Evolving Toward Zero in Affordable Multifamily: Measured Results from Beach Green North

Passive House Institute US
James Ortega, PHIUS Certification Staff
Steve Bluestone, Bluestone Organization
1. Background
   1. Motivation for monitoring
   2. Potential Factors
2. Beach Green North (BGN) - Monitored Data Analysis:
   1. Building Rundown
   2. Data Rundown
   3. Monitored vs Modeled
3. Lessons Learned
IMPORTANCE OF MONITORING

• PHIUS+ Certification is based on design – need to verify actual performance
• Realize & quantify savings
• Troubleshoot issues
• Adjust modeling protocol to improve predicted values
• Shape incentives from local jurisdictions & rating systems
POTENTIAL FACTORS AFFECTING DIFFERENCES BETWEEN MODELED AND MONITORED

• Varying heating setpoint above/below 68F (winter)
• Varying cooling setpoint above/below 77F (summer)
• Climatic differences between measured year and ‘typical year’ used for modeling
• Varying number of occupants from modeled assumption (BR+1)
• Occupant behavior (work from home, kids vs adults, lifestyle, habits)
• Equipment tested efficiency varying from real performance
• System/Operator Error
Beach Green Dunes
Far Rockaway, NY
101 units
107,800 ft²
Central VRF
In-Unit ERVs
Gas Water Heating
Central Laundry
BTU/SF/HDD
BTU/SF/HDD

kBTU/SF

kWh/SF
BTU/SF/HDD

$ / SF

kBTU/SF

Source

EUI kBTU/SF

Btu/kWh/therm/$
<table>
<thead>
<tr>
<th>Building Information</th>
<th>Address: 65-54 AUSTIN STREET</th>
<th>Address: 90-09 160 STREET</th>
<th>Address: 44-19 ROCKAWAY BEACH BOULEVARD</th>
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</thead>
<tbody>
<tr>
<td>Neighborhood:</td>
<td>REGO PARK</td>
<td>JAMAICA</td>
<td>--</td>
</tr>
<tr>
<td>Property Type:</td>
<td>Elevator Apt</td>
<td>Elevator Apt</td>
<td>Elevator Apt</td>
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<tr>
<td>Total Gross SQFT:</td>
<td>51,173</td>
<td>95,465</td>
<td>134,177</td>
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<tr>
<td>Residential SQFT:</td>
<td>38,868</td>
<td>87,546</td>
<td>134,177</td>
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<tr>
<td>Commercial SQFT:</td>
<td>12,305</td>
<td>7,919</td>
<td>--</td>
</tr>
<tr>
<td>Total Units:</td>
<td>50</td>
<td>101</td>
<td>101</td>
</tr>
<tr>
<td>Residential Units:</td>
<td>50</td>
<td>101</td>
<td>100</td>
</tr>
<tr>
<td>Commercial Units:</td>
<td>--</td>
<td>--</td>
<td>1</td>
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<tr>
<td>Total Story:</td>
<td>6</td>
<td>9</td>
<td>8</td>
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<td>Year Built:</td>
<td>2008</td>
<td>2014</td>
<td>2016</td>
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<td>Zoning Code:</td>
<td>R7B</td>
<td>C4-5X</td>
<td>C4-3A</td>
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Beach Green

Dunes

Far Rockaway, NY

101 units

107,800 ft²

Central VRF

In-Unit ERVs

Gas Water Heating

Central Laundry

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WEGOWISE  BUILDING  ELECTRIC BILLS
WEGOWISE BUILDING ELECTRIC BILLS
WEGOWISE  BUILDING
YANMAR  ELECTRIC BILLS
PHOTOVOLTAICS
WEGOWISE
YANMAR
LG VRF SYSTEM
PHOTOVOLTAICS
89% Modeled vs Actual

SITE EUI (NO PV)

- OCC. ADJ.*
- MEASURED
- MODELED

SITE EUI W/ RENEWABLES

- OCC. ADJ.*
- MEASURED
- MODELED
84% Average Occupancy

*Months Under Occupied

BEACH GREEN DUNES

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SITE EUI

Months Under Occupied

kBtu/sf

MODEL + RENEWABLES
MODEL
Occ. Adj.
MEASURED + RENEWABLES
Occ Adj.
MEASURED

BEACH GREEN DUNES

© Passive House Institute US
*Months Under Occupied

SITE EUI - NO PV

kBtu/sf

MODEL
Occ Adj.
MEASURED

© Passive House Institute US
**SITE EUI - PV**

*Months Under Occupied

<table>
<thead>
<tr>
<th>Month</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td>O</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>D</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>M</td>
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<tr>
<td>A</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>M</td>
<td>4.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

