LEED for Homes v4: Multifamily Mid-Rise

2025 Clarendon

April 15, 2021

SUSTAINABLE BUILDING PARTNERS

| 2 | 0 | 0 | Integrative Process | | Possible Points 2 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| 2 | | | Credit 1 | Integrative Process | |

| 14.0 | 1 | 0.0 | Location and Transportation | | Possible Points 15 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| Y | | | Prereq 1 | Floodplain Avoidance | Required |
| 7 | 1 | | Credit 1 | Site Selection (v4.1) | 8 |
| 3 | | | Credit 2 | Compact Development | 3 |
| 2 | | | Credit 3 | Community Resources | 2 |
| 2 | | | Credit 4 | Access to Transit (v4.1) | 2 |

| 3 | 4 | 0 | Sustainable Sites | | Possible Points: 7 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| Y | | | Prereq 1 | Construction Activity Pollution Prevention | Required |
| Y | | | Prereq 2 | No Invasive Plants | Required |
| 1 | 1 | | Credit 1 | Heat Island Reduction (v4.1) | 2 |
| | 3 | | Credit 2 | Rainwater Management (v4.1) | 3 |
| 2 | | | Credit 3 | Non-Toxic Pest Control | 2 |

| 7 | 2 | 3 | Water Efficiency | | Possible Points: 12 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| Y | | | Prereq 1 | Water Metering | Required |
| 7 | 2 | 3 | Credit 1 | Total Water Use | 12 |

| 28.5 | 5 | 3.5 | Energy and Atmosphere | | Possible Points: 37 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| Y | | | Prereq 1 | Minimum Energy Performance | Required |
| Y | | | Prereq 2 | Energy Metering | Required |
| Y | | | Prereq 3 | Education of the Homeowner, Tenant or Building Manager | Required |
| 26.5 | 3 | 0.5 | Credit 1 | Annual Energy Use | 30 |
| | 2 | 3 | Credit 2 | Efficient Hot Water Distribution | 5 |
| 2 | | | Credit 3 | Advanced Utility Tracking | 2 |

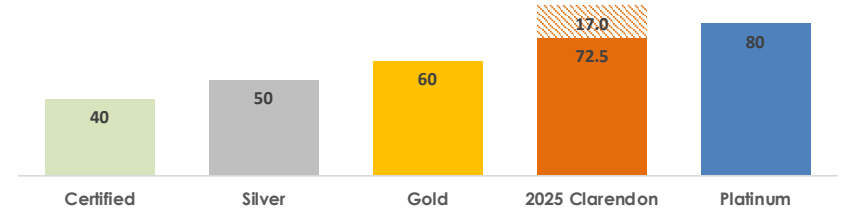
| 3.5 | 0 | 5.5 | Materials and Resources | | Possible Points: 9 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| Y | | | Prereq 1 | Certified Tropical Wood | Required |
| Y | | | Prereq 2 | Durability Management | Required |
| 1 | | | Credit 1 | Durability Management Verification | 1 |
| 0.5 | | 4.5 | Credit 2 | Environmentally Preferable Products | 5 |
| 2 | | 1 | Credit 3 | Construction Waste Management | 3 |

| 6.5 | 3 | 8.5 | Indoor Environmental Quality | | Possible Points: 18 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| Y | | | Prereq 1 | Ventilation | Required |
| Y | | | Prereq 2 | Combustion Venting | Required |
| Y | | | Prereq 3 | Garage Pollutant Protection | Required |
| Y | | | Prereq 4 | Radon-Resistant Construction | Required |
| Y | | | Prereq 5 | Air Filtering | Required |
| Y | | | Prereq 6 | Environmental Tobacco Smoke (v4.1) | Required |
| Y | | | Prereq 7 | Compartmentalization | Required |
| 1 | | 2 | Credit 1 | Enhanced Ventilation | 3 |
| 0.5 | | 1.5 | Credit 2 | Contaminant Control | 2 |
| 1 | | 2 | Credit 3 | Balancing of Heating and Cooling Distribution Systems | 3 |
| | | 3 | Credit 4 | Enhanced Compartmentalization | 3 |
| 1 | 1 | | Credit 5 | Enhanced Combustion Venting | 2 |
| 1 | | | Credit 6 | Enhanced Garage Pollutant Protection | 1 |
| 1 | 2 | | Credit 7 | Low Emitting Products (v4.1) | 3 |
| 1 | | | Credit 8 | No Evironmental Tobacco Smoke (v4.1) | 1 |

| 5 | 1 | 0 | Innovation | | Possible Points: 6 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| 4 | 1 | | Credit 1 | Innovation | 5 |
| 1 | | | Credit 2 | LEED AP Homes | 1 |

| 3 | 1 | 0 | Regional Priority Credits | | Possible Points: 4 |
|---|---|---|---|---|---|
| Y | ? | N | | | |
| 1 | | | Credit 1 | Site Selection (8 pts) | 1 |
| 1 | | | Credit 2 | Community Resources (2 pts) | 1 |
| 1 | | | Credit 3 | Access to Transit (2 pts) | 1 |
| | 1 | | Credit 4 | Total Water Use (12), Rainwater M. (3), Const. Waste M. (3) | 1 |

| 72.5 | 17 | 20.5 | | Possible Points: 110 |
|---|---|---|---|---|




**Note:**
- min 8 points total in LT and EA required
- min 3 points in WE required
- min 3 points in EQ required

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LEED BD+C v4: Multifamily Midrise

4/15/2021 (updated 6/7/21 to addres 4.1 comments)

SD Set 3/19/21

Scorecard

| Credit | Requirement & Comments | Responsible Party | Yes | Maybe | Not Compliant | Compliant | Needs Attention | Action | Drawing Reference |
|---|---|---|---|---|---|---|---|---|---|
| **General Information** | | | | | | | | | |
| 2020 Green Incentive Policy | 0.35 FAR Targeted, summary of elements to be included in project:<br>- LEED Gold<br>- ENERGY STAR Score 80<br>- 20% Energy cost Savings<br>- In-unit ENERGY STAR Appliances and Fixtures (clothes washers, dishwashers, clothes dryers, refrigerators, and 90% of lighting)<br>- WaterSense labeled in-unit toilets, lavatory faucets, and showerheads<br>- Refrigerant leakage verification by CxA<br>- Air sealing of ventilation supply and exhaust w/ aeroslized duct sealant<br>- Human interaction with nature<br>- Bird Friendly Glass<br>- 4% EV Charging Stations & 15% EV Ready<br>- Renewable Energy (2W/sf, or 12% green roof w/ 1.5 W/sf, or 1 pt under LEED v4.1 Renewable Energy Credit(Tier 2). Tier 2 is currently off-site purchase of new renewable energy built within past 5 years representing a 10% offset of annual energy useover 10 years).<br>- Light pollution reduction for 90% of exterior fixtures (do not emit above 90 degrees with no sag/drop lenses or side light panels and ≤3000K temperature; must also be placed on motion/photo/timeclock control<br>- Equity, diversion, and inclusion program<br>- 3 Extras - Envelope Cx+Air Leakage Testing, Advanced Energy Metering, LCA (targeted) | Team | Y | | | | ✔ | Team acknowledges full 2020 Green Incentive Policy requirements.<br><br>Note the following updates on requirements not addressed in the credits below:<br>- Greystar confirms they have an equivity, diversion, and inclusion program<br>- Greystar has contracted ABC to consult on the bird-friendly requirements<br>- Envelope Cx will be contracted<br>- Air leakage testing of conditioned spaces that abut the envelope (units and common area spaces) will occur to meet the whole building Air Leakage testing requirement<br>- LCA kick-off will be scheduled<br>- Exterior light fixtures will be selected and placed on appropriate controls to meet requirements | |
| Area | GSF = 276,079 sf<br>Residential = 271,493<br>Retail = 4,604 sf<br><br>Property Area = 23,089 sf | Cooper Carry | Y | | | | ✔ | Confirm areas. | |
| Occupancy | Residential FTE = 5<br>Total # of Units: 231, approx. 675 Residents (using LEED Default Occupancy)<br>- Micro = 36<br>- Studio = 51<br>- 1 BR-JR = 102<br>- 1 BR = 89<br>- 1 BR+D = 17<br>- 2 BR-JR = 34<br>- 2 BR = 75<br>- 2 BR+D = 19<br>- 3 BR = 2<br>Home Size Adjustment = 11.5 | Cooper Carry | Y | | | | ✔ | Confirm unit matrix. | |
| LEED Boundary | LEED Project Boundary to follow the Building Footprint. | Bowman | Y | | | ✔ | | **No Action Required** | |
| Specifications | Specifications have not been provided at this time. | Cooper Carry | Y | | | | ✔ | "Will provide Div 1 Specs to be incorporated into Project Manual.<br>Will perform full specification reviews." | -- |
| **Integrative Process** | | | | | | | | | |



