URBAN RESIDENT PERCEPTIONS AND PREFERENCES OF LOCAL LARGE-SCALE SOLAR SITED ON BROWNFIELDS AND DISTURBED LANDS

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ABSTRACT

US federal and state agencies have advocated for the development of derelict, polluted, often post-industrial and urban sites, i.e. “brownfields,” with large-scale solar (LSS). So too have local officials, developers, industry experts, and rural community residents arguing LSS development of brownfields represents a ‘win-win-win’. They argue these developments face less opposition from local communities than rural development, are a pathway to remedy prior injustices, and can reutilize industrial sites rather than develop valuable farmland or natural habitats. Yet little research exists examining residents’ perceptions of LSS development of urban brownfields and the perceived local community impacts that accompany such development. This is a key gap and raises the question of whether these developments indeed promote justice and whether and how opposition may arise from local communities. Using the theories of place attachment, procedural justice, along with resident perception of benefits, this study examines urban resident perceptions and preferences of urban LSS developments. The study utilized a mail survey disseminated via the Every Door Direct Mail service provided by the United States Postal Office to gather data from urban residents in three Michigan communities living within one mile of an urban LSS development. The response rate to the survey across all three communities was 10.2%, with 158 complete surveys returned. Respondent support rates were found to be similar to previous studies that looked at large-scale grid-feeding solar developments, with the two significant predictors of support being positive perceptions of local benefits and procedural justice.

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1. INTRODUCTION

1.1. Background

In recent years US federal and state governments have promoted increasing development of renewable energy. At the close of 2021, renewable portfolio standards or clean energy standards had been adopted by thirty-one states and the District of Columbia (EIA, 2022b). Additionally in 2021, five states upped their commitment to renewable energy generation, including Nebraska, which adopted its first clean energy goal. Twenty states now have goals of one hundred percent clean energy generation by 2050 (EIA, 2022b). In 2022 the federal government passed the Inflation Reduction Act (IRA), which provides a number of incentives, including tax incentives for siting large-scale solar (LSS)[1] in communities with brownfield[2] sites (DOE, n.d.). And most recently, in 2023, the State of Michigan passed legislation requiring energy companies to meet a 100% clean energy standard by 2040 and switched from local to state permitting authority for large-scale renewable energy developments (King et al., 2023).

In conjunction with this push for more deployment, the cost of renewables has declined considerably. While the cost of onshore wind turbines has decreased from nearly $2,000 to $1,391 per kilowatt in 2013 and 2019, respectively (EIA, 2021b), solar project construction costs fell even more dramatically, driven by cost declines of crystalline silicon axis-based tracking panels. In 2013 the cost of solar project construction was over $3,500 per kilowatt. In 2019 costs had declined to $1,796/kilowatt (EIA, 2021b). The U.S. Energy Information Administration projects that by 2050, 44 percent of electricity generated in the United States will be from renewable sources with solar energy predicted to account for over half of this renewable capacity generation (EIA, 2022c). Already in 2023, solar power made up just over half of all new U.S. electric generation capacity brought online (EIA, 2023). Most of this solar power generation came from LSS (EIA, 2021a).

Mounting pressure for development is also running into community opposition. Solar development is land *intensive.* LSS, on average, requires approximately 7.5 acres of land per MW (Bolinger & Bolinger, 2022; Hartmann et al., 2016; Ong et al., 2013). Extrapolating from this calculation, projected demand for solar by 2050 brings the land needed for LSS in the US to

[1] LSS developments are ground-mounted solar installments producing at, or over, 1 megawatt (MW) of power (Crawford et al., 2022).

[2] For the sake of this proposal and study, brownfields are derelict, polluted and often post-industrial sites that have the potential for redevelopment (Spiess & De Sousa, 2016).

between 4.0 and 10.3 million acres (Ardani et al., 2021). Most communities in the US will likely be impacted by solar development in the next few decades (Gomez, 2022). Some local residents and communities are pushing back against this rush of development. There is increasing local – specifically rural – resident and community opposition to the siting of LSS projects (Crawford et al., 2022). The growing demand and need for renewable energy development along with growing opposition, highlights the importance of research into local resident and community perceptions.

Rural residents and communities have long been the focus of academic research into local resident opposition and/or acceptance of renewable energy development (Lundheim et al., 2022). Previous work has illuminated a number of influencing dynamics that impact local resident perceptions. The process by which development occurs has been found to be of key importance.

Until recently, research into renewable energy development process has predominantly focused on wind energy. Commonly cited development process issues include a lack of perceived fairness (Batel, 2020; Devine-Wright, 2008; Fast, 2013; Lundheim et al., 2022; Rand & Hoen, 2017; Wüstenhagen et al., 2007), trust (Rand & Hoen, 2017; Segreto et al., 2020; Wüstenhagen et al., 2007), participation (Batel, 2020; Lundheim et al., 2022; Rand & Hoen, 2017; Segreto et al., 2020; Wüstenhagen et al., 2007), transparency (Batel, 2020; Lundheim et al., 2022; Segreto et al., 2020), information dissemination (Segreto et al., 2020), and community influence (Batel, 2020; Lundheim et al., 2022; Wüstenhagen et al., 2007). The influence of development processes on perceptions is not limited to the period during or even immediately after project completion; it also can have a long reaching impact. Some residents who perceive unfair development processes have been found to perceive far more negative impacts of development long after the project is completed (Mills et al., 2019). Many of these issues are integral to the theory of procedural justice (Jenkins et al., 2016; G. Walker, 2009) and centering procedural justice has been posited as crucial in garnering more positive perceptions of development (Lundheim et al., 2022).

Another crucial factor in creating positive local perceptions of renewable development is the final outcome. Previous work has framed this as the distribution of material (largely energy and economic) benefits and costs, and shows the distribution of benefits can have significant impacts on local perceptions (Leer Jørgensen et al., 2020; Lundheim et al., 2022; Rand & Hoen, 2017; Segreto et al., 2020). Resident concerns with distributive fairness may be intra-community (Lundheim et al., 2022; C. Walker & Baxter, 2017), rural vs. urban (Rand & Hoen, 2017), local

vs. multinational extra-local corporations (Rand & Hoen, 2017) and even about the overall amount of financial resources provided to the local community (C. Walker & Baxter, 2017).

In addition to the development process and distribution of outcomes, the location and scale of renewable energy development has a large impact on resident perceptions (Ek & Persson, 2014; Nilson & Stedman, 2022; van der Horst, 2007). While most prior research has focused on wind development, there has been some recent work exploring LSS location, scale, and perceptions. Nilson and Stedman (2022) demonstrated that while national public opinion of solar energy is high, these polls almost never specified the scale of solar (Nilson & Stedman, 2022). They found that overall utility-scale solar (defined as over 100 acres in size, grid-connected and privately or corporately owned) had significantly lower support than community (subscriptions based, and less than 50 acres) and rooftop solar (Nilson & Stedman, 2022). Residents in the Southwestern US preferred LSS to have different proximity from various land types (Carlisle et al., 2016). Preferences for LSS siting included between 1-5 miles distance from residential, cultural, and recreational areas and greater than or equal to 11 miles distances from a wildlife migration route or breeding area (Carlisle et al., 2016). Respondents to a national survey likewise preferred solar development to be sited at least 5 miles from their homes (Sharpton et al., 2020). Rural residents have also argued that LSS development should not occur on prime agricultural land or natural habitat– preferring it be sited on less productive farmland or on brownfields and industrial land (Crawford et al., 2022; Nilson & Stedman, 2022).

Rural residents are not alone in seeing brownfields as good locations for LSS development. The Environmental Protection Agency (EPA) has promoted brownfields as a sustainable development option for siting LSS, stating that these developments could be a "win – win solution for the community and developer" (EPA, 2015). Renewable energy and LSS development of brownfields have also been positioned as a way to enact justice, and to make up for historical injustices in marginalized, overburdened, and underserved communities (Hanke et al., 2021; Heeter & Reames, 2022). This is especially relevant in urban communities that have faced historical environmental and energy injustice and are already facing climate injustice. US federal and state agencies are promoting development in these communities as a way to remediate and reduce this legacy pollution (White House, n.d.).

In addition to these rural stakeholders and government agencies, industry experts perceive that development of brownfields with renewable energy will be met with less opposition. Sixty

percent of experts (brownfield developers and consultants) interviewed in 2016 reported finding less public opposition to redeveloping brownfields verses conventional renewable energy projects (Spiess & De Sousa, 2016). Yet little research exists examining resident perceptions of LSS development on urban brownfields and perceived – and real – local community impacts that accompany such development.

Instead, research on brownfield LSS development has focused on technical and economic factors. The EPA's RE-Powering America's Land initiative that seeks to promote renewable energy development on brownfields is a prime example. (EPA, 2015). Its factsheet emphasizes benefits for local communities such as the raising of adjacent property values and boosting of tax revenue. A 2013 study prepared jointly by the Environmental Protection Agency and the National Renewable Energy Lab, titled *Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills,* focuses almost exclusively on what the authors term as common technical challenges (Kiatreungwattana et al., 2013). These challenges range from design aspects such as stormwater management, landfill cap management, and site security to construction and operational elements including site preparation and adhering with post-closure landfill maintenance and monitoring plans (Kiatreungwattana et al., 2013).

This grey literature is light on social and community elements. In *Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills,* less than one page is devoted to community engagement content (Kiatreungwattana et al., 2013), despite arguing that community engagement *should be* done, and that redevelopment *should* align with local community visions for the site. The report fails to go into detail or suggest best practices for community engagement.

When social dynamics or barriers are mentioned in these reports, they are rarely based on direct interviews or surveys of local residents, and are instead cultivated from secondhand interviews or surveys of experts and government officials. In their report for the Michigan Land Bank, a team of University of Michigan researchers outlined five key challenges for solar development on Michigan brownfields: environmental liability, utility control and resistance, higher cost of developing on brownfields, identification of ideal development sites, and community acceptance (Schaap et al., 2019). Although community acceptance is noted as one of the barriers, the researchers did not interview residents directly – noting community perceptions

secondhand through interviews with Michigan government representatives, solar developers, and other non-resident stakeholders (Schaap et al., 2019).

Academic research into brownfield development suggests that communities may want more from development than just economic benefits. One theme present is a strong preference for parks, sports, and community cultural centers (Greenberg & Lewis, 2000; Martinat et al., 2018). Business, retail and industry uses, such as factories and warehouses, were the least preferred brownfield development options (Greenberg & Lewis, 2000; Martinat et al., 2018). Understanding these preferences is crucial because alignment of brownfield redevelopment with local community visions and lifestyles is important for short and long-term perceptions of the redevelopment (Letang & Taylor, 2013).

Urban communities hosting brownfields are not monolithic and each community has different preferences regarding redevelopment pathways. A recent paper studying local resident preferences in two Czech cities demonstrates the impact of spatial and contextual elements on brownfield redevelopment preferences (Navratil et al., 2018). Residents in one city had stronger preferences for refurbishment while the other city residents preferred demolition (Navratil et al., 2018). Across both cities residents preferred demolition for inner city brownfields and refurbishment for brownfields in city outskirts and centers (Navratil et al., 2018).

All of this raises the questions of whether LSS development of brownfields does indeed promote justice and whether and how opposition may arise from local communities. Using theories of place attachment, procedural justice, along with perceptions of local benefits, this study aims to examine urban resident perceptions of a brownfield LSS development.

1.2. Theoretical Frameworks and Perception Drivers

Place attachment, procedural justice, and the distribution of benefits are three important themes within renewable energy perceptions research. They have been shown through previous work to provide strong explanations for dynamics that have significant impacts on local resident perceptions. These theories will guide my examination of resident perceptions of – and justice implications from – an urban LSS development.

1.2.1. Place Attachment

Place attachment refers to a positive emotional bond, that goes beyond cognition, preference or judgment, between individuals and their environment (Jorgensen & Stedman, 2001) with significant correlation to length of dwelling (Devine-Wright, 2009). Strong local attachment has been found to correlate with more negative perceptions about proposed renewable development (Devine-Wright, 2009; Devine-Wright & Howes, 2010). Local place attachment has also been shown to be an important motivator in community-led renewable energy projects and at the same time being a key source of disagreement (van Veelen & Haggett, 2017). Place attachment has also been utilized in understanding resident and local community perceptions of urban brownfield redevelopment (Letang & Taylor, 2013).

1.2.2. Procedural Justice

Procedural justice focuses on the fairness of decision-making and planning processes (Jenkins et al., 2016; G. Walker, 2009). Four key components make up procedural justice: information accessibility, access to participation and efficacy in decision-making process, unbiased decision-makers, and access to impactful legal processes (Sovacool, 2022). The theory of procedural justice was selected specifically for this study due to process issues illuminated from prior fieldwork at a brownfield-solar case study site. When interviewed, local residents were not aware of the future LSS development. Additionally, both developers and local government officials expressed difficulty in disseminating information about the development to residents (D. Bessette et al., 2023).

1.2.3. Perceived Benefits and Benefit Drivers

Industry experts, government officials, and developers have touted the many potential benefits for local communities stemming from brownfield and urban disturbed land redeveloped with LSS. These marketed benefits have included an increase in adjacent home and/or property values (EPA, 2015), cheap energy provided to the local community (EPA, 2015; Oake, 2016), and the clean-up, remediation and overall ‘improvement’ to a once blighted site (Balaskovitz, 2019; City of Coldwater News, 2018; Oake, 2016). What, if any of these benefits do local residents perceive getting from their local solar development? And how well do these perceptions match the actual benefits reported? This research seeks to explore some of these questions.

Exploring residents' perception of local benefits provided from the solar development is not only important for better understanding predictors of support and opposition but is also important for assessing the truth to the narrative asserted by industry experts, government officials and developers about the positive aspects of these developments. Residents' perceptions of benefits may serve as one signal for how positive or negative the impact from development is having on the community.

1.3. Research Objectives

This research was guided by and sought to examine several key objectives. The structure of my results and discussion were designed to match the below order of objectives for the purpose of clarity. The research objectives (RO) of this research are:

- **RO1**: *Examine urban residents' levels of support for or opposition towards their local LSS brownfield and disturbed land development.*
- **RO2**: *Examine the impact that place attachment, perceived procedural justice, and perceived local benefits have on urban resident perceptions toward LSS brownfield and disturbed land development.*
- **RO3:** *Explore relationship between different perceived benefits and overall local benefits perceived.*
- **RO4**: *Examine urban resident redevelopment preferences for their local LSS development site.*

A fifth research objective involves examining the efficacy of a particular survey method, which will be introduced in the methods section below, but is included here for consistency:

- **RO5**: *Test efficacy of Every Door Direct Mail in eliciting urban resident preferences and perceptions.*

2. METHODS

2.1. Study Developments & Sites

Three Michigan communities were selected to investigate the research questions posed above. These communities are located in Coldwater, Cadillac, and Detroit, Michigan. These three communities/developments were selected based on a few parameters. The solar needed to be developed in an urban community, on a brownfield site, be LSS, and be developed recently. An additional selection criterion was demographic diversity in the neighboring residents. Due to the limited number of Michigan urban brownfields developed with solar some of the sites meet most, but not all, of the selection criteria. Additionally, these three sites had the benefit of being preliminary reviewed (Schaap et al., 2019). I was limited to three sites due to cost and time constraints.

For this study I defined urban in line with the US Census Bureau as areas that have "at least 2,000 housing units or have a population of at least 5,000" (US Census Bureau, 2023). As of the 2020 census, the Census Bureau lists Coldwater, Cadillac and Detroit as qualified urban areas (US Census Bureau, 2022). The sites in Cadillac and Coldwater are both formally recognized brownfields by Michigan's Department of Environment, Great Lakes, and Energy (EGLE). The O'Shea Solar Park in Detroit is not a formally recognized brownfield. However, the site was disturbed land and was previously the location of a playground, sports fields and decommissioned recreation center (Schaap et al., 2019). The solar developments in Detroit and Coldwater are both over 1MW and can be classified as LSS, the Cadillac solar development comes in at only ½ MW, but the project does take up 5 acres – which is close to the 7.5-acre per MW average of LSS. All three solar developments are relatively recent, coming online in the past 6-7 years. Note about census demographic data below – this is a best approximation of community demographics via the closest census analysis unit. The census tracts used do not perfectly align with the USPS mail routes used in this study. Table 1 below shows a quick overview of demographics for each site.

Table 1. Demographic comparison of the three study sites. All numbers reported as percentages.

