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Memorandum

2018 Non-Energy Impacts Baseline Assessment

To: Fernando Morales, AIC; Jennifer Morris, ICC Staff
From: Opinion Dynamics Evaluation Team
Date: February 10, 2020
Re: 2018 Non-Energy Impacts Baseline Assessment: Summary and Findings (Final)

Introduction

As part of Ameren Illinois Company's (AIC) 2018 energy efficiency program evaluations, Opinion Dynamics assessed the potential for three residential Initiatives to result in non-energy impacts (NEIs). NEIs are the types of impacts that an energy efficiency program has beyond the energy and demand savings it was designed to produce. NEIs can include environmental, economic, public health, and other effects, and accrue to participants, the sponsoring utility, and society at large.

To screen for participant economic and health NEIs from the Income Qualified (IQ), Public Housing (PH), and Multi-Family (MF) Initiatives, we asked 2018 participants to describe their health, economic, and housing conditions in the year before they received program upgrades. Results indicate that each Initiative is reaching customers who experienced the types of health, economic, and housing issues that we would expect energy efficiency projects to help improve. As a result, we identify a strong potential for these Initiatives to provide participant NEIs.

Key Findings

Table 1 and Table 2, on the following pages, summarize the baseline conditions observed among the single-family customers served by the Income Qualified Initiative as well as the Multi-Family Initiative (market rate) participants and compares them to baseline conditions in a large national study of Department of Energy (DOE) Weatherization Assistance Program (WAP) NEIs. In general, we identified similar levels of healthcare, safety, economic and housing burden among the customers AIC is reaching through these Initiatives relative to DOE's national sample of weatherization recipients. In the table below, we highlight several key findings from the surveys and interviews.

Table 1. AIC IQ Single-Family and Multi-Family Participants' Baseline Health and Safety, Compared to DOE WAP Participants

Non-Energy Impact Category	AIC IQ Single-Family Residents (n=201)	AIC Multi-Family Tenants (n=89)	DOE WAP[A] Single-Family Residents (n=665)
Thermal Stress	▪ 57% (n=187) reported their home was cold or very cold in the winter, of whom 8% sought medical help due to the cold ▪ 43% (n=187) reported their home was hot or very hot in the summer, of whom 6% sought medical help due to the heat	▪ 46% (n=78) reported that their home was cold or very cold in the winter ▪ 21% (n=77) reported their home was hot or very hot in the summer	▪ 39% reported their home was cold or very cold in the winter; 3% needed medical attention when home was too cold ▪ 41% said their home was hot or very hot in the summer; 2% said someone in their home needed medical attention because their home was too hot
Asthma	▪ 22% reported that they or others in the household have ever been diagnosed with asthma (n=187) ▪ 2% of all respondents said they or a household member sought ER care for asthma, and <1% said they or a household member stayed overnight at the hospital (n=187)	▪ 25% reported that they or others in the household have ever been diagnosed with asthma ▪ 4% of all respondents said they or a household member sought ER care for asthma, and 7% said they or a household member stayed overnight at the hospital (n=84)	▪ 19% reported that they personally have ever been diagnosed with asthma (14% currently have asthma[B]) ▪ 2% of all respondents reported that they personally stayed in the hospital overnight for asthma; 1% reported visiting the emergency room
Missed Work/School	▪ 10 days of work missed due to their or a household member's illness or injury (n=41)	▪ 3 days of work missed due to their or a household member's illness or injury (n=49)	▪ 4 days of work missed due to own illness/injury per year (respondent without asthma) or 16 days missed (respondent with asthma) ▪ 2 days of work missed due to illness or injury of others in the household
Drafts	▪ 38% reported their home was drafty most or all of the time (n=192)	▪ 25% reported their home was drafty most or all of the time (n=84)	▪ 29% reported their home was drafty most or all of the time

[A] Source: Carroll, D., Berger, J., Miller, C., and Driscoll, C. "National Weatherization Assistance Program Impact Evaluation - Baseline Occupant Survey: Assessment of Client Status and Needs". Tennessee: Oak Ridge National Library, 2014.
[B] Public health researchers differentiate between lifetime asthma (has ever had an asthma diagnosis) versus current asthma (still has asthma). Nationally, about half (55%) of people who have ever had asthma still have asthma (CDC "Summary Health Statistics: National Health Interview Survey, 2018" https://ftp.cdc.gov/pub/Health_Statistics/NCHS/NHIS/SHS/2018_SHS_Table_A-2.pdf).

