Memorandum

TO: Kevin J. Jackson, Village Manager

FROM: Lindsey Roland Nieratka, Chief Sustainability Officer

FOR: Village President and Board of Trustees

DATE: January 8, 2025

SUBJECT: Results of participation in the U.S. Department of Energy's (DOE) Energy to Communities (E2C) Expert Match Program: Multifamily Building Energy Modeling

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Purpose

The purpose of this memo is to provide the Village Board with an overview of the results of multifamily building energy modeling performed in the Village of Oak Park, with free technical assistance from the Department of Energy's (DOE) Energy to Communities E2C Expert Match program.

Background

In early 2025, the Office of Sustainability & Resilience applied to the DOE's free technical assistance program, E2C Expert Match, for assistance with building energy programming. The purpose of the technical assistance was to inform and support the development of a One Stop Shop program, which would benefit multifamily properties in the Village. In February 2025, the Village was matched with a project manager, Evan Savage, from the National Renewable Energy Laboratory (NREL) and experts from Argonne National Laboratory, including Chief Building Scientist, Dr. Ralph Muehleisen, and Building Scientists Jeannie Kim and Zhaoyun Zeng.

Sustainability & Resilience Staff provided the expert team with access to data from the Village's benchmarking inventory. Additional information was gathered from building owners.

Notable findings of the E2C study include the following:

- Of the 95 buildings assessed, only 24 had lower site Energy Use Intensity (EUI) relative to a national mean, while 61 had lower source EUI relative to a national mean. This signified that Oak Park multifamily buildings have high energy use but that the energy being used is relatively clean. This is a testament to the work being done by ComEd to decarbonize the electric grid and **highlights the significance of continuing to support grid decarbonization, community solar, onsite renewable energy, and electrification.**
- Small multifamily properties (<55,000 square feet) demonstrated a strong potential for benefit from incentive programs and targeted energy efficiency upgrades due to high energy use and the prevalence of that building size in the Village's building stock.
- Gas EUI and site EUI were strongly correlated, suggesting that space heating and hot water use are major drivers of energy use and **reinforcing the importance of targeting weatherization and heating system upgrades.**
- Modeled energy saving and estimated costs for different efficiency measures found that mini-split heat pump installation provided the most savings in Energy Use Intensity of individual measures.
- When applying ComEd's electric heating rate, the annual energy costs of installing mini split heat pumps were comparable to annual energy costs associated with replacing a boiler with a more efficient version.
- For the modeled building, installing mini split heat pumps had a much higher cost ($380K) than upgrading boilers to a more efficient model ($80K), **highlighting the need for incentives** to encourage heat pump adoption**.**

Next Steps

- The technical assistance results were provided to Elevate Energy, the Village's consultant developing the Energy Efficiency One Stop Shop program, for use in designing the multifamily components of the program.
- Sustainability Staff will create educational content based on the results to provide to multifamily buildings participating in the Benchmarking program.
- Sustainability Staff will evaluate the need for additional assistance from the Energy to Communities program and submit a second request for technical assistance.

For questions, please contact Lindsey Roland Nieratka, Chief Sustainability Officer, via email at LNieratka@oak-park.us or by phone at 708-358-5785.

Attachments:

E2C PowerPoint Presentation

cc: Lisa Shelley, Deputy Village Manager
Ahmad Zayyad, Deputy Village Manager
Jack Malec, Assistant to the Village Manager
Jonathan Burch, Neighborhood Services Director
Christina M. Waters, Village Clerk
All Department Directors

JULY 3, 2025

ENERGY TO COMMUNITIES: VILLAGE OF OAK PARK
MULTIFAMILY HOUSING INCENTIVE PROGRAM DEVELOPMENT

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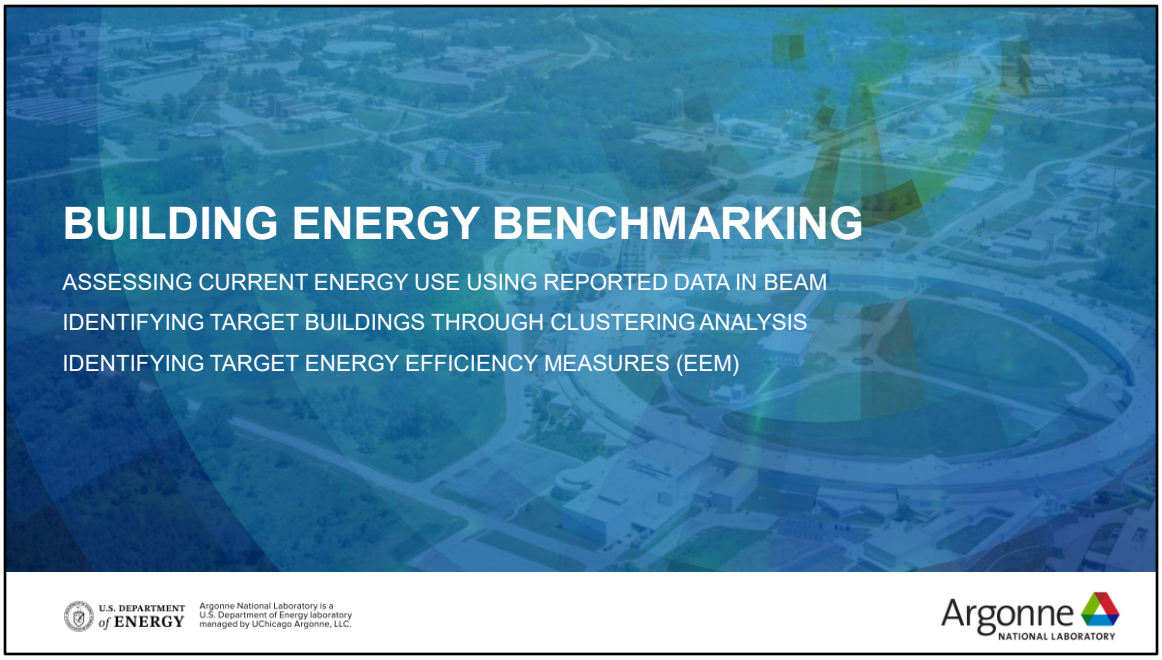
CONTENT OVERVIEW

