

**Building a Sustainable City through the Decarbonization of Affordable Housing:
A Case Study of East LA Community Corporation**

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Abstract

It has increasingly become obvious that the world is in a state of climate emergency; although building decarbonization has emerged as one of the strategies for addressing climate change, there is little research showing how it can be implemented equitably. Implementing any strategy in an equitable manner has been a concern for many as those most affected by the effects of climate change are low-income communities and communities of color. Many cities, such as Los Angeles, have proposed plans, developed programs, and implemented policies that support equitable solutions to climate change. However, the effectiveness of such initiatives is under researched, especially in relation to building decarbonization. It is crucial that Los Angeles focuses on addressing the challenges to building decarbonization as buildings are one of the largest sources of greenhouse gasses in the city. This paper examines the role of nonprofit developers in the equitable decarbonization of buildings, mainly residential buildings that are affordable. Building decarbonization has the potential of not only addressing climate change but also addressing Los Angeles' housing crisis. Through a series of interviews with actors involved in the decarbonization of East LA Community Corporation's buildings, there were five major findings that either corroborated or added to the concerns of building decarbonization. These findings helped support the development of seven recommendations that ensure Los Angeles and nonprofit developers can support the equitable decarbonization of buildings.

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Glossary

Term	Definition
Affordable housing	Housing is considered affordable when no more than 30 percent of gross household income is spent on housing costs.
Area Median Income (AMI)	This is the “middle” income of a household in a specific region or population; usually used to determine eligibility for programs (King 2021).
Building Decarbonization	The process of reducing or completely eliminating carbon dioxide and other greenhouse gas (GHG) emissions produced by the energy systems in buildings and used by buildings.
CalEnviroScreen Score	A score assigned to census tracts according to the level of pollution and population characteristics. A higher score signifies a higher pollution burden, with the highest score being 100 (Public Utilities Commission 2022).
Climate Change	This is a shift in temperatures and weather patterns over a specific period of time in a specific region. Although shifts may be natural, it has been accelerated as a result of human activity (United Nations n.d.).
Decarbonization	The process of reducing or completely eliminating carbon dioxide and other greenhouse gas (GHG) emissions.
Disadvantaged communities (DACs)	Neighborhoods that CALEPA has identified to disproportionately “suffer from a combination of economic, health, and environmental burdens” (Public Utilities Commission 2022).
Energy Efficiency	Refers to the use of less energy to accomplish the same task (EERE n.d.)
Greenhouse gasses (GHG)	According to the EPA, GHG are gasses that trap heat in the atmosphere which include carbon dioxide, methane, nitrous oxide, and fluorinated gasses.
Gentrification	A term used to describe the process in which a low-income community is renovated and rehabilitated but causes the displacement and complete removal of those living there (Shaw

Term	Definition
	2008).
High energy burdened	A household is considered to be energy burdened if they spend over 6 percent of their household income on home energy bills.
Low-Income Housing Tax Credit (LIHTC)	A program that issues tax credits to developers for the acquisition, construction, or rehabilitation of affordable low-income rental housing (PD&R n.d.).
Naturally Occurring Affordable Housing (NOAH)	Housing that has been able to maintain its affordability without the use of subsidies or government funding.

Introduction

It is undeniable that climate change is impacting people all around the world, with some bearing a greater part of the burden due to their geographic location, income, and race (Gardiner 2020; Morello-Frosch and Obasogie 2023). In the last few years, California has experienced a record number of wildfires, high summer temperatures, and worsening air quality. Thus, the state of California is implementing several strategies as a way to mitigate the effects of climate change (Kenney et al. 2021; Rust and Barboza 2020). Among these strategies is “building decarbonization,” which is used to describe the process of reducing or completely eliminating carbon dioxide and other greenhouse gas (GHG) emissions produced by buildings (Kenney et al. 2021).

Although California has pledged to completely decarbonize their buildings by 2045, it will be a challenge to accomplish this in an equitable manner (Krieger, Lukanov, and Shonkoff 2018). Several community stakeholders have voiced their concern over low-income communities of color being left behind in the decarbonization process (Kirk 2021; Morello-Frosch and Obasogie 2023). Low-income communities of color are not only the most affected by the effects of climate change, but also lack the most basic need--affordable housing. In fact, the whole state lacks affordable housing, with this issue being more apparent in cities like Los Angeles and San Francisco (State of California 2021; Levin 2021). The few affordable housing that does exist was secured through the organizing efforts of mission-based organizations (Dahmann and Dennison 2013; Ping 2009).

Mission-based organizations have played a significant role in ensuring low-income communities of color have access to affordable housing. Some of these organizations are owners of affordable housing themselves, so they will be involved in the decarbonization of buildings.

Decarbonizing affordable housing will be an additional challenge for these organizations because they have limited capacity and funds (Kirk 2021). More specifically, it will be a challenge to decarbonize *existing housing* as opposed to new housing because existing buildings already have certain systems in place that may be difficult to remove and replace and there are tenants living in existing buildings (Kirk 2021). Moreover, unlike new buildings, which are being decarbonized through city ordinances, there is no one to enforce the decarbonization of existing buildings. Hence, this study sought to understand *how nonprofit developers in Los Angeles (LA) can support the equitable decarbonization of existing affordable housing* through the case of the East LA Community Corporation (ELACC), a mission-based organization and nonprofit developer in Boyle Heights.

This paper is divided into four sections with the following section providing a description of ELACC, brief history of LA, and a summary of where LA is in terms of building decarbonization. The next section reviews literature relevant to decarbonization, environmental justice, the challenges associated with decarbonization, benefits, and state and local programs. The third section describes the methods used and presents the results of the interviews, while the last section discusses and analyzes the responses of the interviewees to provide recommendations.

History of East LA Community Corporation

In 1995, four individuals founded ELACC with the purpose of transforming the Eastside through community organizing and real estate development. In its early years, ELACC focused on developing single-family homes, rehabilitating and selling homes to first-time home buyers, organizing community members to fight for affordable housing, and advocating for the development of their community. In the early 2000s, Maria Cabildo took over the position of Executive Director, shifting ELACC's focus from the development of single family homes to the development of affordable multi-family homes. During this time, ELACC also created the First Time Homebuyer and Financial Education Programs, which promoted financial literacy and family stability. Then in 2005, the Tenant Services Program was created to connect tenants to the services provided by the community and ELACC.

Eventually, as crime decreased, high schools were built, and residents gained access to economic opportunities, it became apparent that ELACC's organizing and advocacy efforts were successfully transforming the Eastside. However, soon after, questions about who was really benefiting from the development began to arise. This was because of the proposed redevelopment of the Sears Tower that was believed to be promoting gentrification. To address this issue, ELACC spearheaded a coalition that engaged residents in discussions around accountable development.¹ Since then, ELACC has kept an eye on potential gentrifying developments and has sought ways to push back against its effects.

In response to the 2008 economic crisis, ELACC created the Community Wealth program which combined community organizing, state and federal advocacy, and financial

¹ This coalition known as Comunidades Unidas de Boyle Heights was founded by ELACC with the help of InnerCity Struggle, Unión de Vecinos, and Homeboy Industries, all of which are non-profit organizations based in the Eastside, focused on community engagement.

services. Today, this program, along with real-estate development and community organizing, are ELACC's core strategies for achieving its mission. Unfortunately, in 2019, ELACC was forced to lay off half of its staff members due to financial difficulties, resulting in the community organizing department being dissolved. Although the spread of the coronavirus in the second half of the year further affected how ELACC operated, ELACC continues to work towards its mission of advocating for economic and social justice in the Eastside (ELACC 2022).

The Racist Planning and Development of Los Angeles

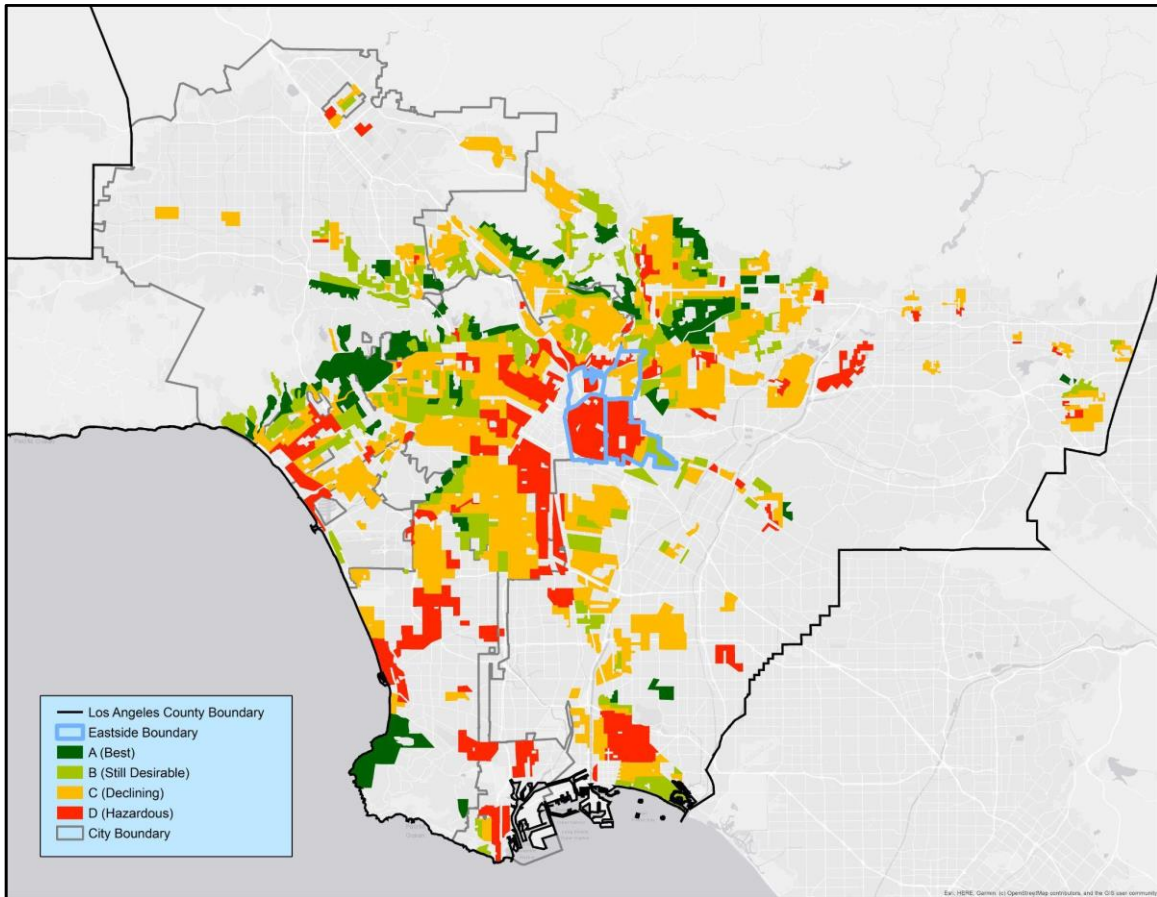
LA was founded in 1781, through the displacement of the Chumash and Tongva tribes (City of LA 2022b). From then on, ownership of land would change from Spain, to Mexico, and finally to the United States (Torres-Rouff 2006). These changes in political power and territory marked the beginning of certain practices that would negatively impact communities of color in East and South LA. In the early 1900s, LA was advertised as a utopia where people could relax and find many economic opportunities, resulting in a population boom and congestion of traffic (Ansari 2022; Macleod and Ward 2002). However, not everyone benefited from these opportunities equally. People of color were denied access to these opportunities and many communities of color were displaced to make way for the infrastructure that was to be built to accommodate the influx of people (Estrada 2005). Additionally, racially restrictive covenants were used to keep people of color out of the neighborhoods LA was advertised for. These covenants legally allowed property owners and developers to discriminate against people of color, resulting in many settling in South LA and East LA.

