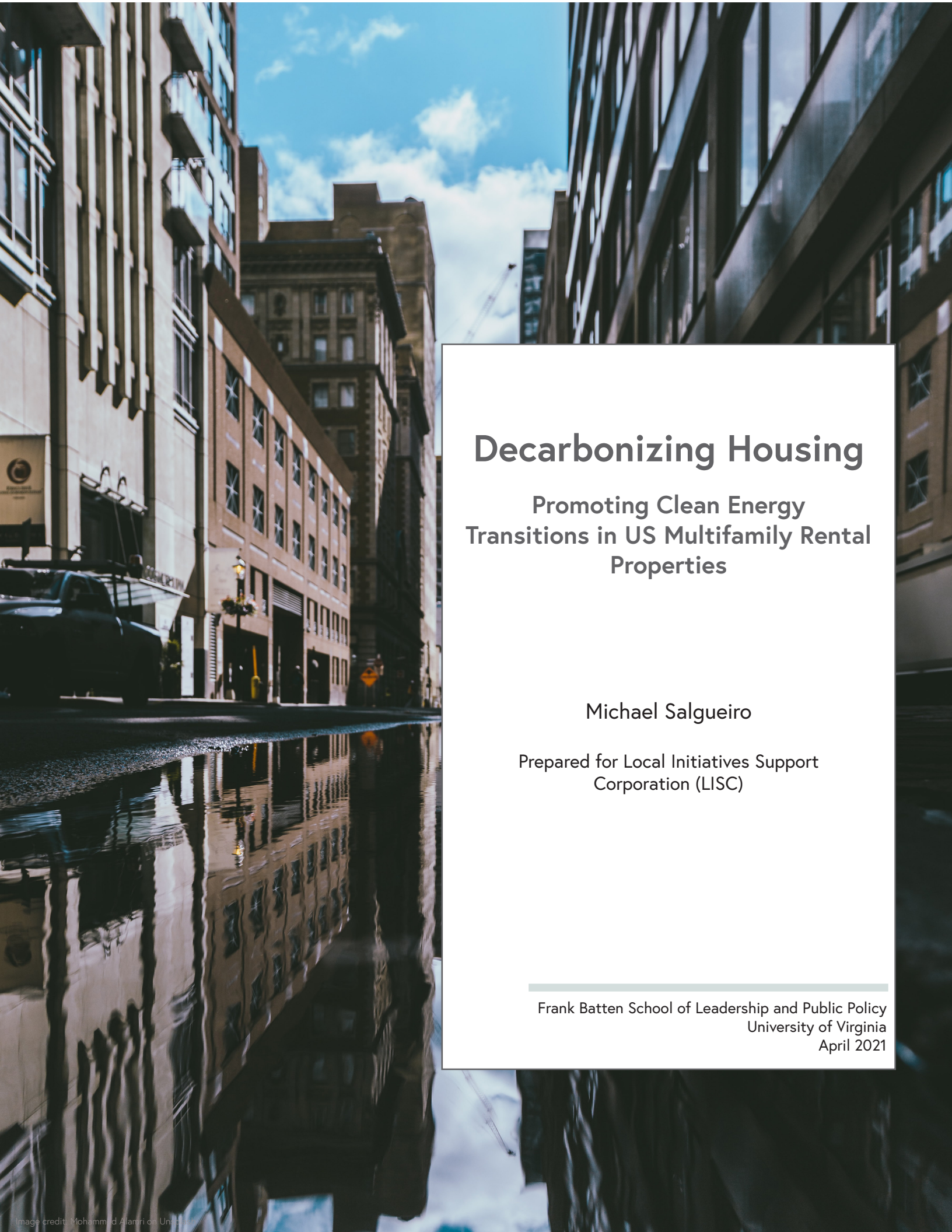

Decarbonizing Housing

Promoting Clean Energy Transitions in US Multifamily Rental Properties

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Prepared for Local Initiatives Support Corporation (LISC)

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DISCLAIMER

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

HONOR PLEDGE

On my honor as a student, I have neither given nor received unauthorized aid on this assignment.

Michael Salgueiro

EXECUTIVE SUMMARY

In order to decarbonize its economy and support global efforts to prevent global temperatures from rising above 1.5 degrees Celsius relative to pre-industrial (late 1800s) levels, the US must decarbonize its buildings (IPCC, 2019). Residential buildings account for 21% of CO_2 emissions in the US (US Energy Information Administration, 2020a).

Existing government programs to limit direct and indirect emissions from residential buildings struggle to reach multifamily rental properties. These failures primarily arise due to inadequate financial resources and challenges coordinating clean energy transitions for these properties. At the same time, the harmful consequences of CO_2 emissions from multifamily rental properties disproportionately impact low-income communities and communities of color.

Community development financial institutions (CDFIs) are nonprofits whose primary role is to pool public and private resources to help solve problems in partnership with historically marginalized groups. Local Initiatives Support Corporation (LISC), one of the largest CDFIs in the US, is interested in determining how it can most effectively promote clean energy transitions in multifamily rental properties. Three alternatives for how to promote clean energy transitions are evaluated:

1. Increase federal advocacy for legislation that promotes clean energy transitions in multifamily rental properties;
2. Create a national solar lending fund to expand solar panel installations to more multifamily rental properties; and
3. Expand existing LISC programming that funds comprehensive energy audits and coordinates clean energy upgrades for multifamily rental properties to local offices

Each of the alternatives are evaluated based on the social benefit of CO_2 emissions avoided through the implementation of the alternative, the financial cost of the alternative to LISC, and the administrative feasibility of initiating the program at LISC. In the end, expanding existing programming for audits and the coordination of clean energy transitions was found to have the greatest social benefit over ten years and to be highly feasible in terms of administration within LISC.

This report recommends that LISC establish funding for comprehensive energy audits and 'One-Stop Shop' programming in local offices to address direct emissions from multifamily rental properties.

Even further, LISC ought to consider ways to make decarbonization of multifamily rental properties, and cities generally, an organizational priority. The establishment of successful 'One-Stop Shop' programming will be an important first step in pursuit of this broader mission.

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INTRODUCTION

> "Today, with the right financial incentives, we could transform our current industrial machine to produce the zero–carbon infrastructure we need. Indeed, it is an opportunity for us to modernize our industrial infrastructure and manufacturing base to again lead the world."
>
> - Saul Griffith, *Rewiring America: A Field Manual for the Climate Fight*

Decarbonization efforts are essential to preventing global temperatures from rising above 1.5 degrees Celsius relative to pre-industrial (early 1800s) levels and avoiding the most catastrophic impacts of climate change. In *Rewiring America: A Field Manual for the Climate Fight* (2020), Saul Griffith, a leading clean energy engineer, argues that we have developed most of the technological capabilities needed to sufficiently decarbonize the US and global economies. Where we fall short, though, is in the political and financial tools that can be used to mobilize the US's industrial, commercial, and residential sectors' shift away from a fossil fuel-based energy system.

This report, prepared for Local Initiatives Support Corporation (LISC), is meant to contribute to the literature around new political and financial tools that can be developed and implemented to bring about a net-zero CO_2 emission residential sector.

Through the report, I evaluate the current state of residential building decarbonization policies and practices in the US, as well as the consequences of failing to decarbonize the residential sector. I then propose three alternatives for how LISC, a community development financial institution (CDFI), can best promote clean energy transitions for multifamily rental properties. After evaluating each alternative, I provide a recommendation for how LISC should intervene to best promote clean energy transitions for multifamily rental properties, as well as considerations for how to most effectively implement the recommended alternative.