I. BUILDING ENERGY BENCHMARKING
- Assessing current energy use using reported data in BEAM
- Identifying target buildings through clustering analysis
- Identifying target energy efficiency measures (EEM)

II. BUILDING ENERGY MODELING
- Modeling a representative multifamily building in Oak Park
- Comparing EEMs and analyzing their impacts on energy reduction

- **BUILDING ENERGY BENCHMARKING**
  - First, we assessed current energy performance using benchmarking data.
  - Reported benchmarking data from BEAM (https://sandiego.beam-portal.org) were used for analysis.
  - Through clustering analysis, we identified groups of similar buildings and selected high-priority targets.
  - This step also informed the selection of relevant energy efficiency measures (EEMs) for each group.
- **BUILDING ENERGY MODELING**
  - Next, we created an energy model of a representative multifamily building in Oak Park.
  - We applied various EEMs in the model to simulate and compare their energy impacts.
  - The analysis quantified potential energy reductions and highlighted the most effective strategies.


BUILDING ENERGY BENCHMARKING
ASSESSING CURRENT ENERGY USE USING REPORTED DATA IN BEAM
IDENTIFYING TARGET BUILDINGS THROUGH CLUSTERING ANALYSIS
IDENTIFYING TARGET ENERGY EFFICIENCY MEASURES (EEM)
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Building Benchmarking Data in BEAM

- Oak Park's Energy and Water Benchmarking Ordinance requires all buildings of 10,000 square feet or larger to report annual energy and water use through Energy Star Portfolio Manager.
- Benchmarking data from 2022 and 2023 is currently available, while 2024 data is still in the process of being uploaded.
- In 2023, 134 buildings submitted benchmarking reports to Energy Star, and their energy use data was uploaded to BEAM.
- This includes 95 multifamily housing buildings, constructed between 1897 and 2019.
- Other reported buildings include three fire stations, one hotel, one library, nine offices, and 25 categorized as "other."

- **Building Benchmarking Data in BEAM**
  - This slide provides an overview of the benchmarking dataset we used as the foundation for our analysis.
  - The 2023 data is the most recent complete set available, and it forms the basis of our clustering and modeling work.

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Assessing Current Energy Use of Multifamily Buildings

- The target of this analysis is multifamily buildings with available data on BEAM.
- Current energy use and building characteristics were assessed using BEAM data.
- The assessment includes information on year built, site energy use intensity (EUI), source EUI, electricity and gas consumption, and floor area.
- Data processing was conducted to handle missing values, remove duplicates, and review outliers in detail.
- K-means clustering was applied to group similar buildings and identify representative targets for further analysis.

- **Assessing Current Energy Use of Multifamily Buildings**
  - This slide outlines the overall approach we used to assess energy performance in multifamily buildings using BEAM data.
  - We looked at key variables including construction year, site and source EUI, fuel breakdowns (gas and electricity), and floor area.
  - We pre-processed the data by cleaning missing entries, removing duplicates, and investigating outliers.
  - Finally, we applied K-means clustering to group similar buildings – this helped us narrow down high-impact targets for more detailed analysis and modeling in the next phase.
  - Slides 6-18 provide a detailed walkthrough of this assessment and key findings.

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Data Processing Overview

- A total of 95 Multifamily buildings submitted benchmarking reports in 2023.
- Missing Data
  - Electricity use from the grid was available for all buildings.
  - Natural gas use was missing for three buildings (fig).
    - » #119130: Grove Garfield Building (built in 1920)
    - » #119277: Greenplan 300 Washington LLC (1920)
    - » #119498: Greenplan 418 Lake LLC (1920)
  - It is unclear whether these buildings are fully electrified, so they were excluded from further analysis.

Fig. Buildings with No Reported Gas Use

- **Data Processing Overview**
  - In total, 95 multifamily buildings submitted benchmarking data in 2023. Electricity use data was available for all of them, but natural gas consumption was missing in three cases. These buildings, all built in 1920, may potentially be fully electrified, but this couldn't be confirmed through the available data. To maintain consistency and avoid skewing the analysis, we excluded them from further modeling and clustering steps.

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Data Processing Overview

- Missing Data
  - Site EUI values were missing for 32 buildings and were calculated based on available electricity and gas use and floor area.

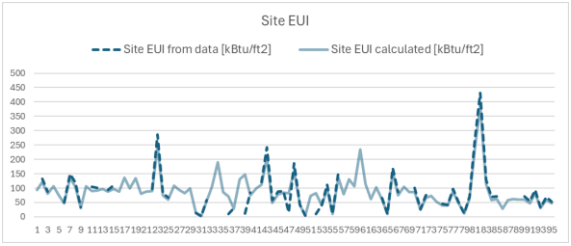

Fig. Site EUI Estimated from Electricity and Gas Use for Missing Cases

- Duplicate Data
  - The building “Eleven33 (el255)” appeared under two IDs: #117637 and #193875.
  - The entries contained the same data, so one duplicate was removed.

- **Data Processing Overview**
  - Site EUI values were missing for 32 buildings, so we calculated them using available electricity and gas consumption data along with floor area. The graph shows a comparison between reported site EUI (dashed line) and calculated values (solid light blue line), with strong alignment between the two. This validation gives us confidence in the calculated values and allowed us to complete the dataset for further analysis.
  - During the data cleaning process, we also identified a duplicate entry for the building “Eleven33 (el255),” which appeared under two IDs (#117637 and #193875). Since both records contained identical information, one was removed to ensure the dataset remained accurate and free of redundancy.