Redlining in Los Angeles

LA further became segregated through redlining practices which were a direct consequence of the National Housing Act of 1934. Redlining was created by the Home Owners

Loan Corporation after they were commissioned to rank LA’s neighborhoods by their security and living desirability. Neighborhoods were given a grade between A and D, with an “A” marking a neighborhood as highly desirable while a “D” indicated a neighborhood as the least desirable. Below is a map showing how neighborhoods in Los Angeles county were graded.

Figure 1. *Redlining Map of Los Angeles County*



Source: Data from GIS

Most, if not all communities of color received a “D” grade, including the neighborhoods in the Eastside, making them ineligible for loans and community investment, while also reinforcing racially restrictive covenants by denying Angelenos of color the right of living in “A” or green zoned neighborhoods (Kilgore 2020). Although covenants were later deemed

unconstitutional through two court rulings, LA had already become racially segregated, with communities of color lacking the necessary investment to prosper.

Displacement Post World War II

The arrival of World War II further exacerbated this economic inequality and solidified racist structures through the removal, relocation, and displacement of communities of color. For example, Japanese Americans were relocated to internment camps due to being suspected of aiding Japan, making it apparent that the government did not truly see them as Americans because of their ethnicity (Verge 1994). Then, during and after the war, LA encountered a homelessness crisis as a result of housing development not being able to keep up with LA's population growth. By the 1980s, most of these homeless individuals were persons of color who were being criminalized for not having a home (Wolf 2021).

Between the 1950s and 1960s communities of color once again faced the threat of displacement due to the construction of the U.S. Interstate Highway. Even before the highway system began to be constructed in LA, it was common for communities of color throughout the country to be destroyed for the construction of the highway. Thus, building the highway through communities of color in LA was a conscious and deliberate decision. Developers knew that these communities lacked political power and would not be able to fight against its placement; thus, entire communities were destroyed under the guise of urban renewal (Dillon and Poston 2021). Additionally, it is unsurprising that these same communities had previously been considered red zones or "D" grade neighborhoods.

While this section has outlined the key moments in history that laid the groundwork for the development of LA, it is beyond the scope of this paper to go into detail. There is plenty of established literature that offers in-depth analyses on this topic. In any case, what is important to

Source: Data from GIS

In the past few years, ELACC has become involved with implementing sustainable practices to improve the lives of their tenants and meet LA's climate goals. In 2015, the city released the *Sustainable City pLAN*, detailing specific environmental, economic, and equitable goals to be met by 2017, 2025, and 2035. The term "decarbonization" is explicitly stated once in relation to the decarbonization of the electricity grid while "building decarbonization" is not mentioned at all; however, goals related to making building energy efficient are discussed (Garcetti 2015).

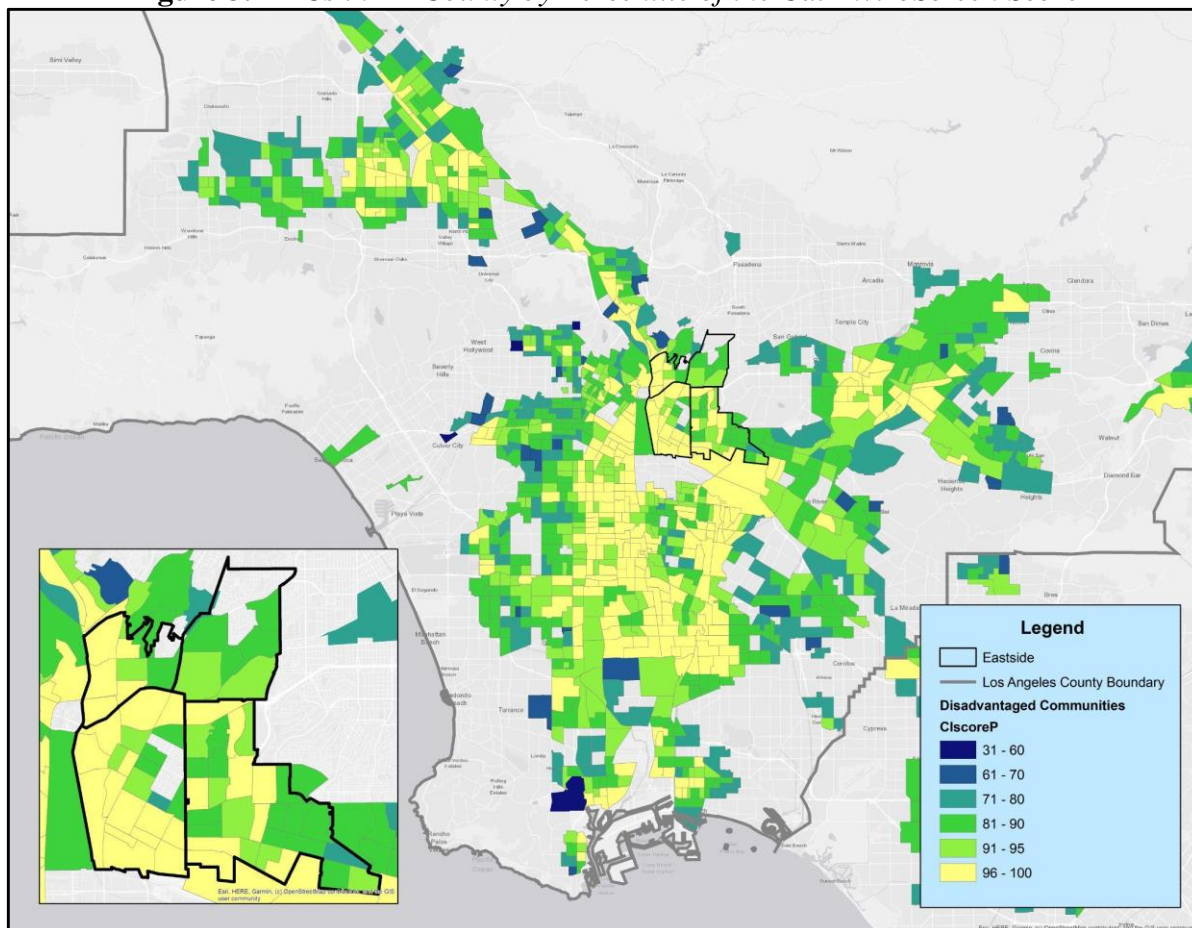
In 2019, the City released an updated version of this plan, known as *L.A.'s Green New Deal*. This plan describes the City's 47 targets and categorizes them into 13 areas: environmental justice, renewable energy, local water, clean & healthy buildings, housing & development, mobility & public transit, zero emission vehicles, industrial emissions & air quality monitoring, waste & resource recovery, and food systems. "Decarbonization" is explicitly mentioned three times, twice in the Clean & Healthy Buildings section and once in the Waste & Resource Recovery section. Similar to the 2015 pLAN, topics related to "building decarbonization" are discussed, with one of LA's targets being for all new buildings to be net zero by 2030 and completely carbon neutral by 2050.

Disadvantaged Communities in Los Angeles

Although the City is working with over 60 nonprofits, businesses, universities, schools, and individuals to achieve their 47 targets, it will be difficult to reach everyone as there are a total of 272 neighborhoods, including unincorporated areas (LA Times 2022; Garcetti 2019). The map below illustrates the neighborhoods that are the most impacted by the effects of climate change, which the city is also supposedly targeting. These neighborhoods are categorized

according to the percentile of the CalEnviroScreen Score, on the lower left is a closeup of the Eastside.

Figure 3. DACs in LA County by Percentile of the CalEnviroScreen Score



Source: Data from GIS

It is no surprise that residents in East LA and South LA suffer from environmental racism. It is important to remember and acknowledge the role of racist policies that aided in the segregation of Los Angeles because it is no coincidence that these neighborhoods are communities of color *and* surrounded by highways and adjacent to waste incinerators (Boer et al. 1997; Bullard 1993a; 1993b; Pulido 2000). It is a fact that communities of color have historically been divested from and denied access from various opportunities that has led to today's situation.