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| **Credit 1** | Integrative Process | **Option 1. Integrative Project Team (1 pt)**<br>- Team includes 3 skill sets<br>- Team involved in 3 phases of design and construction<br>- Team conducts monthly meetings<br><br>Option 2. Design Charrette (1 pt)<br>- 1 full day or 2 half day workshop no later than DD<br><br>**Option 3. Trades Training (1 pt)**<br>- Combined 8 hours of green training for subcontractors | SBP | 2 | | | | ✔ | Maintain list of meetings (date, attendees, length, agenda)<br><br>Note: SBP will conduct trades training before start of construction. | - |
| **Location and Transportation** (min 8 pts total in LT and EA reqd) | | | | | | | | | | |
| **Prereq 1** | Floodplain Avoidance | **Option 1. Project is not built in 100-year floodplain**<br>Option 2. Project building in flood hazard area iaw local flood provisions<br>Option 3. Project is previously developed building and hardscape<br><br>Observed: Project not built in 100-year floodplain | SBP | Y | | | ✔ | | **No Action Required** | Web Research |
| **Credit 1** | Site Selection | Option 1. Sensitive Land Protection (3-4 pts)<br>**Path 1. Previously Developed (4 pts)** - 75% of buildable land located on previously developed land.<br>Path 2. Avoidance of Sensitive Land (3 pts) - Project does not consist of prime farmland, public parkland, 100-year floodplain, endangered species habitat, w/in 50' wetlands, w/in 100' water<br><br>Observed: Project is built on previously developed land. | SBP | 4 | | | ✔ | | **No Action Required** | Web Research |
| | | Option 2. Infill Development (2 pts) - 75% of land w/in 1/2 mi of project boundary is previously developed<br><br>Observed: <75% of land w/in 1/2 mile of the project is previously developed | SBP | 2 | | | ✔ | | **No Action Required** | Web Research |
| | | Option 3. Open Space (1 pt) - Built w/in 1/2 mi public open space > 3/4 acres or public open space provided on project<br><br>Observed: Project is built within 1/2 mile walking distance from Arlington Park. | SBP | 1 | | | ✔ | | **No Action Required** | Web Research |
| | | Option 4. Street Network (1 pt) - Project is in area w/ existing streets and sidewalks that create 90 intersections per sqmi<br><br>Observed: 320/sq mi | SBP | 1 | | | ✔ | | **No Action Required** | Web Research |
| | | Option 5. Bicycle Network (1 pt) - Meet all of the following:<br>- Provide bike storage w/in 200 yds of bike network that connects to ≥ 10 uses, school or employment center, or bus rapid transit/rail/ferry terminal w/in 3 mi of project<br>- Short term bike parking = (2.5% occupants, min 26 spaces)<br>- Long term bike parking = (30% occupants, 1 per Unit, min 425 - or 418 spaces)<br><br>Observed:<br>231 long term, 13 short term required<br>200 long term (bike rooms G2 and G1), 20 site/short term provided | Cooper Carry | 1 | | | | ✔ | Locate 31 additional long term spaces. | |
| | | +1 EP for earning all 8 points | SBP | 1 | | | ✔ | | **No Action Required** | |



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| **Credit 2** | Compact Development | Required: Meet the following density (dwelling units/acre)<br>≥ 30 (1 pt)<br>≥ 55 (2 pts)<br>≥ 80 (3 pts)<br><br>Observed:<br>Lot Size = 0.53 acres<br># of Units = 231<br>435.8 DU/acre | SBP | **3** | | | ✔ | | **No Action Required** | |
| **Credit 3** | Community Resources | Required: Provide community resources w/in 1/2 mi walking distance:<br>4-7 uses (1 pt)<br>8-11 uses (1.5 pt)<br>12-15 uses (2 pt)<br>16-19 uses (+0.5 pt EP)<br>**20 uses (+1 pt EP)**<br><br>Observed: Projects located within 1/2 mi walking distance of 20 use categories. | SBP | **2** | | | ✔ | | **No Action Required** | Web Research |
| **Credit 4** | Access to Transit<br><br>*v4.1 Credit Substitution Requested* | Required:<br>- 1/4 mi walking distance of bus OR<br>- 1/2 mi walking distance of bus rapid, lt/hvy rail, ferry AND<br>- Meet min transit stops below<br><br>Multiple Transit<br>Weekday / Weekend / Pts<br>72 / 30 / 1<br>100 / 70 / 1.5<br>144 / 108 / 2<br><br>Observed: The project is located next to Courthouse Metro (Orange + Silver lines) as well as approximately 10 different bus lines. | SBP | **2** | | | ✔ | | **No Action Required** | Web Research |
| **Sustainable Sites** | | | | | | | | | | |
| **Prereq 1** | Construction Activity Pollution Prevention | Required:<br>1. Include ESC measures in drawings<br>- stockpiling topsoil<br>- manage path/velocity of runoff<br>- protect storm sewers/streams/lakes<br>- divert surface water from hills<br>- stabilize soils +15% slope<br>- prevent air pollution from dust<br>2. Provide ESC drawings that meet 2012 EPA CGP or local codes | Bowman | **Y** | | | | ✔ | Include ESC drawings | - |
| **Prereq 2** | No Invasive Plants | Required: Do not install invasive plants<br><br>Observed: Plant schedule not developed at this time. | LandDesign | **Y** | | | | ✔ | Design for all native plants. Include plant list in drawings and a third party resource for comparison. | |