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Data Processing Overview

- Outliers
  - One building initially showed unusually high site and source EUI values.
  - Upon review, its site EUI was corrected based on electricity and gas usage, adjusted from 431 to 384.6 kBtu/ft^2.
  - Other buildings with similar floor area have site EUI values ranging from 12 to 246 kBtu/ft^2.
  - Although the building still shows high energy use, it is not considered an outlier due to data error.
- After data processing, 91 multifamily buildings were included in the final analysis out of the original 95 submissions.

Fig. Building #121958 with Notably High EUI

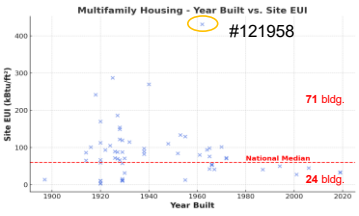

Fig. Site EUI of All Oak Park Multifamily Buildings by Year Built

- **Data Processing Overview**
  - The plot highlights one apparent outlier, building #121958, which initially showed unusually high site and source EUI values. Upon reviewing its electricity and gas consumption, the site EUI was corrected from 431 to 384.6 kBtu/ft². Although this remains on the higher end, it falls within the overall range for buildings of similar floor area (12 to 246 kBtu/ft²) and is no longer considered a data error. After all data cleaning steps, including this correction, 91 multifamily buildings were included in the final analysis.

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Assessment of Oak Park Multifamily Benchmarking Data

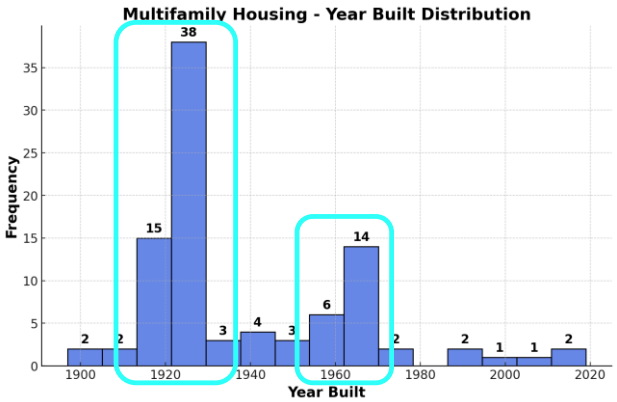

Fig. Distribution of Multifamily Housing by Year Built

- The majority were constructed during two key periods: 1920–1930, with 53 buildings, and 1960–1970, with 20 buildings. These two decades represent the primary construction eras for Oak Park's multifamily housing stock.

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- **Assessment of Oak Park Multifamily Benchmarking Data**
  - The histogram shows the distribution of construction years for the 91 multifamily buildings included in the analysis. There are two clear peaks: one between 1920 and 1930, with 53 buildings, and another between 1960 and 1970, with 20 buildings. These two periods represent the main construction booms for Oak Park's multifamily housing stock, which is important context when considering building age, likely envelope characteristics, and potential energy efficiency upgrade needs.

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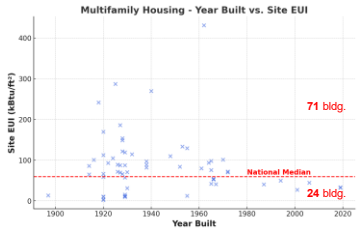
Assessment of Oak Park Multifamily Benchmarking Data



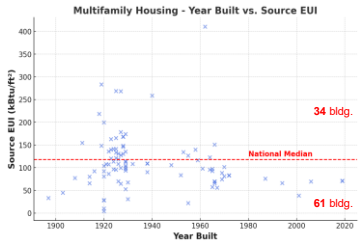


Fig. Scatter Plots of Site and Source EUI by Year Built

When comparing all multifamily buildings in Oak Park to national benchmarks:

- Only 24 buildings have a site EUI lower than the national median.
- However, 61 buildings have a source EUI below the national median.

This indicates that while many buildings may consume more energy on-site, the energy supplied by the grid is relatively sustainable or efficient, leading to lower source energy values.

** source energy = the total amount of raw fuel required to operate a building, including losses from generation, transmission, and distribution, giving a more complete picture of a building's environmental impact than site energy.*

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- **Assessment of Oak Park Multifamily Benchmarking Data**
  - This slide compares Oak Park's multifamily buildings to national energy performance benchmarks. As shown in the top figure, only 24 buildings have a site EUI below the national median, indicating relatively high on-site energy consumption among Oak Park's multifamily stock. In contrast, the lower figure shows that 61 buildings fall below the national median for source EUI. This suggests that despite higher site usage, many buildings benefit from cleaner or more efficient energy supply—resulting in a lower overall environmental impact.

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Assessment of Oak Park Multifamily Benchmarking Data

Table. K-means clustering by floor area

Size	Buildings #	Range of Floor Area [ft²]	Avg. Site EUI [kBtu/ft²]	Avg. Source EUI [kBtu.ft²]
Small	84	2,500 ~ 55,000	96	118
Medium	6	66,000 ~ 230,000	49	74
Large	1	443,271	31	71
			National Mean **59.6 kBtu/ft2**	National Mean **118.1 kBtu/ft2**

- Using K-means clustering, we first grouped all 91 buildings into small, medium, and large categories based on floor area.
- When comparing the average site and source EUI of each group to the national median, small buildings emerged as the best target for incentive programs. Not only do they make up the largest number of buildings, but they also have higher site EUI than the national average.

** K-means clustering: a method used to group similar data points based on how close or similar the values are in terms of selected variables.*

- **Assessment of Oak Park Multifamily Benchmarking Data**
  - This slide presents the results of K-means clustering applied to the 91 multifamily buildings, grouping them into small, medium, and large categories based on floor area. The table summarizes the number of buildings in each group, along with their average site and source EUI values.
  - Small buildings stood out as the most strategic targets for incentive or retrofit programs. They not only represent the largest share of the building stock but also have average site EUI values above the national median, suggesting a greater opportunity for energy savings. By focusing on this group, efficiency programs can achieve broader impact across more buildings with higher potential gains.