	Coldwater *Census Tract 9514*	**Cadillac** *Census Tract 3807*	**Detroit** *Census Tract 5451*	**Michigan**
Population	4689	2,771	1,026	10,057,921
Age				
20-24	6.3	6.2	6.4	6.9
25-34	12.6	13.8	15.4	13.0
35-44	12.1	13.9	11.4	11.9
45-54	9.7	10.4	14.2	12.4
55-64	12.1	13.6	11.2	13.9
65 or older	16.7	15.5	12.7	17.8
Gender				
Male	48.8	49.4	49.8	49.6
Female	51.1	50.6	50.2	50.4
Nonbinary	x	x	x	x
Race/Ethnicity				
white	94.2	90.4	2.1	73.9
Black/African American	2.3	0.7	93.4	13.7
Hispanic/Latino/a	7	2.5	0.8	5.6
Asian	2.4	1	0	0.6
American Indian/Alaska Native	1.5	0.7	0	0.0
Native Hawaiian/Other Pacific Islande	0.1	0	0	3.3
Some other race	6.6	1.2	0.3	2.2
Two or more races	3.9	6	4.2	6.3
Residential Tenure				
Rent	42	43.6	41.7	26.8
Own	58	56.4	58.3	73.2
Education Level				
High school or more	84.9	89	78.7	59.7
Bachelor's degree or more	9.7	12.5	5.5	32.1
Employment				
Employed	41.6	52.1	31.3	58.7
Unemployed	2.5	x	25.4	2.9
Median Household Income	$38,446	$45,489	$16,563	$68,505

2.1.1. Coldwater, Michigan

Coldwater, Michigan is located in central southern Michigan. As of 2020 its population was 13,822: 11,202 white[3], 1,133 Hispanic/Latino/a, 1,010 Black/African American, 137 Asian, 52 American Indian/Alaska Native, 1 Native Hawaiian/Other Pacific Islander, 532 some other race, and 888 two or more races (US Census Bureau, n.d.-e). Coldwater has a 48% employment rate, 5,050 housing units, 4,518 households, 12.2% with bachelor degrees or higher, and a median household income of $48,531 (US Census Bureau, n.d.-e).

Drilling down, census tract 9514 is the most granular/closest census analysis unit to the Coldwater solar development. This census tract, as of 2020, has a population of 4,689: 4,129 white, 329 Hispanic/Latino/a, 60 Black/African American, 40 Asian, 11 American Indian/Alaska Native, 0 Native Hawaiian/Other Pacific Islander, 146 some other race, and 303 two or more races (US Census Bureau, n.d.-d).

Prior to the solar development the 7-acre site was the location of the Midwest Foundry until its closure and demolition in 1990 (City of Coldwater News, 2018). The foundry manufactured gray iron and shell castings (Ruhe & Anderson, 1984). This Coldwater resident reminisces on the importance of the foundry to him and his father. It's worth quoting here in full:

> "When I graduated from Coldwater, High School, in June of 1969, my father had a plan. On the first of October in 1969 I would turn 18. He set out to insure [*sic*] my future. On my birthday Dad said I got you a job at the foundry. Dad was employed at Midwest Foundry from 1951, the year I was born, until 1986, the year my son was born. He was a member of the union and served as union secretary for several years. He considered the job as his best hope for the future and wanted it to be mine also." (Old Sneelock, 2011)

Due to the previous industrial use and an oil leak from Coldwater Board of Utilities tanks adjacent to the property, the site is contaminated with three classes of contaminants: chlorinated and semi volatile organic compounds, elements/metals/other organics and petroleum volatile and semi volatile organic compounds (EGLE, n.d.-a; Schaap et al., 2019). The site remained vacant up until the solar development – which became operational in February 2018.

[3] An important caveat here is that the largest minority population in Coldwater, Michigan are Arab Americans (Barnes & Cialdella, 2017) – whom the federal government currently categorizes as white in the census (Kai-Hwa Wang, 2023). 9% of the Coldwater population is currently estimated to be Arab American (Zip Atlas, 2024).

For years the City of Coldwater wanted to turn the vacant lot into a public park for the community (Siegel, 2008). However, this was prevented due to the site being a formal brownfield under the regulation of EGLE. Additionally, the owner of the site, Marmon, was hesitant to sell or lease the site due to concerns about inherent liability. Finally, the City of Coldwater was able to acquire the land on a lease from Marmon in 2015 after six years of contract negotiations and revisions. One of the main conditions was that the solar installation could not penetrate the ground – necessitating large concrete ballasts being utilized instead (Schaap et al., 2019).

The solar development became operational in February of 2018. It covers 7-acres, produces 1.3MW and is owned and operated by NextEra and all output is bought by CBPU (Schaap et al., 2019). Notably there were no direct carve-outs for local residents and no subscriptions. Figure 1 below shows the site from above before and after the solar development, as well as street levels views from before and after.

Figure 1: Coldwater site pictures. Top left image was before solar development and was taken 04/23/17 (image credit: Google Earth). Top right image was taken after solar development on 09/19/20 (image credit: Google Earth). Bottom left is street view before (image credit: Google Earth) and bottom right is street view after the solar development (image taken by author).

2.1.2. Cadillac, Michigan

Cadillac, Michigan is located in the Northwest region of Michigan's lower peninsula. As of 2020 its population was 10,371: 9,477 white, 306 Hispanic/Latino/a, 100 Black/African, 80 Asian, 55 American Indian/Alaska Native, 0 Native Hawaiian/Other Pacific Islander, 105 some other race, and 554 two or more races (US Census Bureau, n.d.-a). Cadillac has a 51.4% employment rate, 4,956 houses, 4,391 households, 18.6% with bachelor's degrees or higher and a median household income of $45,123 (US Census Bureau, n.d.-a).

Drilling down, census tract 3807 is the closest and best fit census analysis unit to the Cadillac solar development. This census tract, as of 2020, has a population of 2,771: 2,506 white, 69 Hispanic/Latino/a, 19 Black/African American, 27 Asian, 52 American Indian/Alaska Native, 0

Native Hawaiian/Other Pacific Islander, 33 some other race, and 82 two races or more (US Census Bureau, n.d.-b).

Prior to the construction of the solar development the site had been utilized for manufacturing starting in 1894. The site had last been the location of a Mitchell-Bently plant – which was in operation until 1989 and burned down in 2013 (Lamphere, 2019). Both from the previous industrial use, and from the burned down Mitchell-Bently plant, the site was estimated to have several types of contaminants, including chlorinated volatile and semi volatile organic compounds and approximately 9,000 cubic yards debris that contained asbestos (EGLE, n.d.-b; Lamphere, 2019).

The City of Cadillac was able to acquire state grants and loans via Michigan's brownfield redevelopment program – and used this money to clean up the site starting in the fall of 2019. The solar development became operational in June 2021 (Balaskovitz, 2019; Consumers Energy, 2024). The installation produces ½ MW and covers 2.77 acres of the larger brownfield. Consumers Energy buys all of the power from the development. There are no direct benefits provided to local residents, and there is no virtual net-metering (Schaap et al., 2019). Although Consumers Energy customers are able to purchase power from the development for a small added cost via its Solar Gardens program(Consumers Energy, 2024; Schaap et al., 2019). Figure 2 below shows the site from various perspectives and at various different times.

Figure 2: Cadillac site pictures. Top left image was taken 05/23/13 before the plant burned down and the top right image was taken 05/06/18 after the plant burned down (image credit: Google Earth). Bottom right was taken on 05/29/2021 and is after the solar development was constructed (image credit: Google Earth) and the bottom left image is a street side view of the solar development on the site taken 11/01/23 (image taken by author).

2.1.3. Detroit, Michigan

Detroit, Michigan is located in Southeast Michigan. As of 2020 it had a population of 639,111: 68,407 white, 51,269 Hispanic/Latino/a, 496,534 Black/African American, 10,193 Asian, 2,931 American Indian/Alaska Native, 160 Native Hawaiian/Other Pacific Islander, 29,681 some other race, 31,205 two or more races (US Census Bureau, n.d.-f). Detroit has an employment rate of 47%, 309,913 housing units, 243,243 households, 17% with bachelor's degrees or higher, and a median household income of $36,453 (US Census Bureau, n.d.-f).

Drilling down, census tract 5451 is the closest/best fit census analysis unit to the O'Shea Park solar development. This tract, as of 2020, has a population of 1,026: 958 Black/African American, 8 Hispanic/Latino/a, 22 white, 0 Asian, 0 American Indian/Alaska Native, 0 Native Hawaiian/Other Pacific Islander, 3 some other race, 43 two or more races (US Census Bureau, n.d.-c).

Prior to the development of the solar project, the site was the location of a decommissioned playground, sports fields, and closed recreation center. The recreation center was closed in January 2006 – ostensibly due to underutilization and poor condition. However, some local residents perceive this not to be the case and blame city budget cuts (Urbanoutdoors, 2007). These same residents recall playing on the ball fields and also how much the site has changed (Paulmcall, 2007), especially how much the development of the I-96 Highway cut into the park's size (see Figure 3 below).

The O'Shea solar project was conceived around 2015-2016 with talks between Detroit Mayor Mike Duggan's administration and local utility DTE. The local community was only

Figure 3: Detroit site pictures (historic). The top image from 1967 shows O'Shea Park before the development of the I-96 Highway. The bottom image shows the park in 1981 after I-96 development. Image credit: (Quozl, 2007).

informed of the solar project after the proposal and solar development agreements had been signed for the park (Schaap et al., 2019). The solar development went online in 2017 (Fujita et al., 2023), it covers 9.6 acres of the 20 acre park site and produces 2.44MW annually (Schaap et al., 2019). The energy produced goes into the larger grid and not specifically to any local DTE customers.

As to benefits, the City of Detroit will collect about one and a half million dollars in taxes over the 20-year project lease as well as an approximated value-add of a half million dollars in maintenance savings on city property surrounding the solar development that DTE agreed to take care of. The original plan for the solar development included nothing for the community or park but the solar installation itself. After feedback from the community a few elements were added, including new walking paths, a community gathering space, some new trees/flowers, and resurfaced basketball courts. Additionally, a job training program "put Grandale and surrounding neighborhood residents to work" (J. Ranck Electric, n.d.) with almost 40 percent of electrical apprentice labor coming from the park's local residents. Notably, the local residents do not receive cheaper electricity, nor subscriptions to the development (Schaap et al., 2019). Figure 4 below shows the site above/street level from before the solar development and Figure 5 shows the site after the development was installed.

Figure 4: Detroit site pictures (pre-solar). The top image was taken 12/31/01 before the closure of the O'Shea community center (image credit: Google Earth ©2023 Sanborn). The bottom image was taken 07/2013 when the community center was closed but not yet demolished (image credit: Google Earth ©2024 Google).

Figure 5: Detroit site pictures (with solar). Both the top and bottom images were taken after the solar development and new park area were constructed. The top image was taken 08/01/22 and the bottom image was taken 07/2022 (image credits: Google Earth ©2024 Google).

2.2. Mail-Based Surveys

While they might seem a bit antiquated – mail-based paper surveys have still been shown to achieve adequate response rates (Dillman et al., 2014). Indeed, they may have better response rates than telephone or even web-based survey methods in some instances. Previous research has also demonstrated respondent preference for answering surveys via mail when given the option of responding via mail or the internet (Dillman et al., 2014). Additionally mail surveys have

certain advantages over other survey methods. Namely, they may be better for surveying small or specific populations not reachable via the internet, allow for respondent anonymity, are more appropriate for open ended questions, and since they are self-administered by respondents may provide more flexibility (Grubert, 2017). Unfortunately, there has been a significant decline in response rates to mail survey research in the last few decades, dropping from an average of 77% in the 1970s to 43% this past decade and a projected 21% in the 2030s (Stedman et al., 2019). With this in mind, this mail-based survey research, as well as the limitations of the specific method detailed in the next subsection, does not seek the random sampling-generalization nexus but instead as Stedman (2019) phrases it aims "towards depth/stories/narratives that build theory" (Stedman et al., 2019). As such, I acknowledge, but do not justify low response rates and have tempered my findings and conclusions accordingly.

2.2.1. Every Door Direct Mail

This research utilized a specific type of mail-based survey method disseminated via the United States Postal Service product Every Door Direct Mail. Every Door Direct Mail (EDDM) is a USPS census-style, mail postal-route saturation program designed for marketing and advertised to small businesses, restaurants and realtors as a way to reach local customers at affordable prices (USPS, 2017). Users of the program are able to select specific USPS mail routes to send their mailings at the current rate of $0.203 for EDDM Retail® USPS Marketing Flats. However, these cheaper rates come with the caveat that most of the handling work needs to be done by users/customers and with specific limitations on mail piece formatting (USPS, 2017). While intended for marketing, there is the opportunity for EDDM as a suitable method to disseminate surveys. Indeed, there is a nascent literature on the efficacy of EDDM surveys.

Previous work has shown EDDM to be an effective medium for surveys. This work has demonstrated that EDDM has both strengths and weaknesses over traditional addressed mail surveys and that EDDM is better for specific use cases. In terms of strengths, EDDM-based surveys are more anonymous, may solicit less sociable responses, are less resource intensive (both labor and cost), and might solicit responses from more demographically aligned respondents (Al-Muhanna et al., 2023; Grubert, 2019). Potential weaknesses include an inability to conduct household-level sampling, inability for selective nonresponse follow-up, required minimum mailing size, and difficulty with calculating accurate response rates (Grubert, 2019). Grubert (2019) recommends the following conditions for a survey-based study that might be a

good fit for EDDM: geographically based, resource constrained, specific and limited population, and potentially sensitive topic.

Recent qualitative work looking at urban brownfield solar perceptions has illuminated several issues, namely local officials and developers having difficulty getting information to and from urban residents (Bessette et al., 2024). While more qualitative work is needed, I sought to reach as many urban residents as possible. With this prior work in mind, along with the above conditions – specifically its anonymity – I chose EDDM as the mechanism for disseminating surveys for this thesis research. While previous research has demonstrated the general efficacy of EDDM as a vector for surveys, EDDM has not yet been tested as a way to survey resident renewable energy perceptions or redevelopment preferences.

2.3. Data Collection

Data for this research was collected via EDDM between August 8th, 2023 and January 3rd, 2024. Surveys that arrived after the January 3rd cutoff were counted in response rates, but not in the data analysis for the survey measures nor development preferences.

2.3.1. Survey Design and Procedure

A two-contact approach was used for this survey via EDDM for contacting anonymous respondents along three USPS mail routes. These mail routes were all selected due to their immediate proximity to each site's solar development. In total across all three sites 1,554 houses were intended for contact. Broken down by site: 638 households in Coldwater, 459 households in Cadillac, and 457 households in Detroit were intended for contact. Number discrepancies were due to differently sized mail routes and the EDDM requirement of mailing all households on a mail route. (For the images of the specific USPS mail routes contacted see Appendix B, Figures 6 - 8.)

Each of the 1,554 households were intended to be contacted twice, first with the complete survey packet – comprised of an outer envelope (9 x 12 inches), eight-page survey questionnaire booklet (8.5 x 11 inches), a Business Reply Mail Envelope (8 7/8 x 3 7/8 inches), and a crisp 2-dollar bill. Because this mail-survey was sent via EDDM, no addressing or stamping was needed on the outer envelope. Instead, an EDDM indicia provided by the USPS was printed on directly. Business Reply Mail (BRM) envelopes were procured through Michigan State University's Mail Processing Department, thus return address and required BRM markings came pre-printed on. A label with the researcher's departmental mail address was added manually to the BRM envelope

via applied adhesive label (Brand: Avery, Item# 5160). These labels were purchased blank and printed on via a personal printer and the 5160 Avery label template. A post-questionnaire reminder postcard (9 x 6.5 inches) was sent to every household after approximately two weeks. This reminder postcard included a QR code and URL for access to an online version of the questionnaire. The two-dollar bill was placed over the front page of the questionnaire. This was oriented to be at the top of the outer envelope so the 2-dollar bill would be seen immediately when the envelope was opened. (For the survey questionnaire see Appendix A, for images of all other survey materials see Appendix B, Figures 9-13)

2.3.2. Measurements and Survey Questions

The survey instrument had a total of 35 questions, some of which were later combined to form scales. (See Table 1 below for a quick look at key variables and scales measured).

Table 2: Key variables measured.

Independent Variables	Values	Dependent Variables	Values
Place Attachment	1-5 (Likert-type scale)	Support/Opposition	1-5 (Likert - type item)
Perceived Procedural Justice	1-5 (Likert-type scale)	Benefits	1-5 (Likert - type item)
Benefits	1-5 (Likert - type item)		
Preferences	1-5 (Likert - type items)		

The first page of questions (questions 1-3) concerned the interactions and understandings of respondents with the solar development and development process. Question 4, the main dependent variable, asked specifically about support/opposition levels of the solar development. This was a 5-point item specific response scaled from (“Extremely Supportive”) to (“Extremely Opposed”).

The next ten questions (questions 5 – 14) asked about various perceptions related to the solar development process, the development itself, and solar development in general. These questions were scaled on a five-point Likert-scale from (“Strongly Agree”) to (“Strongly Disagree”). Questions 15 and 16 were asked to get a better understanding of the respondent’s interaction with the development site itself and their proximity. Since this survey was disseminated via EDDM, it

was not possible to ascertain where specifically a respondent lived aside from the along the mail-route used. Thus question 15 asked if they could see the project from their house, and question 16 asked how often they saw the solar project. I intentionally did not ask for the specific address so as to protect their anonymity and encourage less sociable responses.

Questions 17-19 asked about respondent knowledge of the existence of a solar community subscription option as well as if they were subscribed and if not, if they would sign up if this option was offered. Questions 20-23 make up the place attachment scale and are measured along a 5-point Likert scale from ("Strongly Agree") to ("Strongly Disagree"). These questions have a long history of use in measuring place attachment and were first used in making a place attachment scale in Jorgensen & Stedman (2001). Most recently this scale was used in Nilson & Stedman (2023) to measure the relationship between place attachment and solar opposition in New York State residents. Question 27 and its sub questions ask about resident preferences for redevelopment options of the solar site. These questions were based on questions asked in Greenberg & Lewis (2000). Questions 29 and 29 concerned the concept of 'fair share' both in regards to one's perceptions about whether they experience their fair share of energy infrastructure and fair share of desirable/undesirable land uses.