BACKGROUND OF THE PROBLEM

PROBLEM STATEMENT

Residential buildings are a major source of CO_2 emissions in the US economy, contributing 21% of overall CO_2 emissions nationwide (US Energy Information Administration, 2020a). The US is taking steps to move its economy to net-zero CO_2 emissions by 2050 in response to the current climate crisis (White House Briefing Room, 2021a), meaning sources of CO_2 emissions from residential buildings must be eliminated in the coming three decades. Among residential buildings emitting CO_2 into the atmosphere are multifamily rental properties, which disproportionately house low-income renters (households making up to 80% of the area median income; Drehobl & Ross, 2016). Multifamily rental properties are especially poorly served by existing policies promoting clean energy transitions due to funding constraints and misaligned incentives.

CLIENT OVERVIEW

Local Initiatives Support Corporation (LISC) is a community development financial institution (CDFI). Its primary mission is to pool public and private capital to make community-directed investments in underinvested neighborhoods across the country. The nonprofit was founded in 1979 with the explicit goal of serving as an intermediary connecting marginalized community groups with capital provided by governments, philanthropists, and private companies (LISC, n.d.a).

LISC raises capital from banks, corporations, foundations, and government agencies. The organization deploys this capital through grants, loans, and equity to community-based organizations, as well as through technical assistance programs for these same organizations. LISC invests this capital in affordable housing, economic and community development, and education, among other areas (LISC, n.d.a).

Today, LISC has 37 local offices in cities across the country, as well as a rural program. Through these offices, LISC is able to reach community groups in 2,200 counties across 45 states (LISC, n.d.b)

LISC has become increasingly interested in developing programs to address the growing threat of climate change and its disproportionate impacts on low-income communities and communities of color. While the organization has engaged in some efforts to promote clean energy transitions in multifamily rental properties in the past, it is interested in specific ways it can more comprehensively influence policy making or sustainably fund projects that promote clean energy transitions for multifamily rental properties.

BACKGROUND OF THE PROBLEM

Climate Change and Residential Buildings as a Source of Emissions

According to the United Nations' Intergovernmental Panel on Climate Change (IPCC), while communities across the globe are already experiencing many of the harmful effects of climate change, humanity can avoid some of its more catastrophic effects if efforts are made to keep global temperatures from rising above 1.5 degrees Celsius compared with pre-industrial (late 1800s) global temperatures (IPCC, 2019). The primary driver of global warming is emissions of the greenhouse gas (GHG) carbon dioxide (CO_2), which accounts for 76% of GHGs emitted into the Earth's atmosphere (US Environmental Protection Agency, n.d.). The United States is both historically and currently one of the leading emitters of CO_2, ranking second amongst all of the world's nations (Union of Concerned Scientists, 2020). Therefore, in order to limit global warming to 1.5 degrees Celsius, the US must take drastic steps to decarbonize its economy.

One of the main sources of CO_2 emissions in the US economy are residential buildings, which account for approximately 21% of all CO_2 emissions in the country (US Energy Information Administration, 2020a). There are two primary ways by which residential buildings emit CO_2: first, indirect emissions, or emissions from fossil fuel-based sources (e.g., coal-fired or natural gas-fired power plants) that generate electricity for buildings; and second, direct emissions, or emissions that come from fossil fuel-based appliances for heating, cooling, and cooking inside buildings (Bipat, 2021). Indirect emissions make up about two-thirds of emissions in the residential sector while direct emissions represent about one-third of emissions in the residential sector (US Energy Information Administration, 2020a).

The Biden Administration has signaled its intention to enact policies that will enable the US to achieve net-zero CO_2 emissions in its economy by 2050 (White House Briefing Room, 2021a). Policies that address indirect and direct emissions from the residential sector will be a crucial facet of decarbonization efforts.

Past Policy Approaches to Reduce Energy Usage

Energy use reduction in the US residential sector has historically been an important objective for policy makers. This objective has been pursued with relative success since the 1970s using building energy codes and appliance standards (Office of Energy Efficiency and Renewable Energy, 2016; US Department of Energy, 2017). Such success is made clear by the fact that average energy consumption by US households has been on the decline since the 1980s despite increased energy demands from greater household use of air conditioning, appliances, and consumer electronics over the same time period. Between 1980 and 2015, average energy use by households decreased by about 32%; this decline is largely attributable to appliance standards and building energy codes. These efficiencies have resulted in a relatively flat level of energy consumption from residential buildings over the last 40 years despite growth in the total number of households (US Energy Information Administration, 2020b). The expectation is that appliance standards and building energy codes will continue to improve, and overall energy consumption by residential buildings will remain flat until 2050, despite a projected population increase of 22.8% (Leung, 2018).

However, despite significant and ongoing improvements in energy efficiency, appliance standards and building energy codes are necessary but insufficient tools for achieving net-zero emissions in the residential sector by 2050. Emerging building energy codes calling for net-zero emissions in a handful of cities may compel some residential building owners to make clean energy upgrades (Institute for Market Transformation, 2021). Yet, residential building owners face two primary issues when seeking to reduce or eliminate sources of direct or indirect emissions in their buildings. First, building and appliance upgrades and the installation of renewable energy infrastructure are resource and capital intensive activities (Harack et al., 2013). Second, in many rental contexts, residents, not building owners, pay utility costs, meaning building owners do not necessarily directly benefit from cost-savings associated with appliance upgrades or renewable energy infrastructure (Penney, 2015). Resource constraints and this split incentive issue make the clean energy transition of residential buildings a challenging policy problem.

Current Policies Supporting Clean Energy Transitions for Residential Buildings

Policies Addressing Direct Emissions

Policy makers have sought to coordinate and finance clean energy upgrades in residential buildings through federal and state grant and subsidy programs. At the federal level, the primary program has been the Weatherization Assistance Program (WAP). The WAP, which is operated by the Department of Energy, provides grant funding via a state-based formula to local community action agencies who then conduct weatherizations and appliance upgrades for low-income households (Tonn et al., 2018). These clean energy upgrades address direct emissions by taking a "whole house weatherization" approach, meaning funds are used to address insulation issues, upgrade space heating/cooling and water heating systems, and mitigate safety issues associated with various appliances in the household (Office of Energy Efficiency and Renewable Energy, n.d.).

Source: Office of Energy Efficiency and Renewable Energy (n.d.)

A recent, rigorous analysis of the WAP used survey data from program participants in its assessment, with results showing the program's relative success in promoting clean energy upgrades and their associated benefits. In 2010, after an expansion of the WAP with the American Recovery and Reinvestment Act, the study showed that the program funded energy efficiency upgrades for 332,000 units nationally and found an average energy and non-energy (including environmental and health impacts) net present value of upgrades of $20,000 per unit, significantly exceeding the $6,800 average cost per unit upgraded. Unfortunately, the program was returned to lower levels of funding after 2010 (Tonn et al., 2018).