Table 2. AIC IQ Single-Family and Multi-Family Participants' Baseline Economic Stress, Compared to DOE WAP Participants

Non-Energy Impact Category	AIC IQ Single-Family Residents	AIC Multi-Family Tenants	DOE WAP[a] Single-Family Residents (n=665)
Utility Disconnections	▪ Not Asked	▪ 8 of 16 property managers were aware of shutoffs due to tenant non-payment	▪ 39% received a shutoff notice ▪ 13% reported service disruptions
Economic Insecurity	▪ 27% received SNAP or WIC (n=200) ▪ 55% (n=198) reported struggles in paying their energy bills: 30% occasionally, 13% often, and 12% constantly ▪ 41% used a utility budget payment plan for their energy bill (n=191)	▪ 11% received SNAP or WIC (n=73) ▪ 28% (n=74) reported struggles in paying their energy bills: 24% occasionally, 4% often, and none constantly ▪ 27% used a utility budget payment plan for their energy bill (n=74)	▪ 55% received SNAP or WIC ▪ 75% reported that their energy bill was hard or very hard to pay ▪ 19% reported using short term, high interest loan to pay for energy bill (did not assess use of utility budget payment plans)

More broadly, our key findings across the Income Qualified and Multi-Family Initiatives are:

- **Many income qualified participants face energy insecurity, as do some tenants living in market-rate multi-family housing.** In the year before participating, these participants often struggled to pay their utility bills, used energy assistance such as a bill payment plan, or used public assistance programs (i.e., SNAP, WIC or others). Energy-burdened participants are likely to realize economic and social NEIs due to efficiency upgrades that enable them to save money on their energy bills. Participants who save more on their bills, as a share of income or expenses, benefit the most.
- **According to participants, properties were generally in good condition before the upgrades.** Few participants reported major structural or safety related concerns about their properties. However, when asked, most income qualified single-family participants did feel that their homes were drafty at least some of the time. The minority of property managers who heard tenant concerns about the property noted that concerns centered on general maintenance and repairs, lighting, and odors or smells from neighboring units. Unsurprisingly, these property managers commonly noted that improved lighting quality was a key benefit of program participation.
- **Before participating, single-family income qualified residents and multi-family market-rate tenants found it challenging to keep their home at a comfortable temperature. But, few experienced adverse medical events as a result.** Of those who felt their homes were too cool in the winter or too hot in the summer, discomfort was their most common concern. Few sought medical attention due to excessively hot or cold temperatures in their home. AIC's Initiatives offer energy efficiency improvements (e.g., insulation, air sealing, advanced thermostats) that can make it easier or more affordable to maintain a comfortable indoor temperature. Baseline data therefore suggest that these types of participants are likely to achieve indoor temperature and thermal comfort NEIs. Any reduction in healthcare utilization or healthcare costs would likely be small, given the low baseline incidence of seeking medical attention for thermal stress symptoms.
- **Asthma is common among participating households.** About one quarter of income qualified single-family respondents (22%) and market rate multi-family respondents (25%) said that they or a

household member has ever had asthma at one point in their lives. These results are in line with CDC data showing that approximately 25% of all Illinois residents have ever received this diagnosis, including adults and children.[1] CDC data suggest that a smaller share of households may still have asthma (i.e., "current asthma"), as 17% have a current asthma diagnosis statewide. Future NEI surveys should focus on those with current asthma, because this subgroup is more likely to currently experience asthma symptoms and benefit from improved indoor air quality associated with weatherization.

- **Participating households rarely sought emergency care for their asthma symptoms before their upgrades.** Few said that they or household members stayed overnight in the hospital for asthma (1% of income qualified single-family, 7% of market rate multi-family). Additionally, 2% of income qualified single-family and 4% of market rate multi-family respondents said someone in their household sought emergency room care for their asthma but did not stay overnight in the hospital.[2] These healthcare utilization rates are within range of prior healthcare research findings, albeit at the higher end.[3] Prior research has shown that low income households suffer disproportionately more-severe consequences of asthma than the general population, including increased use of emergency care and hospitalizations.[4] Interestingly, in contrast to prior research and findings for single-family residents, more multi-family residents had overnight hospital stays than visited the emergency room; additional analysis will be needed in a larger study to understand which factors contribute to the trend.

  - Weatherization improves indoor air quality, which may trigger fewer asthma symptoms and reduce the need for medical care. Prior studies have found that asthma patients who received weatherization used less emergency treatment for their asthma following weatherization (between a 2% to 12% reduction among those with asthma, depending on the analytic method).[5] Reducing the use of medical care for asthma—such as emergency room visits, hospitalization, or going to urgent care centers and other medical providers—is a monetary benefit to participants and, if the participant uses government healthcare, also to society. The benefit can be monetized as the avoided cost of the medical visit. Detecting changes in healthcare utilization will be challenging due to the frequency of asthma and the relatively small treatment effect of weatherization. Future studies should survey a large total sample of customers to gather enough data on those with asthma and provide the chance to detect a change in asthma care utilization over time.

- **Screening assessments did not identify a clear path for efficiency improvements to affect the rental housing market.** Rental markets are complex and influenced by a variety of factors. Economic changes due to energy efficiency in the rental market may include reduced vacancy rates, increased rent,

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[1] CDC's National Asthma Control Program. "Asthma in Illinois." https://www.cdc.gov/asthma/stateprofiles/Asthma_in_IL.pdf

[2] We asked about overnight hospitalizations separately from emergency room care, and asked respondents to not include hospitalizations within the emergency room care category.