The remaining five questions were demographic in nature. Demographic characteristics requested included race/ethnicity, gender, education level, employment status, household income, length of residence in area, length of family residence in area, type of residence (own/rent), and year born.

The perceived procedural justice scale was made from a composite of several different questions and was based on the definition of procedural justice defined by Sovacool & Dworkin (2015) as including: access to information, meaningful participation in decision-making process, and lack of decision-maker bias. Two questions were dropped due to low Cronbach's alpha scores.

2.4. Data Analysis

Data was analyzed via SPSS software package: version: 29.0.0 (241). All data tables and data figures were generated via Microsoft® Excel® for Microsoft 365 MSO (Version 2312 Build 16.0.17126.20132) 64-bit.

2.4.1. Correlations and Regressions

Correlations between variables were calculated using Spearman's rank correlation and regressions were calculated via binary logistic regressions. These calculations were performed following the methods and instructions outlined in Pallant (2016). Spearman's rank correlations were done to assess relationships among the data. Specifically, to examine and compare the various factors across the three different study sites. Two direct logistic regressions were performed on the overall data to assess predictors of perceived local benefits and predictors of support/opposition. Regression results are reported as outlined by Pallant (2016) and correlation results are reported as outlined by Bobbitt (2021).

2.4.2. Response Rates

Response rates were calculated using the American Association for Public Opinion Research (AAPOR) Response Rate 1 (RR1) formula:

Figure 6: Response rate 1 formula. RR = response rate, I = complete survey, P = partial survey, R = refusal and break-off, NC = non-contact, O = other, UH = unknown household occupancy status, UO = unknown/other (AAPOR, 2016).

$$RR1 = \frac{I}{(I + P) + (R + NC + O) + (UH + UO)}$$

Put plainly, RR1 does not calculate any undeliverable/ineligible surveys and is simply the number of completed surveys[4] over the total number of surveys sent out (AAPOR, 2016).

RR1 was chosen due to the unique nature of EDDM surveys. Because EDDM is an anonymous USPS mail route saturation method, calculating undeliverables/household occupancy status is not possible. Additionally, RR1 has been used previously to calculate response rate for EDDM surveys (Grubert, 2019).

2.4.3. Cost & Time

All material costs and EDDM processes described are all from the time period of June 7th 2023 through November 15th 2023. Total costs that are reported include survey materials and

[4] For the purpose of calculating response rates in this research, an 80% completion rate of questions equaled a 'complete survey', 50-80% completion of questions equaled a partial and less than 50% equaled break off (AAPOR, 2016).

costs, such as printing, BRM envelopes, adhesive labels, USPS mailing costs, and driving/gas costs.

All survey preparation was timed via stopwatch and calculated including the stuffing of envelopes and the counting/organization of materials to be 'EDDM ready'. Driving time was also calculated and accounted for. Other times if noted are approximate, such as the purchasing of supplies and pre-survey research (conversations with USPS employees, BRM test runs, reading USPS EDDM regulations).

2.4.4. Demographics

Demographic data from U.S. Census Bureau was compared with self-reported resident demographic data. Self-reported data was compared with tract level U.S Census data. Analysis was done via a simple division of the sample proportions by the census population proportions for each of the demographic characteristics (Grubert, 2019) (see Table 2). This test was done by Grubert (2019) to compare EDDM and addressed mail survey demographics with census demographics.

3. RESULTS

3.1. Respondent Demographics

All respondents lived in close proximity to their respective solar developments. Due to the nature of EDDM exact addresses were not able to be known – however, with the mail routes used all respondents were within one mile of the solar development. Nearly 20% of respondents reported being able to see the development from their home, while 72% reported seeing the development at least weekly (with just under 46% reporting seeing it daily).

Out of the overall survey sample 80.2% self-reported as white, 14% as Black/African American, 1.2% as Hispanic/Latino/a, 0.6% as Asian, 1.2% as American Indian/Alaskan Native, 0.6% as Native Hawaiian/Pacific Islander, 2.4% as some other race, and 1.8% as two or more races. 45.9% reported identifying as male, 53.5% female and 0.6% nonbinary. 51% of survey respondents reported being employed, while 2.5% were unemployed. 64.3% had a high school degree or more and 35.7% had a bachelor's degree or more. The median household income range reported was $25,000 - $49,000. 75% reported owning their house while 24.4% reported being renters.

3.1.1. Coldwater

92.3% of the Coldwater respondents self-reported as white, 1.5% as American Indian/Alaskan Native, 1.5% as Asian, and 4.6% as some other race[5]. 56.9% reported identifying as male, 41.5% as female, and 1.5% as nonbinary. 43.8% of Coldwater respondents reported being employed, while 3.2% were unemployed. 70% had a high school degree or more and 30% had a bachelor's degree or more. The median household income reported was $50,000 – $74,999. 70.1% reported owning their house while 29.9% reported renting.

3.1.2. Cadillac

95.4% of the Cadillac respondents self-reported as white, 1.5% as Hispanic/Latino/a, 1.5% Native Hawaiian/Pacific Islander, 1.5% some other race, and 1.5% two or more races. 41.8% reported identifying as male, and 58.2% as female. 60.3% of Cadillac respondents reported being employed, while 1.5% were unemployed. 60.3% had a high school degree or more and 37.6%

[5] As noted in section 2.1.1, the federal government does not currently have a category for Arab Americans in the census. For consistency, I did not include an Arab American category here either. However, it is important to note that 2 of the 69 Coldwater respondents selected other and wrote in Middle Eastern and Arabic. Unfortunately, it is not possible to know whether any of the respondents who reported as white would have selected Arab American or Middle Eastern if given the option.

had a bachelor's degree or more. The median household income reported was $25,000 - $49,000. 80.8% reported owning their own house while 19.2% reported renting.

3.1.3. Detroit

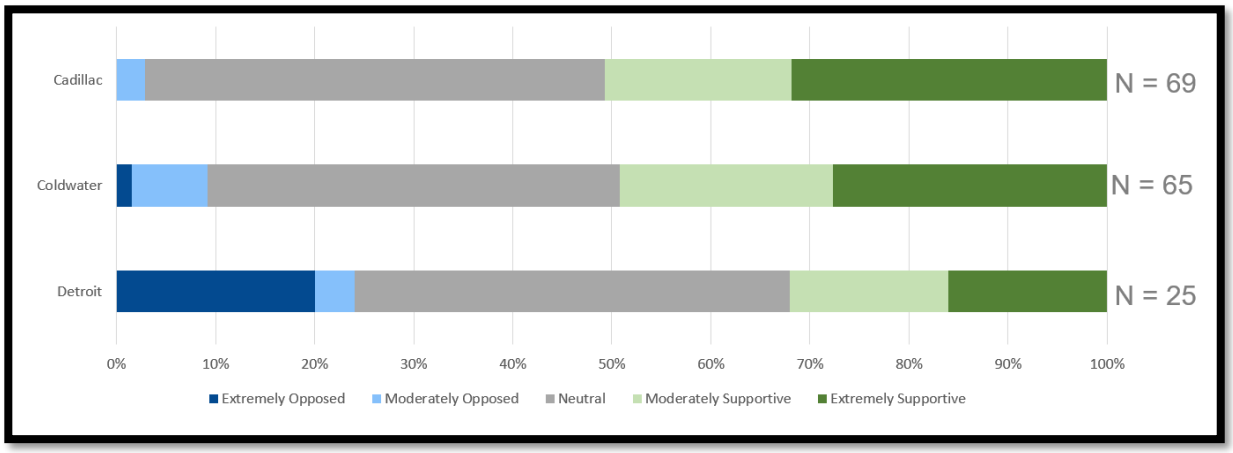
11.5% of the Detroit respondents self-reported as white, 84.6% as Black/African American, 3.8% as Hispanic/Latino/a, 3.8% as American Indian/Alaskan Native, 3.8% as some other race, and 7.8% as two races or more. 29.6% identified as male, and 70.4% identified as female. 44% of Detroit respondents reported being employed, while 3.7% were unemployed. 56% had a high school degree or more and 44% had a bachelor's degree or more. The median household income reported was $50,000 - $74,999. 75% reported owning their house while 25% reported renting.

3.2. Support/Opposition

RO1: *Examine urban residents' levels of support for or opposition towards their local LSS brownfield and disturbed land development.*

Overall, across all three study sites combined, 47.2% of respondents were supportive of their local solar development, 44% were 'neutral', and 8.8% of respondents were opposed. Support/opposition of local solar development differed across the three sites. 49.2% of respondents in Coldwater were supportive of their local solar project, 41.5% were neutral, 9.2% were opposed. In Cadillac 50.7% of respondents were supportive, 46.4% neutral and 2.9% opposed. 32% of Detroit respondents were supportive of their local solar development, 44% neutral, and 24% were opposed to the development. Figure 7 below shows a visual breakdown of support/opposition across the three study sites.

Figure 7: Level of support/opposition measured across study sites.



3.2.1. Place Attachment, Perceived Procedural Justice, and Perceived Local Benefits

RO2: *Examine the impact that place attachment, perceived procedural justice, and perceived local benefits have on urban resident perceptions toward LSS brownfield and disturbed land development.*

RO3: *Explore relationship between different perceived benefits and overall local benefits perceived.*

The first direct logistic regression was performed to analyze the impact of place attachment, perceived procedural justice, and perceived local benefits on respondent's likelihood to report support towards their local solar development. This model contained a total of 6 independent variables (gender, age, residency length in community, place attachment, perceived procedural justice, and perceived benefits)[6]. The full model containing all predictors was statistically significant, X^2 (6, N = 138) = 67.70, p <.001, indicating that the model was able to distinguish between respondents reported support and respondents who did not report support of their local solar development. The model as a whole explained between 38.8% (Cox and Snell R square) and 51.8% (Nagelkerke R square) of the variance in reported support and correctly classified 82.6% of cases. As shown in Table 3 below, only two of the independent variables made a unique statistically significant contribution to the model: perceived benefits and perceived procedural justice. Perceived procedural justice recorded an odds ratio of 8.85, indicating that respondents who perceived the development process to be more just were nearly nine times more likely to have reported support for the solar development. Perception that the solar development provided benefits recorded an odds ratio of 8.39, indicating that respondents who perceived the solar development provided benefits to their local community were just over eight times more likely to report support for the development, controlling for all other factors in the model.

[6] Controlling for each site, such as including them as dummy variables, was not possible due to the small number of responses in Detroit.

Table 3: Summary of logistic regression predicting support of urban solar development.

Variable	*B*	*SE*	*OR*	95% CI	Wald Statistic	*p*
Perceived benefits	2.17	0.511	8.36	[3.080, 22,827]	17.312	<.001
Place attachment	-0.257	0.275	0.773	[.451, 1.325]	0.875	0.35
Perceived procedural justice	2.181	0.665	8.854	[2.403, 32.627]	10.74	0.001
Gender	0.464	0.463	1.59	[.641, 3.944]	1.002	3.944
Age	-0.011	0.016	0.989	[.958, 1.022]	0.426	0.514
Residency length in community	-0.019	-0.012	0.981	[.958, 1.006]	2.306	0.129

Note. Cl = confidence interval for odds ratio (*OR*)

The second direct logistic regression was performed to analyze the impact of a number of factors on respondent's likelihood to report that they perceived the solar development provides benefits to their local community. The model contained a total of 7 independent variables (gender, education, age, residency length in community, perception of reduced price from solar development, perception of site looking better after solar, perception of house and property being worth more, and perception of solar benefiting community more than other developments). The full model containing all predictors was statistically significant, $X^2(11, N = 138) = 63.38$, p <.001, indicating that the model was able to distinguish between respondents who reported and did not report a perception of benefits from the solar development. The model as a whole explained between 36.8% (Cox and Snell R square) and 50.0% (Nagelkerke R square) of the variance in reported benefits and correctly classified 80.4% of cases. As shown in Table 3 below, only two of the independent variables made a unique statistically significant contribution to the model: perception of reduced price and perception of site looking better. The strongest predictor of reporting perceived benefits was a perception of reduced price, recording an odds ratio of 54.99, indicating that respondents who perceived the solar development reduced energy prices were over fifty-four times more likely to report perceiving that the solar development provided benefits for their local community, controlling for all other factors in the model. Perception that the site looked better after solar development had an odds ratio of 3.24, indicating that respondents who perceived the site as looking better were over three times more likely to report

perceiving that the solar development provided benefits for their local community, controlling for all other factors in the model.

Table 4: Summary of logistic regression predicting perception of local benefits provided.

Variable	*B*	*SE*	*OR*	95% CI	Wald Statistic	*p*
Perception of reduced price	4.007	0.853	54.985	[10.334, 292.550]	22.075	<.001
Perception of site looking better	1.175	0.599	3.24	[1.002, 10.470]	3.857	0.05
Perception house and property worth more	-0.016	0.889	0.984	[.172, 5.613]	0	0.985
Perception solar benefiting community more that other developments	0.88	0.56	2.411	[.805, 7.222]	2.47	0.116
Age	0.009	0.017	1.009	[.976, 1.043]	0.275	0.6
Residency length in community	0.001	0.014	1.001	[.976, 1.029]	0.009	0.922
Gender					0.834	0.659
Gender (1)	-0.435	0.477	0.647	[.254, 1.647]	0.834	0.361
Gender (2)	16.486	40192.969	14445234.219	[.0,]	0	1
Education					1.855	0.603
Education (1)	-0.541	0.6	0.582	[.180, 1.888]	0.812	0.368
Education (2)	0.07	0.63	1.073	[.312, 3.687]	0.012	0.911
Education (3)	0.428	0.799	1.533	[.320, 7.342]	0.286	0.593

Note. Cl = confidence interval for odds ratio (*OR*)

3.2.1.1. Place Attachment

Spearman's rank correlation was computed to assess the relationship between respondent place attachment and support for local solar development. This computation was done for all respondents across all three study sites combined, as well as for each specific site.

No significant correlation was found between overall respondent place attachment and solar development support.

There was a positive correlation between place attachment in Coldwater and support of the local solar development, $r(62) = .35$, $p = .005$.

There was no significant correlation between place attachment in Cadillac and support of the local solar development.

There was no significant correlation between place attachment in Detroit and support of the local solar development.

3.2.1.2. Perceived Procedural Justice

Spearman's rank correlation was computed to assess the relationship between respondent's perceived procedural justice and support for local solar development. This computation was done for all respondents across all three study sites combined, as well as for each specific site.

There was a positive correlation between overall perceived procedural justice and support for local solar development, $r(154) = .63$, $p < .001$.

There was a positive correlation between perceived procedural justice in Coldwater and support for the local solar development, $r(61) = .72$, $p < .001$, as well as in Cadillac, $r(66) = .58$, $p < .001$, and in Detroit, $r(23) = .52$, $p = .008$.

3.2.1.3. Perceived Local Benefits

Spearman's rank correlation was computed to assess the relationship between respondent perceptions of benefits and support of the local solar development. This computation was done for all respondents across all three study sites combined, as well as for each specific site.

There was a positive correlation between perceived benefits overall and support of the local solar development, $r(153) = .61$, $p < .001$.

There was a positive correlation between perceived benefits in Coldwater and support of the local solar development, $r(63) = .58$, $p < .001$, as well as in Cadillac, $r(65) = .65$, $p < .001$, and in Detroit, $r(23) = .60$, $p < .001$.

Spearman's rank correlation was also computed to assess the relationship between respondent perceptions of different benefits and perception of overall benefits from the local solar development. This computation was done for all respondents across all three study sites combined.

There was a positive correlation between perceived reduction in price and overall benefits, $r(163) = .77$, $p < .001$, a negative correlation between perceiving the site looked worse after solar and overall benefits, $r(162) = -.27$, $p < .001$, a positive correlation between perceiving increase in house and property value after the solar development and overall benefits, $r(160) = .32$, $p < .001$, and finally a positive correlation between perceiving the solar development benefited the local community more than other development types and overall benefits, $r(161) = .52$, $p < .001$.

3.3. Redevelopment Preferences[7]

RO4: *Examine urban resident redevelopment preferences for their local LSS development site.*

Figure 8 below shows overall respondent preferences between their local solar development and other redevelopment options[8]. A few of the redevelopments that respondents across all three study sites most strongly preferred over solar were housing (55%), a community center (40%), and parks (48%).

Figure 8: Overall respondent redevelopment preferences. Green denotes higher percentages of preferences while red denotes lower.

