential homes, which is particularly relevant to the HFH model. However, research has shown that it is likely legal and acceptable within most states, including Minnesota. Third-party PPA financing is widely available in many states. The Minnesota Supreme Court has consistently rejected a rigid test when defining "public utility," and would require a case-by-case look at what the utility actually does." The Environmental Law and Policy Center determined third-party ownership of a distributed generation (DG) system, i.e. rooftop solar, are legally not to be considered a public utility, circa 2015 (Environmental Law & Policy Center, 2015). Still, there is relatively little third-party solar development in the residential sector with PPAs in Minnesota, and large national players pursuing this model have not made significant inroads into Minnesota. This suggests at least some degree of legal uncertainty. This uncertainty could likely be addressed at scale by the Minnesota PUC, either for all residential projects or for HFH project sites.

Why Might Third-Party PPAs be Legal?

- Solar developers and third-parties are not "natural monopolies;"
- On-site generation is not "dedicated to public use;"
- Third-party organizations do not "duplicate" public utility services;
- Third-parties must compete for business and do not exert undue influence or bargaining power;
- Regulating third-parties as public utilities would not protect the consuming public, it would protect monopoly utilities' market share at other expense; and
- Defining third-parties as "public utilities" would require the state to override private business contracts for competitive services on Minnesota homes without clear public interest purpose.

Case E. Revision Energy

A promising case study exists on a nonprofit operating under a PPA financial model. Revision Energy, a certified B-Corporation based out of the Northeast, offers a PPA for no upfront capital investment to the purchaser. Their motive stems from an understanding that the primary barrier to residential and nonprofit solar accessibility is leveraged by discount rates on upfront cost and buy-back periods. To sustain themselves, Revision Energy utilizes private solar investors who may advantage federal tax programs not otherwise accessible. Then, the investor may build the array on location, and sell the power generated from the array to the homeowner/nonprofit at electric rates defined in the offer letter at competitive energy pricing and appreciating cost, stating the "lowest 40-year cost of electricity from any source." Finally, this puts the purchaser on the path to ownership, as many contracts have stipulations for full ownership after a fixed buy-back or contract length. (Revision Energy, 2018)

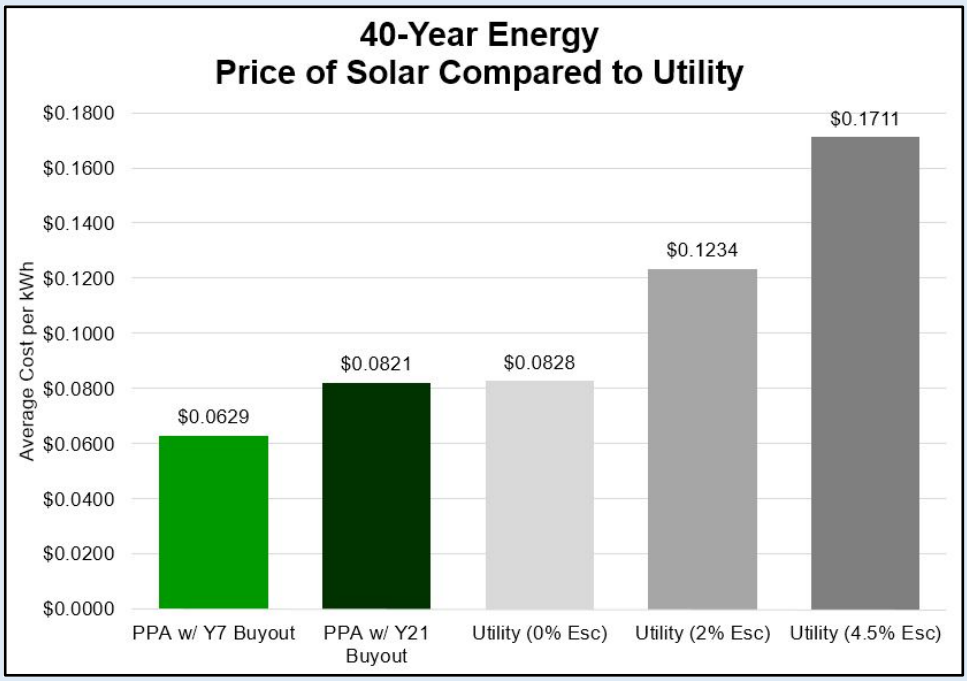

Figure 3.1. Examples of long-term solar costs
Costs are shown per kWh for a PPA compared to standard utility rates with escalators. Figure adopted from Revision Energy (2018).

3.2.3. Green Revolving Fund

Green Revolving Funds (GRFs) are highly customizable internal efficiency and sustainability agreements, typically held to within the affairs of a nonprofit or other organization. Most typically, the purpose of the GRF is utilize pooled capital to support the capital costs of efficiency or clean energy projects that reap long-term benefits. The idea holds that once enough revenue is obtained from investments in completed projects, revenues replenish the GRF so that further projects may be pursued. GRFs may also grow in magnitude as scale is built. For example, the University of Minnesota Duluth has an internal Green Revolving Fund that has provided $100,000 in seed money to lower campus emissions and increase efficiency. Once investments in efficiency measures have recouped their costs, they may be redistributed back into further investment schemes. Ideally, this loop has increasing gains as previous efficiency investments continue to

realize gains. Applied to an NPS, a GRF would mean investing in project sites with pooled capital that slowly regenerates as projects generate energy.

A more experimental interpretation of a GRF may also be considered. If a GRF is coupled with other financing methods, grants, or donations, a GRF may operate at a net-loss and still incentivize further development. In the case of HFH solar inclusion, a net-loss may be necessary to provide sufficient benefit to the homeowner and satisfy the mission statement of HFH. Losses can be mitigated through external donations and grants. In this sense, the GRF does not fully "revolve" but instead only partially recoups investment costs to extend the benefits of an initial capital pool beyond what a simple capital investment pool might allow.

Nonprofit solar developers may advantage principles of a GRF by making contractual agreements with either 1) HFH affiliates, 2) homeowners, or 3) a utility provider for the homeowner. The stipulations would require that the NPS receive some payback from the contract in the form of a donation, monthly payment, or direct net-metering financing.

If contracts are structured properly, the homeowner may receive immediate energy savings, and the affiliate may receive reduced risk on mortgage default. Once a system of operation is specified, a nonprofit may pursue various financing methods to fund their project. Not listed here are options commonly utilized by nonprofits, such as private funding, donors, sponsors, etc. These options are further investigated and compared against one another in Section 4.

3.3. Nonprofit Solar Financing Tools

This section explores several policy frameworks that may provide financing tools for nonprofit solar development: the Community Reinvestment Act, the Minnesota Conservation Improvement Program, and Property Assessed Clean Energy.

3.3.1. Community Reinvestment Act

The Community Reinvestment Act (CRA) was implemented as federal legislation (circa 1977) and set to encourage depository institutions to help meet the credit needs of surrounding communities, with a focus on low- and moderate-income neighborhoods (12 U.S.C. 2901) (Regulations 12 CFR parts 25, 228, 345, and 195). In this sense, the CRA acts as a catalyst for further investment in low-income communities (Bernanke, 2007). The CRA's actual effectiveness is more convoluted and uncertain. The CRA meets evaluation standards through lending, investing, and servicing.

The CRA requires federal regulators to assess the record of each bank or thrift in helping to fulfill its obligations to the community. This "record" is later used for evaluating applications for future approval of bank mergers, charters, acquisitions, branch openings, and deposit facilities.

The size and scope of the CRA has changed significantly since its inception. Between 1993 and 1998, $467 billion in mortgage credit flowed from CRA lenders to low/moderate income borrowers. Loans to CRA-eligible lower income individuals rose 39%, while loans to higher income only rose 17% (Litan et al., 2007). There are no other penalties for non-compliance.

Records are built on the percentage of CRA loans that a mortgage lender originates or purchases in the secondary market. These loans tend to trade at a premium price in the secondary market. Critics of the CRA say that it contributes to risky lending practices (Agarwal et al., 2012). Oversight is conducted by the Federal Reserve System, the FDIC, and the Office of the Comptroller of the Currency (OCC).

Institutions that receive Federal Deposit Insurance Corporation backing are evaluated by federal banking agencies to determine if the bank offers credit consistent with "safe and sound operation" to all communities in which they are chartered to do business. However, this law does not require institutions to undertake high-risk loans. A 2003 study by economists at the Federal Reserve could not find clear evidence that the CRA increased lending and home ownership more in low income neighborhoods than in higher income neighborhoods (Avery et al., 2003; Minton, 2008).

In the boxes below (Cases F and G), we highlight examples of CRA integration with Habitat for Humanity and discussion of integration with solar development, respectively. To our knowledge, the CRA has not yet been used for solar development.

Case F. Examples of CRA Implementation Within Habitat Programs

1) "During 1996, OVB-East made financing available for the purchase of loans made through the Habitat for Humanity for the Eastern Panhandle, Inc. Through this program, the bank and the [West Virginia Housing Development Fund] purchases notes from the Habitat, thereby providing Habitat with funding to build more housing for low-income families (Comptroller of the Currency Administrator of National Banks, 1997). "In addition to conventional lending, the bank offers and originates guaranteed loan products that include United States Small Business Administration, Federal Housing Administration, Maine State Housing Authority, United States Department Agriculture, and Veterans' Administration. The bank also offers secondary market loans sold through Freddie Mac and Federal Home Loan bank. Additionally, BSI offers unique loans through the Equity Builder Program which offers assistance to first-time homebuyers and a Zero Equivalent Mortgage Program which offers zero percent financing for Habitat for Humanity homeowners (Bath Savings Institution, 2015).
2) Signet Bank provided technical assistance and/or donation of financial resources to the Danville-Pittsylvania, Roanoke, New River Valley, Eastern Shore, Arundal, Harford, Chesapeake, Chester, and Warren County affiliates (Federal Reserve Bank of Richmond, 1996).