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| **Credit 1** | Heat Island Reduction<br><br>*v4.1 Credit Substitution Requested*<br><br>*ArlCo GIP Alignment* | Option 1. Shading: Shade hardscape and roof w/ 10 year plant canopy<br>**Option 2. Nonabsorptive Materials:** Use a combination of ENERGY STAR roofing material, Vegetated Roof, Open Pavers, Paving w/ 3-year SR > 0.28 (or initial SR > 0.33) for 50-75% (1 pt) or >75% (2 pts) of roof area.<br><br>v4.1 requirement: Achieve weighted compliance using a combination of green roof and high SRI roofing/paving<br>paving/0.5 + green roof/0.75 + roof/0.75 > Building Footprint<br><br>GIP Requirement - incorporate elements of human connection with nature<br><br>Observed: Green roof located on penthouse and penthouse roof. Amentiy area located on penthouse. 1 pt on track with high-SRI products on remaining penthouse roof areas. | Cooper Carry | 1 | 1 | | | ✔ | Select high SRI products for penthouse roof (white TPO w/ SRI>82).<br>GIP - consider how roof design will implement human interaction with nature. | |
| **Credit 2** | Rainwater Management<br><br>*ArlCo GIP Alignment* | Case 1. Low Impact Development (1-2 pts): Minimize stormwater run-off using low-impact development techniques including:<br>- native or adaptive plantings<br>- vegetated roof<br>- permeable paving<br>- permanent infiltration collection feature that can handle 100% of run-off from 2-yr, 24-hr storm<br><br>Percent of permeable area total lot area<br>- 50-64% (1 pt)<br>- 65-79% (2 pts)<br>- >80% (3 pts)<br><br>Case 2. NPDES Projects (2-3 pts): Use low-impact development and green infrastructure to replace natural site hydrology and manage the percentile rainfall event:<br>- 95th percentile (2 pts)<br>- 98th percentile (3 pts)<br>**- 85th percentile (3 pts for zero lot line projects)**<br><br>Observed: Green roof located on penthouse and penthouse roof. Stormwater vault located on G2 and plumbing narrative indicates rainwater re-use for | Bowman | | 3 | | | ✔ | Advise if the project can manage on-site runoff for the 85th percentile storm event via infiltration and rainwater re-use for irrigation. | A2.01<br>MP Narrative |
| **Credit 3** | Nontoxic Pest Control | Required:<br>- Implement IPM Plan (Reqd)<br><br>Up to (2 pts, each additional +0.5 pt EP up to 1 EP:<br>- Steel mesh barrier termite control system (1 pt)<br>- Physical termite barrier system (1 pt)<br>**- Below grade walls solid concrete, masonry w/ bond beam, concrete filled block (0.5 pt)** ✓<br>**- Post-tension slabs (0.5 pt)**<br>- Borate treatment of wood framing (0.5 pt)<br>- Non-wood structural elements (0.5 pt)<br>- Ports/openings at slab plumbing penetrations (0.5 pt)<br>- 6"+ space btw landscape grade/nonmasonry siding (0.5 pt)<br>**- Seal cracks/joints/penetrations, install pest screens (0.5 pt)**<br>**- Water discharge points 24"+ from foundation (0.5 pt)** ✓<br>- 18"+ btwn landscape and exterior wall (0.5 pt)<br><br>Observed: Concrete structure, all below grade structure is concrete. Roof drainage via storm piping that connects at B1 level | Greystar<br><br>Cooper Carry | 2 | | | | ✔ | Implement an IPM Plan at occupancy. SBP can provide for review and approval or provide copy of one currently in use.<br><br>Add drawing details/notes/specs for 1) sealing all cracks/joints/penetrations and installing pest proof screens (0.5 pt) 2) water discharge points 24"+ from foundation (0.5 pt) | - |



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|---|---|---|---|---|---|---|---|---|---|---|
| **Water Efficiency** (min 3 pts reqd) | | | | | | | | | | |
| **Prereq 1** | Water Metering | Required: Install water meter for each unit or entire building | | Y | | | | ✔ | Clarify whether a whole building water meter or individual unit water meters will be provided. | -- |
| **Credit 1** | Total Water Use<br>*Performance Path*<br>*ArlCo GIP Alignment* | Required: Reduce total water use (indoor + outdoor)<br>10% (1 pt) to 65% (12 pts), 70% (+1 EP).<br><br>30% - 5 pts, 35% - 6 pts, **40% - 7 pts**, 45% - 8 pts, 50% - 9 pts<br><br>GIP - WaterSense labeled in-unit toilets, lavs, showerheads<br><br>Observed: Based on other calculations for building footprint's of this size, estimating plant species/watering needs and rainwater harvesting, further reduction <1% is achieved. | Cooper Cary<br><br>KTA | 7 | 2 | | | ✔ | Plumbing Fixtures and Appliances<br>Target the following for 40%+ water use reduction:<br>- WC = 1.28gpf and WaterSense<br>- Lav = 1.0 gpm and WaterSense<br>- Kitchen = 1.5 gpm<br>- Shwr = 1.75 gpm and WaterSense<br>- CW = Energy Star (required by ArlCo)<br>- DW = Energy Star (required by ArlCo)<br>Reduce water closet and kitchen sink flow rates for additional reduction.<br><br>*Arlington Site Plan Conditions* - Select WaterSense labeled WC, Lav, Shower and Energy Star CW, DW, Refrigerator (and clothes dryer). | -- |
| **Energy and Atmosphere** (min 8 pts total in LT and EA reqd) | | | | | | | | | | |
| **Prereq 1/ Credit 1** | Minimum Energy Performance / Annual Energy Use<br><br>*ArlCo GIP Alignment* | Required:<br>**Energy Model**<br>1. Meet mandatory provisions of ASHRAE 90.1-2010<br>2. Achieve 5% (prereq) to 90% (29 pts). Over 65% earns project +1 EP energy cost savings over ASHRAE 90.1-2010<br><br>AND<br>Option 1. ENERGY STAR MFHR Testing and Verification Protocols<br><br>OR<br>**Option 2. Commissioning**<br>1. In-Unit Duck Leakage<br>(4 cfm25 per 100 sf of conditioned floor area)<br>(6 cfm25 per 100 sf for units smaller than 1,200 sf)<br>(8 cfm25 per 100 sf of conditioned floor area total)<br>2. Central HVAC - meet NC v4 requirements<br><br>3. Include air barrier, compartmentalization sheet, and elements to be sealed.<br><br>4. Provide load calculations, system selection, and duct sizing calculations.<br><br>GIP Requirements - 20% energy cost savings, ENERGY STAR Score 80, aerolsized duct sealant of ventilation supply and exhaust, refrigerant leakage verification by CxA, on-site or off-site renewables.<br><br>EMR 4/15/21 (Box Model): Shows 20% (15 pts) energy cost savings and ENERGY STAR Score of 80 for current design. EEOs included to be discussed throughout design development.<br>On-site vs Off-site renewables: Team plans to meet requirement with offsite | Cooper Cary<br><br>PDI<br><br>KTA | 26.5 | 3 | | | ✔ | Team - Review EEOs. SBP will do a full energy model update at 50% DD.<br>KTA - Provide load calculations, system selection, and duct sizing calculations.<br>Cooper Cary - Include air sealing and compartmentalization details in the drawings.<br>Greystar - Purchase RECs and Carbon Offsets at end of construction. Must be from renewables built within the past 5 years. SBP can provide a list of vendors that meet requirements. | EMR dated 4/15/21 |
| **Prereq 2** | Energy Metering<br><br>*ArlCo GIP Alignment* | Required:<br>1. Electric submeters in each Unit<br>2. Whole building gas meter or submeter in each Unit<br><br>GIP Requirements - whole building energy and water metering<br><br>Observed: Retail, Resi House, and Units metered by utility. Irrigation supplemental/make-up water metered. Unit water metered by utility. Utility meter provided for gas for Resi and Retail. | PDI<br>KTA | Y | | | ✔ | | **No Action Required** | E5.01 Electrical Narrative<br>MP Narrative |