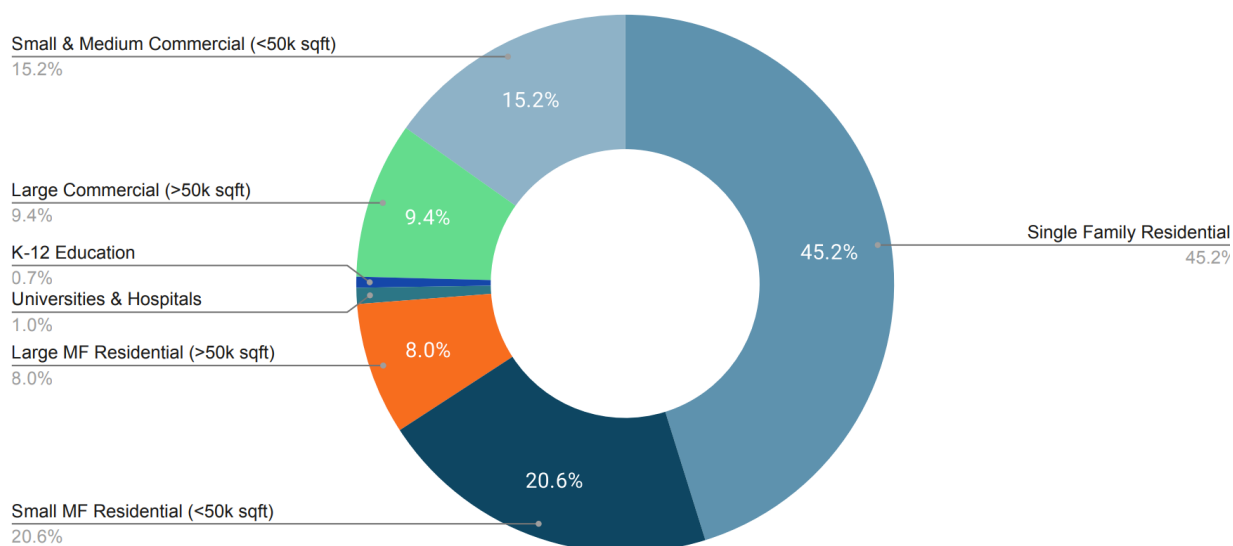
The city recognizes the above which is why “environmental justice” is a whole section in itself in *LA’s Green New Deal* (Garcetti 2019).

The Building Stock of Los Angeles

It is crucial that the city and their partners also consider how to equitably decarbonize buildings because residential and commercial buildings account for 43 percent of total GHG emissions in LA (Kirk, 2021). The figure below shows how residential buildings take up a total of 73.8 percent of total square footage in LA. Even so, there is not enough housing to meet demand because single family homes take up a majority of space.²

Figure 4. *Distribution of Los Angeles Buildings by Square Footage (Jones, 2021)*

LA Buildings (Million Sq Ft)



Source: Jones, 2021

Single family homes and duplexes account for 62 percent of residential buildings, followed by small multi-family homes (28%), and large multi-family homes (10%) (Jones 2021). In an effort to meet housing demand, over half of the buildings built in the last decade were

² This is a consequence of white flight, can refer to Schneider (2008) and Powell (1999) for more information on this topic.

multi-family homes with more than 50 units, followed by small medium multi-family homes (3 to 49 units) and single family homes. Several of the homes being built have been affordable units developed by one of the 117 nonprofit developers LA considers “qualified” enough to develop housing (LA City Planning 2021a). However, building more housing will not solve LA’s housing crisis; policies to protect tenants, control rent, and preserve housing must be considered (Kirk 2021).

Housing in Los Angeles

LA has been in a housing crisis for the past forty years which was only exacerbated by the arrival of COVID as it highlighted the lack of affordable housing. Although an increasing number of multi-family units being developed have been affordable, about 40 percent of households in LA are burdened by housing costs, while an estimated 19 percent of households are severely burdened (Geier 2020; LA City Planning 2021b). Renter in LA face the risk of eviction and displacement especially now that COVID rent protections have ended (Lin 2022; Ellis 2023). The lack of affordable housing is an issue that will need to be addressed through policy and in collaboration with nonprofit housing developers and community members. More attention needs to be directed to preserving the affordability of existing housing, especially those with soon expiring affordability restrictions.

Decarbonization Overview

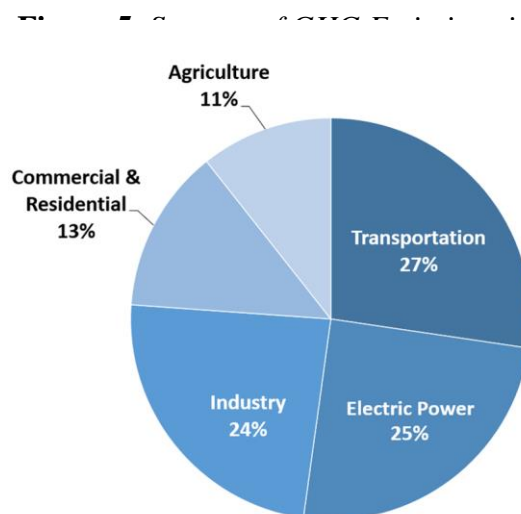
Building decarbonization is a fairly new concept, with the term “decarbonization” being used more frequently in the last decade or so. The existing research on decarbonization varies, discussing everything from its relationship to climate change, the economy, and the environment. As for “building decarbonization,” current research reveals the challenges to decarbonizing buildings, pathways, co-benefits, and implications on residents, tenants, and the work sector.

This review is divided into five sections, with the first section providing an overview of decarbonization, pathways, and what other cities are doing. The second reviews the five major challenges to building decarbonization, the third section examines state/local policies and programs, the fourth reviews the economic and health co-benefits of decarbonization, and the fifth discusses environmental justice in LA in relation to decarbonization.

Building Decarbonization Matters

Scholars agree that the world must decarbonize energy systems by 2050 to mitigate the effects of climate change (Banfill and Peacock 2007; Holmes et al. 2021; Loftus et al. 2015).

In the U.S, the focus has been on decarbonizing the electrical grid and buildings despite transportation being the largest source of GHG emissions (see fig. 5) (Shen, Kahrl, and Satchwell 2021). The reason for this is because buildings use a lot of electrical power so in reality they are responsible for more GHG emissions than transportation (37% vs. 27%) (Berrill et al. 2022).



New York, Los Angeles, and Chicago recognize this fact as they have already started decarbonizing their buildings. These cities are investing in retrofitting programs, incentivizing building decarbonization, and updating their energy codes (Vangala, Tomasziewicz, and Brady 2021; Atwood 2022). While the above is a step in the right direction, there is no mention about whether these cities are targeting the neighborhoods most affected by climate change. Even within California the related policies have shown little evidence of successfully targeting DACs.

Building Decarbonization Pathways

The following table summarizes the strategies the state of California has offered as pathways for building decarbonization. These strategies are not independent of each other; most, if not all, rely on the last strategy to function.

Table 1. *Summary of Pathways to Building Decarbonization*

Strategy	Description
1. Building End-Use Electrification	This strategy requires the electrification of gas appliances and equipment.
2. Decarbonizing the Electricity Generation System	This strategy requires the use of renewables to support the electricity generation system.
3. Energy Efficiency	This strategy requires for the replacement of lighting, heating, ventilation, air conditioning etc. with more efficient appliances and equipment.
4. Refrigerant Leakage Reduction	A strategy at the government level that focuses on creating policies and programs that would encourage the use of low-carbon refrigerants.
5. Distributed Energy Resources	This strategy requires the use of various energy sources such as thermal batteries and lithium-ion batteries to support the generation of energy.
6. Decarbonizing the Gas	This strategy requires the use of alternate sources of gas such as agriculture waste and municipal solid waste to replace fossil fuels.
7. Demand Flexibility	This strategy is meant to support the transition from our current energy system to one that is carbon-free through the use of “automated control technologies.”

Source: Kenney et al. (2021)

In order for each strategy to be implemented, they require the collaboration of different institutions, individuals, and organizations. Although there is existing research for how each strategy would impact new and existing buildings, strategies two, three, and six require more research as the information provided are mostly predictions and estimations (Kenney et al.

2021). Despite claiming that DACs must not be left behind in the process, Kenney et al. (2021) offer few recommendations for how to target these communities. Instead, it is Rosenberg et al. (2021) and Kirk (2021) that offer suggestions for how to do this by stating that stakeholders must focus on affordable housing preservation and tenant protections when decarbonizing buildings to ensure residents in DACs are not left behind in the process.

The Role of Cities in Decarbonization

While federal and state governments play a significant role in ensuring cities play their part in building decarbonization, local governments are the one with the power to create the greatest impact (Holmes et al. 2021). Many international cities such as Oslo, Norway, have already shown results. For example, between 2015 and 2016, Oslo reduced their emissions by 16 percent through its strict climate budget plan (Vangala, Tomaszekiewicz, and Brady 2021). Meanwhile, in 2020, LA set the record for “the most installed solar capacity in the U.S.,” which coincided with California mandating solar installation for new homes. Other cities have taken action by focusing on the electrification of transportation, it all depends on what emission source a region would like to tackle (Vangala, Tomaszekiewicz, and Brady 2021).

Cities can create policies and programs tailored to the needs and wants of their constituents by working with community stakeholders (Vangala, Tomaszekiewicz, and Brady 2021). However, as Lomas (2009) points out, simply establishing policy will not ensure that decarbonization happens. Cities must carefully consider how these policies will be implemented, who will implement them, and who will oversee their implementation. Additionally, cities, nonprofits, and building owners alike need to engage residents during and after a project has been completed to obtain hard evidence, such as post-occupancy evaluations, that confirm that the decarbonization of a building was successful (Lomas 2009). Scholars generally agree that for

any strategy to be “successful,” it must be an equitable environmental justice effort (Blumenfeld et al. 2021; Cha, Wander, and Pastor 2020; Morello-Frosch and Obasogie 2023). Yet, other scholars argue that as long as the effects of climate change are reduced, a strategy is successful (Blumenfeld et al. 2021). The issue with this perspective is that it denies the existing structural racism and inequalities that DACs face and contributes to worsening the climate gap (Morello-Frosch and Obasogie 2023).