Site Development Preference (Overall)	Strongly prefer the solar project over this option (%)	Slightly prefer the solar project over this option (%)	No preference between the two (%)	Slightly prefer this option over the solar project (%)	Strongly prefer this option over the solar project (%)	
Housing	7.2	5.2	32.7	20.9	34.0	N = 153
Stores	12.2	14.3	40.1	16.3	17.0	N = 147
Factories	23.8	12.2	38.8	16.3	8.8	N = 147
Restaurants	15.5	14.9	33.1	24.3	12.2	N = 148
Warehouses	22.4	16.3	45.6	12.9	2.7	N = 147
Parks	8.7	6.7	36.7	19.3	28.7	N = 150
School	9.7	10.3	44.8	15.9	19.3	N = 145
Community Center	8.1	10.1	42.3	17.4	22.1	N = 149
Sports	14.4	11	45.2	15.8	13.7	N = 146
Childcare	10.5	7.9	42.1	19.7	19.7	N = 152
No development	24.3	11.8	54.2	4.9	4.9	N = 144

Overall respondent preference for housing outnumbered solar preference by a 4.5 to 1 margin. I also assessed preferences for redevelopment amongst those who were supportive of their solar project. 43% of those who were supportive of the solar development preferred housing, outnumbering supporters who prefer the solar development by a 2 to 1 margin. Preference for community centers outnumbered solar development preference by a 2 to 1 margin. 27% of those supportive of the solar development preferred a community center, tying with

[7] It is important to note, that due to contamination and the formal/legal classification of two of these sites as brownfields some of these redevelopment options would not have been possible without extensive site remediation. The survey instrument informed respondents of this with the specific language "Please note that many of these options are not possible due to previous industrial site use".

[8] n values vary due to some respondents not answering all of the preference questions. These responses were still included given that participants had completed 80% or more of all survey questions.

supporters who preferred solar to a community center at 1 to 1 margin. Preference for parks outnumbered preference for the solar development by a 3 to 1 margin with 37% of those supportive of the solar development having preference for parks.

In contrast, 39% of residents across all three sites preferred the solar development over a warehouse, 36% preferred solar over factories and 36% preferred solar over no development. Respondent preference for solar outnumbered warehouse preference by a 2.5 to 1 margin with 31% of those opposed to the solar project preferring solar over warehouse development. Preference for the solar development outnumbered no development by a 4 to 1 margin. 23% of those opposed to the solar project preferred the solar development over no development.

A set of Spearman's rank correlations were computed to assess the relationship between resident redevelopment preferences and solar development support. There was a negative correlation between preferences for all other developments other than solar and support of the solar development. Correlation values ranged from $r(137) = -.24$, $p = .005$, to $r(138) = -.486$, $p < .001$. (For specific correlations of each development preference see Appendix C, Table 6

3.3.1. Coldwater

Figure 9 below shows Coldwater respondent preferences between their local solar development and other redevelopment options, 42% of Coldwater respondents preferred housing to the solar development, 31% preferred a community center to the solar development, and 41% preferred parks.

Figure 9: Coldwater respondent redevelopment preferences. Green denotes higher percentages of preferences while red denotes lower.

Site Development Preference (Coldwater)	Strongly prefer the solar project over this option (%)	Slightly prefer the solar project over this option (%)	No preference between the two (%)	Slightly prefer this option over the solar project (%)	Strongly prefer this option over the solar project (%)	
Housing	16.7	10	31.7	16.7	25	N = 60
Stores	15.5	8.6	39.7	17.2	19	N = 58
Factories	27.1	10.2	37.3	15.3	10.2	N = 59
Restaurants	25	5.4	30.4	28.6	10.7	N = 56
Warehouses	24.6	12.3	40.4	19.3	3.5	N = 57
Parks	17.2	5.2	36.2	15.5	25.9	N = 58
School	17.5	7	52.6	14	8.8	N = 57
Community Center	15.5	6.9	46.6	15.5	15.5	N = 58
Sports	19.3	10.5	40.4	15.8	14	N = 57
Childcare	18.3	8.3	40	16.7	16.7	N = 60
No development	31.6	7	45.6	10.5	5.3	N = 57

Coldwater respondent preference for housing outnumbered solar preference by a 1.5 to 1 margin. 25% of those who were supportive of the solar development in Coldwater preferred housing, outnumbering supporters who prefer the solar development by a 1.7 to 1 margin. Preference for community centers outnumbered solar development preference by a 1.4 to 1 margin. 17% of those supportive of the solar development preferred a community center, outnumbered by supporters who preferred the solar development by a 2.2 to 1 margin. Preference for parks in Coldwater outnumbered preference for the solar development by a 1.8 to 1 margin with 36% of those supportive of the solar development having preference for parks.

In comparison, 37% of Coldwater respondents preferred the solar development to warehouse development, 37% preferred solar to factories, and 39% preferred the solar to no development. Preference for the solar development outnumbered warehouse preference by a 1.6 to 1 margin and for solar over no development by a 2.5 to 1 margin. 50% of Coldwater respondents opposed to the solar project preferred a warehouse over the solar development and 33% of those opposed preferred the solar project over no development.

3.3.2. Cadillac

Figure 10 below shows Cadillac respondent preferences between their local solar development and other redevelopment options. 59% of Cadillac respondents preferred housing to

the solar development, 36% preferred a community center to the solar development and 42% preferred parks.

Figure 10: Cadillac respondent redevelopment preferences. Green denotes higher percentages of preferences while red denotes lower.

Site Development Preference (Cadillac)	Strongly prefer the solar project over this option (%)	Slightly prefer the solar project over this option (%)	No preference between the two (%)	Slightly prefer this option over the solar project (%)	Strongly prefer this option over the solar project (%)	
Housing	1.4	1.4	37.7	27.5	31.9	N = 69
Stores	10.8	18.5	46.2	13.8	10.8	N = 65
Factories	16.9	12.3	43.1	18.5	9.2	N = 65
Restaurants	10.4	19.4	43.3	17.9	9	N = 67
Warehouses	18.2	18.2	51.5	10.6	1.5	N = 66
Parks	4.5	9	44.8	25.4	16.4	N = 67
School	4.7	14.1	48.4	20.3	12.5	N = 64
Community Center	4.5	13.4	46.3	17.9	17.9	N = 67
Sports	12.1	12.1	53	16.7	6.1	N = 66
Childcare	4.5	9	47.8	25.4	13.4	N = 67
No development	20	16.9	55.4	1.5	6.2	N = 65

Cadillac respondent preference for housing outnumbered solar preference by 21.2 to 1 margin. 56% of those who were supportive of the solar development in Cadillac preferred housing, outnumbering supporters who preferred the solar development by a 9.5 to 1 margin. Preference for community centers outnumbered solar development preference by a 2 to 1 margin. 26% of those supportive of the solar development preferred a community center, matching supporters who preferred solar at a 1.3 to 1 margin. Preference for parks among Cadillac respondents outnumbered preference for the solar development by a 3.1 to 1 margin with 32% of those supportive of the solar development having preference for parks.

In contrast, 36% of respondents in Cadillac preferred the solar development to warehouse development, 29% preferred solar to factories, and 37% preferred the solar to no development. Preference for the solar development outnumbered warehouse preference by a 3 to 1 margin, and for solar over no development by a 4.8 to 1 margin. 50% of Cadillac respondents opposed to the solar development preferred solar over warehouse development and 50% of those opposed preferred the solar development to no development at all.

3.3.3. Detroit

Figure 11 below shows Detroit respondent preferences between their local solar development and other redevelopment options. It is important to note the lower number of responses (n = ~24) used to conduct these analyses. Nevertheless, 75% of Detroit respondents preferred housing to the solar development, 71% preferred a community center, and 80% preferred parks.

Figure 11: Detroit respondent redevelopment preferences. Green denotes higher percentages of preferences while red denotes lower.

Site Development Preference (Detroit)	Strongly prefer the solar project over this option (%)	Slightly prefer the solar project over this option (%)	No preference between the two (%)	Slightly prefer this option over the solar project (%)	Strongly prefer this option over the solar project (%)	
Housing	0	4.2	20.8	12.5	62.5	N = 24
Stores	8.3	16.7	25	20.8	29.2	N = 24
Factories	34.8	17.4	30.4	13	4.3	N = 23
Restaurants	8	24	12	32	24	N = 25
Warehouses	29.2	20.8	41.7	4.2	4.2	N = 24
Parks	0	4	16	12	68	N = 25
School	4.2	8.3	16.7	8.3	62.5	N = 24
Community Center	0	8.3	20.8	20.8	50	N = 24
Sports	8.7	8.7	34.8	13	34.8	N = 23
Childcare	8	4	32	12	44	N = 25
No development	18.2	9.1	72.7	0	0	N = 22

Detroit respondent preference for housing outnumbered solar preference by a 17.9 to 1 margin. 57% of respondents supportive of the solar development in Detroit preferred housing with 0 supporters preferring the solar development. Preference for a community center outnumbered solar development preference by an 8.5 to 1 margin. 63% of those supportive of the solar development preferred a community center with 0 supporters preferring the solar development. Detroit respondents' preference for parks outnumbers solar development preference by a 20 to 1 margin with 63% of those supportive of the solar development having preference for parks and 0 reporting preference for the solar development.

In contrast, 50% of Detroit respondents preferred the solar development to warehouse development, 56% to factories, and 37% to no development. Preference for the solar development outnumbered warehouse development preference by a 6 to 1 margin and there were

no Detroit respondents who reported preference for no development over solar. 40% of Detroit respondents opposed to the solar development preferred solar over warehouse development and all respondents opposed to the solar development reported no preference between the solar development and no development.

3.4. Every Door Direct Mail

RO5: *Test efficacy of Every Door Direct Mail in eliciting urban resident preferences and perceptions.*

3.4.1. Response Rates

The overall response rate (RR1) for this survey was 10.2%, with a total of 158 complete responses to 1,554 surveys sent out. Overall, 11 partial and 7 break off surveys were returned as well. For Coldwater, the response rate was 9.9%, with 638 surveys sent out and 63 complete surveys returned (4 partials and 2 break offs were also returned.) The response rate in Cadillac was 14.6%, with 67 complete surveys returned out of the 459 that were mailed out. Cadillac had 5 partials and 5 break offs returned as well. Detroit had a response rate of 6.1%, with 457 surveys sent out, 28 complete and 2 partials returned.

3.4.2. Cost

The total material cost of this survey, including the complete survey mailer, post-mailer postcard, EDDM postage, and transportation costs was approximately $9,989.67. With 1,554 total households surveyed, this equates to $6.36 per household. A more detailed breakdown of materials and cost is provided in Table 5 below.

Table 5: Material costs for a 1,554 household EDDM survey in Michigan, 2023.

Budget Item	Total Cost	Cost per unit	Notes
Post-mailer postcards	953.84	0.61	6.5" h x 9" w. Front color, back black. Picked up.
8 - page survey booklets	3497.2	2.22	11"h x 8.5"w. Front color, back black. Stapled. Picked up.
Incentive ($2)	3152	2	New & crisp.
Outer 'catalog' envelope	1090.56	0.69	9"h x 12"w. Two colors: green & black. Picked up.
BRM return envelope	315.2	0.2	Procured from MSU with BRM preprinted.
EDDM postage	615.38	0.4	For survey mailer and post-mailer.
Driving Costs	365.49	0.24	Calculated using IRS 2023 standard milage rate for business (0.655/mile).
Total	9989.67	6.36	

As outlined above, the overall response rate for this survey was 10.2%, with 158 complete surveys returned, bringing the overall cost per response to $63.23. Cost per response for each of the three study sites was: Coldwater $67.17, Cadillac $43.57, and Detroit $103.80.

3.4.3. Time

The time required for preparation or 'stuffing' of all survey materials was approximately just under 34 labor hours or 2,020 labor minutes. Three people in total were involved in survey material preparation – two of whom had no prior survey preparation experience (and none of whom had prepared surveys for EDDM previously). Average time per survey packet put together was 1.28 minutes (note this average time also included a period of applying labels to the BRM return envelopes). Average time did improve over the process, with an average of 1.33 minutes per survey packet for the first study site and a 1.18 minute per packet average for the last study site.

After the survey packets were prepared, they had to be counted and organized for mailing via EDDM. This took approximately 30 minutes for each of the three study sites. An additional 30 minutes was spent per study site counting and organizing the post-mailer postcards. Thus, bringing total time spent on all survey material preparation and organizing to an approximate 36.67 labor hours. This survey could've been prepared in under one 40-hour work week.

3.4.4. Demographics

Survey sample demographics and census demographics were compared to assess how representative the sample demographics were. Analysis was done via a simple division of the

sample proportions by the census population proportions for each of the demographic characteristics (Grubert, 2019). The specific census tracts related to each survey sample and/or study site are detailed above in subsection 2.1. For Table 2 below, a value of 100% demonstrates a perfect match between the sample proportion for that characteristic and the population proportion. A value below 100% indicates that the characteristic was underrepresented in the survey sample, and a value over 100% indicates an overrepresentation of that demographic characteristic in the survey sample compared to the population (Grubert, 2019). Across all three sites, survey respondents were older, had a higher rate of owning their home, were better educated, and were better paid. In Coldwater, the median household income ranged from $50,000 - $79,999 compared to $38,446 for census tract 9514. Cadillac survey respondents had a median household income of $25,000 - $49,000 compared to $45,489 for census tract 3807 and finally Detroit survey respondents had a median household income of $50,000 - $74,999

Table 6: Percentage of site demographics as a percentage of census tract demographics. 100% = sample demographics and population demographics are perfect match, x = characteristic was not recorded in census data, n = characteristic was not present in sample, 0.0 = not present in either.

	Coldwater sample population proportion / Coldwater population proportion (%)	Cadillac sample population proportion / Cadillac population proportion (%)	Detroit sample population proportion / Detroit population proportion (%)
Age			
20-24	25.4	46.8	n
25-34	65.1	42.8	59.1
35-44	81.0	148.2	199.1
45-54	118.6	84.6	95.8
55-64	257.0	183.8	243.8
65 or older	225.7	227.7	215.0
Gender			
Male	116.5	84.6	59.4
Female	81.1	115.0	140.2
Nonbinary	x	0.0	0.0
Race/Ethnicity			
white	98.0	105.5	547.6
Black/African American	n	n	90.6
Hispanic/Latino/a	n	60.0	475.0
Asian	62.5	n	0.0
American Indian/Alaska Native	100.0	n	x
Native Hawaiian/Other Pacific Islander	n	n	0.0
Some other race	69.7	125.0	1266.7
Two or more races	n	25.0	181.0
Residential Tenure			
Rent	71.2	44.0	60.0
Own	120.9	143.3	128.6
Education Level			
High school or more	82.4	67.8	71.2
Bachelor's degree or more	309.3	300.8	800.0
Employment			
Employed	105.3	115.7	140.6
Unemployed	128.0	x	14.6

compared with census tract 5451's of $16,563. Further analysis was also done comparing the overall survey sample to Michigan's population in general. That information can be found in Appendix C, Table 7.

3.5. Comments & Concerns

Many of the survey respondents left detailed comments in their responses (just over 34% of returned surveys had written comments). These comments often addressed one or more of the research objectives this research set out to examine and they provide a more contextual framing to some of the analysis above.

There were many comments addressing the process of solar development itself. Many of them highlight a lack of information provided regarding the development – especially before the project began. Take this comment from a Coldwater respondent:

> "I never heard about the solar project until work was being done and I started asking questions. It would be nice if everyone had more info on things like this."

Here is one from a Cadillac respondent addressing process too:

> "I didn't like the lack of clarity and information of the project before it was voted on by the City Council. The time frame of the project also was a big issue, could have been handled better"

Detroit respondents by far had the most to say regarding their local solar development process. One respondent wasn't even aware of the development until they "rode" past. This respondent was not alone in not getting information about the development as another respondent outlines "No information was provided, about the project. This survey is the only information I have received addressing the solar project." and another "No permission was asked of the residents in this area…. Ask about the community's impact about these projects before they are done or begin. …. In the area where the solar park was a city recreational facility there was no input about the project before or after they put up the solar farm". Some ire from Detroit respondents was focused directly at the utility company involved, DTE. One respondent perceived a disconnect between what they were told from DTE and what actually occurred:

> "DTE told us they would replace the playground area with a "much nicer" more useful area. They tore down the community center and replaced all the playground equipment with a sit-down park area for planting and very little else."

Another Detroit respondent felt similarly about DTE and the process stating “DTE continues to get over on people and swear they are here to help.”

Moving on, respondents also had a lot to say about the impact of the solar development on their community and what benefits, or more specifically lack of benefits they thought were occurring. Many had comments regarding electricity/price – returning to Coldwater again:

> “Since solar project, I have renovated, rewired, LED bulbs, efficient appliances and my electric bill went up! Come to find out I used less kilowatts but got charged more per kilowatt! What a joke”

And another Coldwater respondent:

> “I believe the residents do not benefit from this solar project. I thought it would save us money to have the solar panels but it has made no difference. The only people who benefitted was the CBPU buildings. They have not passed the savings to the Coldwater residents.”

Respondents from Cadillac also had some comments concerning price and where the electricity is going: “If I have to look at that solar system even it being added on to then my electricity should be lower because I should have access to it.” Another Cadillac respondent “Really I see it doesn't help power a thing in my home. Probably worthless when cloudy or snow-covered. It's a garden and it's not beautiful” and a third Cadillac respondent “My electric bill is going up not down so I don't think it is doing any good for our community.”