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| **Prereq 3** | Education of Homeowner, Tenant or Building Manager | Required:<br>1. Provide O&M binder/CD to those responsible for maintaining Units<br>2. Perform 1-hr walkthrough of home with occupants and building manager | Greystar | **Y** | | | | ✔ | Confirm O&M material will be provided and 1-hour walk-through will occur with tenants and building manager. SBP can help develop material or work with Property Management to ensure requirements are met. | -- |
| **Credit 2** | Efficient Hot Water Distribution System | Up to 5 points<br>**Option 1. Efficient Hot Water Distribution (2 pts)**<br>1. Circulating Pump Systems<br>- On timer or water temperature sensor<br>- Demand activated by momentary switch, motion sensor, flow switch, door switch, voice command<br>- Operates until water temperature rises 10degF above initial temp of water in pipe and max temp is 105degF<br>- Automatic or accessible manual switch to turn off pump when not in use<br>2. Piping is insulated if heat trace is installed<br>and<br>Path 1. Max Allowable Pipe Length (2 pts)<br>Path 2. Max Allowable Pipe Volume (2 pts)<br><br>OR<br>Option 2. Performance Test (3 pts)<br>- For no circulation loop or heat trace: Meets WaterSense Labeled New Homes requirements or no more than 0.5 gall water stored in pipe<br>- For circulation loop or heat trace: No more than 0.25 gall water stored in pipe and pipes insulated<br><br>OR<br>**Option 3. Pipe Insulation (2 pts): R-4 insulation on all domestic water piping** | KTA | | **2** | | | ✔ | Explore adding R-4 insulation to hot water piping in units. | |
| **Credit 3** | Advanced Utility Tracking<br><br>*ArlCo GIP Alignment* | **Option 1. Electric and Water (1 pt):** Meet one:<br>- Units: permanent energy-monitoring system at 1-hr interval<br>**- Irrigation:** irrigated area 1,000sf+ w/ submeter<br><br>AND/OR<br>**Option 2. Third Party Utility Reporting (1 pt):** Meet one:<br>- Share utility data with USGBC<br>- 50% of unit owner share utility data with USGBC for 1 year<br><br>+1 EP for metering 4 end uses (i.e. space heating, DHW, lighting, plug loads)<br><br>GIP Extra item - achieve LEED NC v4.1 Advanced Metering credit<br><br>Observed: Resi House metered by utility and end uses submetered. Units metered by utility. Irrigation make-up metered. | PDI | **2** | | | | ✔ | Confirm third-party submetered point to collect energy use for Residential Units. | E5.01 Electrical Narrative<br>MP Narrative |
| **Materials and Resources** | | | | | | | | | | |
| **Prereq 1** | Certified Tropical Wood | Required: All wood is nontropical, reused/reclaimed, FSC | Cooper Carry | **Y** | | | | ✔ | Confirm no tropical wood planned for project (i.e. IPE) | -- |
| **Prereq 2** | Durability Management | Required:<br>1. Complete ENERGY STAR for Homes v3 Water Management System Checklist<br>2. Implement the following:<br>- Nonpaper faced backer board in baths/showers/spas<br>- Water-resistant flooring in kitchen/bath/laundry/spa/3 ft of exterior door<br>- Drain+pan, pan+auto water shut off, braided lines water heaters & CW<br>- Exhaust clothes dryers | KTA | **Y** | | | | ✔ | Arch<br>1. Include requirements for non-paper faced backer board is used at shower/tub. Include note in drawings or specifications.<br>2. Confirm requirements of Water Management System Checklist are included in drawings (attached)<br><br>MEP<br>Include drain+pan OR pan+auto water shut-off provided at clothes washer and water heaters | A3.10 |
| **Credit 1** | Durability Management Verification | Required: ENERGY STAR for Homes v3 Water Management System Checklist verified by Verification Team | SBP | **1** | | | | | **No Action Required**<br>Construction Activity | -- |



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| Credit | | Requirement & Comments | Responsible Party | Yes | Maybe | Not Compliant | Compliant | Needs Attention | Action | Drawing Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit 2** | Environmentally Preferable Products | **Option 1. Local Production:** 50% of products extracted, processed, and manufactured w/in 100 mi project site<br>- Framing (0.5 pt)<br>**- Concrete aggregate (0.5 pt)**<br>- Drywall and interior sheathing (0.5 pt)<br><br>**Option 2. Environmental Preferable Products:** Provide 25% reclaimed / extended producer responsibility, 25% pre and 50% post consumer, FSC, sustainable agriculture standard, 30% fly ash/slag+50% recycled aggregate/90% recycled for 90% of the following<br>- no floor covering (2 pts)<br>- flooring (1 pt)<br>- insulation (1 pt)<br>- sheathing (1 pt)<br>- framing (1 pt)<br>- drywall (1 pt)<br>- concrete (1 pt)<br>- roofing (1 pt)<br>- siding (1 pt)<br>- 3 of the following (1 pt): doors, cabinets, counters, interior trim, decking/patio, windows<br><br>For Option 2, earn 4 points to earn another +2 EP | Cooper Carry | .5 | | | | ✔ | Local concrete aggregate expected. Include Spec 018113 in Project Manual or add notes to drawings. | -- |
| **Credit 3** | Construction Waste Management (ACP) | Required: **(ACP)** Divert at least 50% and 3 waste streams (1 pt) or 75% and 4 waste streams (2 pts) of construction waste from landfill (CIR 10479). | SBP | 2 | | | | ✔ | SBP will provide 018113 specification language. | -- |
| **Indoor Environmental Quality** (min 3 pts rqd) | | | | | | | | | | |
| **Prereq 1** | Ventilation | Required:<br>1. Local exhaust<br>- Meets ASHRAE 62.2-2010 Sections 5-7 for baths (50 cfm) and kitchens (100 cfm)<br>- Exhausted to outdoors<br>- Bath fans ENERGY STAR<br>- Kitchen exhaust > 400 cfm as makeup air<br><br>2. Whole Unit mechanical ventilation that meets ASHRAE 62.2-2010 Sections 4-7<br><br>3. Non-Unit spaces met ASHRAE 62.1-2010 Sections 4-7<br><br>Observed: Units ventilated using DOAS. Kitchens, baths, dryers exhausted. | KTA | Y | | | | ✔ | 1. Meet ASHRAE 62.2-2020 requirements for Unit ventilation<br>Meet ASHRAE 62.1-2020 requirements for Common Space ventilation (the USGBC Calculator must be completed)<br>* Consider EEOs in upcoming Energy Model Report related to ventilation.<br><br>2. Specify ENERGY STAR bath fans that exhaust at 50 cfm to outdoors<br><br>3. Specify kitchen exhaust fans that exhaust at 100 cfm to outdoors | MP Narrative |
| **Prereq 2** | Combustion Venting | Required:<br>1. No unvented combustion appliances (ovens/range excl)<br>2. CO monitor in each unit<br>3. Fireplaces must have doors or glass enclosure, closed-combustion or power-vented or passes BPI/RESNET<br>4. Combustion space and water heating must have closed combustion, or power-vented exhaust, or in detached building/open air facility | Cooper Cary | Y | | | | ✔ | Select fireplace with doors/glass enclosure and power-vent or closed-combustion. | -- |
| **Prereq 3** | Garage Pollutant Protection | Required:<br>1. Locate all AHU equipment and ductwork outside garage<br>2. For conditioned space next to/above garage<br>- Seal surfaces<br>- Seal penetrations and connecting floors/ceilings<br>- Weather strip doors<br>- CO detectors in rooms that share door w/ garage<br>- Seal penetrations and cracks<br><br>Observed: | Cooper Cary | Y | | | | ✔ | Include requirements in design, Provide mechanical drawings indicating all of the requirements within the parking garage spaces. | MP Narrative |



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4/15/2021 (updated 6/7/21 to addres 4.1 comments)