Case G. Examples of CRA Implementation Within Solar Programs

1) Citi and Prosperity Now is **looking to** leverage the CRA to lower costs and build assets for home improvement. Citi found "great opportunities in clean energy finance" ex. Funding solar installations (Ryan, 2017).
2) RMI mentions an "**obligation**" by the CRA to provide solar assistance, namely at the value of $0.10/w, for regulated banking institutions that provide LMI access to economic savings or community benefits (Coleman et al., 2017).
3) Public policy goals underlying the CRA are well-served by the positive attributes of solar energy, but **amendments are necessary** to facilitate this, according to SEIA (Resch, 2013).
   a) Specifically amend 12 CFR 24.6 to add investments in solar energy projects to the list of examples of qualifying public welfare investments.
   b) Amend 12 CFR 25.12(g) to include investments in, or loans to, solar energy projects
   c) Clarify the extent to which under current regulations, investments in, or loans to, solar energy projects installed in designated disaster areas are eligible to receive positive CRA consideration.
4) Federal documents partially contradict this, albeit vaguely. "So long as the benefit from the energy generated is provided to an affordable housing project or a community facility that has a community development purpose. To demonstrate that activities related to a renewable energy facility or project have a primary purpose of community development, an institution may provide a copy of the contractual agreement, such as a lease, power purchase agreement, or energy service contract, that allocates energy or otherwise reduces energy cost to benefit affordable housing or a community development" (Office of the Comptroller of the Currency et al., 2016).
5) Office of the Comptroller of the Currency (circa, 2013) states loans and investments financing "green" buildings, efficiency improvements, wind farms, **solar panels**, or other renewable energy systems **do not** in and of themselves qualify for positive consideration under the CRA (Canavan, 2013). Neither the CRA nor its implementing regulations specifically address these types of activities. The aforementioned activities could receive consideration so long as the national banks or federal savings associations bank's geographic requirements also are met. An activity is considered to possess the requisite primary purpose of community development if a majority of the dollars or beneficiaries of the loan or investment meet one or more of the enumerated community development purposes (See 75 Fed. Reg. 11642, 11649 (March 11, 2010), at __.12(h)–8.).

Positive CRA Considerations to Highlight

- Affordable **housing**
- Community **services** targeted to LMI individuals
- Activities that promote economic development by financing businesses or farms that meet the size eligibility standards of the Small Business Administration's Development Company or Small Business Investment Company programs (13 CFR 121.301) or have gross annual revenues of **$1 million or less**
- **Activities that revitalize or stabilize LMI geographies; Designated disaster areas**; Distressed or underserved nonmetropolitan middle-income geographies designated by the Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation, and the OCC

*Barring any reinterpretation of key-words highlighted above, the installation of energy generating equipment does not meet these requirements, according to the OCC.

There does appear to be selective room within the language of the CRA to advantage assistance for solar installations, particularly by small organizations seeking to advance resiliency and equity in low-income communities. Further, in 2016 12(h)—1 was amended to include financing mechanisms to be provided for renewable energy. "Borrowers to finance renewable energy, energy-efficient or water conservation equipment or projects that support the development, rehabilitation, improvement, or maintenance of affordable housing or community facilities…that provide services for [LMI] individuals" (i.e. energy savings, utilities to affordable housing). This appears promising but has not yet been leveraged in any significant fashion.

To conclude, the CRA is an unprecedented and rather restrictive bundle of incentives for solar integration with HFH. It offers loans to LMI communities and has in some instances donated and/or provided financial resources to HFH affiliates (Welch, 2017). In this sense, it has achieved what it was created to do—namely to increase access of funding to LMI and otherwise disadvantaged communities. However, the CRA may view homeowners of HFH households and affiliates separately. Typically, incentives are handed out at the affiliate or community level. This may provide an opportunity for an affiliate/third-party solar partnership.

However, given these outcomes, the CRA has rather vague stipulations regarding investments in renewable energy. It is not explicitly mentioned within the language of the Act, and though it may be open to interpretation, we were not able to identify examples in practice. In spite of all this, there is still the notion that banks have internal motives for pursuing certain CRA projects over others. Unprecedented and potentially expensive projects may not be a particularly attractive for all CRA investors.

3.3.2. Conservation Improvement Program

The Conservation Improvement Program (CIP) is an efficiency program in Minnesota working to help households with energy conservation and efficiency measures. CIP is funded by ratepayers and administered by electricity and natural gas utilities. In 1989, low-income requirements were added to the CIP.

As of 2014, there are 141 electric community-owned utilities (rural electric cooperatives and municipal utilities) with low-income spending requirements under the CIP (APPRISE Incorporated, 2017; Lobenstein et al., 2018). These CIP programs may be utilized by solar installation projects. Currently, Connexus and Dakota Electric have carved out budgeted spending to dedicate to solar PV projects. In 2014, Connexus spent $228,524 and Dakota Electric spent $18,190 on solar PV. However, neither of these budgets allocated any of the project money to low income individuals.

There has not been precedent of the CIP being used in any applicable example to the scope of this report. While it may be leveraged in theory, there appear to be major barriers of distribution and selection in how CIP financing is applied, particularly considering it is administered by utilities, that would often rather finance solar projects at a larger scale (e.g. community solar) than invest resources in distributed generation on residential homes (Chan et al., 2017).

3.3.3. Property Assessed Clean Energy (PACE)

Property Assessed Clean Energy (PACE) is a federal and state program that incentivizes financing toward energy efficiency and renewable energy installations primarily for commercial, industrial and community nonprofit facilities; residential clauses have been added in Missouri, Florida, and California. Colorado, Vermont, and Minnesota have enabling legislation. Increasingly, attention has also been brought to multi-tenant complexes and rental facilities which are notoriously overburdened by inefficiencies brought on by a lack of incentives for renters and owners.

PACE provides immediate incentives to both third-party nonprofits and homeowners. PACE may offer financial assistance and a sustainable infrastructure for multifamily complexes. However, few multi-tenant and residential stakeholders have utilized PACE.

To participate, interested stakeholders must apply for a PACE loan with the local PACE affiliate. Governments generally facilitate PACE loan partnerships as conduit financiers of sorts; payments are collected from property owners and passed on to project investors. PACE then either approves or denies a special assessment. Finally, in most instances, local governments offer bonds to investors or private lenders to finance owners for a customized retrofit. These loans, namely private lending or municipal bonds, may then be repaid over the course of 5-25 years and bear no liabilities in investment. For these reasons, interest rates on PACE loans are typically around 3% - 4% higher than traditional mortgage loans, with additional administration fees of approximately 1% (U.S. Environmental Protection Agency, 2011). Even so, PACE financing is structured to offer immediate savings; upgrades will come at no added cost to the owner.

Loans offered through PACE cover a spectrum of costs to ensure little-to-no down payment by the applicant. This may include the following: cost of materials and labor, permitting fees, inspection fees, application and administrative fees, development and engineering fees, incidental modifications to existing property, and legal fees.

Under most PACE projects, governments offer a bond to investors or private lenders provide financing to owners for a retrofit. Loans are then repaid over 5-25 years. PACE is funded through private lending or municipal bonds, and therefore creates no liability to parties involved. Interest rates tend to hover around 3-4% higher than traditional mortgage loans, with additional administration fees of about 1%. PACE can be used to finance leases and PPAs. This may allow for lower project costs, as the provider may retain tax incentives, passing benefit along to the owner as a lower lease/service payment. The loan is applied to the property rather than an individual, so PACE will be a nonrecourse to the borrower, alleviating complications if a homeowner were to move. PACE would also allow for easy transfer between and individual and property; nonpayment generally results in repercussions similar to any other portion of a property tax bill (U.S. Department of Energy, 2018).

Financing Scenario Comparison Summary			
	Self-Funded	Conventional Loan	PACE
Out-of-Pocket Investment	($2,500,000)	($500,000)	$0
Savings (First Year)	$473,000	$473,000	$473,000
Annual Payment	$0	($561,568)	($217,961)
Cash Flow Impact Year 1	($2,027,000)	($588,568)	$255,039
Net Project Cash Flow Year 2	($1,554,000)	($677,136)	$510,077
Years to Positive Project Cashflow	5.3	7.0	IMMEDIATE
Debt Service Over Finance Term	0	(2,807,839)	(4,359,228)
10-Year Project NPV	$673,869	$431,691	$1,711,330
20-Year NPV	$2,143,984	$1,901,806	$2,504,007

Figure 3.2. Financial comparison of PACE with conventional approaches
Example financial metrics of a PACE project compared to conventional alternatives. The major takeaways to note are $0 out-of-pocket, immediate savings, and the most attractive 20-year net present value. These advantages are consistent with many objectives of HFH affiliates and homeowners. Adopted from a calculator developed by the Texas PACE Authority (2018).

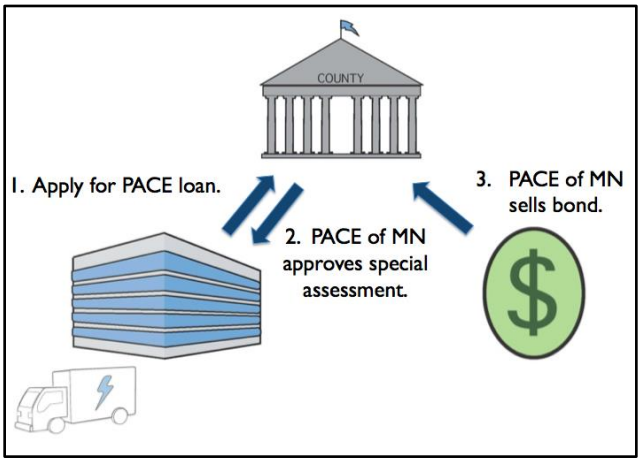

Figure 3.3. Typical cash flow under PACE
Cash flows under PACE involve lenders, the government, and a beneficiary. Figure adopted from the Texas PACE Authority (2018).