Barriers to Building Decarbonization

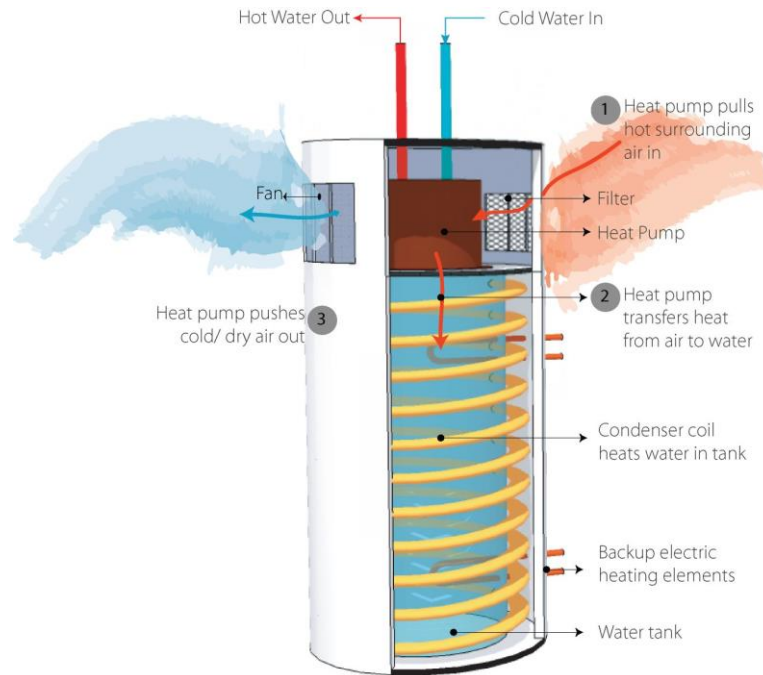
Regardless of what perspective scholars have, data on the success of a project will only be able to be gathered when a building is being decarbonized and after it has been completed. There are several challenges to decarbonizing a building including (1) technological readiness, (2) knowledge and awareness of technologies, (4) policy related barriers, and (5) up-front and hidden costs. Each of these categories are discussed below in the order they are listed above, with a focus on heat pumps in the first two sections due to existing literature focusing extensively on this technology.

Technological Readiness: Heat Pumps

A few of the low- and zero-carbon technologies needed to decarbonize buildings include heat pumps (both space and water heaters), induction cooktops, and LED lighting.³ Some of these technologies, such as LED lighting, have been available for a long time, meaning that they are reliable and easily accessible. However, research indicates that low- and zero-carbon technologies, such as heat pumps, are generally difficult to acquire due to being relatively new and not well researched (Banfill and Peacock 2007; Loftus et al. 2015). Unlike a normal heater that uses gas to heat water, a HPWH uses hot air and electricity (see below).

³ For a list of available technologies refer to Appendix A.

Figure 6. How a Heat Pump Water Heater Works



Source: Figure 2 in Shapiro and Puttagunta (2016)

Researchers in California found that even when they acquired heat pumps, for example, they turned out to be unreliable. In this case, the equipment was performing adequately, however when the manufacturer took the heat pumps off the market due to its poor sales, it left those who purchased the heat pumps with nowhere to buy spare parts (Outcalt et al. 2022). It is quite common for low- and zero-carbon technologies to have poor sales because they are perceived to be costly and unreliable despite evidence showing otherwise.

Knowledge and Awareness of Technologies: Heat Pumps

These negative perceptions can be attributed to a lack of awareness for existing low- and zero-carbon technologies and lack of knowledge for how to install, operate, and maintain these systems. For example, York et al. (2020) describes how contractors revealed that they may sell

heat pumps to those who request them, but will not actively promote them, due to their perceived inefficiency. Heat pumps already have a small market size, so by not advertising them, it creates the false assumption that there are risks associated with buying them (York et al. 2022). This perspective can be harmful for manufacturers because as Outcalt et al. (2022) described, it results in poor sales, which may raise the costs of heat pumps. Even if low and zero-carbon technologies are made available, without training and educating workers, contractors, and consumers about these technologies, it will continue to be a challenge to decarbonize buildings.

Making Space for Equipment. Before decarbonizing a building one must ensure there is enough space for equipment to be installed. York et al. (2022) discusses a study that found that installing HPWHs in confined spaces reduced their efficiency by 16 percent. Buildings that require a HPWH to be installed in each unit will need to consider choosing between installing a smaller, probably less efficient, HPWH or doing construction to make space for the system, subsequently increasing costs and making the process more complicated (York et al. 2022; Outcalt et al. 2022).

Installing Equipment. Additionally, Outcalt et al. (2022), discuss how equipment at two different sites were incorrectly installed due to the subcontractors not having any prior experience. Installing the equipment was a learning experience for them, and as Boardman (2007) explains, operating these systems will be difficult for occupants as well. Therefore, residents will need to be taught about what low- and zero-carbon technologies are, how they operate, and what is needed to maintain them.

So far, the challenges discussed have been in relation to technologies and what is needed to physically decarbonize buildings. In the next two sections, the challenges discussed are more

difficult to address as they exist due to existing policies and economic inequalities. These two challenges are discussed in the context of nonprofits decarbonizing affordable housing.

Policy Related Barriers

Nonprofit developers who plan to decarbonize their buildings must not only conform by the regulations of their city and state, but also by those of the federal government if they receive funding from federal programs (Bartolomei 2016). While these regulations can be helpful for ensuring housing stays affordable, by forcing nonprofit developers to take extra steps, it may discourage them from decarbonizing their buildings. While California has adopted building codes to advance building decarbonization, these codes have been for new buildings, meaning that owners of existing buildings may not qualify for the incentives or programs created thereafter (York et al. 2022). In addition, there needs to be more policies that protect tenants from the negative consequences of decarbonization, otherwise it will be difficult for nonprofit developers of affordable housing to decarbonize existing buildings (York et al. 2022; Kirk 2021).

The Costs of Decarbonizing Housing

It is estimated that an average of \$21,200 will be needed to decarbonize a unit; the larger the building, the more costly this will be (Kirk 2021). Scholars agree that there is a lack of funding for the decarbonization of housing (French 2022; York et al. 2022). Decarbonizing affordable housing will be even more difficult for mission driven developers, such as ELACC, because they must ensure that the low-income families they serve spend no more than 30 percent of their household income on rent. Affordable housing developers tend to “operate on tight margins” and might feel discouraged to adopt low-carbon technologies if it threatens the affordability of the housing they own (Kirk 2021). These concerns are reasonable because as York et al. (2022) explains, developers of affordable housing will have to bear high up-front

decarbonization costs. They simply cannot pass on these costs to tenants as it would only burden them (York et al. 2022). While this may be true, in all cases studied by Outcault et al. (2022), they found that the nonprofit developers paid for their up-front costs through several programs and incentives, meaning they did not have to worry as much about the high up-front costs associated with decarbonizing affordable housing.

Hidden Costs. It is unknown whether other nonprofit developers of affordable housing will have the same experiences, especially when some costs are not accounted for. These costs, which may be overlooked, are known as hidden costs and must be included in the calculation costs (French 2022; York et al. 2022; ürge-Vorsatz et al. 2007). For example, in buildings where gas stoves plan to be replaced with induction cooktops, residents will be required to buy cookware that is compatible with the cooktop. However, not all households can afford the required cookware, resulting in nonprofit developers having to include these cookware costs into their calculations. Not doing so may place additional burdens on tenants and defeat the purpose of decarbonizing the building they live in (York et al. 2022). From all the challenges discussed above, the high up-front costs are one of the biggest barriers nonprofits face to decarbonizing their buildings.

Policies and Programs for Decarbonizing Affordable Housing

California and LA have both implemented policy and created programs and incentives to reduce the high costs associated with building decarbonization. For example, to ensure that cities decarbonize housing in an equitable manner, California has implemented policies such as SB 535 which prioritizes GHG reduction investments to disadvantaged communities (DACs) (Zhao et al. 2019) and SB 1477 which requires gas corporations to fund two programs⁴ that help low-income

⁴ These programs are Building Initiative for Low-Emissions Development (BUILD) and Technology and Equipment for Clean Heating (TECH).

households and developers of low-income housing with purchasing low carbon technologies, technical assistance, and “consumer education and workforce training” (Prieto 2022).

Unfortunately the effectiveness of these policies is yet to be known as only pilot programs have been implemented or are in the process of being implemented (York et al. 2022). Additionally, in 2018, the California Energy Commission created the Clean Energy in Low-Income Multifamily Buildings (CLIMB) action plan to fund programs such as the Low Income Weatherization Program for Multifamily, which has successfully reached many throughout the state of California (York et al. 2022).

Sun et al. (2022) argue DACs will encounter additional decarbonization barriers and must have programs tailored to them. Los Angeles recognizes this fact, creating four programs that aid households in DACs with building decarbonization. These include the Home Energy Improvement Program (HEIP), Comprehensive Affordable Multifamily Retrofits (CAMR), LADWP's Refrigerator Exchange Program, and Energy Savings Assistance Program (ESAP) (French 2022). The experiences of nonprofit affordable housing developers with these programs are yet to be well documented. There is generally a lack of evidence proving the effectiveness of the programs created at the state and local level. The few studies that do exist show that affordable housing is being successfully decarbonized in California (Outcault et al. 2022).

The Expected Benefits of Building Decarbonization

Considering how many affordable housing units are built in DACs, it is expected they will benefit the most from the co-benefits of decarbonization if it were to be implemented equitably (Sun et al. 2022; Zhu et al. 2022). The following table displays these co-benefits in no particular order.

Table 3. *The Co-benefits of Building Decarbonization*

-
1. Improves air quality & health
 2. Creates jobs
 3. Increases efficiency, reducing utility bills
 4. Safety
-

Source: Rosenberg et al. (2021) and Jones (2021)

Several studies found that decarbonizing buildings would improve indoor and outdoor air quality, subsequently improving the health of the people (French 2022; Zhao et al. 2019; Zhu et al. 2022). Gas appliances leak gas emissions that are harmful to one's health so when they are replaced with electric ones, it not only reduces/eliminates the amount of emission being leaked but also reduces the risk of gas hazards such as explosion, and long-term health consequences that result from inhaling these gas emissions (French 2022; Jones 2021).