**EUI**
- MODEL + RENEWABLES
- Occ. Adj.
- MEASURED + RENEWABLES

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Beach Green Dunes
Far Rockaway, NY
101 units
107,800 ft²

NATURAL GAS
COMBINED HEAT & POWER
DOMESTIC HOT WATER
DRYERS
BEACH GREEN DUNES

NATURAL GAS

COMBINED HEAT & POWER (CHP)

HEAT

DHW

ELECTRICITY

LIGHT PLUG LOADS METER RUN-BACK

© Passive House Institute US
*Months Under Occupied

NATURAL GAS

kBtu/yr

2,500,000
2,000,000
1,500,000
1,000,000
500,000

BEACH GREEN DUNES

© Passive House Institute US
*Months Under Occupied

NATURAL GAS

kBtu/yr

Model Cogen
Model Dryers
Model DHW
Occ. Adj.
Aegis Cogen DHW
WegoWise Dryers
WegoWise Cogen
WegoWise DHW
Wegowise Occ. Adj.
Wegowise Total

© Passive House Institute US
*Months Under Occupied

DHW USAGE

- kBtu/yr

- Model DHW
- Occ. Adj.
- Occ. Adj.
- Aegis Cogen DHW
- WegoWise DHW

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**Dryer Usage**

- **Model Dryers**
- **Occ. Adj.**
- **WegoWise Dryers**

*Months Under Occupied*
Beach Green Dunes
Far Rockaway, NY
101 units
107,800 ft²

COMMON
- VRF (HEAT/COOL)
- COMMON LIGHTS
- ELEVATORS
- PUMPS
- PV
- FIRE ALARMS, SECURITY, ETC..

TENANT
- ERV
- UNIT LIGHTS
- UNIT PLUG LOADS / APPLIANCES

ELECTRICITY
Beach Green Dunes
Far Rockaway, NY
101 units
107,800 ft²

ELECTRICITY

COMMON
- VRF (HEAT/COOL)
- COMMON LIGHTS
- ELEVATORS
- PUMPS
- PV
- FIRE ALARMS,
  SECURITY, ETC..

TENANT
- ERV
- UNIT LIGHTS
- UNIT PLUG LOADS / APPLIANCES
The Joy of Flex

http://bit.ly/2wDSHNCY

http://www.energyvanguard.com/blog/joy-flex

© Passive House Institute US
Unit Average Electricity

37 units – 7 months
3 – Studio
17 – 1 Bedroom
10 – 2 Bedroom
7 – 3 Bedroom

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**UNIT ELECTRICITY**

**TENANT ENERGY USE**

\[ 1,340 \text{ kWh/yr} \times 101 \text{ Units} = 135,340 \text{ kWh/yr} \]

**ENERGY USE PER UNIT**

\[ 3.67 \text{ kWh/day} \times 365 \text{ days/yr} = 1,340 \text{ kWh/yr} \]

Average Unit Use

3.67 kWh/day
Beach Green Dunes
Far Rockaway, NY
101 units
107,800 ft²

ELECTRICITY

COMMON
VRF (HEAT/COOL)
COMMON LIGHTS
ELEVATORS
PUMPS
PV
FIRE ALARMS,
SECURITY, ETC..

TENANT
ERV
UNIT LIGHTS
UNIT PLUG LOADS /
APPLIANCES
COMMON ELECTRICITY

- kWh/yr
- Model Common
- Electric Bill

BEACH GREEN DUNES
© Passive House Institute US
Temperature Comparison

![Bar chart showing temperature comparison between actual and model temperatures. The chart displays temperature data for the years 2017 and 2018, with months from January to August. The chart highlights a significant difference in temperatures between actual and model predictions for the months of July and August 2018.]
89% Modeled vs Actual

SITE EUI (NO PV)

SITE EUI W/ RENEWABLES

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LESSONS LEARNED

- Assigning roles/responsibilities upfront is **critical**.

  Need a contact for design, installation, monitoring, debugging, resident.

- Monitoring never seems to be a priority, just “nice to have”.

  Hard to place priority on that over other budgetary/time constraints.

- Systems work incorrectly (or not at all) quite often. Meters also break.

  Whose responsibility is it to check up on that, and then fix it?

- Monitoring should be part of the design process at the start, not finish.

  And maintained throughout all phases of design.

- Critical to follow through with plan during construction.

  And inspect/track after final installation.
PASSIVE BUILDING
PART OF THE SOLUTION

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