3.4. Summary of Financing Models

Solar deployment on HFH project sites is a delicate practice. There is a clear incentive to lower homeownership costs with solar to low-income homeowners over the long-term, but low-income households face pressing short-term concerns. Energy independence and long-term cost savings would lower energy bills and increase the agency of homeowners. However, costs of solar deployment are upfront by nature. Without additional funding/donations, the upfront cost of a solar installation would burden mortgage financiers (i.e. HFH), and thus burden homeowners with higher mortgage rates.

NPS partners typically work to acquire solar panels to donate to HFH. HFH is generally happy to accept these panels for use on project homes. In all instances we identified, HFH does not reap

the benefits of energy bill savings from these panels in a way that would help sustain additional projects. The homeowner sees these savings on their energy bill in the range of $500 to $1,500 a year. There are external costs borne by higher maintenance costs, and in some instances higher mortgage costs to compensate HFH for the gifted energy savings.

The installation of donated solar generally does not help the HFH affiliate, other than to further its mission of more affordable homeownership for the single household receiving the solar installation. In this sense, there is some stagnation in interest, which creates an indifferent market in some places. Some unique case examples and hypotheses have been found which may add incentives to further installations.

1. Nonprofits such as RENEW work to provide solar micro-financing by utilizing donations and government grants (see Case H). The financing is structured as a loan lease which addresses difficulties encountered by upfront costs and may still allow for long-term savings.
2. Another nonprofit strategy by Revision utilizes power purchase agreements to finance panels at affordable costs with long-term savings (see Case E). Third party investors advantage government programs that nonprofits do not have access to and then install panels on nonprofit land with long term agreements.
3. Donated solar panels may be advantaged by HFH if the affiliate reaped the energy savings of the panel, instead of the homeowner. The energy savings could then be indirectly passed on to homeowner via lowered mortgage rates. All else equal, this would lower mortgage default rates and increase guaranteed revenue to the affiliate. The outcomes of this are twofold. First, the affiliate would be free to pursue higher-risk (lower income) homeowners for future projects. Second, the affiliate would actually benefit from partnership with an NPS and may be more willing to seek out funding solutions for solar installation moving forward.
4. Nonprofits/donors that acquire large amounts of guaranteed financing can leverage deals with affiliates and/or state HFH organizations to donate solar onto a large number of project sites (see California example in Section 2.2).

Case H. Wisconsin RENEW

The Wisconsin nonprofit "RENEW" is a case study of solar financing models. They provide grant funding for up to 20% the cost of a solar array, education, and technical support. This erases the burden of upfront capital costs of panels and enables expanded access. Participants in RENEW's "Solar for Good" program must be a nonprofit in good financial standing and be able to accept donations (Huebner, 2018). To fill the remainder of a grant, RENEW recommends:

1. Matching fund for a public fundraising campaign
2. Contribution to an existing budget
3. Gap funding for a financed system

4. Nonprofit Contract Design

Collaboration between NPS developers and HFH affiliates can be implemented by a multitude of contract design options. To preface, contract design in this report is scoped for Minnesota NPS organizations seeking a long-term approach for solar financing to collaborate with local Minnesota HFH affiliates in providing LMI households with solar energy installation on-site to reduce energy burden and further sustainability. While we focus on the Minnesota case, these examples are likely to be relevant in other states as well.

The following section details a multi-step process for operating a sustainable revolving fund between NPS and habitat affiliates. The dimensions of design options for solar integration are described in Section 4.1. These dimensions are then applied to a set of contract design options (Section 4.2) and possible program financing options (Section 4.3).

4.1. Design Options

First, there are three dimensions for classifying the design structure of nonprofit deployment of solar: ownership, panel financing, and rate/payment structure. Options for these three dimensions are shown in Table 4.1 and are explored in turn below.

Table 4.1. Design options for Nonprofit Solar (NPS)
Options for ownership, financing, and rate/payment structure. These options are combined in different program design models in Section 4.2.

Ownership Options	Panel Financing Options	Rate/Payment Structure Options
Homeowner	Donation	Net Metering
Habitat Affiliate	Loan/Fixed Payment	Monthly Payments
NPS	PPA	Green Donation Fund

1. **Ownership** of solar infrastructure can be held by either the NPS, the affiliate, or the homeowner. This offers two choices to the NPS: keep ownership of the solar equipment after installation on a project site or give ownership to either the homeowner or the affiliate. Contract stipulations will enhance understanding of "ownership," but it is primarily important to distinguish ownership for purpose of utility interaction and nonprofit participation.

2. **Panel Financing** details the mechanisms that may be utilized for the transfer of ownership of solar equipment. The three modes for financing are donation, loan/fixed payment, and power purchase agreement. Under the first scenario, an NPS may donate panels, which would transfer ownership to either an affiliate or homeowner without any realized capital gains. This is the most common form of NPS interaction.

   In the second scenario, an NPS may give the panel to a homeowner or affiliate as a loan/lease-to-own installation. Here, the panel may be repaid or subsidized over the course of its lifetime with highly flexible arrangements and may be radically different than conventional loans. Contract design may be based on NEM rates of solar production, smoothed monthly energy payments, or as an integrated payment scheme with affiliate mortgage payments. This would allow for the homeowner to accrue benefits on different time scales (from up-front to fully amortized).

   In the third scenario, an NPS may keep the panel under its ownership, install the panel either on a project site or off-site, and construct a power purchase agreement with the homeowner or even affiliate. This may repay the value of the panel or may be net subsidized over its lifetime, similar to the loan/lease-to-own option.

3. **Rate Structure** will be decided between the service utility and the panel owner as a traditional net energy metering (NEM) or net metering + additional incentives (e.g. Xcel's Solar*Rewards) arrangement. Rates may also be negotiated between the owner and the homeowner, in certain situations where the owner is either the NPS or the affiliate. In addition, the **payment structure** between parties to an agreement will detail how solar production reimbursement and other financial terms are to be structured. These agreements may detail cash flow contract specifics and allows for considerable overlap and cohesion between options. There may be a contract stipulation to mandate a monthly payment to an NPS through a "Green Donation Fund," by the homeowner or the affiliate. A Green Donation Fund is a contractual agreement that would recommend or portion a certain amount of payment from the homeowner to the donating NPS. This could intentionally reduce energy savings but still offer some assistance to the homeowner, but also give the NPS the agency to fund additional projects and pool assets. Another option, in the case a panel is donated to the affiliate, the affiliate may offer homeowner contracts considering a mortgage adder, loan or donation. In the event that the NPS chooses to maintain ownership, payment structure may be contracted between the NPS and the homeowner in the shape of a loan-lease or loan/fixed monthly-bill, which may be set to "smooth" energy bills and/or lower energy bills for the homeowner.

These mechanisms all suppose various homeowner benefits. Options may be stacked to increase the magnitude of benefits either to the homeowner or to future homeowners. Contract design around energy consumption (e.g. flat energy bill), PV production (e.g. energy credit), flat

payment (e.g. rebate), or mortgage (e.g. preferred lending rate from affiliate) are available and may be considered to reduce overall risk or achieve other goals. Mechanisms may also be designed to benefit the NPS and/or the Habitat affiliate. Homeowners may be willing to pay a subsidized amount for energy over a long-term contract instead of the conventional free-energy approach that many NPS developers have used thus far. This is important to realize. Trade-offs are assumed between homeowner benefit and the NPS/affiliate; however, in order for the advantages of Green Revolving Funds to be met, it may be beneficial to utilize some homeowner support in addition to measures the NPS uses to pool capital for projects, i.e. donations, sponsors, other revenue streams, etc. This means an NPS may take a net loss with each contract it designs purposely such that the homeowner receives an energy savings and other funding sources are utilized for the next installation within the Revolving Fund.

4.2. Contract Design Models

This section highlights the possibilities of contract design options available to an NPS organization. Five options are presented, ordered in rough degree of complexity. Each option is described briefly and is accompanied by a schematic representation. In the schematics green arrows signify positive cash/value flow to the NPS, red arrows signify negative cash/value flow to the NPS, black arrows signify contracts between parties, and dashed lines signify cash flow independent of the NPS. While options imply differences in contract design and structure, they do not dictate absolute differences in cash-flow.

4.2.1. Model 1: Status Quo

This model follows a business-as-usual approach to NPS solar financing. Under this approach, nearly all benefits of the solar installation accrue to the single homeowner receiving the installation. The NPS donates a panel to the homeowner, who may actualize NEM credits for energy resilience and financial assistance; the affiliate and the homeowner maintain a standard secondary mortgage structure independent of the NPS.