It is anticipated that building decarbonization will not only reduce GHG emissions, but also provide people with economic opportunities and an improved lifestyle (Jones 2021). For example, skilled workers are needed for performing decarbonization upgrades and maintaining and operating the new systems in place, thus a large number of jobs are expected to be created to keep up with the demand of decarbonization (French 2022; Jones 2021). Even so, there are concerns over who will have access to these jobs and whether they will be of high quality (Morello-Frosch and Obasogie 2023; Cha, Wander, and Pastor 2020). Scholars argue that for decarbonization to be implemented equitably, residents of DACs must be prioritized by offering them training and employment opportunities during the decarbonization process (Jones 2021; Blumenfeld et al. 2021).

While decarbonizing buildings has proven to lower energy bills (French 2022), it is important to keep in mind that existing research also indicates that "bill savings are insubstantial

relative to the high upfront costs of decarbonization” (Kirk 2021). Therefore, it is likely that households will benefit from this co-benefit in the long run. While it is true that people in DACs may benefit the most from decarbonization, there is little research that provides hard evidence or describes the indicators being used to measure these benefits (Zhao et al. 2019; Zhu et al. 2022).

Achieving Environmental Justice Through Decarbonization

Scholars expected DACs to benefit the most from decarbonization because they are disproportionately burdened by economic and environmental inequalities. However, there is also concern over these communities being left behind “to maintain the legacy gas systems, while receiving none of the benefits of the transition” (French 2022; Sun et al. 2022). This is a valid concern because low-income communities of color have historically been divested from and denied from resources. The City recognizes that these communities need to be prioritized and are working with community stakeholders to plan for the equitable implementation of decarbonization policies and programs (French 2022; Prieto 2022).

In 2021, Mayor Garcetti launched LA’s Climate Emergency Mobilization Commission (CEMO) to engage community stakeholders in their decision making process. Marta Segura, “a longtime environmental justice advocate and nonprofit advisor,” who has plenty of experience in working with underserved communities in LA leads this commission (City of LA 2022a). CEMO gained a better understanding of tenants’ concerns on building decarbonization through focus groups hosted by SAJE and NHHA (French 2022).⁵ Among the concerns brought up by tenants is a fear of bearing a higher portion of the up-front costs through utility bills and rent increases. Kirk (2021) warns that both of these may put tenants at risk for eviction and displacement, issues

⁵ SAJE or Strategic Actions for a Just Economy is a nonprofit organization based in South LA that works with residents to advocate for “tenant rights, healthy housing, and equitable development” (SAJE 2020) while NHHA or NoHo Home Alliance is a nonprofit based in the East San Fernando Valley focused on improving community health.

that are already a concern in LA. Although the city has made an effort to involve various community stakeholders in their role in the planning of policies and programs, there is little evidence that proves that these conversations are effectively enabling the City and their partners to decarbonize building equitably.

Methods

ELACC was examined as a case of **how nonprofit developers of affordable housing can support the equitable decarbonization of their existing and future buildings** because it is one of the four cohort members of LA Retrofit. LA Retrofit is a pilot program meant to offer technical assistance and guidance when applying to the available decarbonization incentive programs. It is led by the Los Angeles Better Buildings Challenge (LA-BBC), a network created in collaboration with “LA’s Best Buildings” to support the implementation of LA’s Sustainability City pLAn (LABBC n.d.). Thus, as one of the few nonprofit organizations in LA decarbonizing their existing affordable housing portfolio, ELACC provides a strong case for examining how nonprofit developers can support the equitable decarbonization of existing affordable housing.

My current internship with ELACC further influenced my decision to study ELACC because I have experienced how they plan for the decarbonization of their portfolio. During the last few months, I have participated in their meetings and learned about the incentive programs they are applying to, the specific buildings being decarbonized, and the organizations they are partnering with to complete this work. Having access to this information has allowed me to examine how ELACC’s experience compares to those who have decarbonized housing and the extent to which concerns around decarbonization apply to ELACC.

Description of Selected Properties

Rosenberg et al. (2021) describes how multi-family properties tend to be overlooked when programs and incentives are provided. So, being that ELACC qualifies for the existing decarbonization programs and incentives, ELACC provides the useful case for evaluating the equitable decarbonization of affordable housing, more specifically the decarbonization of small and medium multi-family homes. The table below provides a description of the two properties ELACC plans to decarbonize.

Table 4. *Buildings in ELACC's Decarbonization Portfolio*

Property Profiles		
	Property A	Property B
Affordability Type	NOAH	LIHTC
Year Built	Built in 1905 and 1916	Built in 2006
Owner	Acquired by ELACC in 2017	Owned by ELACC as of 2023
Units/Buildings	16 unit building + single family annex	49 units in 4 buildings
CalEnviroScreen Score	94.2	98.1
AMI	\$97,900	\$97,900
Zip Code	90031	90023

Source: ELACC, AMI Lookup Tool, OEHHA

Although both buildings differ in size, age, and affordability type, they represent the housing generally provided by ELACC. Both properties are located in census tracts with CalEnviroScreen scores above 90 meaning the people living in these communities are extremely burdened by all levels of pollution. Most of ELACC's properties have similar scores, which is not surprising as DACs exist because of environmental racism. Thus, ELACC's efforts

to decarbonize their buildings can be seen as an effort of environmental justice. In prioritizing the decarbonization of affordable housing, ELACC provides a case for understanding the role of nonprofit developers in building decarbonization.

Stakeholder Selection

The number and type of stakeholders to interview was determined according to a previous multiple-case study that examined the experiences of developers involved in three separate projects. These stakeholders included developers, architects, energy consultants, and property staff. An average of 7 stakeholders per project were interviewed to learn about the decarbonization of multifamily affordable housing in California (Outcault et al. 2022). I interviewed a total of 10 relevant stakeholders, including ELACC staff, property staff, a consultant, a tenant, and other related organizations. This was done after receiving approval from the *Institutional Review Board* on November 9, 2022. **Table 5** lists these individuals in alphabetical order and by the following categories: ELACC staff, partners and related individuals, and community.

Table 5. *Interview Participants*

Name	Role and Organization
Adalia Rodriguez	Vice President of Human Capital and COO at ELACC
Joshua Shaw	Associate Asset Manager at ELACC
Mauricio Elizalde	Property Manager at Vallejo from ELACC
Monica Mejia	President CEO at ELACC
Veronica Leon	Assistant Property Manager at ELACC
Dave Hodgins	Executive Director at LA-BBC
Ernesto Espinoza	Chief Real Estate Officer for CRCDC Partners LLC.
Nick Dirr	Director of Programs, at Association for Energy Affordability (AEA)

Tenant	Tenant living in Property B
Frank Dieguez	Property Manager from the John Stewart Company and tenant at Property B

ELACC has a document that lists the contact information of the individuals and organizations partnering with ELACC. I contacted at least two individuals from LA-BBC, AEA, and CRCD. These individuals then referred me to someone I could speak to or volunteered to be interviewed themselves; stakeholders were selected via convenience sampling and snowball sampling. While most stakeholders were reached through email, it is important to note that the resident was reached out to in-person and via phone because they were the only tenant that had some background in decarbonization. This participant was the only individual who attended ELACC's informational meeting on decarbonization.

Interviews with relevant stakeholders, sought to learn how they are (a) overcoming the financial barriers associated with decarbonizing affordable housing, (b) minimizing the financial impact on tenants, and (c) engaging in meaningful conversations with tenants around decarbonization. Participants were interviewed between the months of January and February, with four interviews being held with ELACC staff, three with their partners and related organizations, and two with community members.

The interviews were semi-structured and carried out in both English and Spanish, with six being conducted via Microsoft Teams, two over the phone, and one in-person. During the in-person interview, two individuals were interviewed simultaneously to accommodate for time and availability. I audio-recorded the interviews for note-taking purposes with the consent of the participants. Each interview varied in length, with the shortest one being 14 minutes and longest being 61 minutes, averaging to 37 minutes per interview. **Table 6** shows a sample of questions asked to participants to obtain information about their motives for decarbonizing, challenges and

successes, programs that were applied to, and the extent of tenant involvement. For a full list see Appendix B.

Table 6. *Sample Questions from the Semi-Structured Interviews*

-
1. What is your perspective on the decarbonization building targets set by the City of LA for nonprofit organizations?
 2. What are some challenges in decarbonizing or supporting the decarbonizing of affordable housing?
 3. What resources have you been able to leverage for this (decarbonization) work?
-

Some of these questions were adapted from Outcault et al. (2022) study with the purpose of drawing comparisons between their study and ELACC’s experience, along with that of other studies. The Climate Equity LA video series and LA’s Green New Deal will further help support my analysis in understanding the extent to which organizations such as ELACC can support the equitable decarbonization of affordable housing (Garcetti 2019; City of LA 2022a).

Findings and Analysis

Regardless of the participant’s role in decarbonizing ELACC’s properties, stakeholders agree that there is a lack of information around decarbonization; in particular, information around how to decarbonize and how to hold conversations around decarbonization. While it has been a learning process for all participants, stakeholders recognize that building decarbonization is necessary. High up-front costs, hidden costs, and government related barriers are among the other challenges that stakeholders repeatedly mentioned. Most interviews concluded with stakeholders offering advice for how to facilitate the decarbonization process. There are five major findings in this study that are summarized below.