Detroit respondents had a lot to say about price – but also woven in with other perceptions:

> “The space being used for the solar "project" was where carnivals and neighborhood gatherings were held… The picture you have on this booklet shows how the grounds have been kept as a norm. they rarely cut it…. It looks terrible most of the time. To my knowledge I have never received a dime in discounted energy costs. It's a dust collecting, weed infested eyesore that took away our community center and gave ugliness in return.

Three more Detroit respondents:

> “This project takes advantage of the people that live in the area, due to the fact none of the services are offered to benefit the people in this demographic area…. I've been told this solar farm benefits businesses downtown or in another area. We have constant black out from storms in this area. Our light may be out up to a week. There is no compensation for loss of

food, heat, or lights. If they want to do justice to the area, use a bit of the solar farm's power when there is no service in the area….. Also, none of the energy benefits us in the area."

"How are the people in the neighborhood benefitting from these panels? I remember when O'Shea was a community center and it was for the people. This solar farm does not seem like it is benefiting those in the area/neighborhood."

"Hopefully will contribute to reduction in energy costs to those of us receptive as your "solar hosts." Employment: expect more disposable income due to savings from "solar utility" will foster more monies and (circulation) and result in more jobs."

These comments, and my selection, have focused on many negative aspects perceived by respondents. There were some, albeit fewer, positive comments. Some respondents expressed their support or positive feelings towards the solar, however wished it had been another development for the site. First, a Coldwater respondent again:

"I support the solar project and other efforts to transition to clean energy but I wish that the solar project was not in its current location as that location could be better utilized for housing which the city desperately needs."

A Cadillac respondent expressing similar concerns: I am in favor of the solar project. We are "very short" of "housing" and apartments.".

As to all positive comments – most did have some aesthetic component (also even some supporters did not like the look of the solar), as well as expressing positive feelings towards clean energy in general. Below are related comments from Coldwater respondents:

"I love anything that helps use natural/clean sources for power or industry."

"The solar farm looks better than the bare dirt and remains of the foundry."

"It beautified the neighborhood."

"I am highly in favor of the solar project. We need MORE clean energy sources!"

"Solar is the future! Let's use it!"

And Cadillac responses in the same vein:

"I think the solar projects are good, somewhat of an eye soar [*sic*]"

"but the site, before the solar project was built was an eyesore. So I'm glad this solar project was built there"

"Cadillac has a lot of empty undeveloped space in the industrial area. I would prefer to see solar development in these areas to letting them sit empty."

Detroit respondents did not have any positive comments in the vein of those above. In terms of visual aesthetic we have this comment: “It's ugly to look at. They could of found a better place”.

Finally, before going into the discussion section below. I want to end with one last quote – not about solar – about surveys. This respondent from Coldwater expressed some strong distrust of survey research: “I think the surveys done no matter how answered will give you what you want to hear and not really what the person filling it out feels.” In the below discussion section, I will seek to keep my takeaways and conclusions grounded in respondents’ actual answers – and not manipulate data to support what I want to hear. I will also work to keep this research in frame and tempered in scope/conclusions as I stated I would attempt to do at the beginning of this paper.

4. DISCUSSION

4.1. Discussion

This is one of the first studies within the United States to look at urban residents' support and perceptions of LSS developed on brownfields and/or disturbed lands. Framing for this research was synthesized from two main bodies of literature – that of renewable energy development and brownfield redevelopment. As one of the first studies to explore this area – the research questions that guided the work were explicitly exploratory in nature. This discussion will be outlined loosely in the order of these questions, as a reminder, here they are again:

- **RO1**: *Examine urban residents' levels of support for or opposition towards their local LSS brownfield and disturbed land development.*
- **RO2**: *Examine the impact that place attachment, perceived procedural justice, and perceived local benefits have on urban resident perceptions toward LSS brownfield and disturbed land development.*
- **RO3:** *Explore relationship between different perceived benefits and overall local benefits perceived.*
- **RO4**: *Examine urban resident redevelopment preferences for their local LSS development site.*
- **RO5**: *Test efficacy of Every Door Direct Mail in eliciting urban resident preferences and perceptions.*

Across these three Michigan study sites, urban residents' level of support towards their local LSS development at first glance looks relatively high, with few respondents reporting outright opposition. However, after removing those respondents who replied neutrally and focusing only on supporters/'strong' supporters, this conclusion changes. Levels of support were lower than those that have been reported recently statewide for further solar development[9] in Michigan (IPPSR, 2023). However, they were more in line with Michigan resident support levels for a solar development visible from their residences as well as what has been found previously by Nilson & Stedman (2022) for utility-scale solar in the State of New York[10]. Specifically notable

[9] 63.3% of Michigan residents were either supportive or strongly supportive of more solar development in Michigan (IPPSR, 2023).

[10] 43.9% of Michigan residents were either supportive or strongly supportive of the development of a solar project visible from their residence (IPPSR, 2023) and ~46% of New York State residents reported slight support or strong support for utility-scale solar (Nilson & Stedman, 2022).

here is that those authors reported defining utility-scale solar in their survey instrument as "generating electricity that is not used locally but transmitted and sold for use elsewhere. These are large, often using hundreds of acres of land." (Nilson & Stedman, 2022). Similarly, this research also defined solar developments as feeding electricity into the grid; however, these developments were much smaller in size. All this might suggest that support might be lower for these projects that feed into the grid as opposed to community or rooftop projects whose electricity might supply local uses. Indeed, comments from respondents support this finding. Namely respondents expressed frustration at the solar developments not lowering energy prices for them and the electricity produced not staying local.

Perception of local benefits was also one of the two predictors of support for urban solar developments. This maps on closely to previous research highlighting the importance of perceived local benefits towards local community support (Bessette et al., 2024; Crawford et al., 2022; Lundheim et al., 2022; Mills et al., 2019; Rand & Hoen, 2017; Roddis et al., 2020; Segreto et al., 2020; C. Walker & Baxter, 2017). Perception of procedural justice, that the process was fairer, was the other predictor of solar development support. Just like benefits, so too has previous work demonstrated the key importance of perceived procedural justice to development support (Batel, 2020; Devine-Wright, 2008; Fast, 2013; Lundheim et al., 2022; Rand & Hoen, 2017; Wüstenhagen et al., 2007). Echoing residents living near other solar developments (Bessette et al., 2024) many respondents reported having issues with a lack of information or lack of information clarity regarding the solar developments.

In contrast to perception of local benefits and perceived procedural justice, respondents' place attachment did not predict support or opposition of the local solar development. This, however, highlights some of the issues with aggregating the data across all three study sites. When analyzed separately, place attachment was positively correlated with development support in one of the three communities: Coldwater. Interestingly enough, this positive correlation is the opposite of what has been found before for other types of RET developments (Devine-Wright, 2009; Devine-Wright & Howes, 2010), and even LSS (Nilson & Stedman, 2023). This might be due to more perceived benefits of this specific urban development, or better site and development fit with the local community needs and character (Letang & Taylor, 2013) – however further research needs to be done to uncover the exact dynamic between urban place attachment and solar development perception.

The strongest predictor of perceiving local benefit was a perception that that solar development reduced energy prices. Previous work has shown perceived economic benefits to be among the most common reported for LSS (Crawford et al., 2022). It's important to note here that not a single one of these solar developments provided less expensive[11] electricity to neighboring residents (Schaap et al., 2019); why some respondents perceived reduced energy prices remains unclear. Although one vector that should be further researched is the type of message framing used by developers and local officials. For example, the Detroit Mayor in a statement to the media regarding the Detroit solar development is quoted saying:

> "The tax revenue is going to be $1 million over 20 years…. but the benefit to the neighborhood is going to be dramatically more than that… I hope we are going to be talking about five or six more sites. We could build these solar panels around the city and provide power to residents more cheaply and use the land to for good purpose." (Oake, 2016)

Perception that a respondent's house and property were worth more after the solar project had been developed was not a significant predictor of perceiving general local benefit, nor did many respondents perceive this benefit at all. Only 7.2% of respondents perceived their house and property being worth more with a majority of respondents – over 60% - reporting neutral perceptions. These reported perceptions align with some of the emerging research on the impact of LSS on property values. Recent research has shown that across six states, three showed no difference in sale prices in houses near LSS and the average overall decrease was only 1.5% of home sales price; it should be mentioned that significant reductions in home values were only observed for sites on agricultural land; no impacts were found for urban homes (Elmallah et al., 2023).

Respondents' comments provided additional context on their perceptions – with many comments expressing frustration that the solar development *did not* reduce their energy prices. An additional theme that emerged in these comments was that of distributive justice. Commenters broached elements of distributive justice in several ways, but in general felt that if their community was to host the solar development, it should receive some of its energy or benefits, and not city utility buildings or downtown businesses. Similar sentiments have been

[11] And electricity generated from solar *is* less expensive. As of 2022 the levelized cost of solar electricity (LCOE) was cheaper than natural gas plants and other electricity generation plant types (EIA, 2022a). Solar's future LCOE is expected to get even cheaper.

expressed by other, rural, solar development-adjacent residents (Bessette et al., 2024; Nilson & Stedman, 2023). This might suggest that more nuance be applied to the rural-urban dichotomy, and further research could explore an urban-urban or even a periphery-core divide. While, most notably used towards understanding global political and economic interrelations (Hryniewicz, 2014), the core-periphery framework should be used in future work to examine the power, economic, and social disparities between regions of solar development, and regions where that energy is used. Future research could also utilize a community wealth building framework when examining how benefits are perceived. Community wealth building centers people organizing collectively and exerting greater control over core aspects of their local community—it focuses more on the methods necessary to establish "inclusive, sustainable and democratically controlled local economies," rather than simply using traditional tax incentives and public-private partnerships to extract profit (Guinan & O'Neill, 2019: 385). This work suggests that more local, collective ownership of solar development would improve its perceived benefit.

Perception that the site did not look worse after the solar development was a second, much weaker, predictor of perceiving that solar development provided local benefits. Bessette et al. (2024) previously reported this relationship between brownfield site improvement and resident support of a solar development – albeit secondhand from a local official. Notable is how strongly developers, government officials, and industry experts, tout the clean-up, remediation and overall 'improvement' to once blighted sites as *the* benefit for local communities (Balaskovitz, 2019; City of Coldwater News, 2018; Oake, 2016; Schaap et al., 2019). Yet, this research demonstrates site improvement is a much weaker predictor of perceived local benefits than perceived energy price reduction.

Respondent preferences for their local site redevelopment complicates the support and opposition of solar development investigated above. Overall similar trends were found here in respondent site redevelopment preferences as has been found for other brownfield and/or disturbed land adjacent residents (Greenberg & Lewis, 2000; Martinat et al., 2018). Respondents across all three sites expressed strong preferences for community-oriented redevelopments such as parks and community centers. In one preference there was divergence though: housing preference was by far the strongest preference overall and in two of the three sites, compared to only a moderate preference in previous work. This highlights how urban communities hosting

brownfields are not monolithic and each community has different preferences regarding potential redevelopment pathways.

Indeed, looking at each site independently, different redevelopment preferences emerge as either stronger or weaker. As Navratil et al. (2018) demonstrated, brownfield redevelopment preferences might be driven in part by the impacts of spatial and contextual elements. Detroit respondents had a stronger preference for parks and sports facilities than the other respondents and historically the Detroit site contained a large park and sport fields. In contrast, Coldwater and Cadillac respondents had slightly higher preferences for factories – both sites previously held factories. And, as the above Coldwater resident noted – some perceived the factory as their best opportunity for a better life. This demonstrates the importance of looking at each site uniquely and, as Bessette et al. (2024) recommends, LSS may not always be perceived as a 'beneficial use' of disturbed land. Developers—and local officials—should approach the development of these sites as carefully as they do greenfield development and expect similar concerns.

The fifth research objective, testing the efficacy of EDDM in eliciting urban resident preferences and perceptions, was a success. Urban resident preferences and perceptions were successfully elicited and surveys were sent via EDDM without sufficient difficulty or delay. While EDDM has been used a few times previously to disseminate surveys, it was not a given that it would work this time. Some pushback was received by a few USPS employees and one local print shop on their ability to print or distribute surveys via EDDM. The main difficulty seemed to be with how USPS defines and uses the word "flats". To summarize, flats can include larger envelopes (like the 12inches wide x 9inches tall outer envelope used for this survey), however a USPS employee and one print shop owner perceived flats as meaning only postcards (like the reminder postcard sent out). After further investigation, including reading all pertinent USPS regulation and standard documentation[12], talking with other USPS employees, as well calling their "EDDM hotline", this method was determined to be a viable method for disseminating surveys. An important note here is that the print shop used was not able to advise on if the materials were EDDM appropriate or not – even though they advertised this expertise. Indeed, this was one frustrating aspect of using EDDM. USPS tells potential users that if they

[12] Please see Appendix D for links and images of the relevant USPS documentation regarding flats and EDDM mailers.

need additional help with designing their materials and/or making sure they are EDDM eligible, then they should go and use the services of third party private printshops – however USPS makes sure to state that they have no liability if those companies lead researchers astray. Essentially, as long as the survey materials meet the EDDM physical requirements, then they will be okay. When dropping off survey material at the three postal offices (for a total of six separate occurrences) I received no pushback nor any argument about whether these materials were or were not eligible.

Response rates for this survey were well under the recent 43% average reported for mail-based surveys (Stedman et al., 2019). However, this survey got much higher response rates than previous EDDM surveys. Rates were almost double the response rate Grubert (2019) elicited, nearly four times the rate of Al-Muhanna et al. (2023) and over five times what is advertised as good or feasible to expect by marketing firms (Geofactor, 2021; McCarthy and King Marketing, 2022). These higher response rates could be attributed to a few reasons.[13] First, a larger outer envelope size was used, this has been shown to increase response rates from 1% – 6% (Dillman et al., 2014). Second, a two-dollar incentive was used and placed so that it would be seen immediately upon opening the survey packet (see Appendix B, Figure 20). Previous research has demonstrated both the incentive and placement to be important in increasing response rates (Dillman et al., 2014). A third possible reason is that this survey was possibly more salient than previous EDDM surveys to respondents (Dillman et al., 2014). However, notable here is that no mention of the survey's focus on solar development was provided on the outer envelope – which may have limited salience as a factor in respondents' motivation to open the packet.

Survey costs are tough to compare with previous EDDM research. Grubert (2019) deployed their survey in 2016 and since then the Consumer Price Index (CPI) inflation has been approximately 30.2% (BLS, 2024). The CPI also does not account for more significant price increases in different sectors. Reports have urged more drastic price increases have incurred in the printing and paper industry due to issues with high energy and raw material costs in the last few years (Dillon, 2022; Wallin, 2022). Thus, while it is interesting that Grubert (2019) had a cost of $26.04 - $52.07 (adjusted for inflation) per survey response compared to this survey's

[13] This is a notable limitation of this study. Given that more than one method variable was changed from previous EDDM work, isolating the exact change that increased the response rate is not possible. Future work should endeavor to only modify one method variable.

cost of $63.23 per response, this result should be considered appropriately, given my inability to calculate exactly the price increase in paper, printing, etc.

A more helpful comparison might be to a more recent unpublished survey that also sought to elicit perceptions of residents living near solar developments via mail. This solar survey, distributed as part of the Community-Centered Solar Development (CCSD) project in 2023, was deployed via a more traditional addressed mail-survey approach. The survey was sent to 4,974 households across the U.S. within 3 miles of a solar development, and received 951 complete responses and cost $62,501 (personal communication with author). Thus, the cost per survey sent out was approximately $12.57, and the cost per complete response was $65.72. In contrast to the CCSD survey, my EDDM solar survey was 49.5% cheaper per household contacted and 3.8% cheaper for each complete response. This is only a partial match to previous research, which found EDDM to be about 40% cheaper for each household contacted and between 10-20% cheaper for each response (Grubert, 2019). This EDDM survey was likely more expensive per response for a few reasons, the biggest being inexperience. This was the author's first time developing and deploying a survey, and less expensive services may have been available from print shops or by utilizing online-only printers. Both may have led to reduced material costs. Printing in black and white could also have reduced costs.

The time spent on compiling survey materials improved over the process. This is in line with what previous research has found on survey packet-preparation speed (Grubert, 2017). Like this previous work demonstrated, this research also found that faster speed accompanied a faster process versus personal skill improvement. An assistant brought on later in the process was able to stuff surveys at a similar speed after learning the improved process. The greatest amount of time spent was not recorded above and was primarily made up of innumerable hours researching and reading USPS regulations – to ensure the viability of this method for survey deployment. This is important for future researchers to be aware of if they want to use EDDM. For better or worse, meeting the requirements of EDDM is up to the surveyor and they should not rely on USPS or a printshop.

This research did not specifically test for less sociable responses; however, some comments and responses imply their presence. The most obvious example being the comment below written by a Cadillac respondent – who expresses support of both solar and Donald Trump.

"I am in favor of the solar project…. Trump had the cost of gas at $2.00 a gallon. We need President Trump back in the White House"

While this respondent is highlighting gasoline, not electricity, it is interesting to point out that this is another respondent commenting on *energy* prices, a key perceived benefit of LSS. Additional results may demonstrate less sociable responses. Namely that a portion of respondents who reported supporting or strongly supporting the solar development had strong preferences for other development options and to a lesser extent some respondents who reported being opposed or even strongly opposed to the solar development preferred solar over some development options. Further research, however, needs to be done before any conclusions can be drawn about EDDM's anonymous nature leading to more honest responses. Specifically, an addressed mail-survey asking about solar neighbor redevelopment preferences would need to be done. This future survey (and any future EDDM) surveys may also include a scale to specifically test for less sociable responses such as the Marlowe-Crowne Social Desirability Scale, the Self-Deception Questionnaire, or the Martin-Larsen Approval Motivation Scale (Nikolopoulou, 2022).