SD Set 3/19/21

Scorecard

| | Credit | Requirement & Comments | Responsible Party | Yes | Maybe | Not Compliant | Compliant | Needs Attention | Action | Drawing Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| **Prereq 4** | Radon-Resistant Construction | Required: For Zone 1, design and build with radon-resistant construction techniques. Follow all the requirements listed in Indoor airPLUS, 2.1:<br>- Provide a capillary break per the Indoor airPLUS 2.1:<br>- Provide an electrical outlet near vent piping in the attic to facilitate future fan installation<br>- Install a 3- or 4-inc diameter gas tight vertical vent pipe with no bends greater than 45 degrees extending up through the conditioned spaces.<br><br>*A garage under a building is an acceptable alternative.<br><br>Observed: Project located in Zone 1 and a parking garage is located under the building. | KTA | **Y** | | | ✔ | | **No Action Required.** | A2.01 - A2.03 |
| **Prereq 5** | Air Filtering | Required:<br>Recirculating Space Conditioning - MERV 8 filters<br>OA Systems - MERV 6 filters<br><br>Observed: MERV 8 provided on VRF return in Unit. MERV 8 + MERV 13 on DOAS. | KTA | **Y** | | | | ✔ | Incorporate MERV filter targets in Mechanical Schedule. | MP Narrative |
| **Prereq 6** | Environmental Tobacco Smoke<br><br>*v4.1 Credit Substitution Requested* | Required: Include signage that prohibits smoking in<br>- interior common areas<br>- outside the building except in designated smoking areas within 25 feet of all entries, OA intakes, operable windows | Cooper Carry | **Y** | | | | ✔ | 1. Provide lease agreement that indicates smoking is prohibited in common areas (and Units for credit)<br><br>2. Include signage detail in drawings that states "No smoking within 25 feet of building" | -- |
| **Prereq 7** | Compartmentalization<br><br>*ArlCo GIP Alignment* | Required: Meet all of the following for Units:<br>1. Seal all penetrations<br>2. Weather-strip all doors to common halls<br>3. Weather-strip all exterior door and operable windows<br>4. Achieve max leakage rate of 0.23 cfm50 per sqft (if average unit size is < 1,200 sf max 0.30 cfm50 per sqft) | Cooper Carry | **Y** | | | | ✔ | 1. Include compartmentalization sheet in drawings for units and common area spaces. Include details on:<br>- Top/bottom plates to sheathing and common walls<br>- Floor joist cavities blocked and sealed<br>- Vertical studs sealed to exterior sheathing and common walls (at panel joints)<br>- Ducts, exhaust (kitchen, bath) housings sealed (any penetration)<br><br>2. Add weather-stripping requirement to door schedule, window schedule, and/or specifications for all Unit entry doors, exterior doors, and operable windows. | -- |
| **Credit 1** | Enhanced Ventilation | **Option 1. Enhanced Local Exhaust (1 pt):** Provide one of the following for bath exhaust fans in Units:<br>- occupancy sensor<br>- automatic humidistat controller<br>- continuous fan<br>- timer that runs fan for 20+ min post occupancy<br><br>AND/OR<br>Option 2. Enhanced Whole-House Ventilation (2 pts): Provide whole-house ventilation system that meets ASHRAE 62.20-2010 Sections 4-7 in each Unit. Do not exceed requirements by more than 10%.<br><br>Note: Exhaust only and Supply only systems not eligible. Section 5.3 indicates that the continuous exhaust may be used to meet this requirement. | KTA | **1** | | | | ✔ | Specify Bath Exhaust Fan to meet one of the following:<br>- occupancy sensor<br>- automatic humidistat controller<br>- continuous fan<br>- timer that runs fan for 20+ min post occupancy | -- |



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SD Set 3/19/21

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| Credit | | Requirement & Comments | Responsible Party | Yes | Maybe | Not Compliant | Compliant | Needs Attention | Action | Drawing Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit 2** | Contaminant Control | **Option 1. Walk-off Mats (0.5 pt):** Provide the following:<br>- 4' permanent walk-off mat at primary Unit entryways from outdoors<br>- 10' permanent entryway system at publicly accessible exterior entries to common space<br><br>AND/OR<br>Option 2. Shoe Removal and Storage (0.5 pt): Provide permanent architectural shoe removal and storage system in Unit entryway without carpet.<br><br>AND/OR<br>Option 3. Preoccupancy Flush (0.5 pt):<br>- During Construction: seal all ducts and vents<br>- After Construction: remove dust/debris from ducts and flush Unit for 48+ hours w/ all windows open and a continuous fan or all HVAC fans/exhaust fans<br><br>AND/OR<br>Option 4. Air Testing (1 pt): Testing building for air contaminants<br><br>Achieve 2.5 pts for earn +0.5 EP | Cooper Carry | | .5 | | | ✔ | Walk of Mats<br>Provide 10' long entry mats at publicly accessible entrances.<br><br>Note: Roll-out mats are acceptable as long as they are cleaned 1x/week. | -- |
| **Credit 3** | Balancing of Heating and Cooling Distribution Systems | For Forced-Air Systems (up to 3 pts)<br>**Option 1. Multiple Zones (1 pt):** Meet one of the following:<br>- 2 space-conditioning zones with independent thermostats<br>**- Average unit size is < 1,200 sf**<br><br>AND/OR<br>Option 2. Supply-Air Flow Testing (1 pt): Supply airflow rates are within +/- 20% (or +/- 25 cfm) of Manual J calculations<br><br>AND/OR<br>Option 3. Pressure Balancing (1 pt): Pressure differential between bedroom and rest of Unit is < 3 Pa (transfer grilles) | Power Design Inc. | 1 | | | ✔ | | **No Action Required**<br>Average unit size is < 1,200 sf. Advise of any changes. | -- |
| **Credit 5** | Enhanced Combustion Venting | Option 1. No Fireplaces or Woodstoves (2 pts)<br><br>OR<br><br>**Option 2. Enhanced Combustion Venting Measures (1 pt):** Meet the following:<br>- wood/pellet burning fireplace is power or direct vented<br>- gas/propane/alcohol stove is approved by testing facility and is power or direct vented<br>- gas/propane/alcohol stove has permanently fixed glass front or gasketed door and electronic pilot | Cooper Cary | 1 | 1 | | | ✔ | Select a fireplace that is power or direct vented with fixed glass front or gasketed door and with electronic pilot (1 pt) OR exclude indoor fireplace from design (2 pts) | -- |
| **Credit 6** | Enhanced Garage Pollutant Protection | Option 1. Exhaust Fan on Controls for Garage (1 pt): Meet all of the following:<br>- ASHRAE 62.1-2010 garage ventilation requirements<br>- Negative pressure created<br>- Self-closing doors<br>- Deck-to-deck partitions or hard lid ceiling<br>- Continuous exhaust fan OR CO sensor activated at 35 ppm<br><br>OR<br>Option 2. Detached Garage or No Garage or Carport (1 pt): No garage or a detached garage has been constructed<br><br>Observed: Garage exhaust fans provided. | Cooper Cary<br><br>KTA | 1 | | | | ✔ | PDI - Meet ASHRAE 62.1-2010 garage ventilation requirements (CO/NOX system is compliant).<br><br>Cooper Cary - Include requirement for door closers | -- |



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SD Set 3/19/21

| | Credit | | Requirement & Comments | Responsible Party | Scorecard Yes | Scorecard Maybe | Not Compliant | Compliant | Needs Attention | Action | Drawing Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Credit 7** | Low-Emitting Products<br><br>*v4.1 Credit Substitution Requested* | Required (v4.1): Meet VOC and CDPH v1.2-2017 emissions requirements 2 product categories (1 pt) or 3 product categories (2 pts). Achieve 90% compliance across all targeted product categories (1 pt).<br>**- Site-applied interior paints/coatings**<br>- Site-applied interior adhesives/sealants<br>- **Flooring**<br>**- Insulation**<br>**- Ceilings**<br>- Wall Systems<br>- Composite wood products (CARB ULEF) | Cooper Cary | 1 | 2 | | | ✔ | Seect products that have FloorScore/CRI GLP (flooring) and GreenGuard Gold (insulation, paints/coatings) certificates.<br><br>SBP will provide specification language for Contractor to follow. | -- |
| **Credit 8** | No Environmental Tobacco Smoke<br><br>*v4.1 Credit Substitution Requested* | Required: Prohibit smoking in the entire building (including units). | Greystar | 1 | | | | ✔ | Confirm no smoking in units.<br><br>Provide lease language that prohibits smoking in Units. Language must include restrictions and provisions for enforcement | - |
| **Innovation In Design** | | | | | | | | | | | |
| **Credit 1** | Exemplary Performance | Community Resources - 20 uses | SBP | 1 | | | ✔ | | **No Action Required** | -- |
| **Credit 2** | Exemplary Performance | Site Selection (8 pts) | SBP | 1 | | | ✔ | | **No Action Required** | -- |
| **Credit 3** | Exemplary Performance<br><br>*v4.1 Credit Substitution Requested*<br><br>*ArlCo GIP Alignment* | Electric Vehicles:<br>Install electrical vehicle supply equipment (EVSE) in 2% (2 spaces) of all parking spaces. The EVSE must:<br>- Provide a Level 2 charging capacity<br>- Comply with J1772<br>- Be vehicle to grid connected and network connection.<br><br>Or, provide EV infrastructure for 6% (5 spaces)of all parking spaces.<br><br>Arlington County Green Incentive Policy: Provide EV charging stations for 4% (4 spaces) of parking spaces and 15% EV-ready infrastructure (12 spaces) of parking spaces<br><br>Observed: 80 parking spaces; 4 EV spaces marked | PDI | 1 | | | | ✔ | Show 12 EV-ready spaces. | A2.01-A2.02 |
| **Credit 4** | Innovation in Design<br><br>*ArlCo GIP Alignment* | Whole Building LCA<br>GIP - Achieve 2 pts under LEED v4.1 by demonstrating 5% reduction in GWP and 2 other impact categories | SBP | 1 | | | | | ✔ | Conduct LCA kick-off and explore opportunities for reduced material impact. Consdier material optimization opportuities and tinclude requirements in specifications for Contractor to follow. | -- |
| **Credit 5** | Pilot Credit | Identify a credit.<br>-EPDs (20)<br>-Material Ingredients (20) | SBP | | 1 | | | ✔ | Include requirements in specifications. | -- |
| **Credit 6** | LEED AP for Homes | LEED AP | SBP | 1 | | | ✔ | | **No Action Required** | -- |
| **Regional Priority** | | | | | | | | | | | |
| **Credit 1** | Regional Priority | Site Selection (8 pts) | SBP | 1 | | | | ✔ | See credit requirements. | -- |
| **Credit 2** | Regional Priority | Community Resources | SBP | 1 | | | ✔ | | **No Action Required** | -- |
| **Credit 3** | Regional Priority | Access to Transit | SBP | 1 | | | ✔ | | **No Action Required** | -- |