Table 7. <i>Summary of Findings Accompanied by Supporting Statements</i>

A lack of knowledge around building decarbonization.
--

“The first challenge I would say was it wasn't very clear all the steps we needed to take to decarbonize
--

a building. We're just doing piece by piece, which is a bit overwhelming..." - Adalia Rodriguez
<p>A lack of tenant involvement in building decarbonization.</p> <p>"Solo con mi cuñada [he hablado porque] también vive aquí en el edificio. Yo le pregunte que porque no fue a la junta y dijo que no sabía"</p> <p>Translated as, <i>only with my sister-in-law [did I speak because] she also lives here in the building. I asked her why she didn't go to the meeting and she said that she didn't know about it</i> (Tenant, interviewed on February 10, 2023).</p>
<p>Limited funding and incentives program to support the implementation of building decarbonization.</p> <p>"Without access to capital or just resources to be able to do this work, it's going to be really difficult, especially for nonprofits..." - Ernesto Espinoza</p>
<p>A lack of action by the city to support the implementation of the pLAN.</p> <p>"Actually, I've been on the [CEMO] commission for about maybe six months now... We're not doing much anymore, and we need to figure out a purpose..." - Monica Mejia</p>
<p>A need for capacity building and collaboration among organizations to accomplish building decarbonization.</p> <p>We try to be inclusive and accessible...we can't necessarily be good at everything... AEA does not have the in-house expertise and experience on [translating and transcribing material]. We'd be relying on sort of partners to help collaborate and innovate on that." - Nick Dirr</p>

A Lack of Knowledge Around Building Decarbonization

All stakeholders mentioned how the limited information around building decarbonizing makes it difficult to understand building decarbonization and work towards achieving it. While stakeholders might have heard about decarbonization strategies and its related technologies, they were not familiar with the term “building decarbonization” itself. For example, one can assume stakeholders were more familiar with the terms “electrification,” “sustainability,” and “green” improvements/technologies by the number of times these terms were mentioned in comparison to decarbonization (75 times vs. 49 times). Because of how familiar they were with these terms, it made ELACC staff, for example, able to more easily understand what decarbonization may look like. Learning **how** to decarbonize was a whole other issue. There is a lack of information around decarbonization, more specifically on how nonprofit developers of affordable housing can

successfully decarbonize their buildings, after all ELACC is the ones “testing the waters” (Shaw interviewed on February 1, 2023).

A Need for Reliable Sources of Information

While organizations like AEA and LA-BBC might be well informed about building decarbonization, it is not their responsibility to teach organizations and their tenants about it. Thus, ELACC is currently developing various materials they plan to share with their tenants to provide them with an overview of what decarbonization is and the specific changes that will occur in the building they live in (Rodriguez, interviewed on January 26, 2023).

However, considering how ELACC is learning about building decarbonization through their own projects, they must be cautious when teaching property management and tenants about it. **There are many technical terms related to decarbonization that are not easily defined or translated so it can be easy to provide the wrong information** (Dirr, interviewed on January 27, 2023). If such a thing were to happen, the myths and misconceptions around decarbonization may be perpetuated, leading tenants to be wary about building decarbonization. In fact, the interviewed tenant brought up a question about the reliability of solar panels, stating that more information around decarbonization technologies is needed (interviewed on February 10, 2023).

A Need for Better Education Strategies

Two community members and one ELACC staff member explained how they first learned about decarbonization through the media and friends. However, what they learned was in regards to the city’s plan to electrify cars (Dieguez, interviewed on February 2, 2023; Leon interviewed on February 3, 2023; Tenant interviewed on February 10, 2023). Even though both the electrification of cars and the electrification of buildings are important, the former appears to be receiving more attention, suggesting **a need for better education and engagement**

strategies from both the city and nonprofit organizations alike. While it is true that the city has been making an effort to inform property managers about the decarbonization related programs, it is not enough. Frank Dieguez and Mauricio Elizalde describe how they learned about energy efficiency rebate opportunities from LADWP and applied due to the agreement of ELACC.

Without the agreement of property owners, tenants and property managers would not be able to decarbonize the building they live in. Despite an incentive existing, if property owners are not interested in building decarbonization due to being misinformed or simply lacking the knowledge on it, building decarbonization will be difficult to accomplish.

Challenges Related to a Lack of Knowledge Around Building Decarbonization

Several of the challenges mentioned in the stakeholder interviews can be attributed to the lack of information on building decarbonization. **Table 8** provides a list of these challenges in order of what was found to be more closely related to the finding discussed above, along with the total number of interviewees who mentioned these challenges. Considering how parallels can be found between what stakeholders mention and what was mentioned in the reviewed literature, categories were made according to what was previously discussed in the *Barriers to Building Decarbonization* section.

Table 8. *Summary of Challenges*

Building Decarbonization Challenges	Times Mentioned
1. Lack of Knowledge/Education	9
2. Timing/Convenience	5
3. Social/Cultural Barriers	4
4. Financial Costs and Hidden Costs	5
5. Governmental Barriers	6

Aligning Organizational Goals with Decarbonization Plans

As discussed in the section above, there is a need for information around building decarbonization, including information about the available decarbonization programs. Several of the existing programs such as LIWP, MAHEP, and CAMR **do not** explicitly state they are decarbonization programs. Thus, when searching for building decarbonization programs, one needs to be well informed about the related terminology. Once such programs are found (or even before that), finding the **right timing** and **motivation** to decarbonize is essential. Below is a table showing how organizations have done this.

Table 9. *Statements Describing How Nonprofit Organizations Are Decarbonizing*

Participant	Statement
Joshua Shaw	“So it's kind of aligning the organizational and like property goals and needs with what exists as far as current funding”
Nick Dirr	“Nonprofits are very aggressive in the sense that they've made it an organizational goal ”
Dave Hodgins	“I think we have been able to get people engaged because we say ‘ I hear you ’, I hear ‘health and well being of your residence is important,’ let's look at that more deeply.”

Adalia Rodriguez describes how ELACC became involved with LA Retrofit because decarbonizing their buildings would potentially reduce their operating expenses and stabilize rents (interviewed on January 26, 2023). Additionally, Mauricio Elizalde described how Property A requires a lot of maintenance and renovations due to its old building age so building decarbonization would be extremely beneficial for ELACC and the tenants (interviewed on February 3, 2023). ELACC is able to decarbonize their buildings due to **matching their organizational goals and needs to the available programs** (Shaw, interviewed on February 1, 2023). They are not the only ones to have done this, in fact, some organizations may amend their

organizational goals according to the priority of that year. This is a practice that is quite common among nonprofit organizations like ELACC already.

Planning for Decarbonizing

Even so, it might be challenging to do the above successfully when one is not well informed about the process. Adalia Rodriguez mentions how **some processes are taking longer than expected** due to requiring specific information. Although ELACC is ready to hire a contractor, they cannot do so until benchmarking is complete, a process that takes over two months (interviewed on January 26, 2023). Although ELACC could have completed the benchmarking prior to considering doing the actual decarbonization work, they did not because (a) they did not know it could be done before plans were completed and (b) did not know how to complete it. Some application processes can be difficult to complete especially if one does not have the background knowledge, pointing to the fact that the lack of information around building decarbonization is **hindering** work from being done. Additionally, as a nonprofit, ELACC has **limited staffing resources**, meaning that they must **balance** between the general operations of an organization and decarbonization (Hodgins, interviewed on February 14, 2023 and Dirr, interviewed on January 27, 2023). Currently, most of the decarbonization work is being done by three or four individuals who have other responsibilities within the organization. Considering how they are not experts and are still learning about decarbonization, it makes sense that they have been **slow** throughout the process.

Government Related Barriers

Before even considering whether ELACC's properties could be decarbonized, it was necessary for them to review all their loan and regulatory agreements to ensure that the planned changes would not conflict with the agreements (Shaw, interviewed on February 1, 2023). For

nonprofit developers of affordable housing, this can be a **tedious and challenging process** especially if one does not have the personnel or individuals with the right experience. Meanwhile Nick Dirr and Dave Hodgins describe how **getting the required permits for unit and building inspections can also be difficult** as this is another responsibility of the owner (Dirr, interviewed on January 27, 2023; Hodgins, interviewed on February 14, 2023). Adalia Rodriguez further adds that a Tenant Habitability Plan is needed before decarbonizing their buildings (January 26, 2023). The challenge with this is that it **takes time** to write and get approval from the city. Once approval has been given, the owner must notify tenants 60 days before the work begins. While not necessarily difficult, **going through this process can slow down** the work being done and even the resources being received (Hodgins, interviewed on February 14, 2023).

A Lack of Tenants Involvement in Building Decarbonization

Table 10. *Statements Describing Social and Cultural Barriers*

Participant	Statement
Dave Hodgins	“If people are having just a really tough time and then we come talking to them about this health survey or something that we're trying to do they're going to be like ‘No, no. I don't have time . I can't do that or...I don't think so”
Adalia Rodriguez	“The other thing is that many of our tenants work different hours ... I think that when the time comes to do the rehab, it's just going to be a big impact”
Nick Dirr	“You know, language sometimes can be a challenge. You know, just finding ways to share information can be a challenge”
Frank Dieguez	“I know that after the pandemic the attendance of the tenants definitely lowered down you...”

In order to engage tenants, they must be persuaded that building decarbonization matters which cannot be done without informing them about what it is. Additionally, the role of COVID-19 cannot be ignored in making the above happen. The pandemic greatly

affected how organizations like ELACC interacted with tenants because **relationship building happens most effectively in-person.**

In the month of January, ELACC arranged a meeting in which building decarbonization was to be introduced to the tenants of Property B, however they had a **low participation rate.** Besides COVID, another reason for this was because some tenants may work long and irregular hours, making them reluctant to attend meetings, especially if there is no incentive, such as refreshments or snacks (Dieguez, interviewed February 2, 2023 and Rodriguez, interviewed on January 26, 2023). ELACC needs to find a way in which to make building decarbonization a priority for tenants so that they become interested in learning and participating in ELACC's projects.

Tenant Concerns: Induction Tops

Besides the fact that tenants may need to switch out their cookware, their way of cooking may also change. The interviewed tenant describes how she has heard negative comments about cooking on electric stoves and fears the same may be true for induction cooktops. She explains how a demonstration of cooking on an induction cooktop would be helpful for herself and other tenants to understand the benefit of switching (interviewed on February 10, 2023). This stakeholder was open about talking and learning about decarbonization due to having attended a previous community meeting. However, to get her to attend the meeting, an ELACC staff member had to knock on her door. **There needs to be better communication between ELACC and tenants.**

Aligning Organizational Goals with Building Decarbonization Benefits

Making building decarbonization a priority is important not only for tenants but for organizations as well. One way to do this is by aligning one's organizational goals and needs

with the co-benefits of decarbonization. **Table 11** provides a list in alphabetical order of the benefits that stakeholders mentioned.