[3] CDC 2018. "Most Recent National Asthma Data" https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm
Mazurek, J. M., Syamlal, G. 2018. Prevalence of Asthma, Asthma Attacks, and Emergency Department Visits for Asthma Among Working Adults — National Health Interview Survey, 2011–2016. CDC Morbidity and Mortality Weekly Report. 67(13);377–386. https://www.cdc.gov/mmwr/volumes/67/wr/mm6713a1.htm

[4] Wolstein, J., Meng, Y.Y., and S. H. Babey. 2010. Income Disparities in Asthma Burden and Care in California. UCLA Center for Health Policy Research.
http://vid.chis.ucla.edu/publications/Documents/PDF/Income%20Disparities%20in%20Asthma%20Burden%20and%20Care%20in%20California.pdf

[5] Tonn, B., Rose, E., Hawkins, B., and B. Conlon. 2014. Health and Household-Related Benefits Attributable to the Weatherization Assistance Program. Oak Ridge National Laboratory Report ORNL/TM-2014/345.

reduced property O&M costs or reduced turnover costs. Neither income qualified nor market-rate property managers have struggled with high vacancy rates or to find new tenants in recent years. And, while most market rate property managers plan to market the efficient upgrades to new tenants, few of the income qualified multi-family property managers plan to do so. Moreover, few of the market rate property managers anticipate that the upgrades will enable them to reduce the types of activities they do to turn over a unit to a new tenant, or that they would reduce the amount of time it takes to do so. Some of the market rate property tenants reported planning to extend their lease given the new upgrades. Our screening study did not identify a strong potential for changes in rental rates/vacancy rates, rent costs, or O&M costs. Additional study would be needed to identify any other types of housing market effects.

- **Early feedback suggests that few, if any, participants experienced negative NEIs.** Few participants reported any negative effects of program participation, and of the effects mentioned, all are associated with the energy-saving measure itself. For example, the costs of a co-pay under the Income Qualified Initiative that one participant mentioned are direct costs of participation. We will continue to frame surveys to capture both positive and negative non-energy impacts but expect that negative impacts will be rare.
- **More research is needed to understand the baseline and potential for NEIs among the low-income multi-family segment specifically.** Our screening studies focused on low-income single-family and market rate multi-family participants, but prior research has shown that the low-income multi-family segment experiences different baseline conditions (e.g., housing, health, and economic) and different types of NEIs from weatherization compared to the groups we surveyed.[6] To best capture the range of experiences and NEIs moving forward, we will survey both low-income multi- and single-family residents as part of our 2020 Income Qualified Initiative participant NEI survey.

Methods

We developed and fielded a short set of NEI screening questions for AIC's Income Qualified (IQ), Public Housing (PH) and Multi-Family (MF) Initiatives. We selected these Initiatives based on literature review findings that suggested that these three Initiatives are likely to produce high-impact participant NEIs based on the population served as well as the measures and upgrades provided to each. Table 2 summarizes these Initiatives and the measures that AIC provides through each one.

[6] Hawkins (2019) found that, in the baseline, multi-family households had different demographic characteristics than single-family households, experienced more asthma flares, and missed fewer days of work and lost fewer hours of productivity due to illness. Hawkins, B. "Go Big or Go Home: Scaling NEIs to the Multifamily Sector." 2019 IEPEC Conference. https://www.iepec.org/2019_proceedings/#/paper/event-data/100-pdf

Table 3. AIC Initiative Summaries

Initiative	Description	Measures Installed
IQ Initiative	▪ Home energy diagnostic services and whole-house retrofits ▪ Serves single-family and multi-family AIC electric and/or gas customers with total annual household income between 0% and 300% of federal poverty guidelines for household size ▪ IQ Initiative implementers and program allies conduct energy audits in participating households and offer energy efficient direct install measures	▪ *Direct install* -- LEDs, showerheads, faucet aerators, advanced power strips, pipe insulation, and programmable/advanced thermostats at no cost to the participant ▪ *Building shell measures* -- air sealing and insulation ▪ *HVAC measures* -- central air conditioner replacements, boilers, and heat pumps ▪ Distributes *energy efficiency kits* by mail or during community events
MF Initiative	▪ Property audits and direct installation of in-unit and common area measures ▪ Serves market-rate multi-family housing (buildings with three or more units managed by a private entity)	▪ *In-Unit* - LEDs, low-flow showerheads, faucet aerators, programmable thermostats, advanced thermostats, pipe wrap, and Tier 1 advanced power strips ▪ *Common Areas* – LEDs
PH Initiative	▪ Home energy diagnostic services and whole-property retrofits ▪ Serves multi-family properties within AIC territory that are owned or managed by public housing authorities (PHAs), including federal, state, and municipal government authorities ▪ Serves communities where the average household income is at or below 300% of federal poverty guidelines	▪ *Direct install* -- LEDs, low-flow faucet aerators and showerheads, pipe wrap, programmable or advanced thermostats, and advanced power strips at no cost to the participant ▪ *Building shell measures* -- air sealing and insulation, either independently or in addition to direct install measures

We designed surveys to gather baseline information about household and property conditions in the year before participants received upgrades. The goal was to determine whether each Initiative is serving customers who may benefit from weatherization's NEIs based on the types of health, safety, energy burden, or cost issues that they experienced before their upgrade. Table 3 lists the types impacts we asked each group of participants about.