This EDDM survey was able to be put together relatively quickly, by only a few people, and was able to achieve a response-rate-to-cost ratio similar to a more expensive survey fielded by a larger team of researchers.

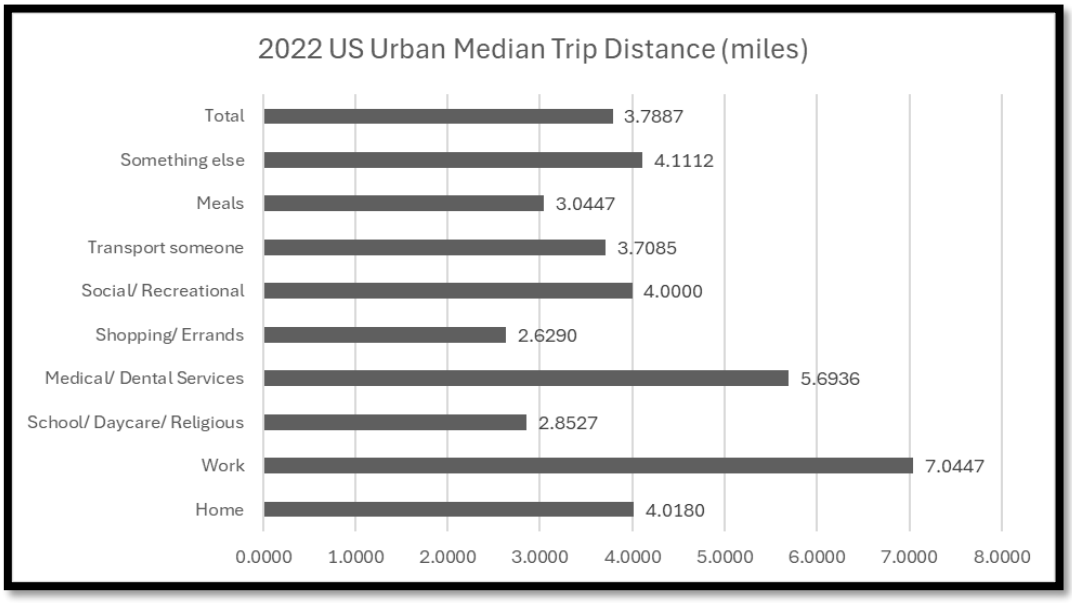
5. CONCLUSION

5.1. Final Remarks and a Reframe

To wrap up this thesis, I would like to bring us back to where we started – with a push in the US, and specifically a more dramatic push recently by policy-makers in Michigan – for achieving 100% clean energy generation by or around 2040. Achieving carbon neutrality will require more than rolling out renewable energy at an accelerated pace, using every viable site, often in opposition to locals' wishes. It will require a rethinking of how our communities are structured and how land is developed. It is possible that urban communities preferring redevelopment other than LSS are not in fact at odds with meeting our clean energy goals at all – and could in fact support them!

Figure 12 below represents an analysis I conducted using data from the U.S. Department of Transportation's 2022 National Household Travel Survey (FHWA, 2022).

Figure 12: 2022 US urban median vehicle trip distance.



The table shows the median travel distance for all urban household driving trips in 2022. A typical urban trip required about 3.8 miles, with some trips being shorter for specific reasons such as shopping or meals. This demonstrates a prime opportunity for cutting emissions—and electricity-use assuming vehicles were hybrids or fully electric—using urban redevelopment. Fewer vehicle trips would be necessary if shopping, meals, and social & recreational needs were

located within walking distance from homes and did not require a vehicle trip. With fewer trips and fewer cars – requiring less energy and critical materials for manufacturing, and less emissions and less electrical load on the grid, clean energy targets could be met using less energy overall. Put simply, there are ways of pursuing preferred urban redevelopment, while also meeting clean energy goals.

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APPENDIX A: SURVEY QUESTIONNAIRE

MICHIGAN STATE UNIVERSITY

Department of Community Sustainability

College of Agriculture & Natural Resources

Michigan Brownfield Solar Survey

Informed Consent

Please read this consent agreement carefully. You must be at least 18 years old to participate.

Purpose of the research: The purpose of this study is to learn about how solar projects are developed on brownfields and their impact on the community and community members. Information obtained from this study will be used to improve the processes by which solar projects are developed. You are receiving this survey due to your proximity to a brownfield solar project.

Your contribution and compensation: You will have the opportunity to answer questions about your views on a local solar project and your community. Your participation is completely voluntary. The $2 you received does not require you to participate or complete this survey and is yours to keep, regardless of whether you choose to participate.

Risks: There are no anticipated risks, beyond those encountered in daily life, associated with participating in this study.

Voluntary Withdrawal: Your participation is completely voluntary. You may skip over questions that you do not feel comfortable answering and can stop the survey at any time.

Confidentiality: Your participation in this study will be completely confidential and anonymous, unless you choose to identify yourself or provide identifying information in your written response. All returned surveys will be stored in a locked room and electronic data will be stored on a password-protected, MSU-owned computer and server.

Results of this study may be presented at conferences and published in books, journals, and/or in the popular media; however, those results will be in the form of summarized and anonymous data.

Who to contact about your rights in this study: If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, Michigan State University's Human Research Protection Program at (517) 355-2180, Fax (517) 432-4503, or e-mail irb@msu.edu or regular mail at 4000 Collins Rd, Suite 136, Lansing, MI 48910.

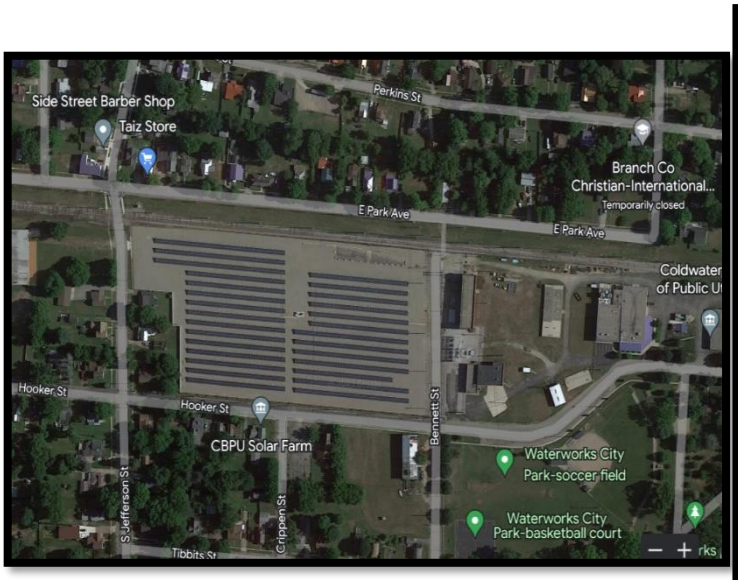
If you have questions about this study, please contact:

- Jake White, Michigan State University, Natural Resources Building, 480 Wilson Rd. Room 150, East Lansing, MI 48823. Email: **white202@msu.edu**, phone: 517-618-1248. Or,
- Doug Bessette, PhD, Associate Professor, Michigan State University, Natural Resources Building, 480 Wilson Rd. Room 327, East Lansing, MI. 48823. Email: **bessett6@msu.edu**

This survey seeks to understand your thoughts and experiences about a solar project that has been built near you, specifically the Coldwater Solar Project. Solar projects like this one are made up of rows of ground mounted solar panels that feed electricity into the grid.

1. The Coldwater solar project is pictured below. It covers about 7 acres, is built on land that was previously an industrial site, and is located at 74 Hooker Street. Below are some images. The first shows satellite imagery, the second shows the project from ground level. Have you heard of this project before now?

   ☐ Yes ☐ No



2. If you marked 'Yes,' when did you ***first*** hear about this solar project?

☐ Before the permitting process began.	☐ Before construction began.	☐ During construction.	☐ After the project was completed	☐ This is the first time I'm hearing of the project.

3. Did you participate in any of the planning processes for this solar project (for example, attend public meetings, submit comments, or speak with developers or officials)?

   ☐ Yes ☐ No If 'Yes', please describe _____

4. Please identify your level of support for or opposition to this solar project:

☐ Extremely supportive ☐ Moderately supportive ☐ Neutral ☐ Moderately opposed ☐ Extremely opposed

Please indicate how strongly you agree or disagree with the following statements about the solar project:

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
5. The Coldwater community receives benefits from this solar project	☐	☐	☐	☐	☐
6. The Coldwater solar project reduces energy prices for Coldwater residents	☐	☐	☐	☐	☐
7. The planning process for the Coldwater solar project was unfair	☐	☐	☐	☐	☐
8. The company that developed the Coldwater solar project prioritized the community's wellbeing	☐	☐	☐	☐	☐
9. The local government in approving this solar project has prioritized the community's wellbeing	☐	☐	☐	☐	☐
10. The land on which the project was built looks worse than it did before	☐	☐	☐	☐	☐
11. My home and property are worth more now because of this solar project.	☐	☐	☐	☐	☐
12. Solar should be sited on rural farmland rather than urban land.	☐	☐	☐	☐	☐
13. This solar project benefits our community more than other types of development	☐	☐	☐	☐	☐
14. Solar is an industrial land use.	☐	☐	☐	☐	☐

15. Are you able to see the solar project from your home?

☐ Yes ☐ No

16. How often do you see the solar project?

☐ Daily ☐ Weekly ☐ Monthly ☐ A few times per year ☐ I have never seen the Coldwater solar project

The next few questions concern community members subscribing to a solar project. Community subscription allows residents to purchase some of their electricity from local solar projects.

	Yes	No	I don't know
17. To best of your knowledge does the Coldwater Solar project offer community subscription?	☐	☐	☐
18. [*If you answered 'yes' above*] Do you subscribe to the solar project?	☐	☐	☐
19. [*If you answered 'no' or 'I don't know' to question 17*] Would you be interested in subscribing if the project offered this option?	☐	☐	☐

These next 4 questions will ask how you feel about living in Coldwater. Again, please indicate how strongly you agree or disagree.

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
20. I feel relaxed when I am in Coldwater	☐	☐	☐	☐	☐
21. I feel happy when I am in Coldwater	☐	☐	☐	☐	☐
22. Coldwater is my favorite place to be	☐	☐	☐	☐	☐
23. I miss Coldwater a lot when I am away from it	☐	☐	☐	☐	☐

24. I have lived in Coldwater for about _____years.

25. My family has lived in Coldwater for about_____years.

26. Do you own or rent where you currently live?

☐ Own ☐ Rent

27. Now we'd like you to compare the Coldwater solar project to other development or land-use options. Which type of development do you prefer? [Please note that many of these options are not possible for 74 Hooker St due to previous industrial site use]

	Strongly prefer this option over the solar project	Slightly prefer this option over the solar project	No preference between the two	Slightly prefer the solar project over this option	Strongly prefer the solar project over this option
Housing	☐	☐	☐	☐	☐
Stores	☐	☐	☐	☐	☐
Factories	☐	☐	☐	☐	☐
Restaurants	☐	☐	☐	☐	☐
Warehouses	☐	☐	☐	☐	☐
Play areas and parks	☐	☐	☐	☐	☐
School	☐	☐	☐	☐	☐
Community cultural and agricultural center	☐	☐	☐	☐	☐
Sports facilities	☐	☐	☐	☐	☐
Child-care center	☐	☐	☐	☐	☐
No development	☐	☐	☐	☐	☐
Other: _____	☐	☐	☐	☐	☐

28. Thinking about all the energy infrastructure, for example, power plants, transmission lines, oil and gas wells, coal mines, solar and wind farms, etc., do you think your community hosts more or less than its *fair share* of energy infrastructure. . .

	More than its fair share	About its fair share	Less than its fair share
. . .*prior to the solar* project being built?	☐	☐	☐
. . .*now with the solar* project being built?	☐	☐	☐

29. Thinking beyond energy infrastructure do you think your community hosts more or less than its fair share of. . .

	More than its fair share	About its fair share	Less than its fair share

. . ."desirable" land-uses	☐	☐	☐
. . ."undesirable" land-uses	☐	☐	☐

The next few questions are about demographics. As a reminder these are all voluntary.

30. In what year were you born_____?

31. Which of the following best describes your racial or ethnic group (check all that apply)
    - ☐ White
    - ☐ Black or African American
    - ☐ American Indian or Alaskan Native
    - ☐ Native Hawaiian or Pacific Islander
    - ☐ Hispanic, Latino/a
    - ☐ Don't know
    - ☐ Asian
    - ☐ Some other race or ethnicity [please specify]_____

32. What is your gender?
    - ☐ Male
    - ☐ Female
    - ☐ Nonbinary
    - ☐ Prefer to self-describe_____

33. What is the highest level of education you have completed?
    - ☐ High school (with or without diploma)
    - ☐ Some college (no degree)
    - ☐ Bachelor's or associates degree
    - ☐ Master's, doctorate or professional degree

34. Which of the following best describes your current employment status?
    - ☐ Employed Full-time
    - ☐ Unemployed and not looking for work
    - ☐ Employed Part-time
    - ☐ Retired
    - ☐ Unemployed and looking for work
    - ☐ Homemaker/manage your home
    - ☐ Something else [please specify]_____

35. Which of the following categories best describes your total annual household income before taxes in 2022?
    - ☐ Less than $25,000
    - ☐ $25,000 - $49,000
    - ☐ $50,000 - $74,999
    - ☐ $75,000 - $99,999
    - ☐ $100,000 - $149,000
    - ☐ $150,000 - $199,000
    - ☐ $200,000 - $249,000
    - ☐ $250,000 or more
    - ☐ Don't know

I'd be happy to send you the results of this study. What would be your preferred method to receive the results?

- ☐ U.S. Mail. My address is_____
- ☐ Email. My email address is_____

☐ Neither. No need to send me the results.

In the below box please feel free to share any additional comments you have about the solar project.

Please Fold, Place in Return Envelope, and Drop in Mail.

Return postage is already on return envelope.

Thank you for your time today! Your responses are greatly appreciated.

If you would like to speak more about the Coldwater solar project, please feel free to contact me (Jake) via email or phone at: **white202@msu.edu** or **(517) 618-1248**.

APPENDIX B: SUPPLEMENTAL SURVEY DOCUMENTS

Figure 13: Coldwater USPS mail route surveyed. Red line is approximately one mile from solar development.

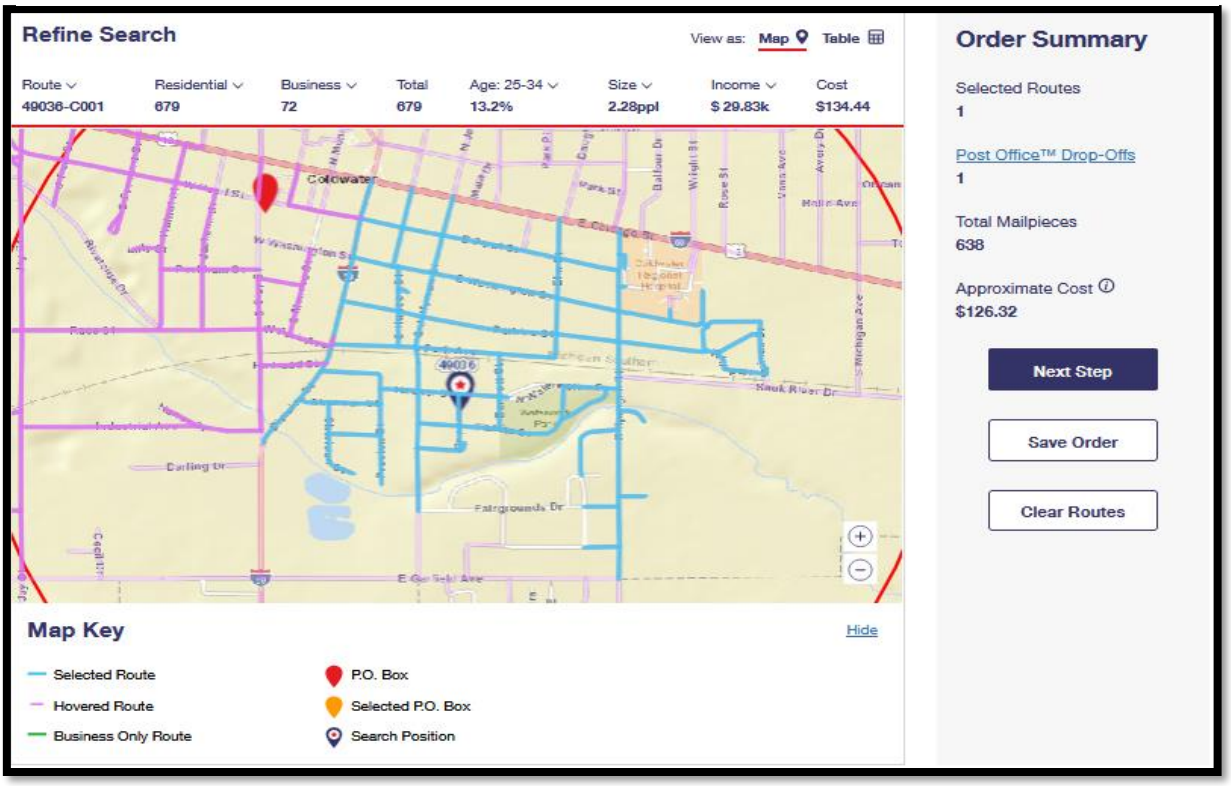


Figure 14: Detroit USPS mail route surveyed. Red line is approximately one mile from solar development.