Despite showing significant benefits, the WAP struggles to reach a specific qualifying subgroup: low-income households living in multifamily rental properties. Multifamily properties are residential properties that contain at least two housing units; these can include property types like duplexes, townhomes or apartment buildings (Araj, 2021). Multifamily rental properties make up a disproportionate number of units in the US built prior to 1970 that are still in use and are most in need of clean energy upgrades (Sarkar, 2011). These multifamily residences are also more likely to house low-income renters and renters of color (Harak et al., 2013). Multiple studies show that the WAP program disproportionately serves owner-occupied, detached single family homes compared with multifamily rental properties; inadequate funding and an inability to address split-incentive issues are the primary drivers of these shortfalls (Tonn et al., 2018; Penney, 2015). Therefore, at the federal level, there remain programming shortcomings associated with delivering clean energy upgrades to multifamily rental properties.

A similar pattern exists when state policies are examined. Energy efficiency resource standards (EERS) have been the primary policy lever used to encourage unit upgrades. Twenty-four states have adopted EERS's, or specific energy savings targets for regulated utility companies, which compel these utilities to make various investments to improve energy efficiency across the value chain. Utilities will offer rebates, loans, technical services, and retrofits to customers to achieve parts of these efficiency gains (Center for Climate and Clean Energy Solutions, 2019). Unfortunately, again, low-income renters and

multifamily rental properties are the least likely to be offered or to take advantage of such programs, largely due to financing and coordination challenges (Harack et al., 2013). In summary, federal and state policies are currently failing to provide adequate resources and coordination to promote clean energy upgrades in multifamily rental properties across the country.

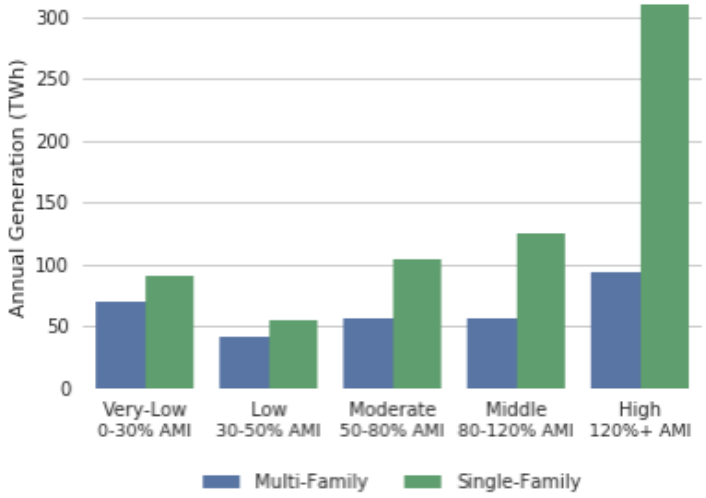
Policies Addressing Indirect Emissions

At the individual residential building level, policy makers have primarily sought to promote residential solar photovoltaic panel ('solar panel') installations as a means of addressing indirect emissions. Solar panels are a renewable energy source that converts the energy from solar rays into electricity for building electrification (Davis et al, 2021).

Since the early 2000s, an array of policy instruments have been implemented by federal, state, and local governments to promote residential adoption of solar panels. At the federal level, the main incentive is the solar investment tax credit (ITC), which allows residential and commercial solar panel owners to earn a 26% and 30% tax credit, respectively, against tax liabilities in the year solar panels are installed. The solar ITC was first enacted in 2005 and has been crucial to the rapid adoption of solar panels nationally. Multifamily property owners would secure the more valuable commercial ITC, as the panels would be purchased by a business entity rather than a household. The solar ITC is typically combined with other state or local tax credits or rebates to reduce the financial burden of solar panel purchase and installation (Solar Energy Industries Association, 2021).

Despite significant growth in the residential and commercial solar sectors in the last decade, they remain a small part of the total energy production market (Davis et al., 2021). Furthermore, solar panels in residential contexts have primarily been adopted by higher-income households in the US (Moezzi et al., 2017). Notably, the disproportionate adoption by higher-income households is not a function of spatial or physical constraints. According to an innovative study by Sigrin and Mooney (2018) that used light detection and ranging (LiDAR) based scans to approximate buildings that could accommodate

Generation potential by income group and building type



Source: Sigrin & Mooney (2018)

solar panels, there is significant potential for solar panel installation on the approximately 25.5 million buildings housing low-income households. In fact, 60% of the solar potential area for low-income households sits on multifamily rental properties.

Rather than available space, the primary obstacle to residential solar panel adoption is access to financing and clear modeling of anticipated cost-savings associated with installing solar panels. In a comprehensive analysis of federal, state, and local residential solar financial incentives, Matisoff and Johnson (2017) highlight that in the absence of underlying policies (e.g., net metering) and access to financing to cover the costs of the upfront investment, the solar ITC fails to substantially incentivize residential solar panel adoption in households that otherwise would not have opted to install solar panels. Multifamily rental property owners are especially likely to have inadequate funds and require competitive financing to initiate solar panel installation efforts (Brown et al., 2020). Additional financial and technical capacity must be made available to facilitate solar panel adoption in multifamily rental property contexts.

CONCLUSION

In sum, multifamily rental properties, especially those housing low-income households and households of color, are the class of residential buildings least likely to be served by existing policies to promote clean energy transitions. These building owners lack the requisite resources and incentives to take steps to decarbonize their buildings. If the US is to achieve net-zero emissions in the building sector by 2050, new programs must be designed to promote clean energy transitions of multifamily rental properties. CDFIs, like LISC, are well-positioned to intervene to help finance and coordinate clean energy transitions for multifamily rental properties.

CONSEQUENCES OF THE PROBLEM

General Consequences of Climate Change
The primary motivation for achieving net-zero emissions in the US economy by 2050 is to limit global warming to 1.5 degrees Celsius as compared with pre-industrial levels. Addressing emissions in multifamily rental properties is a small part of that overall effort, so it is worth considering the overall impacts of insufficient action to decarbonize the US and global economy generally.

According to the IPCC, global warming that exceeds 1.5 degrees Celsius will make large swaths of our planet uninhabitable and result in significant economic costs and human suffering (IPCC, 2019). The IPCC develops models to estimate the economic costs of warming, and its calculations put the mean net present value of the global market and non-market costs of 1.5 degrees Celsius of warming at $54 trillion. The same report puts the costs of 2 degrees Celsius of warming at $69 trillion, meaning comprehensive and timely action to limit warming today could ultimately save the global economy up to $15 trillion (Warren et al., 2018).

While steps taken today to decarbonize the economy may allow us to limit warming to 1.5 degrees Celsius, many of the harmful consequences and costs we expect to see between now and 2050 will be a product of GHG emissions already in the Earth's atmosphere. According to the UN Environment Programme, the estimated annual global costs of warming due to already released GHG emissions are expected to reach $140-$300 billion by 2030 and $280-$500 billion by 2050 (Olhoff et al., 2016). Steps taken to decarbonize today will allow us to avoid future costs, but will do little to address short-term costs.

Specific Impacts of Emissions from the Residential Sector
Importantly, the aforementioned costs are not equally distributed across each person, rather they are primarily concentrated amongst specific subgroups. In the US, the costs of a fossil fuel-based energy system fall disproportionately on low-income communities and communities of color. The specific negative consequences of failing to address the direct and indirect emissions of multifamily rental properties are distributed across similar class and racial lines.