Table 4. Summary of NEIs Assessed by Initiative and Study

Non-Energy Impact Category	IQ Initiative		PH Initiative	MF Initiative	
	Single-Family Residents	Multi-Family Property Managers	Property Managers	Tenants	Property Managers
Health and Safety					
Thermal Stress	✓	✓	✓	✓	✓
Asthma	✓			✓	
Missed Work/School	✓			✓	
Energy Insecurity/Utilities					
Utility Disconnections	✓	✓	✓	✓	✓
Resident or Tenant Energy Security	✓		✓	✓	

Non-Energy Impact Category	IQ Initiative		PH Initiative	MF Initiative	
	Single-Family Residents	Multi-Family Property Managers	Property Managers	Tenants	Property Managers
Use of Payment Plans or Assistance Programs	✓			✓	
Property Conditions					
Common Area Lighting	✓	✓	✓	✓	✓
Maintenance	✓	✓	✓	✓	✓
Odors in Halls	✓	✓	✓	✓	✓
Draft	✓			✓	✓
Rental Property Marketability					
Vacancies		✓			✓
Marketing Plans		✓			✓
Other NEIs					
Negative Effects (Open-ended) and/or Additional Costs	✓	✓	✓	✓	✓
Other Benefit to Organization/ Agency/Household	✓	✓	✓	✓	✓

Note: We asked each participant group about applicable impacts (e.g., tenant turnover is only applicable to property managers). In some cases, we asked about a subset of applicable impacts given space constraints within individual surveys.

We developed question wording following the Lawrence Berkeley National Laboratory's (LBNL) 2012 evaluation of the DOE WAP. To facilitate cross-Initiative comparisons, we used a core set of questions and adapted wording to the context of each Initiative. For example, when asking participants to describe the pre-upgrade conditions at their property, we tailored language to the type of participant (e.g., property managers vs. residents) and property (i.e., home, apartment, or property that they manage). We asked these questions as part of the participant surveys or interviews which Opinion Dynamics conducted to support each initiative's process evaluation. We provide an attachment with the list of the questions asked in Appendix A. Table 4 summarizes the surveys and interviews.

Table 5. NEI Data Collection Methods by Initiative

Research Component	IQ Initiative		PH Initiative	MF Initiative	
Respondent Type	IQ Single-family Residents	IQ Multi-family Property Managers	PHA Staff and Property Managers	Tenants	Multi-family Property Managers
Mode	Telephone Survey	In-depth Interviews	In-depth Interviews	Web Survey	Telephone Survey
Dates Fielded	October 10 - 24, 2018	October 2 - 9, 2018	September 28 – December 12, 2018	March 12 – April 15, 2019	March 27– April 10, 2019
Sample Size	N = 2,126[a]	N=21[a]	N = 13[a]	N = 1,600	N = 50
Completes	n = 201	n = 8	n = 8	n = 89	n = 16
Response Rate	9%	N/A	N/A	8%	42%
Cooperation Rate	77%	N/A	N/A	94%	76%

[a] Samples were generated using partial program tracking data from January through September 2018.

Baseline Conditions

In this section, we present detailed findings from the various research studies conducted in 2018 as part of our process evaluation efforts for each of the three AIC Initiatives.

Income Qualified Initiative

Health and Safety

Thermal Stress

- About half of IQ single-family (SF) respondents (n=201) reported experiencing some discomfort due to extreme cold or hot temperatures during the winter and/or summer prior to their energy efficiency upgrades. However, SF respondents rarely reported that they experienced any health emergencies or required medical attention due to the indoor temperature in their homes.
  - Fifty-seven percent of SF respondents (n=187) reported that the indoor temperature in their homes was cold or very cold in the winters prior to receiving upgrades from the IQ Initiative, while 42% reported that their homes were comfortable.
    - Of the 107 SF respondents who reported that their homes were cold or very cold during the winters prior to the energy efficiency upgrade, 8% reported that a household member needed medical attention due to the cold indoor temperature in their homes, while 92% noted that none of their household members needed medical attention.
  - Forty-four percent of SF respondents reported that their homes were hot or very hot in the summers prior to the upgrade, while 54% noted their homes were comfortable (n=187). Only 3% of SF respondents reported that their homes were cold during the summer.

- Of the 81 SF respondents who reported that their homes were hot or very hot during the summers prior to the upgrade, 6% reported that a household member required medical attention to due to the hot indoor temperature in their homes, while 94% indicated that none of their household members needed medical attention. Nine of the ten who sought medical attention noted that the emergencies did not coincide with a natural disaster or power outage.