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Assessment of Oak Park Multifamily Benchmarking Data

Table. K-Means Clustering of Small Multifamily Buildings based on Site EUI

Size	Site EUI Category	Buildings #	Avg. Site EUI [kBtu/ft2]	Avg. Elec Use [kBtu/ft2]	Avg. Gas Use [kBtu/ft2]
Small	Low	38	58	9	49
	Medium	40	107	11	96
	High	6	249	12	237

National Mean
59.6 kBtu/ft2

- Among the small multifamily buildings, a second round of k-means clustering was performed to categorize them into low, medium, and high site EUI groups.
- The medium and high clusters both showed site EUI values above the national median.

- **Assessment of Oak Park Multifamily Benchmarking Data**
  - This slide shows the results of a second round of K-means clustering, applied specifically to the small multifamily buildings. In this step, we grouped them into low, medium, and high categories based on site EUI. The goal was to further segment this target group and identify which buildings may benefit most from energy efficiency improvements. As shown in the table, both the medium and high site EUI clusters exceed the national median, confirming that a substantial portion of the small building stock has elevated energy use and could be prioritized for intervention.

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Assessment of Oak Park Multifamily Benchmarking Data

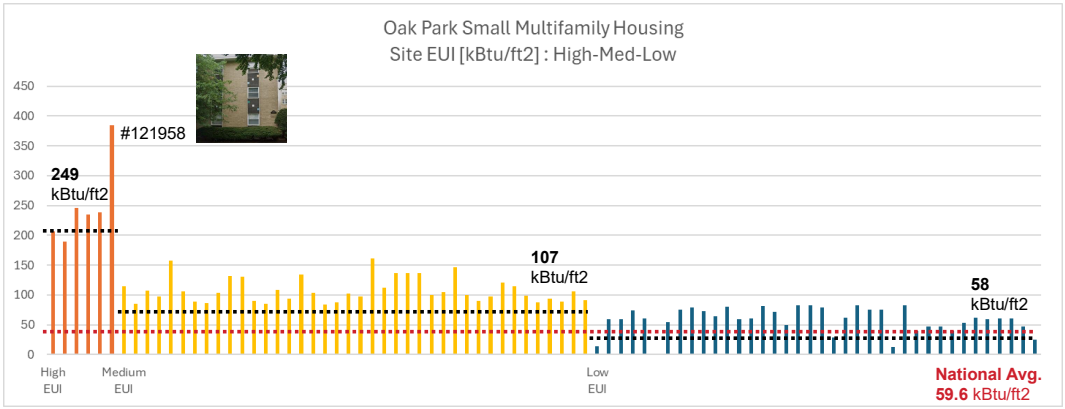

Fig. Site EUI of Small Multifamily Buildings Grouped by Site EUI

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- **Site EUI of Small Multifamily Buildings Grouped by Site EUI**
  - This figure visualizes the individual site EUI values for buildings in the small multifamily group, further divided into high, medium, and low EUI clusters based on the second-round K-means clustering. The building with the highest EUI, #121958, which we flagged earlier during data processing, was corrected from 431 to 384.6 kBtu/ft². As shown, both the medium and high clusters have average site EUI values above the national median, reinforcing their potential for targeted energy efficiency upgrades. These groups are strong candidates for incentive program recommendations due to both their higher energy use and their representation within the building stock.
  - The details of these clusters and their characteristics are summarized in the next slide.

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Assessment of Oak Park Multifamily Benchmarking Data

Site EUI of Small Multifamily Buildings

- Individual Site EUI values are shown for buildings in the small multifamily – high/med./low EUI groups.
- The building with the highest Site EUI (#121958) was previously reviewed during data processing and adjusted from 431 to 384.6 kBtu/ft².
- Both **the medium and high Site EUI clusters** show average values above the national median, indicating strong potential for energy savings.
- These groups represent **key targets for incentive program** recommendations.

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Assessment of Oak Park Multifamily Benchmarking Data

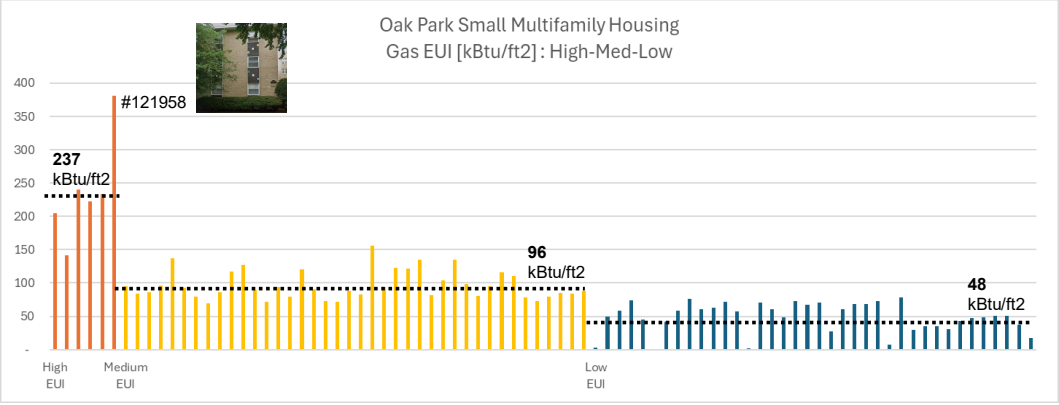

Fig. Gas EUI of Small Multifamily Buildings Grouped by Site EUI

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- **Gas EUI of Small Multifamily Buildings Grouped by Site EUI**
  - This figure shows the distribution of gas EUI across small multifamily buildings and reveals a strong correlation with site EUI clusters. Buildings categorized in the high site EUI group also tend to have higher gas consumption, which points to space heating and domestic hot water as major drivers of energy use. This pattern reinforces the importance of targeting envelope improvements and heating system upgrades. Prioritizing small buildings with both high site and gas EUI would maximize the impact of energy incentive programs.
  - The details of these clusters and their characteristics are summarized in the next slide.