In terms of health consequences, the primary driver of negative health consequences of emissions from the residential sector is poor air quality. First, direct emissions in buildings, especially from gas stoves, produce polluted indoor air conditions. While affecting all residents, the presence of a gas stove especially harms children, increasing their risk of asthma by 24-42 percent. Furthermore, lower-income populations and communities of color are more likely to live in older multifamily rental properties. Therefore, those groups are more susceptible to the harmful pollution of gas stoves, which exacerbate asthmatic symptoms in communities where asthma rates are already quite high (Seals, 2020).

Second, while it is difficult to quantify the specific harms of indirect emissions, there are discernible patterns about who suffers most from fossil fuel-based electricity generation.

According to a study by the Clean Air Task Force in partnership with the National Association for the Advancement of Colored People (NAACP), one in five African American residents live within a half mile of a natural gas production, processing, or storage site. These households are likely exposed to heavily polluted air and toxic emissions that elevate the risks of asthma, cancer, and other negative health-related outcomes. In fact, the study attributes 138,000 asthma attacks and over 100,000 missed school days for African American children annually to emissions from oil and gas sites (Fleischman& Franklin, 2017). While it is not clear how many multifamily residential properties sit within these sites, installation of solar panels can displace pollution from traditional energy sources and mitigate the disproportionate impact of air pollution on low-income communities and communities of color (Franklin & Osborne, 2017). Transitioning multifamily properties to sources of renewable energy would result in substantial mitigation of the existing harms to individuals living near oil and gas production, processing, and storage sites.

Financially, the current fossil-fuel based energy regime is associated with higher utility costs for residents in multifamily rental properties. In particular, low-income renters and renters of color face energy burdens, or the proportion of monthly income a household pays in utility bills, that are three times higher than the burdens faced by the average household nationally (Drehbohl & Ross, 2016). Higher energy burdens, especially during the warmest and coldest months, can push families into the 'heat or eat' dilemma, whereby households must choose between paying higher utility bills or purchasing food. One slightly older study found that a 10 degree drop in temperature was associated with an $11 decrease in food expenditures and a 10% reduction in caloric intake by children in low-income households, with implications for the wellbeing of children (Bhattacharya et al., 2003).

Conversely, as noted in the summary of the WAP program above, there are significant financial benefits associated with clean energy upgrades for residents (Tonn et al., 2018). Additionally, the installation of solar panels has been found to save low-income households living in multifamily rental properties hundreds of dollars a year on utility bill payments (Gallucci, 2019). Failure to finance and coordinate clean energy transitions leaves those who would gain the most from such upgrades out of the benefits of existing clean energy technologies.

Conclusion

To conclude, the negative consequences of inaction on decarbonizing the US economy in general are significant. The health-related and financial harms of direct and indirect emissions from the residential sector fall disproportionately on children, low-income communities, and communities of color. It is worthwhile to consider alternatives for how LISC can help promote clean energy transitions for multifamily rental properties in cities across the US.

POLICY ALTERNATIVES

As a CDFI with a national presence and local offices, LISC's primary function is to connect communities with financial and technical resources. The first part of this work involves mobilizing the organization to lobby or fundraise for financial and technical resources in coordination with coalitions of community-based organizations solving local problems. The second part of this work is structuring products to deploy these resources. These two activities form LISC's core competencies.

Additionally, as outlined above, clean energy transitions must address the two sources of emissions in multifamily residential properties. First, steps must be taken to eliminate indirect emissions by transitioning the energy source for buildings away from fossil-fuel based generation and toward renewable energy generation, like solar panels. Second, direct emissions must be eliminated through upgrades to existing fossil-fuel based appliances (e.g., heating and cooling systems, gas stoves) and building insulation. Existing government programs are inadequate to promote each of these activities in multifamily rental property contexts.

In light of these competencies and required activities, there are three alternatives LISC ought to consider implementing:

Alternative 1. Dedicate resources to advocacy for new federal legislation for clean energy transition incentives, or to defend or expand existing federal clean energy transition incentives.

As discussed earlier in the report, there are existing federal policies that seek to promote clean energy transitions for multifamily rental properties. However, these programs, notably the Weatherization Assistance Program (WAP) and the solar ITC, have programmatic deficits that make it difficult for multifamily rental property owners and tenants to take advantage of their benefits. Additionally, in the case of the solar ITC, the program is currently slated to be significantly reduced for commercial solar installations in 2024 (Solar Energy Industries Association, 2021).

LISC has a robust federal policy team that promotes policies, programs, and funding sources that support community development. They do this work by educating policy makers through policy briefs, participating in coalitions with community and industry groups to develop policies, and conducting advocacy campaigns. *LISC could opt to expand staff resources to advocate for federal policies that expand financing opportunities and technical support for clean energy transitions in multifamily rental properties nationally.*

In particular, there are two causes to which these resources could dedicate their efforts. First, LISC can work with coalition partners, including the National Housing Trust, to secure the passage of the Green, Resilient, Efficient, and Affordable Homes for Tenants (GREAHT) Act. The Act would provide $75B in grant and loan financing over ten years for retrofitting

activities in existing affordable housing buildings (National Housing Trust, 2021). A similar but smaller proposal, the Neighborhood Homes Investment Act (NHIA), has been included in President Biden's recently unveiled American Jobs Plan (White House Briefing Room, 2021b). LISC could also engage in advocacy for the NHIA and advocate generally for any legislation that promotes clean energy upgrades in multifamily rental properties.

The resources could also work to protect and reform the solar ITC and extend it into future years. In terms of extending the solar ITC, the tax credit has been extended numerous times since its passage in 2005 due to its relative success and effective advocacy by industry leaders and coalitional partners (Solar Energy Industries Association, 2021). LISC could opt to join coalitional partners to push for the extension of the solar ITC beyond its slated drawdown date. In terms of reforming the solar ITC, the Growing Renewable Energy and Efficiency Now (GREEN) Act proposed by Representative Mike Thompson, (D-CA) offers reforms that would significantly improve the solar ITC. Specifically, a major constraint of the solar ITC is that property owners with insufficient tax liability are unable to take full advantage of the tax credit program. The GREEN Act makes the tax credit refundable, meaning taxpayers could take a credit as a refund despite not having sufficient taxable income to credit (KPMG, 2021). LISC could also choose to work with coalitional partners to advocate for passage of the GREEN Act or similar reforms.

Elements of federal legislation must constantly be defended during annual budget appropriation negotiations. Furthermore, new legislation or reforms to existing legislation must be aggressively lobbied for, often in coordination with coalition partners. The LISC team could opt to dedicate resources to defend and promote legislation that facilitates clean energy transitions for multifamily rental properties.

Alternative 2. Create a national solar lending fund for multifamily rental properties.

As mentioned above, multifamily rental properties must transition their source of electricity away from fossil fuel-based sources in order to address indirect emissions. While federal tax credits are used to subsidize solar installations, initiating installation of solar panels requires financing, which can be difficult to secure in multifamily rental property contexts. Additionally, building owners are not always aware of or do not understand how they might financially benefit from solar panel installation (Brown et al., 2020). Yet, the cost of solar energy has become competitive with traditional energy sources (Brown et al., 2020), and there is evidence of ample available rooftop space to install solar panels on multifamily rental properties (Sigrin & Mooney, 2018).