Asthma

- While almost one-quarter of SF participants have asthma, or have a household member with asthma, only a few required medical attention due to asthma during the 12 months before their upgrades.
  - Among 197 answering SF respondents, 22% reported that they or a household member has asthma. Among these households, 7% (n=43) reported visiting the emergency room due to asthma and 1% (n=43) noted having to stay in the hospital overnight due to asthma in the 12 months prior to the energy efficiency upgrades. Across the broader respondent population, this equates to 2% seeking emergency room care for asthma, and less than 1% staying overnight due to asthma (n=197).
- A large share of the interviewed MF property managers reported that their properties experienced either extreme hot (five out of eight) or extreme cold temperatures (seven out of eight) lasting more than three days in a row, during the year before their property upgrade. However, none of the MF respondents were aware of tenants experiencing any danger or medical emergencies due to thermal stress.

Absence from Work or School

- Where weatherization improves indoor air quality, some household members may get sick less often. Depending on household members' employment and school attendance, this may enable family members to avoid taking time off work or to miss fewer days of school due to illness. Missing fewer days of work or school may avoid lost wages or income (for those without paid sick time) or avoid falling behind in school. To understand the potential for wage and school attendance benefits, we asked respondents how often they got sick and how often they missed work or school in the year before their upgrade. About half (56%) of the 201 SF respondents noted getting sick at least once during that time. However, only one-fifth (20%) of the 201 SF respondents reported missing at least one day of work or school as a result of their or a household member's illness, while 35% did not miss a single day of work or school, and 38% were either retired or unemployed. Most (88%) of the 41 respondents who missed at least one day of work or school were absent for no more than twelve days during that year, for an average of 10 days missed.

Energy Insecurity/Utilities

- Over half of IQ SF residents reported that they have a bit of a concern or struggle in paying their energy bills. A little over half of the SF participants who struggle with bill payment already have a payment plan in place or receive some form of financial assistance. About half of IQ MF property managers also noted that they believe their tenants may struggle to pay their energy bills.
  - When it comes to paying utility bills, 45% of SF respondents (n=198) indicated that paying their energy bill is not an issue for them. However, 55% of SF respondents reported having issues paying their energy bill—some (30%) reported having issues occasionally, others (13%) reported often having issues paying their bill, and 12% reported struggling with bill payment constantly.

- Of the 191 answering SF respondents, 41% indicated using a budget payment plan to pay for their home energy bills in the 12 months prior to receiving their upgrades, while 27% of 200 answering SF respondents noted receiving financial assistance from either the Supplemental Nutrition Assistance Program (SNAP) and/or Women, Infants, and Children Nutrition (WIC) Program during the 12 months preceding their energy efficient upgrades.

- Many of the SF respondents reported indicators of economic stress (expressing a struggle paying bills at least occasionally, being on an energy bill payment plan, and/or receiving SNAP or WIC assistance).

  - Of the SF respondents who reported having some level of difficulty in paying their energy bill (n=109), 40% noted having a budget payment plan for their energy bill, while 38% of customers who struggle to pay energy bills also noted receiving financial assistance from either SNAP and/or WIC during the 12 months preceding their energy efficient upgrades.

  - A relatively high share of IQ MF property managers believe that their tenants struggle with paying their energy bill, as five of seven MF property managers reported that their property has had some power disconnections due to non-payment of energy bills. The frequency of disconnections varies among responding property managers. Some experience disconnections once a month, others only experience it one to two times a year.

Property Conditions

- Results suggest that IQ properties are in generally good condition as neither SF residents nor MF managers reported major issues or concerns with their properties. However, the majority of SF respondents indicated that their homes were occasionally drafty before their upgrade, while several of the responding MF property managers noted receiving reports of tenant health and/or safety concerns due to lack of lighting, odors, or need for building repairs or maintenance.

  - Over three-quarters (77%) of SF respondents (n=192) found their homes to be drafty at least some of the time during the 12 months prior to their upgrades. Over half (51%) of those who reported their homes to be drafty (n=147) indicated that their homes were drafty only “some of the time”, while 27% and 22% noted their homes to were drafty “most of the time” and “all of the time”, respectively.

  - Most responding MF property managers have not heard any tenant concerns due to poor lighting in common areas, odors from other units, or complaints about maintenance issues. Only a minority of MF property managers reported receiving complaints regarding lighting (one of eight), odors (two of eight), or maintenance needs (one of eight). Five of eight MF respondents noted having vacancies lasting at least one to two months.

Other Non-Energy Impact Findings

In addition to collecting baseline information about pre-upgrade conditions, we also asked respondents to describe any positive or negative non-energy changes at their property following the upgrade.

Positive NEIs

- Apart from energy bill savings, increased comfort and improved temperature control are the primary NEIs that SF respondents mentioned, while MF property managers noted an improvement in lighting (i.e., increased brightness) in their properties.

- When asked about how else they might have benefitted from the IQ Initiative in addition to energy bill savings, 31% of SF respondents (n=162) reported experiencing an increased level of comfort in their homes, while 13% reported an improvement in temperature control, and 10% reported that their homes have become less drafty. Nearly one-third of SF respondents (30%) reported that they have not observed any other benefits as of the time of the survey, while others indicated that it is too early to tell (6%).
- Since receiving energy efficient upgrades in their properties, some responding MF property managers reported that their tenants have been appreciative of the upgrades and are quite happy with the smart thermostats and lighting upgrades in their properties.
- Two of seven responding IQ MF property managers noted using the upgrades to market their property. When asked why they are not marketing the upgrades, one respondent noted that the measures they received were marginal as they were limited to direct install measures[7], while another respondent indicated that because they have a waitlist of MF tenants, they believe that the upgrades may not matter much to potential tenants.