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Assessment of Oak Park Multifamily Benchmarking Data

Gas EUI of Small Multifamily Buildings

- Gas EUI distribution among small multifamily buildings shows a trend similar to site EUI.
- Buildings in the high site EUI group also tend to have higher gas consumption, indicating space heating or domestic hot water as likely contributors.
- This alignment supports **the need to target envelope and heating system upgrades** in these buildings.
- Prioritizing small buildings with **high site and gas EUI for incentive programs**.

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Assessment of Oak Park Multifamily Benchmarking Data

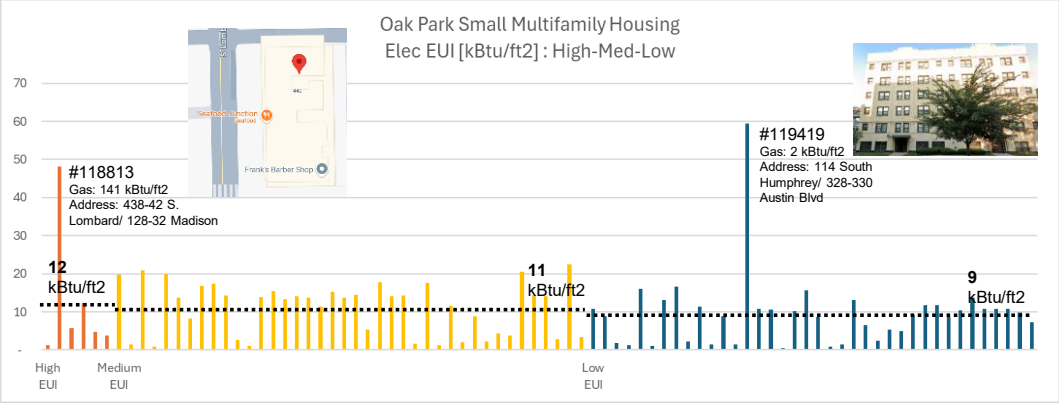

Fig. Electricity EUI of Small Multifamily Buildings Grouped by Site EUI

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- **Electricity EUI of Small Multifamily Buildings Grouped by Site EUI**
  - This figure shows the electricity EUI distribution across the small multifamily buildings, grouped by site EUI cluster. Unlike gas EUI, electricity use remains relatively consistent across the low, medium, and high site EUI groups, with average values between 9 and 12 kBtu/ft². This indicates that electricity consumption does not strongly influence total site EUI for these buildings. Two buildings stand out with unusually high electricity use. Building #118813 likely includes commercial space on the first floor, explaining its elevated usage, while the high consumption observed in building #119419 could not be clearly explained from available data. Overall, these results suggest that gas use—rather than electricity—is the main driver of variation in site EUI among small multifamily buildings.
  - The details of these clusters and their characteristics are summarized in the next slide.

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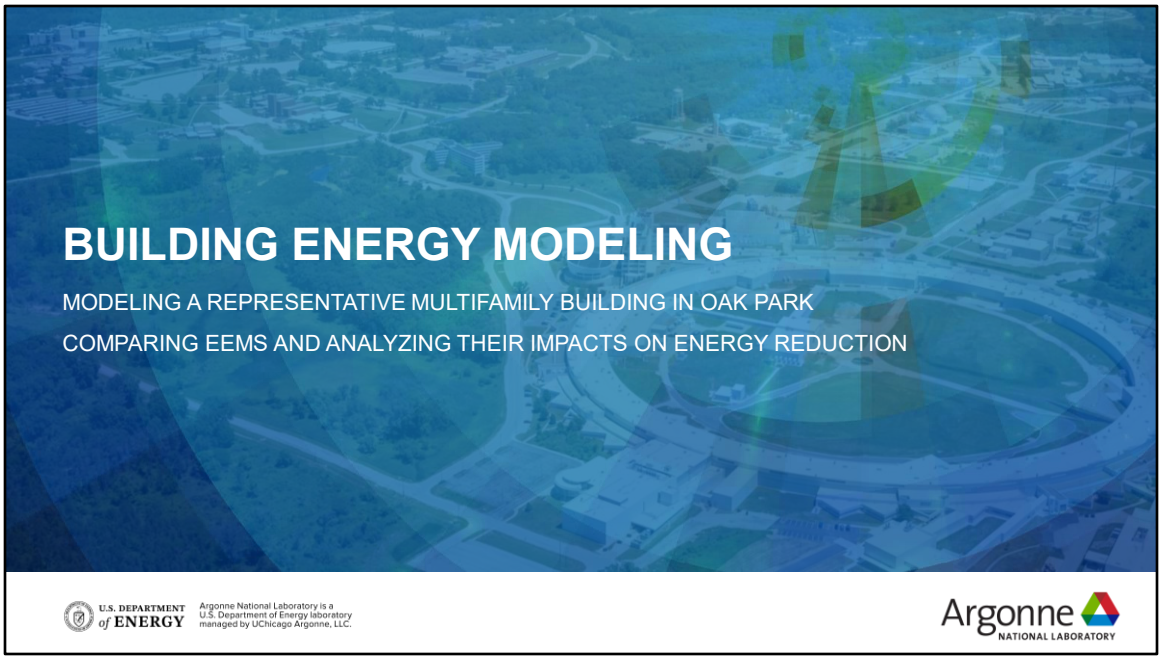
Assessment of Oak Park Multifamily Benchmarking Data

Electricity EUI of Small Multifamily Buildings

- Electricity EUI shows no significant difference across the low, medium, and high Site EUI groups.
- Each site EUI group (low, medium, high) has an average electricity EUI in the range of 9–12 kBtu/ft², showing no significant difference across clusters.
- Two buildings stand out with notably high electricity use:
  - #118813: Likely due to commercial spaces on the first floor.
  - #119419: High usage observed, but the cause is not clear.
- These findings suggest that **electricity use is less correlated** with total site EUI compared to gas.