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SD Set 3/19/21

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| Credit | | Requirement & Comments | Responsible Party | Yes | Maybe | Not Compliant | Compliant | Needs Attention | Action | Drawing Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit 4** | Regional Priority | Rainwater Management (3) | SBP | | 1 | | | ✔ | See credit requirements. | -- |



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ENERGY STAR® Portfolio Manager®

## Portfolio Manager

Help

## Target Finder Results

Based on the information you have provided, we have calculated metrics to help you understand the energy efficiency associated with your current design and/or target (jump to the detailed table below). For a print out of this information, you can download your Statement of Energy Design Intent.

### Your Design Score

85
**Congratulations! Your design is eligible for Designed to Earn the ENERGY STAR.**

Did you know that property design projects can achieve Designed to Earn the ENERGY STAR for meeting energy efficient criteria? Learn more .

**Download Your Statement of Energy Design Intent (SEDI)**
This document provides an overview of your design and metrics. It is also used for Designed to Earn the ENERGY STAR applications.

Download & Print Statement

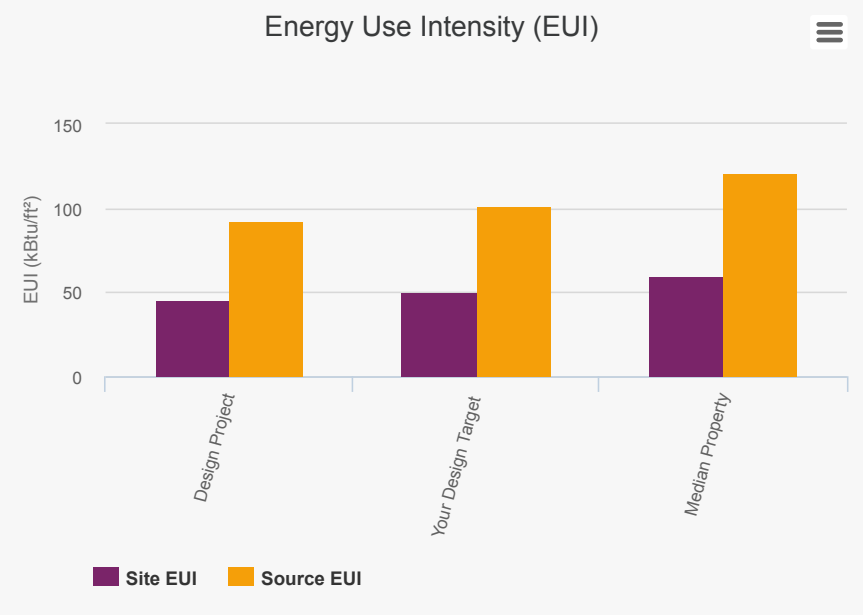
### About this Property's Design

| | |
|---|---|
| **Target:** | Target ENERGY STAR Score: 75 |
| **Uses:** | Multifamily Housing (100.0%)<br>Parking |
| **Energy Types:** | Electric - Grid (56.0%)<br>Natural Gas (44.0%) |

Edit

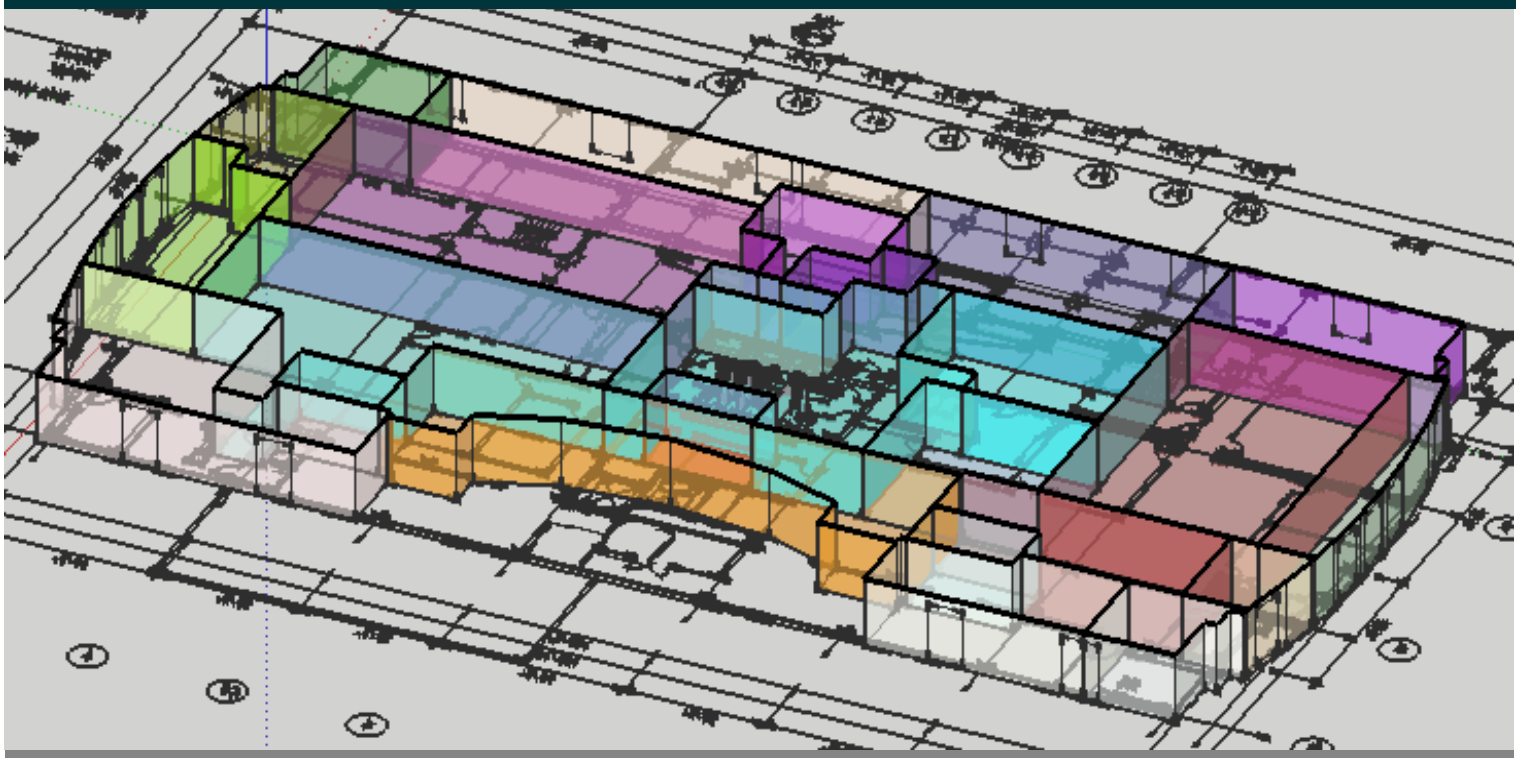
Your Design's estimated energy and GHG emissions are 9.5% better than your Design's target.