Negative NEIs

- SF households and MF property managers reported only a few disadvantages to participating in the IQ Initiative. Added costs varied by program. SF respondents noted that they incurred out of pocket costs either as part of their copay for HVAC and/or shell retrofits or to complete prerequisite mechanical work or repairs. On the other hand, MF respondents reported receiving complaints from some tenants about their thermostats and advanced power strips.
  - Cost is one of the primary barriers to both program participation and investing in energy efficiency upgrades among low-income customers. As such, we asked IQ SF respondents whether their household has incurred any costs from participating in the initiative and/or installing energy efficiency equipment. We found that 75% of SF respondents (n=182) did not incur any costs for participating in the initiative and installing energy efficient equipment in 2018. However, 12% of SF respondents noted having to pay for part of their HVAC and/or shell retrofits and 5% noted paying for the necessary mechanical work/repairs required for their energy efficient equipment to be installed. There was also one (0.5%) SF respondent who noted that they *"paid for repairs needed on damages caused by contractor work"*.
  - Few MF respondents had any issues with the upgrades installed in their properties. One of five answering MF respondents noted receiving some complaints about the thermostats, while one other MF respondent who had issues noted that one of their tenants refused to use the advanced power strip after learning about how the equipment works.

Public Housing Initiative

- Public Housing Authority (PHA) staff and property managers do not perceive that their residents experienced much thermal stress during the 12 months prior to property upgrades, with just two of

[7] Per 2018 program tracking data, the property received direct install measures such as LEDs, pipe insulation, and faucet aerators but no thermostats or shell or HVAC measures.

seven reporting that residents experienced either extreme hot (1) or cold (1) temperatures prior to the upgrades.

- In terms of bill payment, some PHA staff (three of eight) recalled that some residents may have experienced power disconnections that were due to non-payment. While these types of power disconnections do occur, PHAs noted that power disconnections are infrequent because it is a violation of PH residents' lease agreement. Further, PHA residents are required to notify PHA staff should there be a risk of this happening.
- According to PHA staff, PHA properties are in good condition. Only two of eight PH staff noted receiving reports from residents regarding needs for maintenance or repairs, while none of the eight PH staff reported hearing from their residents regarding health and safety issues due to poor lighting, odors, or other factors.
- Participation in the PH Initiative has been mostly beneficial for PHAs. Improvements in lighting and property aesthetics, as well as energy bill savings are the most common benefits that PHA staff observed for their residents. Notably, PHA staff did not report any negative feedback on the upgrades.
  - Four of the eight of PHA staff received resident feedback about the upgrades. Those who did, said that residents noticed improvements in lighting (two of four), reduced energy bills since the upgrades (one of four) and that their property improved aesthetically (one of four). Another PHA staff received reports that their residents are satisfied with the smart thermostats they received. PHA staff added that since the upgrades, they have observed a decrease in requests for light bulb replacements (two of four), an improvement in common area lighting (one of four), and a decrease in maintenance requests (one of four), which may be helpful to PHAs that are understaffed.

Multi-Family Initiative

Health and Safety

Thermal Stress

- Almost half of multi-family tenants reported experiencing some discomfort due to extreme cold during the winter and less than a quarter of tenants reported experiencing discomfort in the summer prior to receiving their energy efficiency upgrades. Like the IQ single-family participants, respondents who experienced discomfort rarely reported that they experienced any health emergencies or required medical attention due to the indoor temperature in their homes.
  - Forty-six percent of multi-family tenants (n=78) reported that the indoor temperature in their homes was cold or very cold in the winters prior to receiving upgrades from the Multi-Family Initiative, while 53% reported that their homes were comfortable. Only one respondent indicated their home was hot during the winter.
    - Of the 36 respondents who reported that their homes were cold or very cold during the winters prior to the energy efficiency upgrades, only one respondent reported that a household member needed medical attention due to the cold indoor temperature in their homes (3%). This respondent also reported that this medical emergency did not coincide with a time when their unit was too hot or cold due to a natural disaster or power outage.
  - Twenty-one percent of multi-Family tenant respondents reported that their homes were hot or very hot in the summers prior to receiving the upgrades, while 78% noted their homes were comfortable

(n=77). Only one respondent reported their home was cold during the summer. None of the respondents who reported that their homes were hot or very hot during the summers prior to the upgrade reported that a household member required medical attention to due to the hot indoor temperature in their homes.

- All market-rate multi-family property managers reported that their properties experienced extreme hot temperatures lasting more than three days in a row, during the year before their properties received energy efficiency upgrades (n=15). Similarly, almost all property managers reported their properties faced extreme cold temperatures during this time period (14 out of 15). Property managers rarely reported these events caused tenants to experience any danger due to thermal stress, as only one property manager of the 15 we interviewed reported these periods of extreme heat caused tenant units to become dangerously hot and none of the 14 property managers who said their property faced extreme cold said that the cold caused tenant units to become dangerously cold.