- **BUILDING ENERGY modeling**
  - Based on the findings presented so far, we focused our efforts on small multifamily buildings in the high site EUI category, where gas consumption—primarily for space heating and domestic hot water—was identified as a key driver of energy use. To evaluate the potential impact of energy efficiency measures, we selected a representative small multifamily building in Oak Park for detailed modeling. The goal was to simulate and compare various upgrade scenarios targeting heating-related energy reduction.
  - The results of this modeling analysis are presented in slides 20 through 29.

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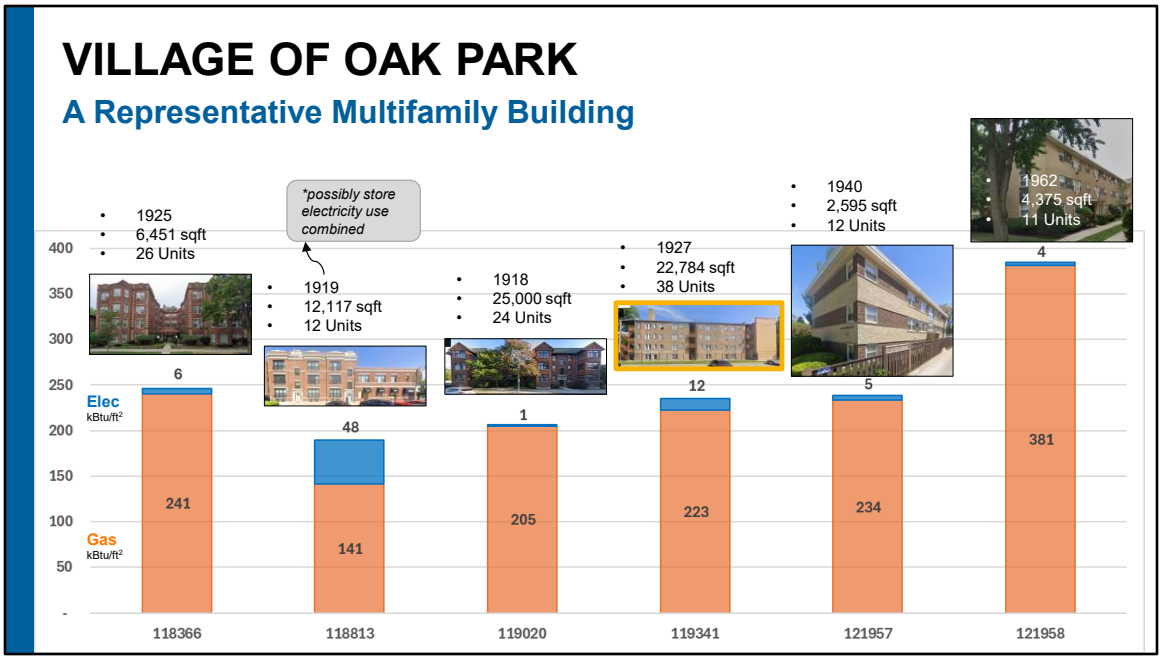
Modeling a Representative Multifamily Building in Oak Park

- Building #119341 was selected from six high Site EUI buildings.
- Chosen for its representative shape and energy use composition (next slide).
- Contacted Oak Park Residence Corporation to collect detailed building information for accurate modeling.

- **A Representative Multifamily Building in Oak Park**
  - This slide introduces the selection of Building #119341 from six small multifamily buildings in the high site EUI cluster. It was chosen for its representative size, shape, and energy use profile. We also contacted Oak Park Residence Corporation to obtain detailed building information for accurate modeling. The next two slides present the full comparison and highlight why this building was selected.



- **A Representative Multifamily Building in Oak Park**
  - This figure shows the six small multifamily buildings in the high site EUI cluster, along with key details for each: building photo, construction year, floor area, number of units, and gas and electricity EUI values. Building #119341 is highlighted as the representative building selected for modeling. It was chosen for its typical size, energy use characteristics, and form, which make it a good stand-in for others in the group.
  - Building IDs, addresses, and contact person information are stored separately and can be found in the file *CONFIDENTIAL_OakPark_SmallMFBldgs_HighEUI.pptx*.

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Collected Building Information (#119341: 206-214 N Austin)

- Three-floor walk-up vintage apartment building with 38 units, built in 1927
- Brick exterior with a flat membrane **roof** – likely **minimal** insulation
- **Single-hung vinyl windows**, expected to reach **end of life by 2027**
- Residents are allowed to install **window-mounted air conditioners**
- Appliances:
  - 29 units have gas stove, dishwasher, microwave, and refrigerator
  - Nine units have only a gas stove and refrigerator
- A central **boiler** provides steam to **radiators** for space heating
- A separate **boiler** supplies domestic **hot water**
- A common laundry room includes three washers and three dryers

- **Collected Building Information**
  - This slide presents detailed information about the selected representative building, #119341, located at 206–214 N Austin. These details were provided by the Oak Park Residence Corporation to support accurate energy modeling. The building is a 3-story walk-up with 38 units, constructed in 1927, and has typical features of vintage multifamily stock—brick exterior, minimal insulation, and older windows nearing end-of-life. It uses a central steam boiler for heating and a separate boiler for hot water. Appliance configurations vary slightly between units, and residents are allowed to install window A/C units. A shared laundry room serves all tenants.