Table 11. *Building Decarbonization Co-Benefits*

-
1. Improved Air Quality & Health
 2. Increased Building Efficiency & Safety
 3. Mitigates Climate Change
 4. Reduced Utility Bills
-

Dave describes how LA-BBC has engaged organizations by listening to what their major concerns are and framing building decarbonization in a way that addresses those concerns. Through the use of several assessment tools, LA-BBC is able to provide projections of the health and economic impacts of decarbonization to every organization they partner with (Hodgins, interviewed on February 14, 2023). As a result, they can frame building decarbonization as ‘preventing x-amount of premature deaths and respiratory related hospitalizations’ to those concerned with the health and well-being of their tenants. Five stakeholders reference examples of how building decarbonization would help improve air quality and health in the short term, highlighting how it is especially beneficial for children and the elderly (Mejia, interviewed on February 1, 2023; Shaw, interviewed on February 1, 2023; Rodriguez, interviewed on January 26, 2023; Dirr, interviewed on January 27, 2023; Leon, interviewed on February 3, 2023).

Engaging Tenants Through Building Decarbonization Co-Benefits

Meanwhile, what may be the most attractive to tenants are the reduced utility bills because as Frank Dieguez and the Tenant from Property B point out, in the past few months there has been a notable increase in utility expenses (Dieguez, interviewed on February 2, 2023; Tenant, interviewed on February 10, 2023). Building decarbonization must be framed around the issues that directly impact people, such as rising rents or utility bills, in order to be successful

(Hodgins, interviewed on February 14, 2023). This is something that not only organizations like ELACC must do but also the city. To implement building decarbonization equitably and reduce the effects of climate change, those most affected by it must be prioritized.

Understanding the Potential (Hidden) Costs

ELACC must carefully consider what decarbonization pathway they will take because their **tenants run the risk of becoming burdened by utility costs**. For example, in the table below, the projected savings for not installing solar panels are displayed for each property.

Table 12. Projected Saving for Not Installing Solar Panels

Property A	Property B	
\$1,547/year	\$4,098/year	Projected Savings for ELACC
-\$758/year	\$18,805/year	Projected Savings for Tenants

Source: ELACC

Tenants in Property A would not benefit in this scenario. However, this does not necessarily mean that installing solar panels would bring their losses into the positive range. As Monica Mejia describes, when installing solar panels, **the direction and size of the roof matter** as it determines how much solar power can be generated (interviewed on February 1, 2023). If Property A is not apt for having solar panels installed, saving may continue to be negative.

Additionally, during the building assessment of Property A, lead and asbestos were found in the rooftop, meaning that besides the planned retrofits, ELACC must dedicate funding towards addressing this issue. Among the other **hidden costs** to consider are the expanding of closets to make space for equipment and cookware needed for the induction stoves (Mejia, interviewed on February 1, 2023). ELACC's goal, like that of many other nonprofits, is to ensure that housing stays affordable by charging tenants a fair rent. Thus, it is necessary that these hidden costs are

accounted for when planning to decarbonize, otherwise, costs may be passed onto tenants.

Meanwhile, in the case of Property B, ELACC found that regardless of whether solar panels were installed, tenants had great savings.

A Lack of Funding and Questionable Incentives Programs

Stakeholders emphasize how the first priority of ELACC, and other nonprofit developers of affordable housing, is to **ensure that housing stays affordable** (Mejia, interviewed on February 1, 2023; Espinoza, interviewed on January 24, 2023; Dirr, interviewed on January 27, 2023; Shaw, interviewed on February 1, 2023; Hodgins, interviewed on February 14, 2023). Considering how ELACC makes little income from its properties, it makes sense for them to have limited capital to complete these types of projects. **Table 13** provides a breakdown of ELACC's funding sources.

Table 13. *Financing the Decarbonization of Property A and B*

Capital Budget		
	Property A	Property B
Replacement Reserves	\$60,000	\$23,000
Incentives	\$164,000	\$824,000
Source TBD	\$169,000	\$10,000
Total Sources	\$393,000	\$857,000

Source: ELACC

While ELACC has been approved for the incentives they applied to, they will not be able to receive them until after the projects are completed and have passed inspection. This means

that a total of \$1.2 million (incentives + TBD) is still needed to cover the up-front costs. ELACC is fortunate in that they can consider a loan to cover the costs for Property B because the promise of incentives ensures they have evidence of being able to repay debt. However, whether this will be true for other nonprofit developers of housing is still questionable. According to Dave Hodgins, most decarbonization incentive programs, including the ones ELACC applied to, **do not have a stable and/or dedicated funding source** (interviewed on February 14, 2023). A stable source of funding is crucial for nonprofit developers like ELACC because of their tight budgets. Nonprofit developers of affordable housing run the risk of being left behind in making building decarbonization happen. While nonprofits may qualify and ‘receive’ incentives, it may take longer than expected to actually decarbonize. And as Nick Dirr points out, these incentives may not be available in the future, so nonprofit developers of affordable housing may become burdened with costs (interviewed on January 27, 2023). In the worst case scenario, nonprofit developers are forced to sell some of their properties resulting **in the loss of those affordable homes**. Ultimately, without a source of funding that organizations can rely on, decarbonization is least likely to be implemented.

Creating a City Budget for DACs

Despite the existence of incentive programs, **high up-front costs continue to be a problem** due to funds not being given until a project is completed. To make matters worse, these programs have **short lifespans and have no dedicated funding** (Hodgins, interviewed on February 14, 2023). Monica Mejia provides one suggestion that can help with this issue, stating that LA should reexamine their budget and **shift capital into a fund that dedicates investments into DACs** (interviewed on February 1, 2023). I would further argue that it would be more effective to create a budget that focused on building decarbonization because buildings are the

largest emitter of GHGs. By doing this, the city would also reach their building decarbonization goals and support the equitable implementation of building decarbonization.

City (In)Action in Implementing the pLAN

When asked about their perspectives on the building decarbonization goals set by the city of LA, most stakeholders had a positive outlook. These targets might be aggressive, but set a standard that stakeholders agreed to be achievable. Unfortunately, as pointed out by Monica Mejia, there is little being done to support the targets outlined in the plan. Monica Mejia points out that in the 6 months that she has been part of the commission not much has been done besides hiring a foundation to write a report that was submitted to the city council. There has been no talk about the recommendations made nor any communication with the new mayor (interviewed on February 1, 2023). This is even more true for the building decarbonization targets because when asked about the resources the city has made available for nonprofits, only Adalia Rodriguez, Dave Hodgins, and Nick Dirr were able to give a response, with two individuals providing the same answer (Rodriguez, interviewed on January 26, 2023; Dirr, interviewed on January 27, 2023; Dave Hodgins, interviewed on February 14, 2023). Additionally, no stakeholder was able to answer the question about whether the city was providing any resources to support tenant engagement, pointing to a lack of outreach or resources provided by the city. Despite the city making claims on the importance of tenant involvement for the equitable implementation of decarbonization, interviews revealed how the city is not supporting that (City of LA 2022a).

Accomplishing Building Decarbonization through Capacity Building and Collaboration

Among the advice provided by stakeholders, the importance of **collaboration and capacity** building was mentioned by multiple individuals (Mejia, interviewed on February 1,

2023; Shaw, interviewed on February 1, 2023; Dirr, interviewed on January 27, 2023; Hodgins, interviewed on February 14, 2023). Whether it be within an organization or among organizations, it is essential that different individuals/organizations are recruited **according to their area of expertise**. So far, ELACC has been successful due to their collaboration with organizations such as AEA, who provides them with technical assistance (interviewed on February 1, 2023). AEA cannot help ELACC with talking to tenants about the decarbonization technologies as this is not their area of expertise. As Nick Dirr and Dave Hodgins point out, they cannot be experts in everything, even if its related to decarbonization; thus, it is up to ELACC to do what they cannot or **find someone who can fill in the gaps** (Dirr, interviewed on January 27, 2023; Hodgins, interviewed on February 14, 2023). Ernesto Espinoza explains how they do this by connecting small mom-and-pop landlords and their own tenants to energy efficiency programs and/or organizations that do decarbonization work (interviewed on January 24, 2023). **CRCO recognizes that they do not have the capacity** to teach about decarbonization or guide others in doing this work; thus, they leave this to organizations who can.

Recommendations

Many recognize that the city of LA has not always had the best interest in mind for low-income, communities of color. Thus, several reports have been released describing their concerns and what can be done to implement decarbonization equitably. **Table 14** summarizes the recommendations they have made in relation to the decarbonization of existing housing.

Table 14. *Recommendations from Existing Reports*

Recommendations from Existing Reports
1. Develop better stakeholder engagement practices
2. Mandate tenants protections
3. Create incentives that target affordable housing

4. Offer free technical assistance for owners and contractors
5. Develop new financial tools
6. Develop a one-stop shop for retrofits
7. Combine government resources for the decarbonization of affordable housing
8. Improve the Tenant Habitability Plan Program and require it for decarbonization
9. Mandate holistic decarbonization retrofits that result in habitable, energy efficient, all-electric, and climate-resilient homes

Source: Jones 2021; Kirk 2021; Rosenberg et al. 2021

In addition to the recommendations mentioned above, there are a few additional steps that the city of LA, nonprofit developers of affordable housing, and other stakeholders can take to ensure the equitable implementation of building decarbonization. **Table 15** provides a list of the recommendations I developed according to the challenges and advice mentioned by stakeholders listed in the order of what is believed to be most to least feasible.

Table 15. *List of Recommendations*

<ol style="list-style-type: none"> 1. Reframe Building Decarbonization as a solution for developing healthy homes 2. Collaborate with community based organizations (CBOs) and EJ organizations to develop a tailored tenants engagement strategy
<ol style="list-style-type: none"> 3. Develop an equipment demonstration program 4. Establish a building decarbonization committee 5. Develop a network among nonprofit developers so they can exchange decarbonization resources 6. Set up a loan targeted to nonprofit developers of affordable housing 7. Create a budget dedicated to the decarbonization of existing affordable housing

A New Perspective on Building Decarbonization

The main reason the city is encouraging the decarbonization of buildings is because it would mitigate the effects of climate change, however as revealed through the interviews with

stakeholders, tenants and owners alike are more concerned about the issues that affect their immediate lives. Thus, the City must frame building decarbonization as a solution for healthy living in their pLAN, programming, and conversations. By doing so, tenants and owners alike may be more likely to become involved in building decarbonization and support its implementation.