Loan programs with credit enhancements have been found to be an effective approach for promoting solar development in multifamily rental property contexts (Brown et al., 2020). In lending contexts, credit enhancements produce lower interest rates for customers by infusing loans with low-cost capital, or otherwise adjusting repayment structures to protect certain sources of capital. In the case of solar investments, credit enhancements would

reduce the cost of solar loans and significantly expand the number of multifamily rental property owners who would have access to the needed capital for solar installations (Low-Income Solar Policy Guide, n.d.). CDFIs, like LISC, have extensive experience in structuring loan programs with credit enhancements and have the expertise to secure public funds or raise philanthropic funds needed to build a loan product with credit enhancements.

LISC has issued loans for solar panel installations on multifamily rental properties in the past. However, according to my client, despite interest from multifamily building owners, LISC's current interest rates and inexperience underwriting solar investments make solar panel loans inaccessible for many multifamily property owners, especially those housing low-income tenants.

In order to address these shortcomings, LISC can raise funds and conduct training in order to create and implement a national solar lending fund. There is currently general interest from philanthropic organizations and banking institutions for funding efforts to promote building decarbonization (Philanthropy News Digest, 2018), meaning LISC could reasonably raise funds to include as credit enhancements in a solar loan product for multifamily property owners. LISC program officers could issue solar investment loans in any of the 34 localities in which LISC operates. In an ideal situation, LISC could also offer education and technical assistance related to solar investments for multifamily rental property owners.

Alternative 3. Develop local office 'One-Stop Shop' programming to fund comprehensive energy audits and coordinate clean energy upgrades in multifamily rental properties.

Lastly, to address direct emissions, multifamily rental properties require upgrades to replace existing appliances and aging insulation infrastructure. As alluded to earlier in the report, barriers to successfully completing clean energy upgrades in multifamily rental properties include lack of access to capital, split incentives between building owners and tenants, insufficient data about projected savings of upgrades, and lack of coordination between technical stakeholders. A particularly financially and technically resource intensive activity, which serves as a barrier to moving forward with clean energy upgrades in multifamily rental property contexts, is the comprehensive energy audit (Regional Energy Efficiency Organizations, 2016).

Comprehensive energy audits serve to establish a benchmark of energy use, map existing energy infrastructure in the building, and estimate energy savings associated with upgrades. While building owners typically cannot move forward with clean energy upgrades without a comprehensive energy audit, audits are extremely technical exercises that can be cost-prohibitive for many multifamily property owners (LISC, 2018).

In order to address this crucial barrier, LISC Boston, in partnership with the Massachusetts Clean Energy Center, developed a grant program (called the 'Comprehensive Energy Audit + Clean Energy Technology Optimization Program') to help affordable

housing building owners pay for comprehensive energy audits in anticipation of larger rehabilitation efforts on their property. The program provided 24 building owners with a free comprehensive energy audit and then helped to coordinate financial and technical resources needed to implement recommended clean energy upgrades. These upgrades were financed by the Massachusetts Low-Income Energy Affordability Network's (LEAN) Low-Income Multi Family (LIMF) energy program, a ratepayer-funded utility energy efficiency program. The program found that a high-quality energy audit was essential to the incorporation of clean energy upgrades in rehabilitation plans by building owners. The program resulted in significant clean energy upgrades and reduced emissions from the multifamily properties (LISC, 2018).

In addition to providing funds for the audits, LISC, with its coalition of financial and technical partners, established what the Regional Energy Efficiency Organizations (2016) call a 'One-Stop Shop' program design. LISC staff provided technical support to building owners through each step of the process and coordinated with third-party contractors or agencies (LISC, 2018). This coordination work is pivotal to the success of such programs. In fact, a recent comprehensive review of affordable multifamily housing energy efficiency programs found that the single most important component of an effective program is the provision of technical assistance throughout the upgrade process (Samarripas & York, 2019).

The proposed alternative, then, calls for similar 'One-Stop Shop' programs modeled off the Comprehensive Energy Audit + Clean Energy Technology Optimization Program to be established in local offices across the country. Twenty-two states currently have energy-efficiency resource standards (EERS), the precursor to most utility funded energy efficiency and clean energy upgrade programs targeted toward low-income or multifamily contexts (Center for Climate and Energy Solutions, 2019). LISC can raise funds from philanthropic organizations to establish similar programs in various LISC local offices and build coalitions with local utility and technical service providers. The philanthropic organization can provide funding for comprehensive energy audits and LISC staff can provide 'One-Stop Shop' services, coordinating financial and technical services with the goal of promoting clean energy upgrades in multifamily rental properties.

EVALUATIVE CRITERIA

Each of the stated alternatives will be evaluated along three evaluative criteria:

Criterion 1 - Social Benefit of Avoided CO_2 Emissions
Given the urgent timetable for needing to decarbonize the economy and reduce CO_2 emissions from multifamily rental properties, alternatives that avoid more CO_2 emissions during a ten year time period will be evaluated more favorably than those that reduce fewer emissions in that time period. Emissions reductions will be calculated in metric tons of CO_2, a common industry standard for measuring GHG emissions. The social cost of CO_2, a dollar figure that estimates the environmental, health, and other social costs of a metric ton of CO_2 (Chemnick, 2021), will be applied to calculate the net present value of avoided CO_2 emissions over ten years.

Criterion 2 - Financial Cost to LISC
The net present value of the financial costs to LISC over ten years will be calculated for each alternative. LISC is a non-profit that relies on public, private, and philanthropic funds to fulfill its mission. When developing a program, it must be respectful and responsible with the funds with which it has been entrusted. At the same time, LISC simultaneously faces many urgent priorities. Determining the cost of each alternative will provide a sense of the scale of resources that must be dedicated to the intervention and may provide needed justification for the chosen alternative. In general, alternatives that are least financially costly will be judged more favorably.

Criterion 3 - Administrative Feasibility
Each of the proposed alternatives would require changes to staffing and resource allocation, which would require approval from LISC leadership. Such changes might also impact current employees or require the hiring of new employees, which could be disruptive to existing teams. Therefore, each of the alternatives will be evaluated against LISC's current strategic, organizational, and budget constraints. An ideal alternative would most easily secure buy-in from LISC leadership and would be least disruptive to the organization's status quo.

EVALUATION OF POLICY ALTERNATIVES

The evaluations of each of the alternatives will be summarized below. For detailed benefit and cost calculations, see Appendix A.

Alternative 1. Dedicate resources to advocacy for new federal legislation for clean energy transition incentives, or to defend or expand existing federal clean energy transition incentives.

Criterion 1 - Social Benefit of Avoided CO_2 Emissions: $0 - $5.4M
For this alternative, a range has been included for the social benefit of CO_2 emissions avoided over the ten year period. The $5.4M figure was calculated based on a few assumptions. First, the full effect of passing the GREAHT Act and protecting the solar ITC are estimated at 1.52B metric tons of CO_2 avoided over ten years (National Housing Trust, 2021; Mai et al, 2016). However, LISC's participation in federal advocacy does not guarantee passage or protection of federal legislation. Given the uncertainties and complexities associated with federal advocacy, LISC's additional impact toward the passage of the relevant legislation was assumed to be .01%. The new estimated CO_2 reduction was then multiplied by the social cost of carbon ($51) and then discounted using a standard 7% discount rate.

The $0 figure is included because, as noted, it is possible that LISC and its coalition of partners are unsuccessful at passing the GREAHT Act or extending the solar ITC. Therefore, such policy failure would result in no additional social benefit associated with this alternative.