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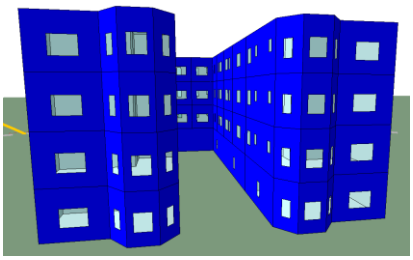
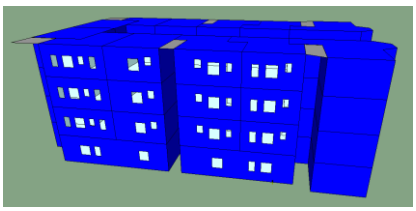
#119341: 206–214 N Austin vs. Simulation Model





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- **Simulation Model**
  - This slide shows a visual comparison between the actual building and the simulated energy model developed in IES-VE 2024. Where building-specific information was unavailable, assumptions were made based on ASHRAE 90.1 standards to ensure consistency.
  - Supporting documentation—including building characteristics, dimensions, floor plans, and unit details—can be found in the final deliverables. Key files include:
    - ***Building_Info_Gathering (070325).xlsx*** for collected data and simulation summary
    - ***footprint_googleearth (061825).pptx*** for aerial images and assumed dimensions
    - ***UnitDirectory05_16_2025 (061825).xlsx*** for unit-level address, type, and square footage
    - ***OakPark_v4 [VE2024].zip*** for the active IES-VE model file
  - All materials are included in the final package. For any further questions, please contact Jeannie Kim at Argonne National Lab (jihyun.kim@anl.gov).

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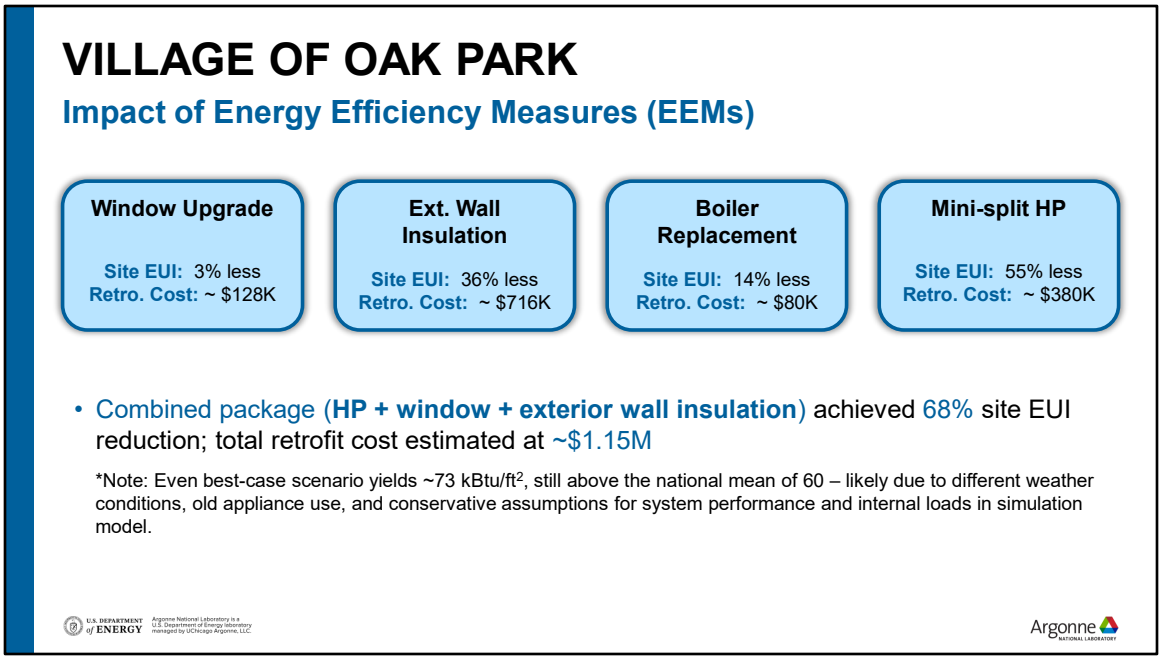
Impact of Energy Efficiency Measures (EEMs)

- Built energy model using provided inputs and ASHRAE 90.1 assumptions; site EUI differed by only 3% from 2023 utility data with no further model calibration.
- Applied five upgrade scenarios:
  a) Window replacement (single to double-pane glazing)
  b) Exterior wall insulation
  c) Boiler replacement (80% to 95%)
  d) Mini-split HP for units
  e) Combined upgrades (HP + window + insulation)

- **Impact of Energy Efficiency Measures (EEMs)**
  - Using the IES-VE 2024 model with inputs from Oak Park Residence Corporation and ASHRAE 90.1 assumptions, the simulated site EUI matched the 2023 utility-reported value within 3%, even without calibration—giving us confidence in the baseline model. We tested five upgrade scenarios: window replacement (single to double-pane), exterior wall insulation, boiler upgrade (from 80% to 95% efficiency), installing mini-split heat pumps in units, and a combined package of HP + windows + insulation. The following slides present the results of these simulations.



- **Impact of Energy Efficiency Measures (EEMs)**
  - This slide summarizes the modeled energy savings and estimated retrofit costs for each energy efficiency measure (EEM) scenario. The results show varying levels of impact and investment required:
    - Window replacement reduced site EUI by 3%, with an estimated cost of $128K.
    - Exterior wall insulation showed a significant 36% reduction, but with a much higher retrofit cost of up to $716K.
    - Boiler replacement (from 80% to 95% efficiency) reduced site EUI by 14%, with a relatively low cost of $80K.
    - Mini-split heat pumps installed in all units provided the most savings among individual measures, achieving a 55% reduction for about $380K.
    - The combined package—heat pumps, windows, and insulation—delivered the greatest energy savings:68% site EUI reduction, with a total estimated cost of ~$1.15M.
  - Note: Even in this best-case scenario, the final site EUI remains around 73 kBtu/ft², still above the national mean of 60. This may be due to factors such as local climate, aging appliances, and conservative assumptions used in the simulation for system performance and internal loads.