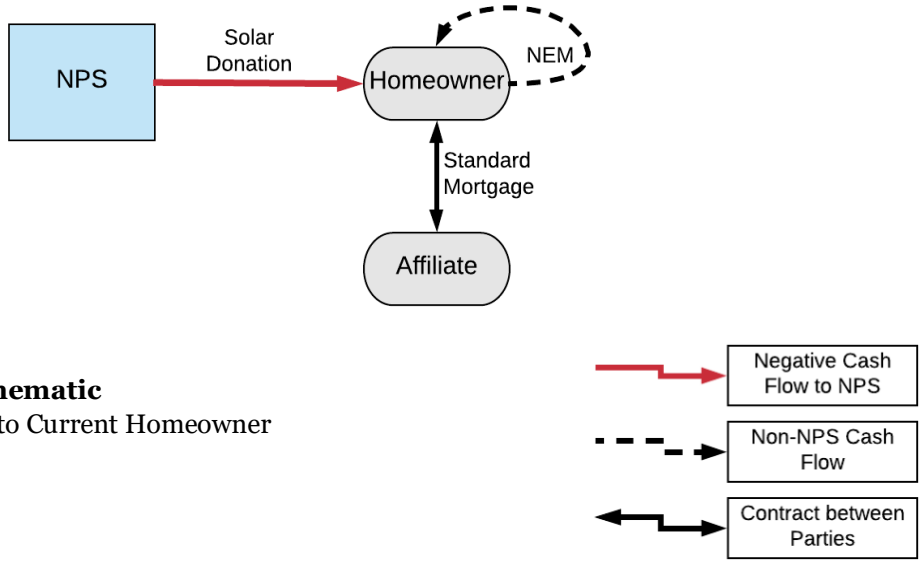

Figure 4.1. Model 1 Schematic
Status Quo – All Benefits to Current Homeowner

4.2.2. Model 2: Donation to Homeowner with Green Donation Fund

In a second example, the NPS may still donate a panel to the homeowner but benefits are shared between the current homeowner and future homeowners by enabling future solar projects. That homeowner may now actualize NEM credits for energy resilience and financial assistance. A portion of the NEM financial benefit may diverted from the homeowner to be passed along in a contractual "Green Donation Fund" held with the NPS, which in-turn helps replenish the Green Donation Fund. These donation contracts may be highly flexible and could be generally non-binding. One potential way to structure this approach would be to set a monthly average expected solar bill credit amount based on expected monthly production as a ceiling for NEM reimbursement with excess generation above this amount (generally in the summer when Minnesota energy bills are typically lower) to be donated to the revolving fund. This approach allows an NPS to recoup some of its costs and allow the homeowner to maintain independence and agency in their financial decisions. While the homeowner has the ability to maintain a high level of affordability within this model, this produces large GRF uncertainty and may generally lack incentives to drive homeowner repayment to the NPS.

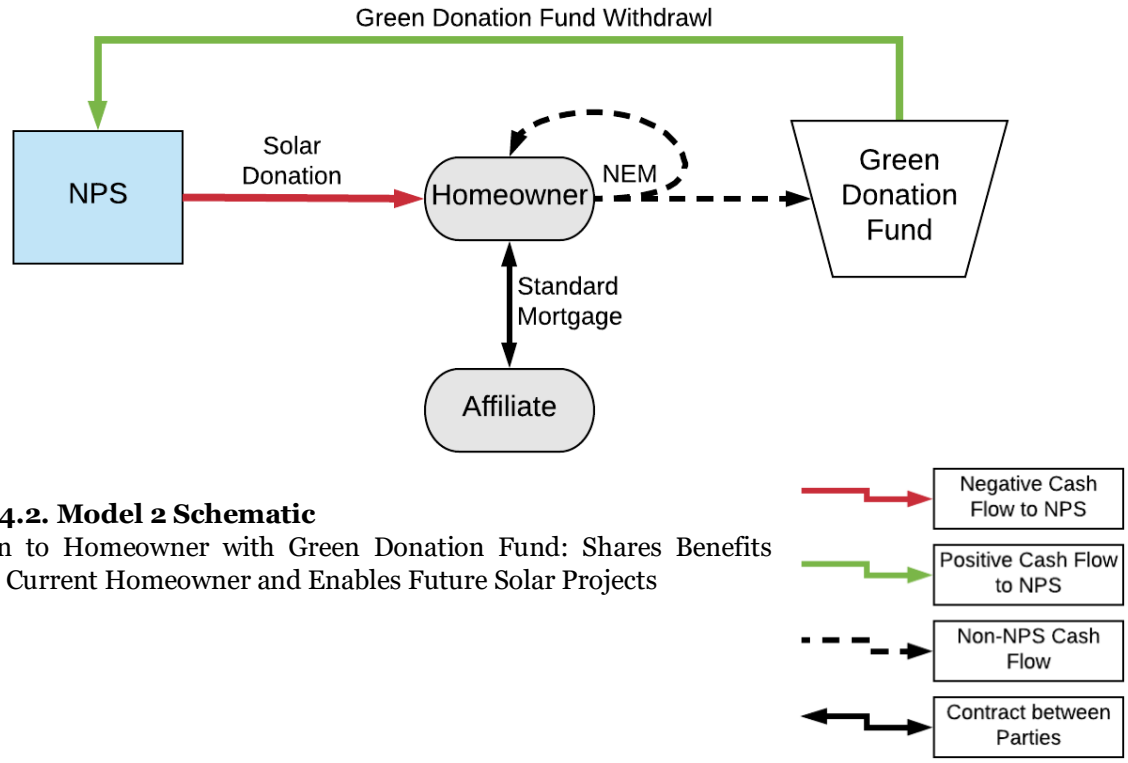

Figure 4.2. Model 2 Schematic
Donation to Homeowner with Green Donation Fund: Shares Benefits between Current Homeowner and Enables Future Solar Projects

4.2.3. Model 3: Donation to Affiliate with Homeowner Mortgage Fund

In a third example, the NPS may donate a panel to the affiliate, who then locates the installation on a homeowner's roof. As the owner of the panel, the affiliate may now actualize NEM credits. The affiliate then passes along a portion of the credit to the homeowner, while it maintains a second portion for a Homeowner Mortgage Fund, which is then used to reduce mortgage costs to future Habitat homeowners. This may also allow the affiliate to pursue more disadvantaged customers with higher credit risk by offsetting some of the increased default risk. While the homeowner would receive less credit under this model, the affiliate may be in a position to better integrate and distribute benefits of NEM credits than in Model 2. This approach is also more likely to help develop long-standing partnerships between affiliates and the NPS; the NPS may receive no benefit/payback for its donation.

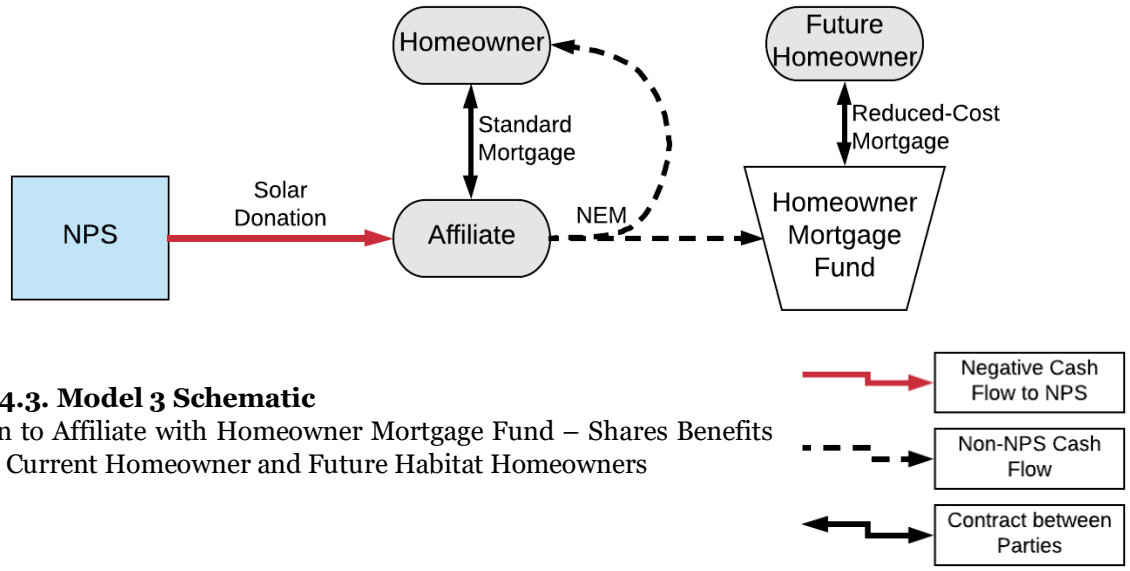

Figure 4.3. Model 3 Schematic
Donation to Affiliate with Homeowner Mortgage Fund – Shares Benefits between Current Homeowner and Future Habitat Homeowners

4.2.4. Model 4: Solar Contracts with Homeowner Financed through a GRF

In a fourth example, a green revolving fund is structured with a flexible solar contract to benefit current homeowners and enable future projects. In this model, the NPS may develop highly customizable solar contracts with the homeowner to actualize long-term payback on a portion of the solar installation, in conjunction with other financing options and in-kind donations. Contracts with the homeowner may include loans, fixed (ex. monthly) payments, or follow a power purchase agreement. In this sense, the NEM revenue is indirectly funneled towards a GRF, as contractual cash flow is paid for by offsetting credits. These may be intentionally structured so as to subsidize the true cost of a solar-panel to the homeowner or at a discount (not fully revolving). This model would guarantee that the NPS recoups some or all costs and would also allow for the homeowner to receive benefit without providing up-front capital into a solar installation