Criterion 2 - Financial Cost to LISC: $845K
The financial cost to LISC for this alternative was straightforward to calculate. In order to implement this alternative, the federal advocacy team would simply need to hire one staff member. This staff member would be responsible for completing the relevant advocacy activities, including meeting with and developing advocacy strategies with coalitional partners, educating policymakers, and coordinating with local LISC stakeholders to better understand and communicate the impacts of specific policies. Alternatively, the LISC policy team could opt to conduct such advocacy with the existing team. Given the amount of time required for such advocacy, it was agreed with the client that the overall cost would be similar to the cost of hiring a new staff member.

Criterion 3 - Administrative Feasibility: Low
This alternative is noted as having 'Low' administrative feasibility for a few reasons. First, federal policy advocacy is not LISC's primary activity, meaning it may be difficult to fundraise or dedicate adequate resources to the necessary advocacy activities for the amount of time discussed. Relatedly, it is difficult to know the extent to which additional advocacy contributes to the passage or protection of federal programs. Therefore, while it is the least costly effort, it may also be the most difficult alternative to justify from a

resource allocation perspective. Last, LISC already has a number of policy priorities around expanding affordable housing, economic development, and education-related federal programs. Efforts to transition attention to clean energy programs may take away from efforts to promote already established policy priorities, which may not sit well with existing program teams.

Alternative 2. Create a national solar lending fund for multifamily rental properties.

Criterion 1 - Social Benefit of Avoided CO_2 Emissions: $1.6M
While a solar lending program does not currently exist within LISC, in conversations with my client, there is an expectation that such a program could be established within a year. There would naturally be a ramp up period, during which program officers would be hired in local offices and the lending committee would gain training in making loans. Based on discussions with my client, it was agreed that over the course of the ten years being evaluated, an average of 50 solar loans could be expected to be issued each year; each of the projects financed could be expected to involve 75 kW worth of panels installed, on average. Based on these assumptions, the net present value of the social benefits of the avoided CO_2 emissions was approximated at $1.6M.

Criterion 2 - Financial Cost to LISC: $23M
The net present value of the total financial cost to LISC is $23M. This value captures several inputs, including solar lending training costs over three years, program fundraising costs, program administration costs, and staff costs over ten years to execute the program (see Appendix A for a detailed list of included costs).

Notably, although this alternative has quite high costs relative to its social benefit, unlike the alternatives, Alternative 2 involves issuing loans. Therefore, LISC can anticipate recouping some of the costs by issuing interest-bearing loans for solar panel installations. Given the ramp up period involved with this alternative, LISC may begin to recoup some of these costs beyond the ten year period covered in this report. Yet, issuing loans (versus grants) make this program potentially more sustainable in the long run.

Criterion 3 - Administrative Feasibility: High
Establishing a solar lending program is very feasible for LISC. According to my client, LISC has already issued a few successful loans for solar panels and has noted demand from both building owners and private lenders interested in partnering with LISC to issue loans. The work also fits neatly into LISC's core competencies of pooling public and private funds to lend resources to communities, meaning it would not need to make many changes to its organization. It is very likely that LISC could successfully establish a national solar lending program that would promote clean energy transitions for multifamily rental properties nationally.

Alternative 3. Develop local office 'One-Stop Shop' programming to fund comprehensive energy audits and coordinate clean energy upgrades in multifamily rental properties.

Criterion 1 - Social Benefit of Avoided CO_2 Emissions: $27M
As noted above, LISC Boston's team wrote a report documenting the outcomes of its Comprehensive Energy Audit + Clean Energy Technology Optimization Program from 2016-2018. The report notes that the LISC program catalyzed approximately 5,000 metric tons of CO_2 reductions in a year. While these results were from one local office program, the estimates above show the net present value of the social benefit of avoided CO_2 emissions for programs in up to 25 local offices over ten years. Based on conversations with my client, it was deemed reasonable to assume up to 25 offices could accommodate such a program given the size of existing local offices and the number of offices in areas with utility-funded low-income energy efficiency programs (see Appendix B for a list of LISC local offices and whether states where offices are located have EERS or Low-Income Clean Energy Upgrade programs).

Criterion 2 - Financial Cost to LISC: $32M
The $32M cost above reflects costs associated with fundraising for the program and administering the program. Fundraising will be necessary to establish these programs in local offices, as local offices currently do not have sufficient resources to initiate clean energy upgrade programming and fund comprehensive energy audits for multifamily rental properties. Local staff will be necessary to administer the programs and coordinate with various stakeholders in the local clean energy ecosystem.

Criterion 3 - Administrative Feasibility: High
Given that a program already exists in one local LISC office, it seems feasible that LISC could replicate such efforts in other local offices across the country. However, this alternative is quite time and resource intensive at the local level, meaning the alternative would require substantial buy-in from local stakeholders from a staffing and operations standpoint. Despite these considerations, this alternative is scored as 'High' in terms of administrative feasibility. Given the pervasiveness of EERS's and the increased attention building electrification and decarbonization are receiving nationally, it seems reasonable that 'One-Stop Shop' programs could be established in up to 25 offices with sufficient leadership support.

General Note
Each of these alternatives has a low or negative net social benefit when comparing the values for Criteria 1 and 2. These negative values within the ten year time period are unsurprising, and in fact justify the role CDFIs like LISC must play in promoting clean energy transitions in multifamily properties. Profit-maximizing firms have no incentive to execute these activities, meaning nonprofits with expertise in financing and coordinating complex activities in the built environment, in partnership with governments, are critical to moving the decarbonization of multifamily rental properties forward.

Additionally, these criteria do not include the specific financial benefits of clean energy upgrades to utility bill payers. These benefits often come beyond the 10 year period evaluated in this report given financing structures. However, including such analyses could be added to the current analysis and result in even greater net benefits for the stated alternatives.

OUTCOMES MATRIX

This matrix summarizes the evaluation results for the alternatives. For a detailed accounting of assumptions and calculations for Criteria 1 and 2, see Appendix A.

Alternative / Evaluative Criteria	**Criterion 1 - Social Benefit of Avoided CO_2 Emissions***	**Criterion 2 - Total Financial Cost to LISC***	**Criterion 3 - Administrative Feasibility**
Alternative 1. Expanded Federal Advocacy for Clean Energy Incentives	$0 or $5,444,680	$845,639	Low
Alternative 2. National Solar Lending Program	$1,592,971	$23,888,483	High
Alternative 3. Funding for Comprehensive Energy Audits +'One-Stop Shop' Programming	$27,331,741	$32,941,630	High

*These values reflect the net present value for each alternative over 10 years using a discount rate of 7%. A sensitivity analysis was conducted using 5% and 2% discount rates and did not result in any significant changes to the relative or absolute size of calculated benefits or costs. Therefore, the more conservative 7% value was used.

RECOMMENDATION

The evaluation exercise aims to evaluate each alternative on a set of comparable criteria. It is worth noting, however, that these alternatives are not necessarily mutually exclusive, but rather, are complementary to one another. Should adequate funding become available, I recommend that LISC aim to implement each of these alternatives. However, such an outcome is likely infeasible, so a single recommendation is provided.

This report recommends that LISC implement Alternative 3 and establish funding for comprehensive energy audits in multifamily rental properties as well as 'One-Stop Shop' programming to address direct emissions in the residential sector.

Based on the evaluation, despite high costs, the program has the largest projected social benefit and has a high likelihood of being able to be adopted and implemented by LISC. Establishing a 'One-Stop Shop' program would be a clear and effective step for LISC to take in promoting clean energy transitions for multifamily rental properties across the country.