VILLAGE OF OAK PARK

#119341: 206–214 N Austin vs. Simulation Model

**ComEd's electric heating rate, approximately 17% lower than the standard rate, was applied. Based on the U.S. Energy Information Administration (EIA) 2023 average delivered electricity price of 11.75¢/kWh, a discounted rate of 9.8¢/kWh was assumed (more details in the next slide).*

	Elec EUI [kBtu/ft²]	Gas EUI [kBtu/ft²]	% Diff of Site EUI	Energy Cost [$/yr]	$ Cost
Measurement (2023 BEAM)	12	223	-	**$82K**	-
Model: as-is High uncertainty in AC and appliance usage	19	210	3%	**$85K**	-
Upgrade: Replacing windows Single to double-pane windows	18	204	3%	**$82K**	$40–$55/ft² (total ~$128K)
Upgrade: Adding insulation to ext. walls No-insulation brick wall to exterior/interior insulation	19	128	36%	**$59K**	Exterior: $1.3K – $2.8K/100ft² (total ~$716K) Interior: $700 – $1.3K/100ft² (total ~$358K)
Upgrade: Replacing boilers From 80% to 95% efficiency condensing boiler	19	178	14%	**$75K**	$40K – $80K
Upgrade: Installing HP (mini-split) HP (heating COP 2.5, cooling SEER 14) installed in all units	88	16	55%	**Std. / Elec. Heat*** **$91K / $77K***	$228K – $380K
Upgrade: HP + Window + Ext Wall	57	16	68%	**Std. / Elec. Heat*** **$60K / $51K***	$790K – $1.15M

Table. Energy Efficiency Measures: EUI and Cost Estimations

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- **Impact of Energy Efficiency Measures (EEMs)**
  - This slide summarizes the results of each energy efficiency measure (EEM) scenario, including key metrics: electric EUI, gas EUI, percentage change in site EUI, estimated energy cost, and retrofit cost.
    - The top two rows (in gray) show the 2023 BEAM-reported data and the as-is simulation model, with only a 3% difference in site EUI, confirming the reliability of the baseline model.
    - The rows below (in blue) show simulation results for each EEM scenario, including both individual upgrades and the combined package, compared directly to the as-is model.
  - For estimating energy cost:
    - We used 2023 average delivered gas and electricity rates for Illinois, based on EIA data.
    - For heat pump scenarios, energy costs are also calculated using ComEd's electric heating delivery rate, shown in purple text. This rate is approximately 17% lower than the standard electricity rate, providing a more accurate reflection of utility costs under electrification. Details on ComEd's electric heating rate are shown in Slide 29.

VILLAGE OF OAK PARK

Impact of Energy Efficiency Measures (EEMs)

- When comparing annual utility costs (electricity + gas), the as-is building model shows an estimated $85K per year. **EIA, 2023, Illinois average delivered electricity price (11.75 cents/kWh) and delivered residential natural gas price ($11.57/thousand ft^3)*
- Window replacement, exterior wall insulation, and boiler upgrades show similar trends in reducing site EUI – primarily by lowering space heating gas consumption.
- Installing minisplit HPs for individual units results in a $6K higher annual utility cost, despite lower EUI, due to increased electricity use and higher electricity rates compared to gas.
- The combined upgrade package results in a $60K annual utility cost, comparable to the exterior insulation case ($59K), but achieves significantly lower site EUI (73 vs. 147 kBtu/ft^2).

- **Impact of Energy Efficiency Measures (EEMs)**
  - This slide summarizes the key findings from the table presented on Slide 27. The next slide will provide more detail on the electric heating rate used in the heat pump scenarios.

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Impact of Energy Efficiency Measures (EEMs)

- Applying ComEd's discounted electric heating rate (17% lower than the standard rate for gas-heated homes*) and switching all units to minisplit HPs results in $77K annual utility costs and drops further to just $51K when combined other upgrades.
  - *ComEd's delivery rate for electric heating is approximately 50% lower than for nonelectric heating customers, while supply rates remain the same for both. When combining delivery and supply charges, the total rate for electric heating is about 17% lower per kWh. This comparison is based on ComEd's 2025 rates and the EIA 2023 average delivered electricity and gas prices in Illinois. Accordingly, a 17% lower electricity rate was assumed for the electric heating case.*
  - *https://www.citizensutilityboard.org/blog/2025/01/10/new-electric-rates-for-comed-and-ameren-customers-in-2025/*
  - *EIA, 2023, IL Delivered Electricity Average Price*
  - *EIA, 2023, IL Delivered Residential Natural Gas Average Price*
- Notes:
  - ✓ Demand charges are excluded because Oak Park's multifamily residential electricity rate structure does not incorporate demand-based pricing.
  - ✓ Building electrical panel upgrades are not included in the cost estimate.

- **Impact of Energy Efficiency Measures (EEMs)**
  - ComEd offers a discounted **delivery rate** for electric heating customers—about 50% lower than for those with gas heating.
    - Since **the supply rate remains the same**, **the combined total rate is approximately 17% lower per kWh** than the standard electricity rate.
    - We applied this 17% discount when estimating utility costs for the two heat pump scenarios—individually and in combination with other upgrades.
    - As shown, switching to mini-split heat pumps alone results in $77K/year in utility costs, and drops to $51K/year when combined with window and insulation upgrades.
    - These figures better reflect the potential operational savings from electrification under ComEd's rate structure. The comparison is based on ComEd's 2025 posted rates and EIA's 2023 Illinois electricity and gas price averages.
  - It's important to note:
    - Demand charges were excluded because Oak Park's multifamily rate structure doesn't include them.
    - Electrical panel upgrade costs were not included, though they may be required in real-world implementation.


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