Asthma

- A quarter of all tenants reported that someone in their household had asthma (21 out of 84) and some of these tenant households required medical attention for their asthma.
  - Among the 21 tenant households with asthma, three reported visiting the emergency room due to asthma (14%) and six reported having to stay in the hospital overnight due to asthma in the 12 months prior to the energy efficiency upgrades (29%). Among the broader sample of respondents, this equates to 4% of participants seeking ER care, and 7% staying overnight in the hospital due to asthma (n=84).

Absence from Work or School

- In the 12 months before tenants received their energy efficiency upgrades, 35% of tenants with a full-time wage earner at home reported the primary wage earner(s) in their household missed at least one day of work because they, or someone else in the household, were sick or injured (n=49). For the 18 tenants that reported their primary wage earner missed work, the average number of missed days was 3, while the maximum number of days missed was 8.

Energy Insecurities

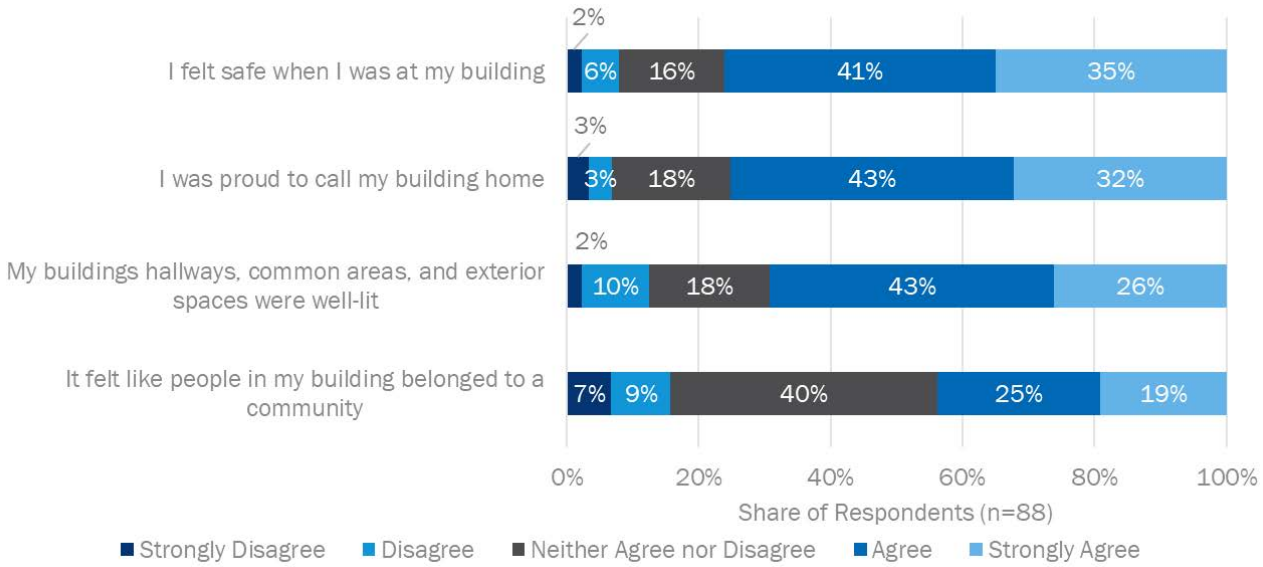
- Most market rate multi-family tenants reported they do not struggle with energy insecurity.
  - Seventy-two percent of multi-family tenants who are responsible for paying their energy bills indicated that paying their energy bill is not an issue for them (n=74). Some tenants (24%) reported they struggle to pay their bill occasionally, while only 4% of tenants reported they often struggle to pay their energy bills (n=74).
  - However, some tenants served through this program do receive assistance with bills and household costs. Over a quarter of tenants that are responsible for paying their bills indicated they used a budget payment plan to pay for their home energy bills in the 12 months prior to receiving their upgrades (20 out of 74). Eleven percent of tenants also reported receiving financial assistance from either the Supplemental Nutrition Assistance Program (SNAP) and/or Women, Infants, and Children Nutrition (WIC) Program during the 12 months preceding their energy efficient upgrades (n=73).

- Half of market-rate multi-family property managers reported that they were aware of their property experiencing some power disconnections due to tenant non-payment of energy bills (n=16). Where they occur, disconnections seem to happen infrequently; four of eight property managers reporting disconnections recalled disconnections about every year, one recalled them every few months, two recalled they happen most months but not every month, and one was unsure about the frequency.

Property Conditions

- Property managers reported their properties were generally in good condition before the upgrades as they rarely reported hearing concerns from their tenants about property conditions. Tenants corroborated that their properties were in good condition as they did not report any major issues with their units. However, most tenants did experience issues with their units being drafty before the program and some tenants also reported their units needed maintenance or repairs.
  - Most tenants reported they felt their buildings were safe and well-lit (Figure 1). Most tenants were also proud to call their buildings home and they felt like the people in their building belonged to a community (n=88). A share of tenants did report their building conditions needed improvement as 32% of tenants strongly agreed or agreed that their unit, hallways, common areas, or the exterior areas needed maintenance or repairs (n=87).