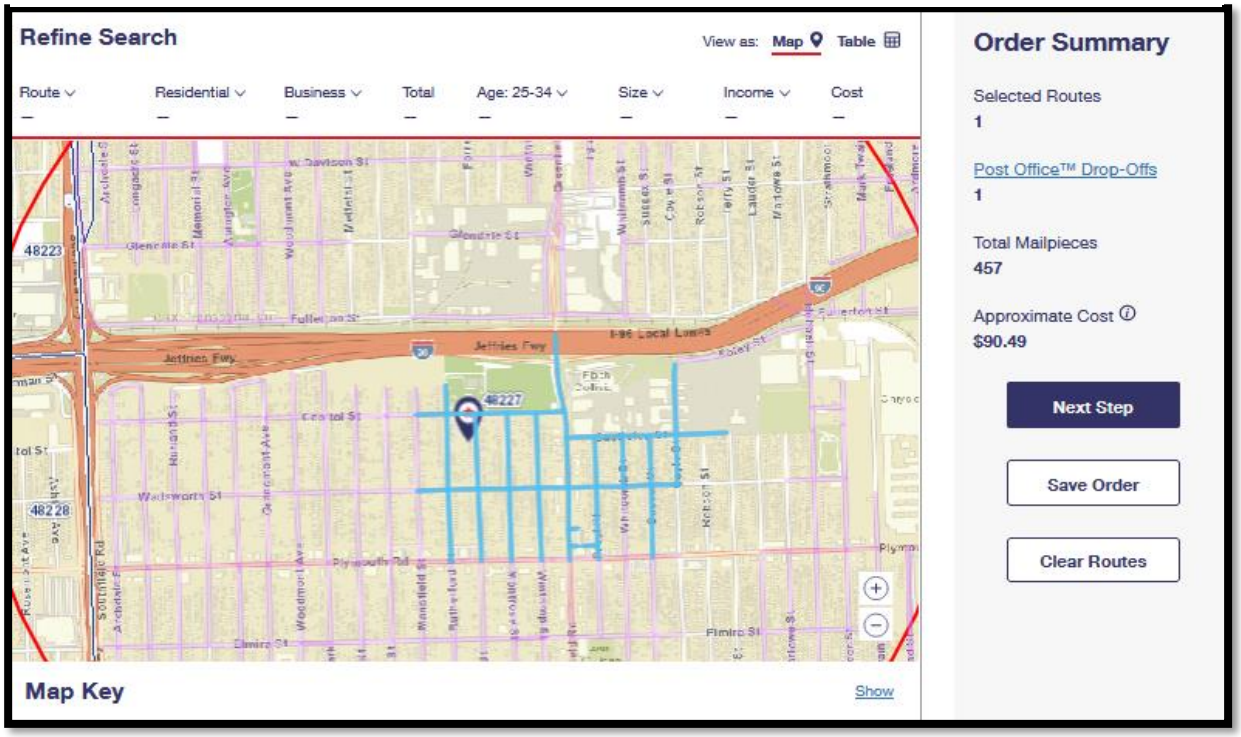


Figure 15: Cadillac USPS mail route surveyed. Red line is approximately one mile from solar development.

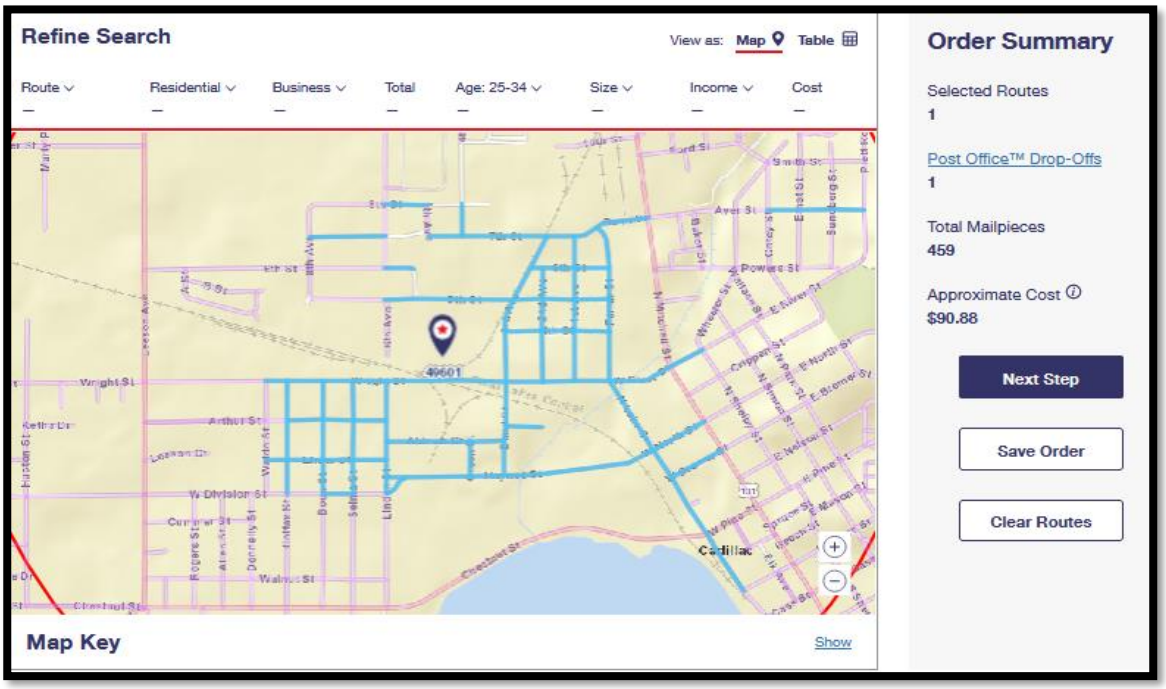


Figure 16: Outer envelope. 12 inches wide by 9 inches tall.

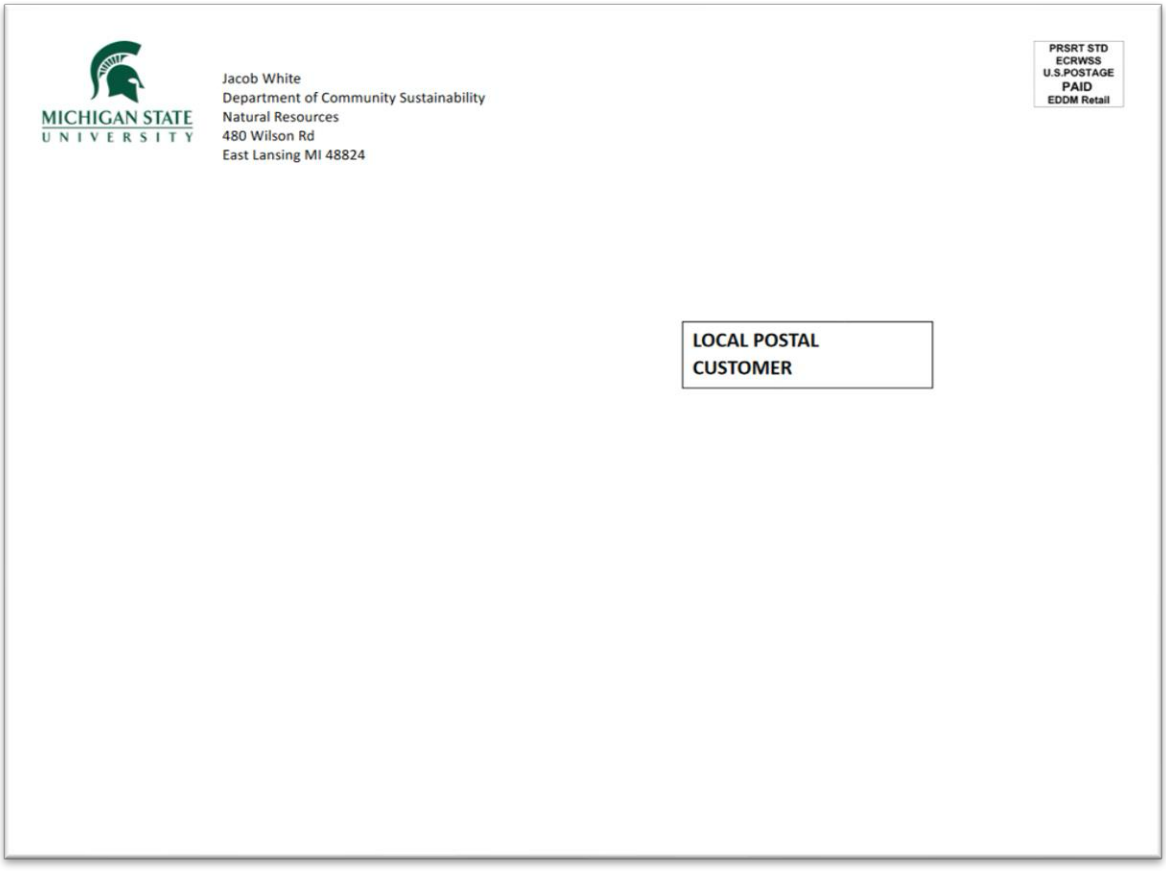


Figure 17: Business Reply Mail Envelope. 8 7/8 inches wide by 3 7/8 inches tall.

Figure 18: Front of reminder/follow-up postcard. 9 inches wide x 6.5 inches tall.

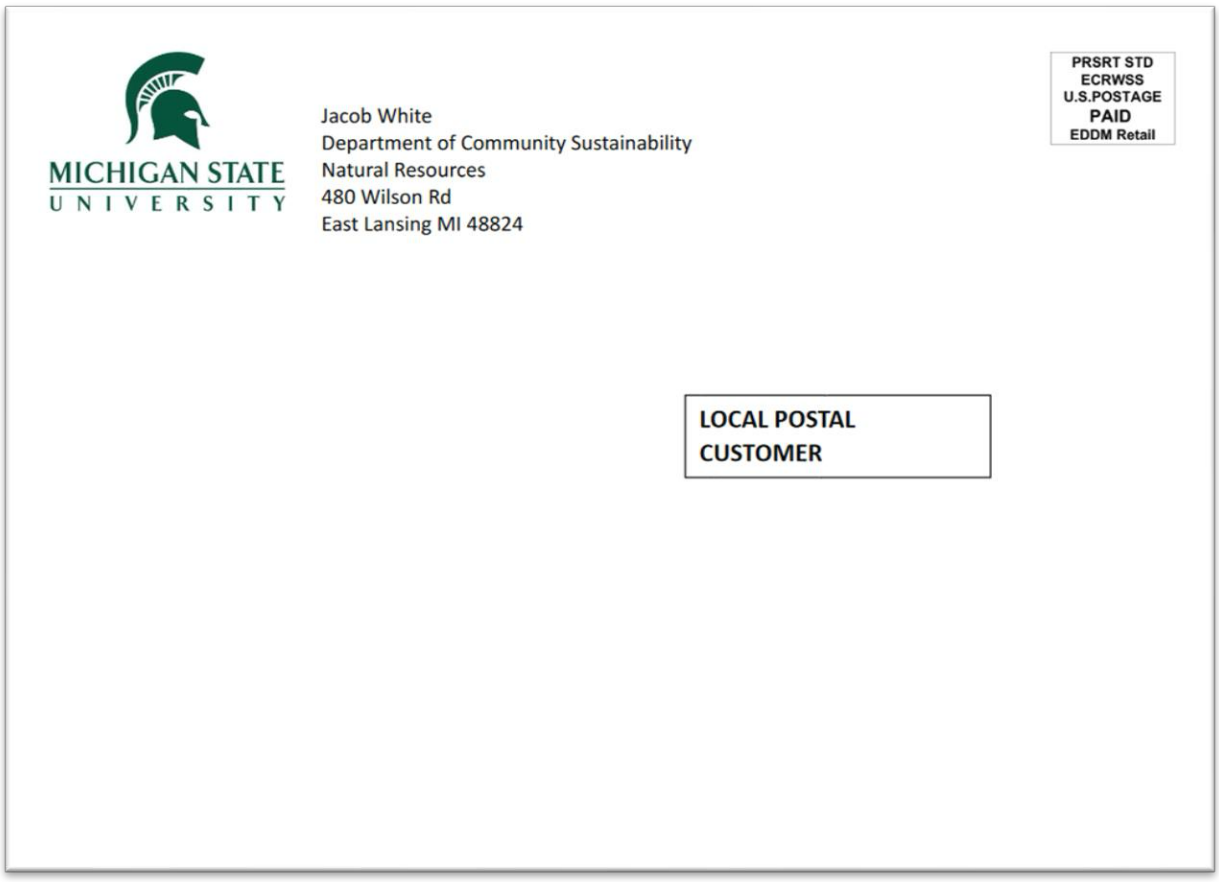


Figure 19: Back of reminder/follow-up postcard. 9 inches wide x 6.5 inches tall.

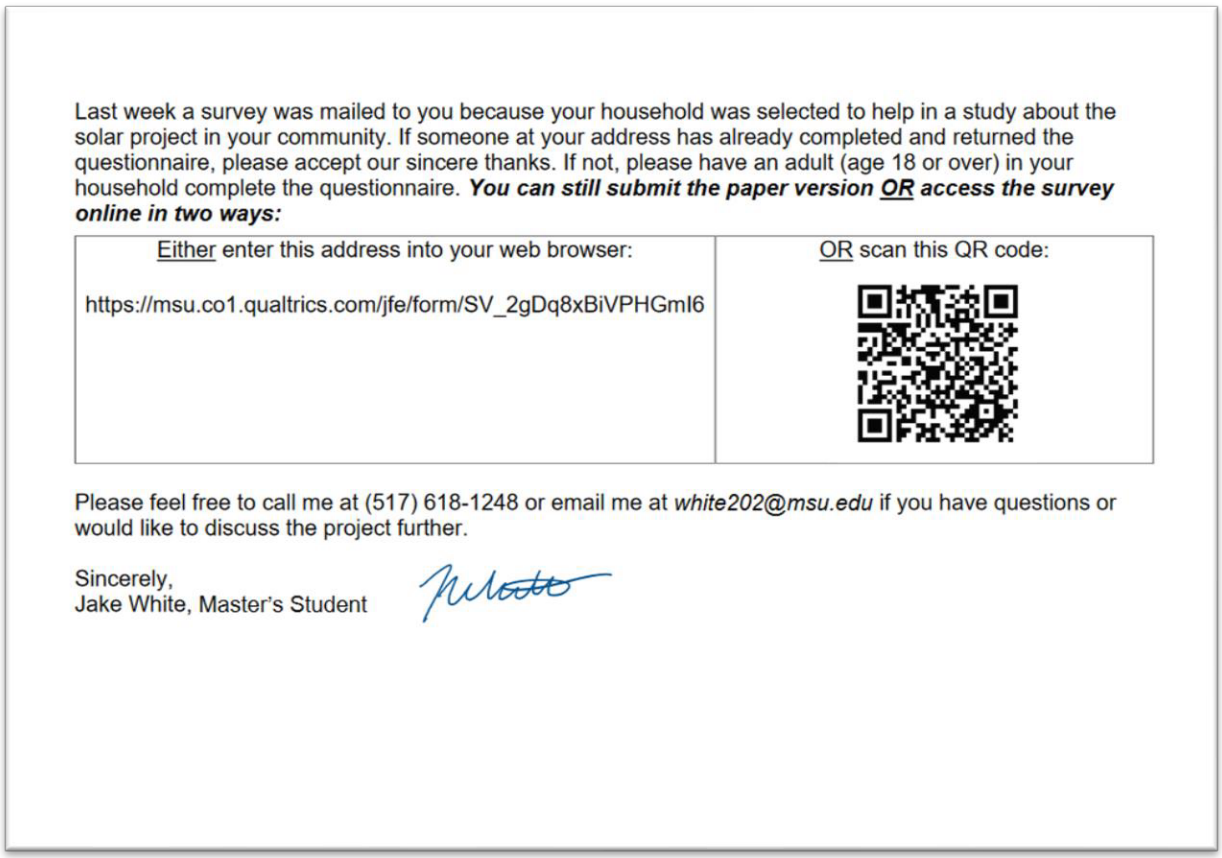


Figure 20: Front of questionnaire booklet showing placement of 2-dollar bill. The bill was folded over the front page and oriented to be at the top of the outer envelope so the 2-dollar bill would be seen right away when envelope was opened.

APPENDIX C: ADDITIONAL SITE/COMMUNITY DATA

Table 7: Spearman's rank correlation redevelopment preference and reported support.