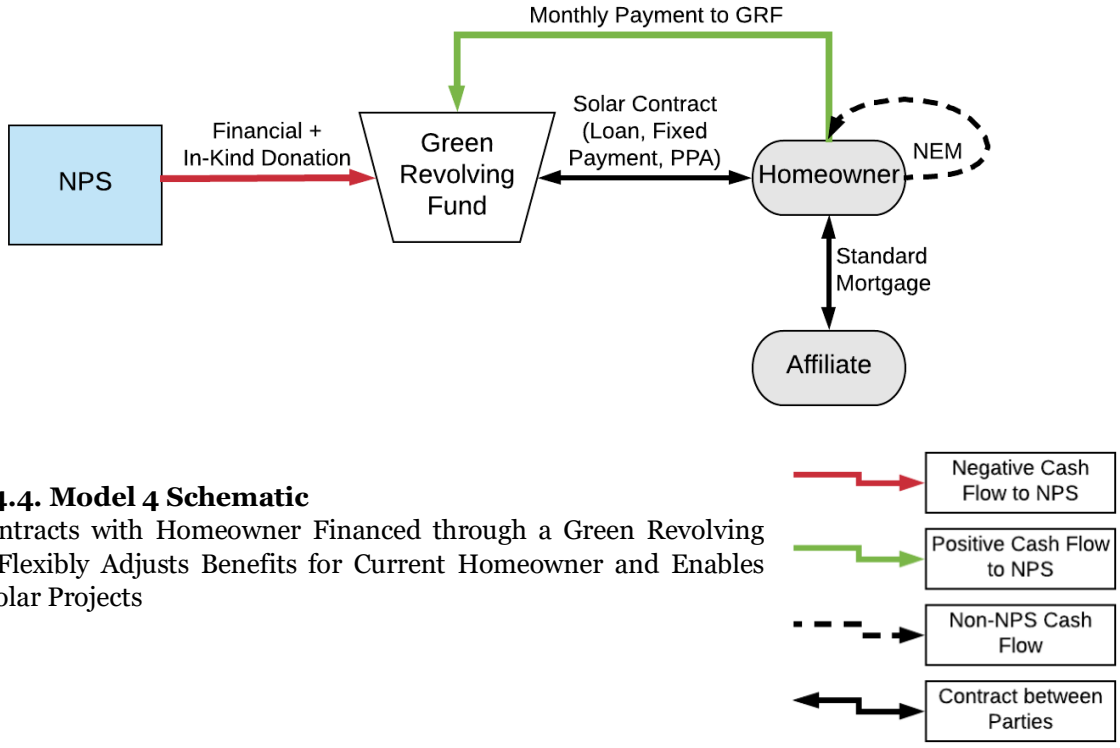

Figure 4.4. Model 4 Schematic
Solar Contracts with Homeowner Financed through a Green Revolving Fund – Flexibly Adjusts Benefits for Current Homeowner and Enables Future Solar Projects

4.2.5. Model 5: Solar Contracts with Affiliate Financed through a GRF

A final example builds off Model 4 but structures the solar contract with the Habitat affiliate rather than the homeowner, which allows for flexible adjustment of benefits to the homeowner and opens the possibility of reducing mortgage risk, thereby expanding access of solar. In this model, the NPS may develop a highly customizable solar contract with the affiliate to actualize long-term payback on a portion of the solar installation (to be installed on a homeowner's roof), in conjunction with other financing options and in-kind donations. Contracts with the affiliate may include loans, fixed (ex. monthly) payments, or follow a power purchase agreement. The homeowner would be given partial benefit of the NEM; some of the NEM benefit may be passed back to the affiliate to recoup on its contractual investment as an optional adder. This model may again allow for reduced-risk of default for the homeowner, as it works to integrate energy payments into a mortgage structure. The homeowner would benefit from NEM assistance, and the NPS would benefit from the GRF.

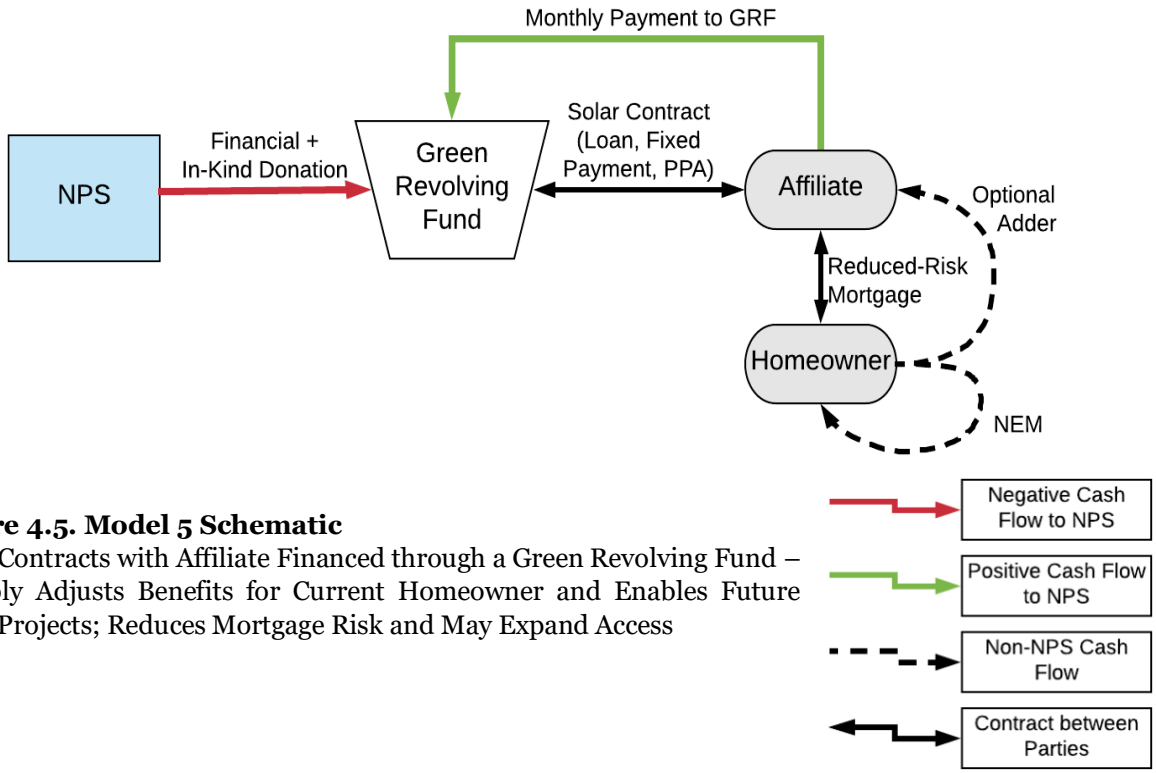

Figure 4.5. Model 5 Schematic
Solar Contracts with Affiliate Financed through a Green Revolving Fund – Flexibly Adjusts Benefits for Current Homeowner and Enables Future Solar Projects; Reduces Mortgage Risk and May Expand Access

4.3. Financing Options and Tradeoffs

The contract structure options described in the previous section are not exhaustive – more combinations within the range of mechanisms we describe are possible, as is the integration of other mechanisms. Still, the question remains, what is the best model for combining financing tools with contract design options to increase affordability of projects? This section details

tradeoffs between selected financing tools that can be applied with the contract options described above. In theory, these may all be utilized by an NPS, but some would represent first-of-a-kind program integration.

Firstly, and most commonly, an NPS can use a collection of internal funds, donations, sponsors, and grants to finance projects. This is evidenced across case examples, specifically in D.C., California (PG&E), and Minnesota (RREAL). Benefits of this model are up-front interest-free capital, no payback limitations or risks, and the possibility to offer the most favorable and discounted homeowner contracts. While this is the most prevalent financing approach in practice, it is also most often paired with solar donations to a homeowner (contract Model 1). We note however, that the other contract options we lay out can also be paired with this finance approach. Relying on internal funds, donations, sponsors and grants has major limitations to scale and long-term NPS sustainability; this approach relies on good relationships, is not guaranteed (high uncertainty), poses risk of internal liability and NPS onus, and has a zero regeneration-rate (i.e. not revenues to support future projects).

A second option is to introduce outside private investors into project financing, facilitated by the NPS. This may benefit the NPS because they will have reduced liability for any capital investments or would not suffer any consequences of project buy-back. However, projects may be limited to PPA system operations that allow outside investors to maintain ownership, as is common amongst private investors (e.g. Revision). Additionally, NPS involvement would be indirect and would not further incentivize GRF contributions. For legal reasons, this option would have to be implemented separate from other options, although there may be room for experimentation.

A third option is to leverage the Community Reinvestment Act, which could front significant amounts of up-front capital for attractive loan offers on project sites. The CRA would remove risk to the NPS and allow the NPS to remain directly involved in project management, GRF flow, etc. However, the CRA is unprecedented in the nonprofit solar community, and would likely be a tedious process for the first project of its kind.

A fourth option is to seek-out conventional debt-financing to allow for access to wider project distribution with long-term payback. Debt financing is a common approach to renewable development and would likely be a feasible option. Debt-financing models are highly ingrained across many payment schemes to moderate success. However, debt financing cannot advantage tax-equity and traditionally suffers from high interest-rates.

A fifth option is to utilize Property Assessed Clean Energy programs within allocated regions. PACE has many benefits to the NPS: long-term loans backed by the government, explicit servicing of solar-systems, and immediate cost savings to the recipient. However, PACE has not yet been curated in residential homes in Minnesota, even though enabling legislation exists, and interest rates are significantly higher than typical mortgage rates.

In a sixth option, the NPS may consider the Conservation Improvement Program. There is specific language enabling benefit to low-income purchasers and carve-outs for “Solar PV” on spending reports. The CIP would not require a pay-back, and would function as a grant/donation, which would be beneficial to the NPS and the homeowner. However, the CIP has not yet been used at the residential scale for solar (to our knowledge). Further, the CIP has not yet been used on low-

income solar; all of which suggests that the first project to utilize CIP support would require breaking new ground.

To conclude, many NPS financing outcomes will be dependent on affiliate interaction, available financing tools, and contract design. For this reason, success is subjective and should be pursued as such. In recognizing known tradeoffs, best decisions may be made in order to find a customized model (financing sources and contract design) that works best for each party and their missions.