Your Design's estimated energy and GHG emissions are 23.8% better than the median property.




### Metrics Comparison for Your Design and/or Target

| Metric | Design Project | Design Target* | Median Property* |
|---|---|---|---|
| ENERGY STAR score (1-100) | 85 | 75 | 50 |
| Source EUI (kBtu/ft²) | 92.2 | 101.9 | 121.0 |
| Site EUI (kBtu/ft²) | 45.4 | 50.2 | 59.6 |
| Source Energy Use (kBtu) | 25,359,880.1 | 28,010,839.8 | 33,263,650.5 |
| Site Energy Use (kBtu) | 12,494,599.5 | 13,800,705.5 | 16,388,721.2 |
| Energy Cost ($) | 270,600.01 | 298,886.92 | 354,936.30 |
| Total GHG Emissions (Metric Tons CO2e) | 987.2 | 1,090.4 | 1,294.9 |



# Energy Model Report

*Arlington County 4.1 Site Plan Submission*

## 2025 Clarendon Blvd

*Arlington, VA*

**4.1 Submission Report v1.0**

*April 16th, 2021*

SUSTAINABLE BUILDING PARTNERS

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# Table of Contents



*Disclaimer: This analysis is not intended to predict the absolute energy consumption of the proposed facility but rather it is intended to estimate order of magnitude savings for alternative systems and building options based on refined assumptions, building performance metrics and energy modeling expertise. Change in weather conditions, operational characteristics, end-user, miscellaneous electrical loads, controls alterations and other unpredictable metrics prevent the model from accurately predicting the actual annual energy consumption of any facility.*

# Purpose

Sustainable Building Partners, LLC (SBP) has developed a whole building hourly energy simulation using EnergyPlus V9.2 via the OpenStudio v2.9.1 interface for the proposed 2025 Clarendon multifamily building in Arlington, VA. SBP utilizes the model as a design tool specifically for the purpose of enhancing the energy performance of the facility. SBP's modeling methodology is consistent with LEED Multifamily Midrise and ASHRAE 90.1-2010 Appendix G modeling protocol and best practices.

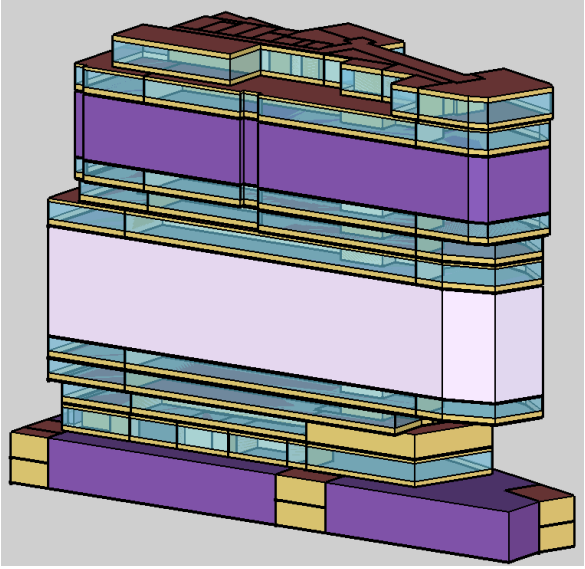

**Figure 1: Energy Model Rendering of 2025 Clarendon**

## Arlington County – 4.1 Site Plan Submission

As part of the conditions package of the Site Plan submission and additional bonus density targets, the project design will be required to demonstrate specific energy performance thresholds and design strategies. In support of this requirement, this analysis evaluates the preliminary energy performance of the facility in the context of LEED, site and source energy, greenhouse gas emissions, and energy cost savings. This analysis also evaluates various electrification strategies and additional savings opportunities within the same context.

*Note that this analysis is based on preliminary design information and may change as the design progresses.*

## LEED Benchmarking

This project will be pursuing LEED V4: Multifamily Midrise. As part of this process, the design is required to achieve 5% energy costs savings as compared to an ASHRAE 90.1-2010 Appendix G Baseline design. This analysis does not specifically evaluate LEED performance, but follows the general modeling guidelines required for LEED benchmarking.

# Energy & Environmental Performance Statement

This section of the report summarizes the results of the whole building hourly energy simulation. Figure 2 of this report summarizes the energy modeling results for the baseline and proposed design.

## Summary of Performance & Primary Design Alternates

**The current design is projected to achieve ≥20% energy cost savings** as of the 3/19/21 SD design documents. Table 1 summarizes the proposed performance benchmarking as well as potential design alternates. Note that many of the design alternates are *not feasible* within the current building scope and have been provided for informational purposes only.

**Table 1: Annual Energy Performance & Electrification Alternates**

| Model Deign | Description | Annual Energy Cost (Cost/Unit) | Energy Cost Savings[1] | Site EUI (kBtu/sf) | Source EUI (kBtu/sf) | GHG (MT CO2e) | Energy Star Score |
|---|---|---|---|---|---|---|---|
| **Proposed** | **As of 3/19/2021 SD Design**<br>Heating: Gas DOAS<br>DHW: Gas Condensing Boilers | $1,190 | **20 - 22%** | **46** | **101** | **970** | **80+** |
| **Alt #1** | Heating: Gas DOAS<br>DHW: Electric Storage (In-Unit) | $1,450 | **20 - 21%** | **46** | **119** | **1,075** | **70 - 75** |
| **Alt #2** | Heating: Gas DOAS<br>DHW: Heat Pump | $1,250 | **30%+** | **41** | **103** | **940** | **80+** |
| **Alt #3** | Heating: Heat Pump DOAS<br>DHW: Gas Condensing Boilers | $1,230 | **20 - 22%** | **38** | **100** | **895** | **85+** |
| **Alt #4** *(all elec)* | Heating: Heat Pump DOAS<br>DHW: Electric Storage (In-Unit) | $1,490 | **20 - 21%** | **38** | **118** | **1,000** | **70 - 75** |
| **Alt #5** *(all elec)* | Heating: Heat Pump DOAS<br>DHW: Heat Pumps | $1,280 | **30%+** | **32** | **101** | **860** | **85+** |