Figure 1. Multi-Family Initiative Tenant Perceptions of the Condition of Their Buildings



  - The majority of tenants (64%) experienced issues with their unit being too drafty, meaning their unit was too breezy or cold or had damp air blowing in the year before they received their upgrades (n=84). Thirty-nine percent of tenants reported experiencing these issues "some of the time," while 17% reported experiencing them "most of the time," and 8% reported experiencing them "all of the time."
  - A minority of property managers reported their tenants shared concerns about the safety of the lighting of their property's common areas or smelling odors from other units. Four property

managers reported receiving complaints regarding odors and one reported their tenants shared concerns or frustrations related to safety of the lighting in hallways, stairwells, or entryways at their property (n=16).

- Two property managers also reported that they could not complete all the maintenance they wanted or needed to do in the 12 months before the upgrades at the property, because it was too expensive (n=14). Future participant satisfaction or NEI surveys could gather more detail about the extent to which utilizing the program's no-cost energy efficiency upgrades opens room in property management budgets to address these other maintenance needs.

Property Turnover and Vacancies

- Almost half of property manager respondents reported they had a tenant unit that was vacant for a month or longer in the 12 months before the upgrade, but they generally do not experience challenges finding renters for their property. Most property managers plan to market the energy-efficient upgrades they received through the Initiative to potential tenants and some tenants believe they are more likely to renew their lease than they otherwise would have been if they did not receive upgrades through the Initiative. Most property managers reported they anticipate having to complete the same amount of tenant turnover and maintenance activities for the units that received upgrades through the Initiative.
  - Forty-four percent of property managers reported that at least one of the tenant units at their property was vacant for one month or longer, although it is interesting to note that close to one fifth (19%) did not know about turnover (n=16). Just over two-thirds of property managers (69%) reported it has not been challenging to find renters for their property, while the remainder reported that it has been slightly challenging (31%) (n=16).
  - Two-thirds of property managers plan to market the new energy-efficient upgrades they received through the Initiative to potential tenants (n=15). Some tenants also reported the upgrades will have an impact on their decision to renew their lease as 39% of tenants reported they are more likely to renew their lease since receiving the upgrades, while 56% reported they are about as likely, and 5% of tenants reported they are less likely to renew their lease (n=75).
  - Property managers reported they complete a variety of activities when they turn over tenant units. Five property managers clean the units; two complete deferred upgrades, such as replacing cabinets, countertops, flooring, appliances; and one conducts general maintenance, such as painting the walls and replacing light bulbs. Most property managers (81%) reported they anticipate having to complete the same amount of these activities for the units that received upgrades through the Initiative, while a few (19%) anticipate they will need to complete fewer turnover activities (n=16).

Other Non-Energy Impact Findings

Both tenants and property managers reported experiencing additional benefits from the upgrades they received through the Multi-Family Initiative. The most common benefits tenants and property managers experienced were improvements in the brightness and quality of the lighting in their units and improvements in temperature control and comfort of tenant units.

- Six of the 16 property managers we surveyed reported that their tenants approached them to share their thoughts about the upgrades they received. Of these six, almost all characterized their tenants' feedback as positive. Of all feedback received, property managers most often recalled receiving

positive tenant feedback about the brightness or quality of the lighting in tenant units and common areas (Table 4). Negative feedback was rare and centered around tenants' concerns or frustrations with the new equipment.

Table 6. Tenant Positive and Negative Feedback about Upgrades, According to Property Managers

Benefit/Cost	Number of Tenants Providing Mostly Positive Feedback (n=6)	Number of Tenants Providing Mostly Negative feedback (n=6)
The temperature in their unit	1	0
The brightness or quality of the lighting in their unit	3	0
The brightness or quality of the lighting in common areas	2	0
Energy bill savings or the cost of their energy bills	1	0
Changes in their health that seem related to the upgrades	1	0
Tenants' new equipment	1	1

- Over one quarter of tenant respondents reported experiencing additional non-energy impacts from the upgrades they received (22 out of 85).
  - Tenants that reported experiencing benefits beyond energy bill savings most frequently reported the advanced thermostats they received gave them better control over the temperature in their units (seven tenants) and three tenants also reported this increase in temperature control resulted in their units becoming more comfortable. Five tenants also reported the brightness or quality of the lighting in their units increased after they received LEDs.

Tenants rarely (8%) indicated their households experienced drawbacks due to the upgrades (n=87). Four of the seven tenants experiencing drawbacks reported they faced challenges operating their advanced thermostats; in some of these cases, tenants believe this resulted in higher electricity bills. Three tenants reported they would have preferred to receive different energy efficient upgrades.

Appendix A. Survey Questions

The embedded file lists the survey and interview questions we asked in these studies.

AIC 2018 NEI Screening Survey an