IMPLEMENTATION CONSIDERATIONS

Establishing a Clear National Priority
LISC currently operates a 'One-Stop Shop' program model in only one local office: Boston. LISC currently does not have the capacity to establish such programs or fund comprehensive energy audits in its other local offices. Capacities are inadequate partly because clean energy transitions for multifamily rental properites have not historically been a priority for the organization.

In order to create new 'One-Stop Shop' programs, LISC should first establish decarbonization of multifamily residential properties as a national priority, as it has with affordable housing and economic development-related initiatives (LISC, n.d.c). This prioritization should include a broad vision as well as specific approaches and metrics for achieving the vision. For example, LISC can state its aspiration of creating a carbon-free built environment and its goal of creating 'One-Stop Shop' programs in 10 local offices in the initiative's first three years of operation. These statements should be issued by LISC leadership, especially the incoming CEO, with buy-in across organizational units and local office sites.

Fundraising
Next, to establish 'One-Stop Shop' programs, LISC must raise funds to grant out to multifamily property owners. In order to run its housing and community development programs, LISC raises private funds from philanthropists and banking institutions and pools those funds with public money. LISC will need to initiate a similar process to establish local 'One-Stop Shop' programs. Notably, there is currently general interest from philanthropic organizations in building decarbonization (Philanthropy News Digest, 2018).

Based on initial calculations, LISC will need to raise about $300,000 per local office program per year. Part of these funds will be allocated as grants to multifamily rental property owners to complete comprehensive energy audits, which cost, on average, between $10,000 to $15,000 per property (LISC Boston, n.d.). The remaining funds will be allocated toward program administration by LISC local office staff. In order to raise such funds, materials, including a fundraising strategy, a pitch deck, a business case with anticipated program administration costs, and sample projects will need to be developed prior to meeting with philanthropists.

Establishing Local Office Programs
As mentioned previously, LISC Boston has experience operating a 'One-Stop Shop' program. However, such programs are extremely context-specific given the policies and programs in a locality. The Boston program relied on a utility ratepayer funded low-income energy efficiency program (LIMF) to finance the clean energy upgrades recommended in the comprehensive energy audits. Audits and upgrades also require skilled technical workforce in the local area. Staff establishing the 'One-Stop Shop' programs in the various localities will need to gain expertise in existing energy efficiency programs offered by the state or local utility. These staff may also need to build coalitions with groups to lobby for

improved policies or programs around clean energy upgrade processes for multifamily rental properties.

The coalition-building component of the 'One-Stop Shop' program is absolutely crucial to the program's success. Based on conversations with my client, educating policy makers and property owners about the benefits of audits and upgrades can be challenging. Creating a rich network of partners to promote and facilitate the work will help to maximize the benefits of the program and promote greater decarbonization of multifamily rental properties across the US.

Data Collection and Communications

LISC's local 'One-Stop Shop' programs will be most effective if their benefits are tracked and clearly communicated within and outside of the organization. In terms of tracking benefits, LISC should collect data on the number of projects completed through its programs, the CO_2 emissions reduced as a result of the program, and any financial, health, or social benefits for tenants and building owners associated with the program. Data about the program should be reported out to employees, funders, and local stakeholders on a regular basis, with additional quantitative and qualitative data points added based on provided feedback. Additionally, a broader communications campaign conveying program successes should be developed. LISC has experience communicating program successes on its website and in reports (LISC, n.d.b). LISC should plan to dedicate funds to such efforts related to the various 'One-Stop Shop' programs, especially in the early years of the program.

Put together, efforts to establish national priorities, fundraise, build coalitions, and communicate the program's success should set the foundation for a successful implementation effort. LISC should constantly evaluate the program and make needed changes as financing demands or policy regimes change. Even more, LISC should envision its 'One-Stop Shop' programs as an initial step toward investing in more programs that will catalyze clean energy transition efforts for multifamily rental properties across the country.

CONCLUSION

This report seeks to contribute to the literature around financial tools that could accelerate the decarbonization of the US's residential sector. LISC, a CDFI, was interested in how it could help catalyze more clean energy transitions in multifamily rental properties. After reviewing the shortcomings of current policies and practices, as well as the consequences of not addressing direct and indirect emissions in the residential sector, three policy alternatives were presented. The social benefit, financial cost, and feasibility of each alternative were calculated in order to make a final recommendation to LISC.

The report recommends that LISC create 'One-Stop Shop' programs in local offices to address direct emissions in the residential sector. The programs would allocate grants to multifamily property building owners to complete comprehensive energy audits, a crucial step in planning for and financing clean energy upgrades. The programs will also provide essential technical support to building owners throughout the upgrade process. With adequate funding, it is possible that up to 25 programs can be established within the next ten years, resulting in significant levels of avoided CO_2 emissions.

My client should initiate steps to communicate the benefits of 'One-Stop Shop' programs with LISC leadership and begin crafting a plan for raising the necessary funds to establish the programs. LISC should draw on its rich network of philanthropic partners to identify potential funders.

In the end, promoting clean energy transitions in the residential sector specifically, and for the economy generally, is essential to avoiding the most catastrophic effects of climate change. Ideally, the recommended alternative will not only catalyze clean energy upgrades to address direct emissions, but will also spur LISC to make additional investments in decarbonization, such as through the other alternatives listed in this report. LISC is well positioned to contribute significantly to national decarbonization efforts and help create a healthier, greener future for all.

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APPENDIX A - DETAILED BENEFIT AND COST CALCULATIONS

Assumptions for All Calculations

Discount Rate: 7%

A discount rate of 7% was chosen for social benefit and cost calculations, as that value is a conservative estimate used in other social cost of carbon pollution estimates historically (Rennert & Kingdon, 2021). A sensitivity analysis was done with discount rates of 5% and 2%, which did not result in any meaningful changes to the relative outcomes in the analyses.

Social Cost of Carbon: $51

The Biden administration recently announced that it would peg the social cost of carbon pollution, the value used to calculate the social and health costs associated with a metric ton of carbon emissions, at $51 (Chemnick, 2021).

Alternative 1. Dedicate resources to advocacy for new federal legislation for clean energy transition incentives, or to defend or expand existing federal clean energy transition incentives.

Benefits

A. Additional CO_2 Emissions Avoided Through Clean Energy Transitions over 10 Years (metric tons): 100,000,000 (National Housing Trust, 2021)

B. Additional CO_2 Emissions Avoided Through Extensions of Solar ITC over 10 Years (metric tons): 1,420,000,000 (Mai et al., 2016)

C. Total CO_2 Emissions Reduced over Ten Years (metric tons; A x B): 1,520,000,000

D. Additional Likelihood of Passage Due to LISC Advocacy: .01%

. Note: Value arrived at based on discussions with LISC staff. Sensitivity analysis found the LISC team would need to increase likelihood of passage of legislation by .06% in order to exceed emissions avoided from Alternative 3.