[1] Savings compared to ASHRAE 90.1-2010 Appendix G Baseline design

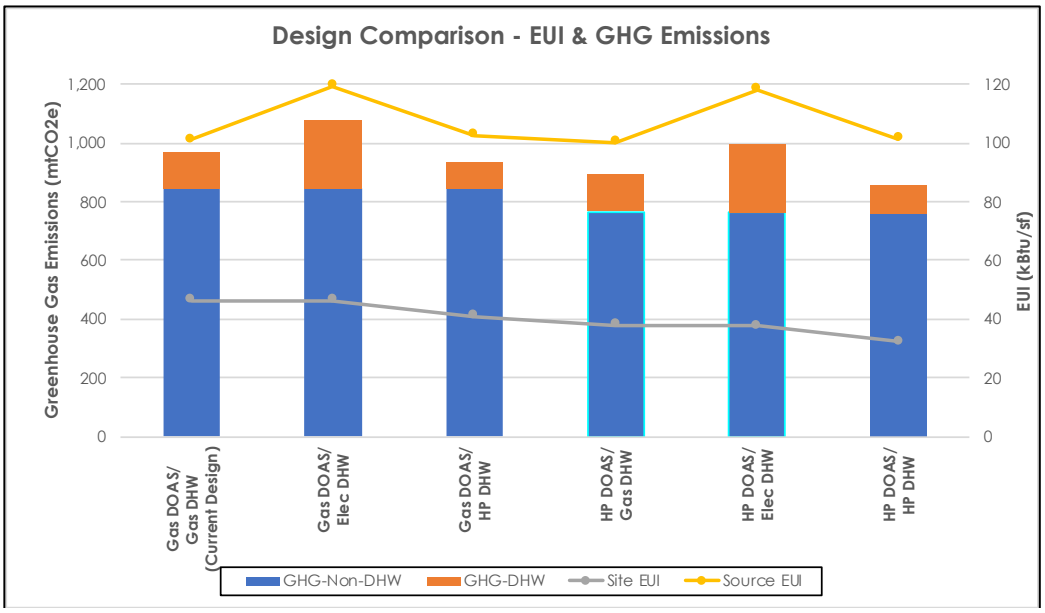


**Figure 2: Design Alternates - Greenhouse Gas Emissions**

## Primary Design Features Driving Energy Cost Savings

As of the 3/19/2021 SD set, the follow features are the primary drivers of energy performance though many other factors play in to the overall energy profile of the building:

- Air-cooled variable refrigerant flow systems
- Decoupled ventilation provided by gas-fired DOAS
- High-efficiency gas-fired condensing boilers provide DHW
- Anticipated 20% interior lighting power reduction (common only, ≤0.48 W/sf)
- Anticipated 82%+ garage lighting power reduction (LED fixtures, ≤0.11 W/sf)
- EnergyStar appliances (fridge, dishwasher, clothes washer)
- Low flow plumbing fixtures
- High performance windows

## Additional Energy Efficiency Opportunities & Alternatives

The following is a list of Energy Efficiency Opportunities (EEOs) that the project team is interested in evaluating. These represent *big-ticket* items that need to be defined at this design phase as they impact the primary building configuration and layout. Additional opportunities have been discussed, but are not included in this preliminary analysis. All savings estimates are approximations based on the current design and various assumptions.

**Table 2: Detailed EEO Summary**

| EEO | Measure | Energy Cost Savings | | Base Design Assumption | EEO Summary |
|---|---|---|---|---|---|
| **1** | Corridor Outside Air Reduction | $3,500–$7,200 | **1 – 2%** | *Corridors: 0.30 CFM/sf. Conditioned & pressurized by DOAS.* | **0.20 CFM/sf** |
| **2** | Decoupled Corridor Outside Air | $7,200-$10,000 | **2 – 3%** | | **0.10 - 0.15 CFM/sf + Local recirculating VRFs** |
| **3a** | Window Area Reduction – 45% | $3,500 - $5,400 | **1.0 – 1.5%** | 65% Window Area | **45% Window Area** |
| **3b** | Window Area Reduction – 55% | $1,800 - $2,700 | **0.5 – 0.8%** | | **55% Window Area** |
| **4** | DOAS Energy Recovery | $10k–$18k | **3 – 5%** | No energy recovery | **Enthalpy wheel pretreats all incoming outdoor air** |

## Design Challenges & Limitations

The following subsections summarize the primary limiting factors associated with various electrification strategies and design alternates.

Heat Pump DOAS

*A heat pump DOAS would provide an all-electric, high-performance DOAS option, but is generally limited by equipment technology. Heat pumps are typically capped at about ≤70-tons for a 100% outside air application which exceeds the anticipated capacity for this facility. A dual-DOAS configuration with smaller units is a possible alternative, but likely isn't feasible in this building given the smaller footprint and limited available floor and roof area. Secondly, this system would require a large auxiliary electric resistance backup system to support the heat pump at low ambient temperatures which would likely require an increase in electric infrastructure.*

Air-to-Water Heat Pump DHW – Central Plant:

*Scalability is the primary limiting factor for an air-to-water heat pump DHW system in a high-rise multifamily application. Heat pump water heaters are widely available at residential and small commercial sizing, but these cannot be effectively packaged and scaled for a larger facility like this. This has been studied on similar projects in Arlington with the conclusion that the quantity of heaters and necessary space are not feasible for this type of facility.*

Air-to-Water Heat Pump DHW – In-Unit:

*Smaller in-unit heat pump water heaters are available at a residential scale and would provide a high-performance, all-electric DHW option. In addition to being cost-prohibitive, these systems require considerably more space than a traditional electric-resistance storage water heater which likely cannot be accommodated within this building. On average, manufacturer's recommend 700 – 800 $ft^3$ of air surrounding the units to ensure adequate heat transfer.*

DOAS with ERV

*This is a valuable solution to minimize ventilation loads, but is generally limited by the space required for capturing vertical exhaust and routing it back to the DOAS. This is particularly challenging in smaller footprint, high-rise buildings that are unable to lose the floor area for additional vertical chases and roof area for larger DOAS units.*

# Basis of Design

This section of the report provides details on assumptions and preliminary design parameters related to the equipment included in the energy modeling analysis.

## Building Envelope

Envelope performance has been estimated based on preliminary design narratives and derivations from the Courthouse Metro project:

- Window Area: **65% window-to-wall ratio**
- Typical Wall: 2" mineral wool + R-13 batt insulation between metal studs
- Typical Roof: R-25 insulation above deck
- Typical Floor: R-10 stick-pin
- Windows *(Proposed Design Specifications)*
    - Typical: U-0.32 / 0.23 SHGC
    - Curtainwall: U-0.36 / 0.27 SHGC
    - Storefront: U-0.38 / 0.35 SHGC

## Electrical - Lighting

Interior and exterior lighting has not yet been defined as of the 3/19/21 SD Set. Design targets have been established for the interior lighting. All other lighting has been treated as cost neutral.

- Multifamily: **0.48 W/sf** (*Proposed Design Target*)
- Parking: **0.11 W/sf** (*Proposed Design Target*)
- Dwelling Units: 0.90 W/sf (*not regulated by ASHRAE 90.1*)
- Retail: 1.40 W/sf (*not in scope*)

All lighting controls are assumed to meet the mandatory provisions of ASHRAE 90.1-2010.

## Electrical – Unit Appliances

Appliance selections have been assumed to be as follows:

- Refrigerator – EnergyStar qualified (required by SPC)
- Dishwashers – EnergyStar qualified (required by SPC)
- Clothes washer - EnergyStar qualified (required by SPC)
- Electric Dryer (standard, non-EnergyStar)
- Electric Range

### HVAC

Primary Space Conditioning: Variable refrigerant flow (VRF) heat pumps
Serves: Dwelling units, amenity, common areas, & corridors areas

Ventilation: Decoupled. 100% outside air packaged rooftop unit with air-cooled DX cooling, gas heating, and hot gas reheat.
Preliminary Sizing: 21,000 CFM, 150 - 160 tons (estimated)

Miscellaneous:

- Corridors – Pressurized and conditioned by DOAS at 0.30 – 0.35 CFM/sf. No additional recirculating systems are provided.
- 1st Floor Retail: Not in Scope. Treated as cost neutral in the energy model.

### Domestic Hot Water

DHW is provided by gas-fired condensing boilers estimated at 95 – 96% $E_t$.

## Pending Items

The following items will need to be addressed as the design is finalized:

### Architectural

- Full architectural set
  - Opaque assembly sections and details
- Final window NFRC ratings

### Mechanical/HVAC

- Mechanical schedules
- HVAC floor plan layouts
- Ventilation calculations
- Equipment submittals
- Sequence of Operation

### Electrical/Lighting

- Interior lighting COMCheck (verify 0.48 W/sf design target)
- Exterior lighting COMCheck

### Plumbing/DHW

- Plumbing schedule
- Plumbing fixture selections
- Water heater specifications & equipment submittals