Table 4.2. Summary of Benefits and Limitations of Financing Options

Finance Source	Benefits	Limitations
Internal-Funds, Donations, Sponsors, Grants	Up-front, interest-free capital **May allow for more favorable and discounted homeowner contracts** No payback	Relies on good relationships; not guaranteed Internal liability, risk Slow
Outside Private Investors	Reduces risk to NPS More time for facilitation and coordination	**Likely to be limited to PPA system operation** NPS action would be indirect and limited
Community Reinvestment Act	Significant potential for loans Removes risk to NPS	Unprecedented in nonprofit solar community Likely only available on case-by-case basis
Debt Financing	May allow for access to a wider project distribution with long-term payback Generally common in renewable development	Interest rates Does not advantage tax equity
Property Assessed Clean Energy (PACE)	Long-term loans with government support; city and/or county backing Flexible system usage Specific language for solar installations May retain tax incentives; nonrecourse to borrower **Immediate cost savings**	**Enabling legislation in Minnesota has not yet curated residential projects** Not a donation Often advantaged at the city level High interest rates (3-5% above mortgage rates)
Minnesota Conservation Improvement Program (CIP)	Several utilities have budgeted carve-outs for "Solar PV" on CIP spending reports Low-income spending requirements which could be leveraged	Not precedent in this context; administered by utilities Spending has not been utilized on low-income for solar yet

5. Conclusion

This report explores the existing landscape of solar integration with HFH home builds and potential models for future projects. Compared to existing projects, new models may allow for more sustainable project finance and expanded access to HFH's affordable housing.

The models we present may be considered as composed of highly flexible and adaptable "puzzle pieces." As no project site is the same, the same follows that no NPS and no affiliate is the same. Lessons learned point to the importance of connections and communication and collaboration between actors with aligned missions. In order to best implement these measures, it is of primary importance that an NPS have a legitimate connection with its partnering affiliate and homeowner.

A highly flexible model design can allow for greater tailoring of approaches. All approaches have inherent tradeoffs, and the best solution in a particular context may depend on stakeholder and community characteristics. Each "pathway" towards financing may be efficiently and effectively achieved if the motivations and organizational characteristics between actors are understood and aligned. He present examples of how financing can be tailored to specific conditions:

1. If an NPS capitalizes upon a lucrative financing options and identifies a scenario where a homeowner is greatly disadvantaged and unable to participate in a long-term loan/fixed payment scheme, then a donation coupled with a highly-flexible GDF may be the best approach.
2. In another instance, an affiliate may express a desire to take on a larger role in a partnership and to integrate payments into a secondary mortgage to the homeowner. The affiliate may realize benefits of decreased risk of default because utility payments and solar benefits reduce overall homeowner expenses; homeowners may realize benefit in a more efficient and affordable payment scheme; and the NPS may realize benefit in operating a contract with the affiliate, rather than the homeowner.
3. In a final instance, the affiliate may be indifferent of NPS and homeowner partnership, the homeowner may be in relatively good financial standing, and the utility landscape may present opportunities to pursue a PPA, where a contract can be made between the NPS and the homeowner, and a second agreement can be made with the homeowner and the utility for excess NEM production credit. The NPS should find advantage in recouping a portion of the project financing via the PPA, at (e.g.) 50% of the panel cost over the length of the contract.

These examples serve as a reminder of the complexity of the goals and limitations of actors and the necessity for an NPS to navigate the tradeoffs between pathways so as to find an adaptable mechanism for contract negotiation. So long as the NPS realizes some benefit from model design, it should be incentivized to pursue project development.

The partnership of an NPS and its affiliate may be the defining piece of a model's long-term sustainability. With the intent to maximize its potential, an NPS should seek out pilot projects in which the HFH affiliate expresses interest in becoming an active participant. Regardless of whether contract design uses the affiliate as a medium, the affiliate should 1) work to break barriers of communication between the NPS and the homeowner, 2) lobby support for financial

options, and 3) build partnerships for additional projects. In this way, a more sustainable and community-oriented approach may be taken to build a resilient and equitable platform for homeowner support and energy assistance. Affiliate mission statements could be served by solar integration, and certain aspects of financial security may be realized by mortgage integration payments, which work to integrate the gains of subsidized solar directly into ensuring that mortgages can be more affordable and attainable by homeowners. In theory, this may allow for the affiliate to pursue lower-income customers and work to increase its coverage to more disadvantaged individuals and families.

References

Administration for Children & Families, 2018. Low Income Home Energy Assistance Program (LIHEAP).

Agarwal, S., Benmelech, E., Bergman, N., Seru, A., 2012. Did the Community Reinvestment Act (CRA) lead to risky lending? National Bureau of Economic Research.

APPRISE Incorporated, 2017. Low-Income CIP Spending Requirements: Regulatory and Policy Analysis for COUs. Prepared for the Minnesota Department of Commerce.

Avery, R.B., Calem, P.S., Canner, G.B., 2003. The Effects of the Community Reinvestment Act on Local Communities.

Barbose, G., Darghouth, N., 2018. Tracking the Sun: Installed Price Trends for Distributed Photovoltaic Systems in the United States - 2018 Edition. Lawrence Berkeley National Laboratory.

Bath Savings Institution, 2015. Community Reinvestment Act Performance Evaluation.

Berger, Z., 2016. Third-Party Power Purchase Agreements and Solar Installations: How Non-Profits can Take Advantage of this Growing Industry. UMN Energy Transition Lab.

Bernanke, B., 2007. The Community Reinvestment Act: Its Evolution and New Challenges [WWW Document]. Board Gov. Fed. Reserve Syst. URL https://www.federalreserve.gov/newsevents/speech/Bernanke20070330a.htm (accessed 12.6.18).

Boyce, D., Wirfs-Brock, J., 2016. High Utility Costs Force Hard Decisions For The Poor [WWW Document]. Energy. URL http://insideenergy.org/2016/05/08/high-utility-costs-force-hard-decisions-for-the-poor/ (accessed 12.6.18).

Brainerd Dispatch, 2018. Backus solar organization teams up with Habitat for Humanity [WWW Document]. URL https://www.pineandlakes.com/news/4488827-backus-solar-organization-teams-habitat-humanity (accessed 12.18.18).

Bures, F., 2018. Solar power could be huge in Greater Minnesota — if they can find the people to build it. MinnPost.

Burke, J.M., Friel, M.K., 2016. Understanding federal income taxation, Fifth edition. ed, Understanding series. Carolina Academic Press, Durham, North Carolina.

California Energy Commission, 2016. Docket Number 16-OIR-02 SB 250 Barriers Study Draft Report.

Canavan, S., 2013. Community Developments Investments (Fall 2013) - How 'Green' Investments May Qualify for CRA Consideration [WWW Document]. Off. Comptrol. Curr. URL https://www.occ.treas.gov/publications/publications-by-type/other-publications-reports/cdi-newsletter/wind-energy-fall-2013/wind-energy-ezine-article-5-green-investment-cra.html (accessed 12.6.18).

Chan, G., Evans, I., Grimley, M., Ihde, B., Mazumder, P., 2017. Design choices and equity implications of community shared solar. Electr. J. 30, 37–41. https://doi.org/10.1016/j.tej.2017.10.006

Coleman, K., Blank, T.K., Probst, C., Waller, J., 2017. Financing Community-Scale Solar.

Comptroller of the Currency Administrator of National Banks, 1997. Community Reinvestment Act Performance Evaluation.

Drehobl, A., Ross, L., 2016. Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities. American Council for an Energy-Efficient Economy.

Engen, B., 2017. Habitat for Humanity implementing innovative building solutions through a partnership with the University of Minnesota [WWW Document]. Habitat Humanity.

URL https://www.tchabitat.org/blog/innovative-building-solutions-partnership-with-u-of-m
Environmental Law & Policy Center, 2015. Third-Party Financing of Distributed Generation Does Not Create a "Public Utility" in Minnesota. Environmental Law & Policy Center.
Farrell, J., 2016. Inclusive Financing for Efficiency and Renewable Energy. Institute for Local Self Reliance.
Federal Reserve Bank of Richmond, 1996. Community Reinvestment Act Performance Evaluation.
Fisher, Sheehan & Colton, 2017. The Home Energy Affordability Gap 2016: Minnesota. Public Finance and General Economics, Belmont, Massachusetts.
Guerin, E., 2018. California to Require All New Homes to Have Solar Panels Starting In 2020 [WWW Document]. NPR.org. URL https://www.npr.org/2018/05/17/612082781/california-to-require-all-new-homes-to-have-solar-panels-starting-in-2020 (accessed 12.4.18).
Habitat for Humanity, 2018a. Habitat for Humanity in the United States [WWW Document]. URL https://www.habitat.org/where-we-build/united-states-america (accessed 12.4.18).
Habitat for Humanity, 2018b. Our mission, vision and principles [WWW Document]. Habitat Humanity. URL https://www.habitat.org/about/mission-and-vision (accessed 12.4.18).
Habitat for Humanity, 2016. Habitat for Humanity receives Self-help Homeownership Opportunity Program funds to increase impact across the United States [WWW Document]. Habitat Humanity. URL http://www.habitat.org/newsroom/2016/05-15-Shop-Grant (accessed 12.6.18).
Habitat for Humanity, T.C.H. for, 2018. The Mortgage Process [WWW Document]. URL https://home.tchabitat.org/tchfh-lending-inc (accessed 12.4.18).
HUD Demonstration Act of 1993, 1993.
Huebner, T., 2018. Solar For Good.
Humanity, T.C.H. for, n.d. TCHFH Lending, Inc. [WWW Document]. URL https://home.tchabitat.org/tchfh-lending-inc (accessed 12.6.18).
Litan, R.E., Retsinas, N.P., Belsky, E.S., Haag, S.W., 2007. The Community Reinvestment Act After Financial Modernization: A Baseline Report.
Lobenstein, M.S., Fryer, A., Carroll, D., McGrath, K., 2018. Opportunities for Making MN Low Income Programs more Effective.
Low Income Solar Policy Guide, 2018. Summary of State Approaches to Low-income Single-Family Solar, by Program, Carveout, Incentive.
Minton, M., 2008. The Community Reinvestment Act's Harmful Legacy. Competitive Enterprise Institute.
MN DOC Office of Energy Security, 2010. Assessing the Feasibility of Third Party Owned Solar Photovoltaic Installations in Minnesota Schools.
North St. Louis County Habitat for Humanity, 2011. Home #41 The Montgomery Family [WWW Document]. URL http://www.nslchfh.org/families?project=50 (accessed 12.18.18).
Norton, P., Stafford, B., Carpenter, B., Hancock, C.E., Barker, G., Reeves, P., Kriescher, P., 2005. Affordable High-Performance Homes: The 2002 NREL Denver Habitat for Humanity House, A Cold-Climate Case Study (No. NREL/TP-550-31650). National Renewable Energy Laboratory.
Office of the Comptroller of the Currency, Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation, 2016. Community Reinvestment Act; Interagency Questions and Answers Regarding Community Reinvestment; Guidance.
Oxman, M., 2018. Understanding Energy Burden and its Potential Solutions for Atlanta.
Perl, L., 2018. LIHEAP: Program and Funding.