Preference	Support x Preference
Housing	-0.316
Stores	-0.378
Factories	-0.237
Restaurants	-0.319
Warehouses	-0.32
Parks	-0.376
School	-0.346
Community Center	-0.34
Sports	-0.486
Childcare	-0.324
No development	-0.266

Table 8: Percentage of sample demographics as a percentage of Michigan demographics. 100% = sample demographics and population demographics are perfect match, x = characteristic was not recorded in census data, n = characteristic was not present in sample, 0.0 = not present in either.

	Overall sample population proportion / Michigan population proportion (%)
Age	
20-24	37.7
25-34	56.2
35-44	139.5
45-54	85.5
55-64	200
65 or older	197.2
Gender	
Male	92.4
Female	106.3
Nonbinary	x
Race/Ethnicity	
white	108.6
Black/African American	102.5
Hispanic/Latino/a	21.4
American Indian/Alaska Native	197.4
Native Hawaiian/Other Pacific Islander	3963.5
Asian	18.1
Some other race	109
Two or more races	28.6
Residential Tenure	
Rent	91
Own	103.3
Education Level	
High school or more	107.7
Bachelor's degree or more	111.2
Employment	
Employed	86.9
Unemployed	86.2

APPENDIX D: ADDITIONAL USPS EDDM DOCUMENTS

Figure 21: USPS initial guidance on EDDM mailpiece requirements. Found at https://www.usps.com/business/every-door-direct-mail.htm.

Figure 22: USPS mailpiece size checker tool. Found at https://eddm.usps.com/eddm/select-routes.htm?_gl=1*162xwg*_gcl_au*MTc0MzgwNTg2LjE3MDgzNTg3Mjc.

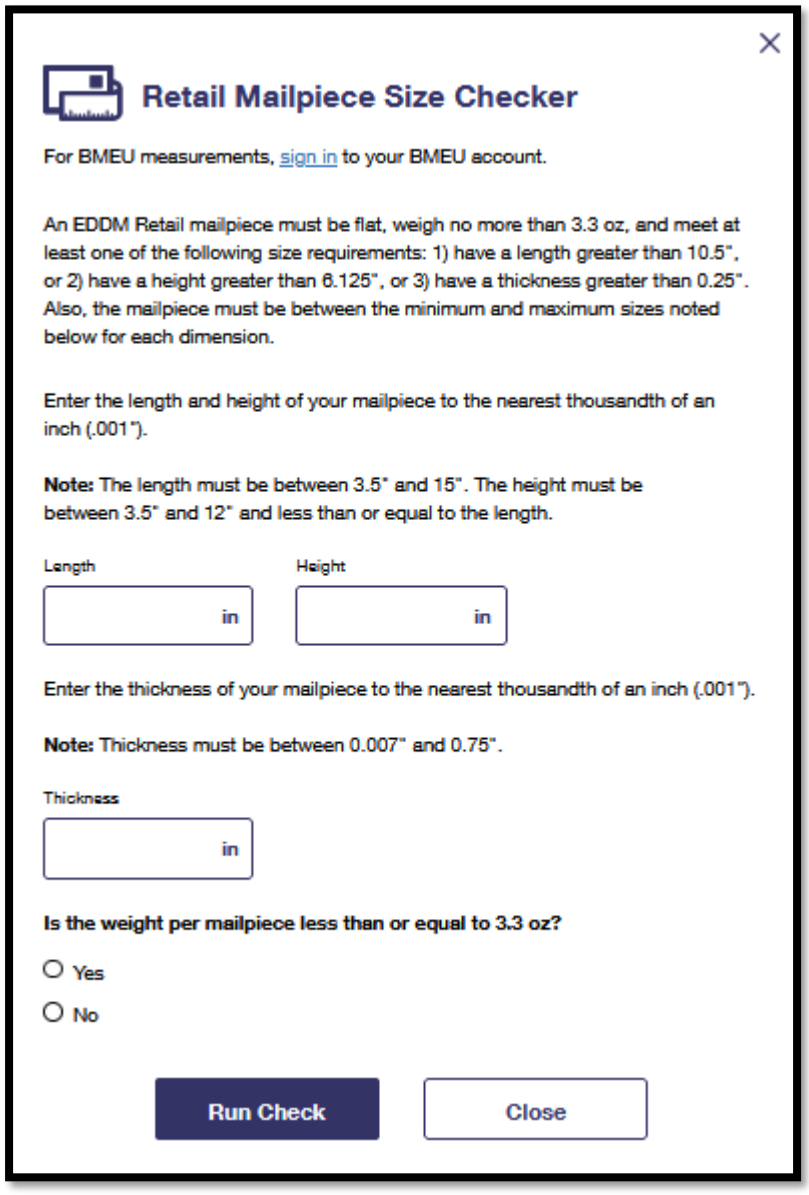
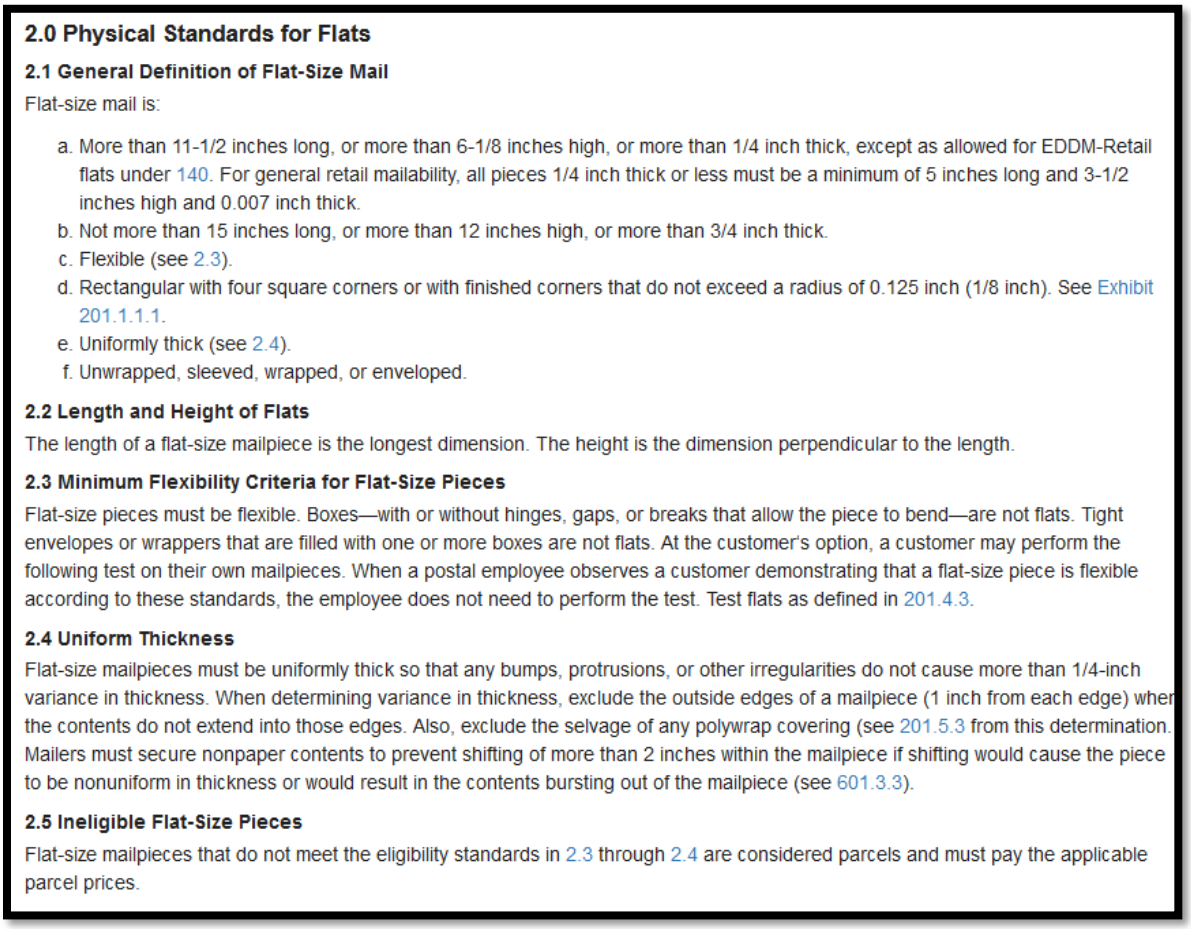


Figure 23: USPS physical standards for flats. Found at https://pe.usps.com/text/dmm300/101.htm#ep1002686.



2.0 Physical Standards for Flats

2.1 General Definition of Flat-Size Mail

Flat-size mail is:

a. More than 11-1/2 inches long, or more than 6-1/8 inches high, or more than 1/4 inch thick, except as allowed for EDDM-Retail flats under 140. For general retail mailability, all pieces 1/4 inch thick or less must be a minimum of 5 inches long and 3-1/2 inches high and 0.007 inch thick.
b. Not more than 15 inches long, or more than 12 inches high, or more than 3/4 inch thick.
c. Flexible (see 2.3).
d. Rectangular with four square corners or with finished corners that do not exceed a radius of 0.125 inch (1/8 inch). See Exhibit 201.1.1.1.
e. Uniformly thick (see 2.4).
f. Unwrapped, sleeved, wrapped, or enveloped.

2.2 Length and Height of Flats

The length of a flat-size mailpiece is the longest dimension. The height is the dimension perpendicular to the length.

2.3 Minimum Flexibility Criteria for Flat-Size Pieces

Flat-size pieces must be flexible. Boxes—with or without hinges, gaps, or breaks that allow the piece to bend—are not flats. Tight envelopes or wrappers that are filled with one or more boxes are not flats. At the customer's option, a customer may perform the following test on their own mailpieces. When a postal employee observes a customer demonstrating that a flat-size piece is flexible according to these standards, the employee does not need to perform the test. Test flats as defined in 201.4.3.

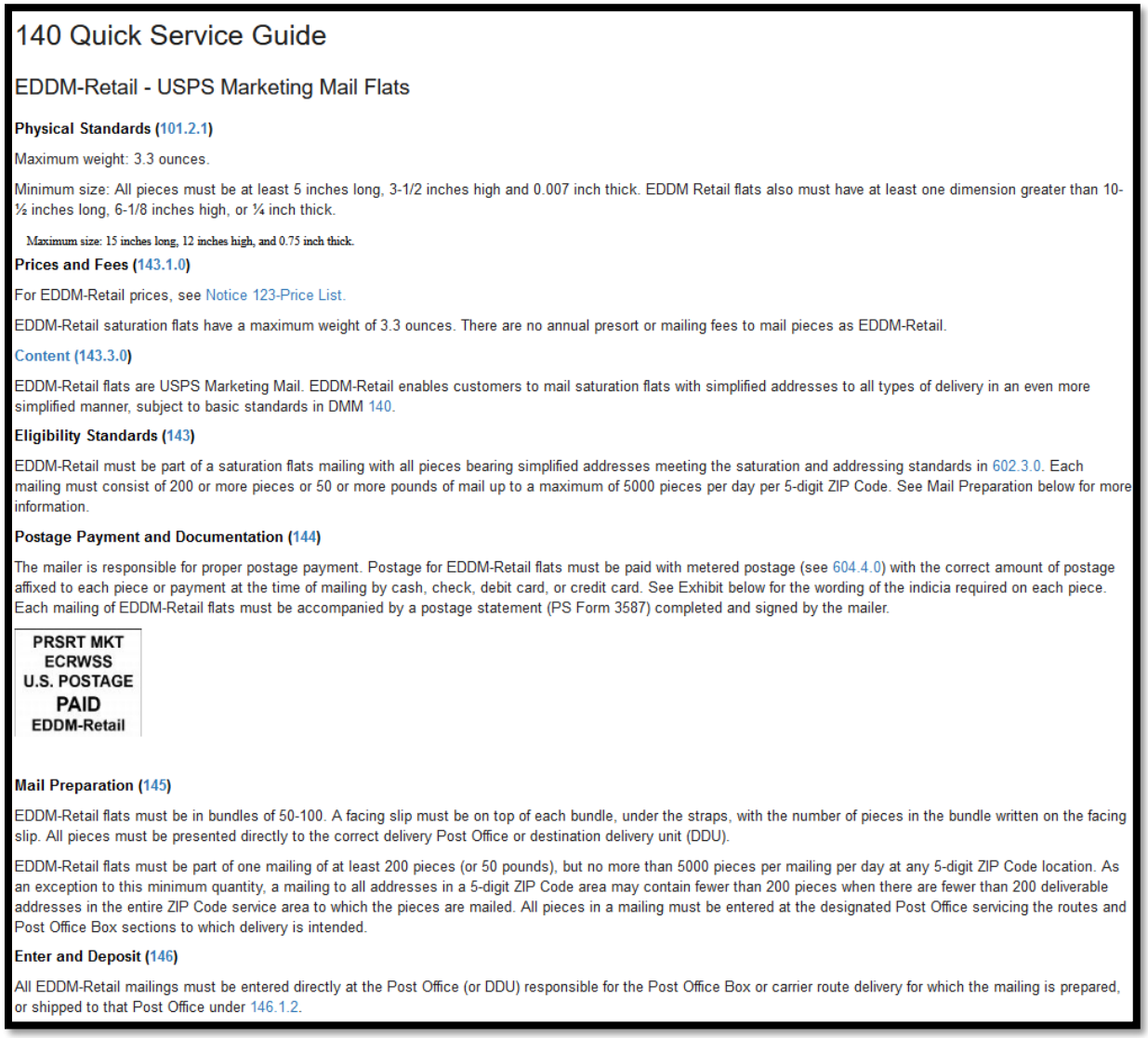
2.4 Uniform Thickness

Flat-size mailpieces must be uniformly thick so that any bumps, protrusions, or other irregularities do not cause more than 1/4-inch variance in thickness. When determining variance in thickness, exclude the outside edges of a mailpiece (1 inch from each edge) when the contents do not extend into those edges. Also, exclude the selvage of any polywrap covering (see 201.5.3 from this determination. Mailers must secure nonpaper contents to prevent shifting of more than 2 inches within the mailpiece if shifting would cause the piece to be nonuniform in thickness or would result in the contents bursting out of the mailpiece (see 601.3.3).

2.5 Ineligible Flat-Size Pieces

Flat-size mailpieces that do not meet the eligibility standards in 2.3 through 2.4 are considered parcels and must pay the applicable parcel prices.

Figure 24: USPS EDDM quick service guide. Found at https://pe.usps.com/text/qsg300/Q140.htm.



140 Quick Service Guide

EDDM-Retail - USPS Marketing Mail Flats

Physical Standards (101.2.1)

Maximum weight: 3.3 ounces.

Minimum size: All pieces must be at least 5 inches long, 3-1/2 inches high and 0.007 inch thick. EDDM Retail flats also must have at least one dimension greater than 10-½ inches long, 6-1/8 inches high, or ¼ inch thick.

Maximum size: 15 inches long, 12 inches high, and 0.75 inch thick.

Prices and Fees (143.1.0)

For EDDM-Retail prices, see Notice 123-Price List.

EDDM-Retail saturation flats have a maximum weight of 3.3 ounces. There are no annual presort or mailing fees to mail pieces as EDDM-Retail.

Content (143.3.0)

EDDM-Retail flats are USPS Marketing Mail. EDDM-Retail enables customers to mail saturation flats with simplified addresses to all types of delivery in an even more simplified manner, subject to basic standards in DMM 140.

Eligibility Standards (143)

EDDM-Retail must be part of a saturation flats mailing with all pieces bearing simplified addresses meeting the saturation and addressing standards in 602.3.0. Each mailing must consist of 200 or more pieces or 50 or more pounds of mail up to a maximum of 5000 pieces per day per 5-digit ZIP Code. See Mail Preparation below for more information.

Postage Payment and Documentation (144)

The mailer is responsible for proper postage payment. Postage for EDDM-Retail flats must be paid with metered postage (see 604.4.0) with the correct amount of postage affixed to each piece or payment at the time of mailing by cash, check, debit card, or credit card. See Exhibit below for the wording of the indicia required on each piece. Each mailing of EDDM-Retail flats must be accompanied by a postage statement (PS Form 3587) completed and signed by the mailer.

PRSRT MKT
ECRWSS
U.S. POSTAGE
PAID
EDDM-Retail

Mail Preparation (145)

EDDM-Retail flats must be in bundles of 50-100. A facing slip must be on top of each bundle, under the straps, with the number of pieces in the bundle written on the facing slip. All pieces must be presented directly to the correct delivery Post Office or destination delivery unit (DDU).

EDDM-Retail flats must be part of one mailing of at least 200 pieces (or 50 pounds), but no more than 5000 pieces per mailing per day at any 5-digit ZIP Code location. As an exception to this minimum quantity, a mailing to all addresses in a 5-digit ZIP Code area may contain fewer than 200 pieces when there are fewer than 200 deliverable addresses in the entire ZIP Code service area to which the pieces are mailed. All pieces in a mailing must be entered at the designated Post Office servicing the routes and Post Office Box sections to which delivery is intended.

Enter and Deposit (146)

All EDDM-Retail mailings must be entered directly at the Post Office (or DDU) responsible for the Post Office Box or carrier route delivery for which the mailing is prepared, or shipped to that Post Office under 146.1.2.