Collaborate to Develop a Tailored Tenant Engagement Plan

Not all nonprofit developers of affordable housing have a tenant services program like ELACC, therefore it is essential that developers collaborate with local CBOs and EJ organizations to create a tenant engagement plan. To engage tenants, there must be trust between the two parties, thus partnering with organizations who have a positive reputation in the community, who have previously interacted with residents and/or have established relationships would facilitate the process of engaging tenants. Additionally due to their involvement in the community, they might know the best way to approach tenants so that they are willing to discuss building decarbonization. Additionally it would be helpful if CMOs and EJ organizations took the initiative to involve tenants so that they can pressure their landlord to not only decarbonize but also rehabilitate their units if needed.

An Equipment Demo Program

Considering how unknown net-zero technologies are to the general public, it would be helpful for LADWP to create a program that offers on-site equipment demonstrations. This program would be targeted towards tenants and owners of multi-family housing. In order to apply for a demo, the tenants/owners would have to be located in the area that LADWP provides their services and own or live in affordable housing, with priority being given to nonprofit developers of affordable housing. Bearing in mind that LADWP might not have the capacity to

do this, it would be ideal if a community based organization focused on sustainability could take on this responsibility. Either way, the goal would be for tenants and owners to experience these zero-net technologies and develop an understanding of how they work, their effectiveness, and whether it is worth the investment based on how comfortable and satisfied they feel. By bringing the equipment to the people, the public has a chance to voice their concerns, ask questions, and provide their feedback on the equipment; subsequently, enabling developers of net zero technologies to better understand their customers and reach them so that building decarbonization can be done equitably.

Building Decarbonization Committee(s)

To ensure the equitable decarbonization of buildings, the city developed milestones and initiatives meant to be accomplished by 2021. However, as learned by the case of ELACC and stakeholders, not much progress has been made in regards to building decarbonization. Therefore, I recommend that the city creates a committee focused on developing and overseeing the implementation of a city-wide plan for engaging tenants and nonprofit developers in building decarbonization. While CEMO does exist, their commission is involved in a broad range of climate related issues, therefore it is necessary that a separate committee focused only on building decarbonization is created. This committee would of course work with CEMO, nonprofits, and tenants to ensure that the plan being developed is feasible and equitable. Potential members can be identified through LA's list of qualified nonprofit developers of affordable housing, known developers of affordable housing who have participated in its incentive program, and through the recruitment of tenants involved in community organizations concerned with affordable housing, health, and/or sustainability.

Given that each neighborhood has different needs, it might be difficult for a single committee to create and oversee a plan that can be applied city wide, therefore it would be wise to create a committee at each of the 272 neighborhoods in LA. These committees would function in a similar fashion to neighborhood councils while also gathering data to develop a report on their neighborhood's progress. This would not only allow the city to identify the neighborhoods that require the most aid, but also track whether decarbonization strategies are being implemented equitably. Theoretically, the city would do this by comparing the progress of building decarbonization in DACs to non-DACs.

Develop a Network for the Exchange of Resources

In addition to a committee, it would be helpful to create a network among the nonprofit developers of affordable housing. The purpose of this network would be to identify individuals or organizations that can help facilitate the decarbonization of affordable housing. These individuals/organizations would be able to provide material, personnel, expertise, and/or funding sources that have been used and proven successful for the implementation of decarbonization strategies. In fact, I encourage an organization who has successfully decarbonized their affordable housing properties to spearhead this network by developing a website or actual physical network group that tracks the resources they are using to aid other organizations. The only difficulty with this is that no organization in LA is known to have successfully decarbonized an affordable housing property, or at least, none have been covered in the media or recognized by the city of LA. Additionally, due to their agreements, developers may be restricted from sharing who they contracted with, hindering them from sharing their resources through this network.

City Loan Targeting Affordable Housing Nonprofit Developers

As repeatedly mentioned throughout this paper, even with the existence of incentive programs, the high up-front costs are one of the biggest challenges and concerns with decarbonizing affordable housing. Thus, to facilitate and accelerate the process of building decarbonization, the city can offer a loan to nonprofit developers of affordable housing. Similar to a normal loan, this loan would be made available to organizations based on their ability to show proof of repayment, with priority being given to developers who are decarbonizing their properties for the first time. In this way, those who were unable to take advantage of available incentives can also decarbonize their buildings. Acquiring a loan for the decarbonization of housing would normally be difficult due to the risks involved with this type of project thus it is important that the city offers an alternative form of funds. By doing so, they can ensure that building decarbonization is implemented equitably.

A Decarbonization Budget for Existing Affordable Housing

In addition to doing the above, the city can also develop a budget for the decarbonization of affordable housing in DACs. In fact, one of the stakeholders mentioned how doing so would definitely help building decarbonization be implemented equitably. The way in which this would work is that a part of this budget would go towards supporting the current incentive programs so that they can continue to offer their services, another part would go towards supporting the creation of the committees previously mentioned, and another part would go towards supporting LADWP with the demo program. To develop this budget I would suggest that the police budget is reduced to move funds into a decarbonization budget. However, the likelihood of this happening might be low, thus it is more realistic for this budget to be developed from the House LA fund and the Inflation Reduction Act.

Conclusion

Although the process has not been smooth, ELACC has been able to successfully plan for the decarbonization of their portfolio and contrary to expectations, they are unlikely to pass on the up-front costs to tenants. This is one of the major concerns around ensuring building decarbonization is implemented equitably. While there are several benefits to building decarbonization, none of them would be worthwhile if tenants had to be burdened with the costs. Supporting mission based organizations, like ELACC, is important for the equitable implementation of decarbonization because they prioritize the well-being of their tenants.

Despite the challenges related to building decarbonization, the city should support building decarbonization because it would reduce utility bills, increase indoor and outdoor air quality, and overall provide a better quality of life. While the city of LA did pass an ordinance that would require new buildings to be all-electric, this is not enough. There are still many unknowns, thus based on the case of ELACC, to ensure building decarbonization is implemented equitably, a lot of funding, planning, outreach, and collaboration between organizations, the city, and community will be required. In the end this study provided a case for how decarbonizing affordable housing owned by a nonprofit developer would look like.

Limitations

There are several limitations in this study including a lack of stakeholder interviews and tenant engagement. I initially planned to interview one to two tenants from each property and survey a total of 40 tenants (10 from Property A and 30 from Property B). However, things did not go as planned due to several reasons. It is generally not allowed to post flyers in buildings without permission from property management, thus going through this process took some time. Additionally, even when posted, the likelihood of tenants taking the surveys was low due to there

being no incentive for taking the survey and a lack of knowledge around decarbonization. I planned to recruit tenants to survey through the tenant meeting held by ELACC, however these meetings had a low participation rate, suggesting a need for better engagement strategies. Additionally, being an intern at ELACC is a limitation in itself due to there being a certain extent of bias in this study and as a case study, this is limiting in itself because it is unknown whether what was found can be applied to other organizations.

Appendices

Appendix A: List of Low- and Zero-Carbon Technologies

1. Solar panels
2. Electric stoves
3. Induction cooktops
4. Heat pump water heater
5. Heat pump space heaters
6. LED lighting
7. Electric dryers

Appendix B: Interview Questions

Questions asked to ELACC Staff, Partners, and Related Organizations

1. Can you please state your name?
2. Can you please tell me the name of your organization?
3. What type of work do you do for your organization?
4. What is your perspective on the decarbonization building targets set by the City of LA for nonprofit organizations?
5. What are your perceptions of these goals in terms of achievability for your organization?
6. What are some challenges in decarbonizing or supporting the decarbonizing of affordable housing?
7. What resources have you been able to leverage for this (decarbonization) work?
8. As nonprofit developers of affordable housing, what factors influenced your decision to adopt a low-carbon design for the selected community?
 - a. What low-carbon design did your organization decide to adopt and why?
 - b. What policies or incentives influenced this decision?

9. What were the development teams' experiences with the design, construction, and operation of the selected community?
10. In what ways is the design, construction, and operation/maintenance of this lower-carbon building different from or similar to a typical building?
11. How have your experiences influenced decisions to build all-electric and/or ZNE buildings again in the future?
12. Have you designed or developed any lower-carbon buildings since the selected community? Why or why not?
13. What should affordable housing development teams do or not do when pursuing a lower-carbon project?
14. What resources are you able to leverage for this work? What resources or support has the city of LA made available to nonprofit developers to facilitate decarbonization work?
15. What are the key capabilities required to enable effective engagement between stakeholders (developers and residents)?
16. How can nonprofit developers effectively leverage stakeholder engagement as a resource to reduce the barriers associated with decarbonizing their building?

Questions Asked to Community Members

1. Can you please state your name?
2. In which community do you live?
3. How long have you lived there for?
4. How would you describe your relationship with ELACC?
5. How would you describe the current quality of your home?
6. How satisfied are you with living in this building?

7. Buildings use a lot of energy to maintain the systems used for everyday life (for example, gas for heating and cooking). When in use, these systems release carbon and other greenhouse gasses into the air that are harmful not only for the environment but for our health as well. Therefore, the city is working to make sure buildings reduce their carbon emissions by setting certain standards and goals. Do you know whether your building has plans to make changes to the systems in your building?
8. What do you think about having solar panels and electric appliances added to your home?
9. What do you think will happen as a result of your building going through these changes? What other changes would you like to see?
10. How involved have you been in the process of deciding what new technologies are added to the building you live in?
11. To what extent do you think that you should be involved in this process? Do you want to be involved in this process?
12. What are some concerns you have regarding the upgrades being planned for the building you live/work in?
13. The City of LA set goals to be net zero by 2050, meaning all systems that use gas, such as stoves, water heaters, cars, and more will no longer be used. Did you previously know about these goals? If so, how did you learn of them?
14. How involved do you think you should be in making this happen, as individuals and as a community?

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