Resch, R., 2013. Community Reinvestment Act: Interagency Questions and Answers Regarding Community Reinvestment.
Revision Energy, 2018. Solar at Work: No Upfront Cost Solar for Municipalities and Non-Profits [WWW Document]. Revis. Energy. URL https://www.revisionenergy.com/at-work/solar-ppa-schools-non-profits/
Rural Renewable Energy Alliance, 2017. Solar Assistance for the Bayliss Family [WWW Document]. Rural Renew. Energy Alliance. URL https://my.rreal.org/campaign/solar-assistance-for-the-bayliss-family/c118787 (accessed 12.18.18).
Ryan, D., 2017. Seizing Opportunity to Connect Low- and Moderate-Income Communities with Energy-Efficient Tools and Best Practices | Prosperity Now [WWW Document]. URL https://prosperitynow.org/articles/seizing-opportunity-connect-low-and-moderate-income-communities-energy-efficient-tools (accessed 12.6.18).
Smith, C.A., 2013. The Rise of Habitat for Humanity Subdivisions. Focus Geogr. 56, 95–104. https://doi.org/10.1111/foge.12017
Smith, G., 2016. 6 steps to securing debt financing for your next commercial solar project [WWW Document]. Sol. Power World. URL https://www.solarpowerworldonline.com/2016/07/6-steps-securing-debt-financing-next-commercial-solar-project/ (accessed 12.4.18).
Solaripedia, 2010. Habitat Breaks Poverty Cycles with Solar [WWW Document]. Solaripedia. URL http://www.solaripedia.com/13/254/165/habitat_for_humanity_solar_home_(denver,_colorado,_usa).html (accessed 12.4.18).
Stoel Rivers LLP, 2017. Project Finance for Solar Projects [WWW Document]. URL https://www.stoel.com/legal-insights/special-reports/the-law-of-solar/project-finance-for-solar-projects (accessed 12.4.18).
Tarbi, L., 2017. Free Solar Panels: Are They Really Free in 2018? energysage. URL https://news.energysage.com/free-solar-panels-really-free/ (accessed 12.4.18).
Texas PACE Authority, 2018. New Financing Option for Multifamily Property Owners. Tex. PACE Auth. URL https://www.texaspaceauthority.org/what-is-pace/multifamily/ (accessed 12.6.18).
U.S. Department of Energy, 2018. Property Assessed Clean Energy Programs [WWW Document]. URL https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs (accessed 12.6.18).
U.S. Environmental Protection Agency, 2011. Clean Energy Financing Programs.
Welch, S., 2017. Habitat for Humanity affiliates rehab their business models [WWW Document]. Crains Detroit Bus. URL https://www.crainsdetroit.com/article/20170305/NEWS/170309916/habitat-for-humanity-affiliates-rehab-their-business-models (accessed 12.6.18).

Appendix A. Survey of Solar-Integrated Habitat for Humanity Projects

Table A.1. Identified Examples of Solar-Integrated Habitat for Humanity Projects

State	City/Region	Affiliate	Number of Homes	Link(s)
AL	Florence, AL	Shoals Habitat for Humanity	1	http://www.solaripedia.com/13/254/habitat_breaks_poverty_cycles_with_solar.html
AR	Little Rock	Habitat for Humanity of Central Arkansas	1	https://www.habitatcentralar.org/single-post/2017/04/27/Habitat-goes-Solar
AZ	Scottsdale	Habitat for Humanity Central Arizona	5	https://www.businesswire.com/news/home/20090515005884/en/American-Solar-Electric-KYOCERA-Leading-Component-Manufacturers
AZ	Phoenix	Habitat for Humanity Desert Foothills, Harmon Solar	25	http://harmonsolar.com/blog/alternative-energy/harmon-solar-to-donate-solar-systems-for-all-future-arizona-habitat-for-humanity-desert-foothills-homes
CA	Oakland	Habitat for Humanity of Oakland County	54	http://www.energy.ca.gov/2009publications/CEC-180-2009-001/CEC-180-2009-001.PDF
CA	Montebello	Habitat for Humanity of Greater Los Angeles	Unknown	http://www.habitatla.org/building-greener-southern-california-edison-grid-alternatives/
CA	Butte County	Habitat for Humanity of Butte County	>600	https://www.pge.com/en/about/newsroom/newsdetails/index.page?title=20150723_pge_commits_1_million_to_solar-powered_habitat_for_humanity_homes NREL Report: https://www.nrel.gov/docs/fy05osti/38587.pdf https://www.southernenvironment.org/uploads/words_docs/SolarForAll_InlineDoc_061716_Final.pdf
CA	San Andreas	Habitat for Humanity Calaveras		
CA	Silicon Valley/ East Bay	Habitat for Humanity East Bay/Silicon Valley		
CA	El Dorado County	El Dorado County Habitat for Humanity		
CA	Fresno	Habitat for Humanity Greater Fresno Area		
CA	Bakersfield	Habitat for Humanity Golden Empire		
CA	Sacramento	Habitat for Humanity of Greater Sacramento		
CA	San Francisco	Habitat for Humanity Greater San Francisco		
CA	Clear Lake	Habitat for Humanity Lake County CA		
CA	Fort Bragg	Habitat for Humanity of the Mendocino Coast		

State	City/Region	Affiliate	Number of Homes	Link(s)
CA	Santa Cruz & Monterey	Habitat for Humanity Monterey Bay		
CA	Stockton	Habitat for Humanity of San Joaquin County		
CA	San Luis Obispo County	Habitat for Humanity for San Luis Obispo County		
CA	Solano and Napa	Solano-Napa Habitat for Humanity		
CA	Santa Rosa	Habitat for Humanity of Sonoma County		
CA	Sonora	Habitat for Humanity of Tuolumne County		
CA	Los Banos	Habitat for Humanity West Side Merced County		
CA	Yuba City & Marysville	Habitat for Humanity Yuba/Sutter		
CO	Fort Collins	Berthoud Habitat for Humanity	1	https://www.denverpost.com/2018/01/08/habitat-for-humanity-home-solar-panels/ http://www.reporterherald.com/news/ci_31575948/fort-collins-company-installing-solar-panels-free-berthoud
CO	Denver	Habitat for Humanity of Metro Denver	1	https://www.builditsolar.com/Projects/SolarHomes/36150_affordable_2002_habitat.pdf https://www.nrel.gov/docs/fy08osti/43188.pdf
CO	Carbondale	Habitat for Humanity Roaring Fork	11	https://www.aspentimes.com/news/habitat-celebrates-with-solar-panels-on-earth-day/
CO	Colorado Springs	Pikes Peak Habitat for Humanity	1	https://elightelectric.com/project/pikes-peak-habitat-for-humanity-residential-solar-project-2-3-kw/
CO	Durango	Habitat for Humanity of la Plata County	61	http://fourcore.org/solar-barn-raising/
DC	Washington D.C.	Habitat for Humanity of Washington D. C.	10	https://www.energy.gov/eere/articles/sunshot-installs-solar-energy-system-local-habitat-humanity-home
GA	Forsyth County	Habitat for Humanity North Central Georgia	1	https://radiancesolar.com/radiance-solar-installs-habitat-for-humanitys-first-solar-array-on-home-in-forsyth-family/
HI	Hawai'i Island	Habitat for Humanity Hawai'i Island	unknown	https://hawaiihabitat.wordpress.com/habitat-renewable-energy-program/
HI	Maui Island	Habitat for Humanity Maui	unknown	
HI	O'ahu Island	Honolulu Habitat for Humanity	unknown	