E. Effective Additional CO_2 Emissions Avoided Over Ten Years (metric tons of CO2; C x D): 152,000

Alternative 1 Benefits Continued

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Metric Tons of CO_2 Avoided	15200	15200	15200	15200	15200	15200	15200	15200	15200	15200
Social Benefit of Avoided CO_2 Emissions	$775,200	$775,200	$775,200	$775,200	$775,200	$775,200	$775,200	$775,200	$775,200	$775,200
Discounted Social Benefit (7%)	$724,486	$677,090	$632,794	$591,396	$552,707	$516,548	$482,756	$451,173	$421,657	$394,072
Net Present Value of Total Social Benefit	$5,444,680									

Costs

- Staff cost (annual salary): $120,400
  This figure was calculated based on the average salary of a Program Officer at LISC ($86,000, based on conversations with a LISC staff member) multiplied by 1.4 to include benefits.

Alternative 1 Costs Continued

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Annual Costs	$120,400	$120,400	$120,400	$120,400	$120,400	$120,400	$120,400	$120,400	$120,400	$120,400
Discounted Costs (7%)	$112,523	$105,162	$98,282	$91,853	$85,844	$80,228	$74,979	$70,074	$65,490	$61,205
Net Present Value of Total Annual Costs	$845,639									

Alternative 2. Create a national solar lending fund for multifamily rental properties.

Benefits

A. Pounds of CO_2 Avoided per kW of Solar Panel Installed: 3,000 (ARE Solar, 2016)

B. Pounds of CO_2 per Metric Ton: 2,205 (Bank of the West BNP Paribas, n.d.)

C. Metric Ton of CO_2 per kW of Solar Panel Installed (A / B): 1.36

D. Average kW of Solar Panel Installed per Project: 75
Note: Based on proprietary analysis of historic LISC projects and discussion with LISC staff members.

E. Average Number of Projects per Year: 50
Note: Based on conversation with LISC staff members.

Alternative 2 Benefits Continued

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Number of Projects	5	8	12	25	50	60	70	80	90	100
Metric Tons of CO_2 Avoided	510.20	816.33	1,224.49	2,551.02	5,102.04	6,122.45	7,142.86	8,163.27	9,183.67	10,204.08
Social Benefit of Avoided CO_2 Emissions	$26,020	$41,633	$62,449	$130,102	$260,204	$312,245	$364,286	$416,327	$468,367	$520,408
Discounted Social Benefit (7%)	$24,318	$36,364	$50,977	$99,254	$185,522	$208,062	$226,859	$242,306	$254,761	$264,549
Net Present Value of Social Benefit	$1,592,971									

Costs

- Solar Finance and Lending Training (three years): $168,000
  Note: Based on opportunity cost estimate for employee, using $100K salary, 100 hours of training per year, 35 people needing training.

- Solar Lending Program Fundraising (one year): $180,600
  Note: Assumed 1.5 full time employees, using aforementioned average Program Officer salary of $86,000 times 1.4 to account for benefits.

- Additional Solar Lending Program Fundraising per Year (nine years): $120,400 ($86,000 x 1.4)

- Program Officer Cost per Year (one per local office, 25 local offices): $3,010,000 ($86,000 x 1.4 x 25)

- Annual Program Administration Costs (inclusive of legal services, marketing, etc.): $200,000
  Note: Based on conversations with client.

Alternative 2 Costs Continued

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Annual Costs	$3,558,600	$3,498,400	$3,498,400	$3,330,400	$3,330,400	$3,330,400	$3,330,400	$3,330,400	$3,330,400	$3,330,400
Discounted Costs (7%)	$3,325,794	$3,055,638	$2,855,736	$2,540,746	$2,374,529	$2,219,186	$2,074,006	$1,938,323	$1,811,517	$1,693,006
Net Present Value of Total Annual Costs	$23,888,483									

Alternative 3. Develop local office 'One-Stop Shop' programming to fund comprehensive energy audits and coordinate clean energy upgrades in multifamily rental properties.

Benefits

- Metric Tons of CO_2 Avoided per Local Office Program per Year: 5,000
  Note: Based on analysis in *Comprehensive Energy Audit + Clean Energy Technology Optimization Project: Final Report* (2018); total metric tons avoided over two years was 10,626 metric tons, so approximated annual avoidance of 5,000 metric tons.

- Average Number of Local Office Programs over 10 Years: 17
  Note: Based on conversation with LISC staff member and assessment given existing EERS programs nationally. See Appendix B for list of local office sites in states with EERS programs or low-income clean energy upgrade programs.

Alternative 3 Benefits Continued

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Number of Programs	1	2	7	15	20	25	25	25	25	25
Metric Tons of CO_2 Avoided	5,000	10,000	35,000	75,000	100,000	125,000	125,000	125,000	125,000	125,000
Social Benefit of Avoided CO_2 Emissions	$255,000	$510,000	$1,785,000	$3,825,000	$5,100,000	$6,375,000	$6,375,000	$6,375,000	$6,375,000	$6,375,000
Discounted Social Benefit (7%)	$238,318	$445,454	$1,457,092	$2,918,074	$3,636,230	$4,247,932	$3,970,030	$3,710,308	$3,467,578	$3,240,727
Net Present Value of Social Benefit	$27,331,741									

Costs

- Annual Program Administration Costs per Program: $300,000 (LISC, 2018)

- Annual Program Fundraising (one Program Officer level full time employee): $112,000 ($86,000 average Program Officer salary x 1.4 for benefits)

Alternative 3 Costs Continued

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Annual Costs	$412,000	$712,000	$2,212,000	$4,612,000	$6,112,000	$7,612,000	$7,612,000	$7,612,000	$7,612,000	$7,612,000
Discounted Costs (7%)	$385,047	$621,888	$1,805,651	$3,518,473	$4,357,772	$5,072,197	$4,740,371	$4,430,253	$4,140,424	$3,869,555
Net Present Value of Total Annual Costs	$32,941,630									

APPENDIX B - EXISTING EERS PROGRAMS NATIONALLY

LISC Local Office	State	Energy Efficiency Resource Standard (EERS) in Place?	Low-Income Clean Energy Upgrade Programs in Place?
Phoenix	AZ	Yes	Yes
Bay Area	CA	Yes	Yes
Los Angeles	CA	Yes	Yes
San Diego	CA	Yes	Yes
Connecticut	CA	Yes	Yes
Washington	DC	Yes	Yes
Jacksonville	FL	No	No
Atlanta	GA	No	Yes
Central Illinois	IL	Yes	Yes
Chicago	IL	Yes	Yes
Indianapolis	IN	Yes	No
Louisville	KY	No	No
Boston	MA	Yes	Yes
Detroit	MI	Yes	Yes
Flint	MI	Yes	Yes
Kalamazoo	MI	Yes	Yes
Duluth	MN	Yes	Yes
Twin Cities	MN	Yes	Yes
Great Kansas City	MO	Yes	Yes
Newark	NJ	Yes	Yes
New York	NY	Yes	Yes
Western New York	NY	Yes	Yes
Charlotte	NC	Yes	No
Cincinnati	OH	No	No
Toledo	OH	No	No
Philadelphia	PA	Yes	Yes
Rhode Island	RI	Yes	Yes
Upstate South Carolina	SC	No	Yes
Memphis	TN	No	No
Houston	TX	Yes	Yes
San Antonio	TX	Yes	Yes
Hampton Roads	VA	Yes	Yes
Richmond	VA	Yes	Yes
Washington State	WA	Yes	Yes
Milwaukee	WI	Yes	Yes

Sources: American Council for an Energy Efficient Economy (2020a, 2020b)
For a more detailed account of existing EERS's and low-income programs, see Samarripas & York (2019)

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