State	City/Region	Affiliate	Number of Homes	Link(s)
HI	Leeward O'ahu	Habitat for Humanity Leeward O'ahu	unknown	
HI	Kaua'i county	Kaua'i Habitat for Humanity	unknown	
IA	Iowa City	Iowa Valley Habitat for Humanity	1	https://energynews.us/2014/10/08/midwest/habitat-homes-aim-for-net-zero-with-energy-monitoring-tools/
IL	Marion	Habitat for Humanity of Williamson County	unknown	https://thesouthern.com/news/local/communities/marion/marion-habitat-for-humanity-homeowner-receives-solar-energy-through-new/article_b686c529-8848-568f-aacc-2bb6d9ac0ee2.html
IL	Waukegan	Habitat for Humanity Lake County	1	https://www.zion-bentontimes.com/story/2018/06/22/news/solar-panels-first-on-habitat-for-humanity-home-in-illinois/271.html
MA	Brewster	Habitat for Humanity Cape Cod	6	http://www.capeandislands.org/post/habitat-humanity-unveils-new-solar-powered-affordable-homes#stream/0 https://solarindustrymag.com/solar-installed-on-habitat-for-humanity-homes-in-cape-cod/ http://habitatcapecod.org/our-projects/paul-hush-way-brewster
MD	Gaithersburg	Habitat for Humanity Metro Maryland	1	https://blog.directenergysolar.com/direct-energy-solar-habitat-for-humanity-team-up-to-power-american-dream/
MI	Michigan	Habitat for Humanity Grand Traverse Region	10	https://energynews.us/2014/10/08/midwest/habitat-homes-aim-for-net-zero-with-energy-monitoring-tools/
MN	Hibbing	North St. Louis County Habitat for Humanity	1	http://www.nslchfh.org/families?project=50
MN	Brainerd	Lakes Area Habitat for Humanity	1	https://my.rreal.org/campaign/solar-assistance-for-the-bayliss-family/c118787
MN	Minneapolis	Twin Cities Habitat for Humanity	unknown	https://www.mprnews.org/story/2014/02/21/environment/energy-efficient-habitat-house https://www.minnpost.com/the-line/2014/05/solar-twin-cities-where-urban-farming-social-justice-green-tech-and-sustainable-living/
MN	Foley	Central Minnesota Habitat for Humanity	1	http://www.pineandlakes.com/news/4488827-backus-solar-organization-teams-habitat-humanity

State	City/Region	Affiliate	Number of Homes	Link(s)
NC	Charlotte	Habitat for Humanity Charlotte	10	https://illumination.duke-energy.com/articles/habitat-homes-roll-out-welcome-mat-to-solar
NC	Chatham	Chatham Habitat for Humanity	1	http://chathamhabitat.org/gridfree-nc-donates-first-solar-array-to-chatham-habitat/
NY	Yonkers	Habitat for Humanity of Westchester	3	https://emp.lbl.gov/sites/all/files/case-study-low-income.pdf
OH	Columbus	Habitat for Humanity Mid-Ohio	unknown	https://www.solarpowerworldonline.com/2017/11/ohio-residential-solar-installations-will-help-bring-solar-habitat-humanity-homes/
OR	Medford	Rogue Valley Habitat for Humanity	2	http://sunlightsolar.com/rogue-valley-habitat-for-humanity-gets-solar-panels-for-6-homes-provided-by-sunlight-solar-energy-and-solar-for-all/
TX	Dallas	Dallas Area Habitat for Humanity	15	https://www.seia.org/news/solar-industry-donates-solar-arrays-and-installation-services-dallas-area-habitat-humanity
UT	Orem	Habitat for Humanity of Utah County	2	https://www.heraldextra.com/news/local/central/orem/habitat-for-humanity-installs-solar-panels-for-the-first-time/article_38a8beb4-ba01-5241-91be-aaea6850e925.html
WA	Port Orchard	Habitat for Humanity of Kitsap County	32	http://archive.kitsapsun.com/news/local/letting-the-sun-shine-in-habitat-for-humanity-neighborhood-gets-solar-panels-ep-453274758-355570031.html https://usa.apsystems.com/portfolio-item/harris-courthabitat-for-humanity/
WI	River Falls	St. Croix Valley Habitat for Humanity	18	https://energynews.us/2014/10/08/midwest/habitat-homes-aim-for-net-zero-with-energy-monitoring-tools/
WI	Milwaukee, WI	Milwaukee Habitat for Humanity	7	http://www.solaripedia.com/13/254/habitat_breaks_poverty_cycles_with_solar.html

Appendix B. Best Practices for Solar Electricity Integration in Habitat for Humanity

Adapted from Norton, et al. (2005).

Solar Electricity for Habitat Homes Step-By-Step

A grid-connected PV system is the lowest cost of the different types of PV systems. However, it can still be relatively expensive relative to the total house cost and other household systems. The total installed cost of a system can range from $10,000 to $20,000 for a 1- to 2-kW system. The total system cost may be less if there are federal, state, or local rebates.

Step #1. Will the house be located in an area where a utility grid-connection is permitted or available? Is there a local or national supplier willing to donate system components? Check with your local utility company, or check with a local PV system installer who has installed grid-connected systems. PV system costs can be high, so component donations may be a key factor that determines if PV can meet affordability requirements.

Step #1b. Will the homeowner accept responsibility for the system after it is installed? There is some maintenance required, such as periodically checking the installation to see that it is undamaged and operating properly. When the roof needs replacing the homeowner will incur an additional cost because the PV system must be removed and then reinstalled. The type of mounting system will affect this cost.

Step #2. Most utilities are required to buy back the excess PV electricity. The questions are at what price and are there additional charges, liability insurance requirements, or equipment requirements? It may be legally required, yet difficult to implement. In the best cases, the utility pays a higher price for the renewable PV electricity than the homeowner pays for energy from the grid. More commonly, the utility offers "net metering" where the utility pays the same for the PV electricity as it charges for its own electricity. Usually, net metering uses a single meter system that "spins" forward when the home is consuming more electricity than it is producing and backward when producing more than it is consuming. Most homes are on a standard fixed rate – the energy price is the same for every hour of the day. Ask the local utility whether the home could be converted to a time-of-use schedule with net billing. Because the PV system produces power that often closely matched peak demand, it is beneficial to be on a time-of-use schedule where electricity is priced higher during peak demand hours.

Step #3. Make sure the house can accommodate a PV system on the roof. Generally, the roof can support the additional weight of the PV modules, but check with the local building codes and the architect. A sufficiently large, generally south-facing roof is required. The PV system should be installed parallel to the roof, but with a 4-6" separation from the roof.

Several PV mounting systems exist. Many are "retrofit" systems that are installed after the roof is completed. A "retrofit" system will include roof penetrations through the roofing system into the rafters. Care needs to be taken to prevent leaks—follow the manufacturers installation instructions. Other PV mounting systems include mounting posts that are mounted first and then flashed around when the roof is installed. These systems require a slightly greater roofing skill level because there are many more flashings, but are easier when a roof replacement is required.

Solar Electricity for Habitat Homes Step-By-Step (continued)

Step #3b. Make sure there is space for the inverter and disconnects. Most inverters and disconnects can be installed in a 4-ft x 4-ft wall area. Reserve or plan for this space inside the garage or outside by the service entrance. Make sure the area is at a good working height and yet reasonably protected from accidental physical damage. For example, don't place the inverter in the garage where a car or house door could hit it or in the normal people-traffic path. All system displays and indicators should be at eye-level for the homeowner.

The best location for outdoor-rated inverters is outside on the north wall. The worst location is outside on the south wall. While the inverter is outdoor-rated, high temperatures caused by direct sunlight on the inverter will have a negative effect on the performance of the inverter and the lifetime of the inverter. Check the installation requirements for the specific inverters. A location inside a garage may be acceptable, but, again, check the installation instructions because there may be insufficient air flow for some inverters. Read the instructions or have the installer point out the relevant manufacturer installation instructions. In a tactful manner, don't accept an installer's general assertion that he always does it this way, and he's never had any problems. Follow the installation instructions in case there are future warranty claims and to maximize the lifetime beyond the warranty period.

Step #4. Who will install the PV system? People familiar with the PV mounting system, and preferably a licensed electrician or a certified solar installer, should install most PV systems. Check with the local and state codes for installation regulations.

Step #5. Who will pay for the PV system? It's great if you can get someone to donate a system and the installation. Ask around. Someone may donate the system cost, and someone else may sell the system to you at cost. One can ask local installers or contact the manufacturers directly. However, the difficulty of asking manufacturers is that there are several manufacturers for a complete PV system. There are different manufacturers for the PV modules, the mounting structure, the inverter and the miscellaneous switches and boxes. We found a module manufacturer that would also pick up the tab on the other equipment—this may not be available in all cases.

Step #6. Fill out the paperwork. There may be application forms for rebates—check the exact requirements before the system is bought or installed. Coordinate with the local utility on their requirements for the system checkout.

Step #7. Have a system orientation and checkout with the homeowner. Make sure there is a one-page laminated quick instructions and guidelines next to the inverter or closeby that tells how to turn the system on or off and how to tell if it's working okay. Leave a name and phone number for future questions.

Step #8. Follow up with the homeowner in a month or so, to see how the system is working, check for roof leaks, and ask if there are any questions.

Appendix C. Power Purchase Agreements and Net Metering

Power Purchase Agreement (PPA)

- Example Contract: homeowner and utility
- Contract type: 6-25 year PPA contract
- Payment Structure: Homeowner at ad-hoc rate

Benefits	Limitations
More resilient; long-term payback	Legality (loopholes; likely legal)
Advantage MACRS, ITC, other tax advantage	PUC interaction
Minimize risk; long-term contracts	Separate negotiation per NPS
Immediate benefit to homeowner	**Ad-hoc rate negotiated by NPS**
Attractive to investors	

Net Energy Metering (NEM)

- Example Contract: NPS and homeowner/affiliate
- Contract Type: Loan-lease and/or donation agreement to GRF
- Payment Structure: 1) Utility at retail rate and 2) Homeowner/affiliate at ad-hoc rate

Benefits	Limitations
Potentially avoid complications with utility	Vulnerable to policy modification
Direct contact/benefit with homeowner/affiliate	Less resilient
Allows for affiliate participation	
Immediate benefit to homeowner/affiliate	
Guaranteed retail rate production credit	

PPA and NEM-GRF may be leveraged in conjunction with one-another, or exclusively, to various benefits and limitations. A PPA that does not utilize NEM would lose benefit from excess production, a NEM without a PPA may lose flexibility in contract for payback mechanisms and rate customization to the NPS, if it does not advantage other rate design options.