Comparison of the ENERGY STAR Multifamily New Construction Program to ENERGY STAR MFHR

When developing the new ENERGY STAR Multifamily New Construction (MFNC) Program, the requirements of the current Multifamily High Rise (MFHR) and Certified Homes (ESCH) Programs were merged and used as the basis of the new program, with a goal to limit significant increases in stringency of the merged requirements.

With respect to formatting, a decision was made for the Multifamily New Construction program documents to adopt the format used in the Certified Homes program documents. For MFHR Program participants, this reflects a significant change in how program requirements are presented in comparison to these three MFHR documents: Performance Path, Prescriptive Path, and Testing & Verification Protocols.

This comparison document summarizes the most significant technical changes and is organized according to the new MFNC program documents. Appendix A shows an annotated version of the MFHR Performance Path to further identify key changes.

1. **National Program Requirements**
   General: In MFHR, there was a Performance Path document and a Prescriptive Path document, and each contained all information related to the certification process and mandatory requirements of that Path. In the MFNC program, there is a National Program Requirements document, which instead combines information related to all Paths and moves mandatory technical requirements to these separate documents: Rater Design Review & Field Checklists, HVAC Design Report, HVAC Functional Testing Checklist, and Water Management System Requirements (see #5-#9).
   a. MFNC eligibility includes all configurations of MF except two-family dwellings and is no longer limited by building height. The percentage of common space is also no longer a factor.
   b. Builder/Developer Partners are now required to take an online orientation training.
   c. Online orientation training is now mandatory for the Functional Testing agent (role described in #8) and the ASHRAE modeler.
   d. Individuals conducting 3rd party inspections and testing (ie. Raters, Inspectors) are required to complete ENERGY STAR MF Rater Training offered through an RESNET Accredited Rater Training Provider.
   e. In addition to the ASHRAE Path used in MFHR, a modeling path based on the Energy Rating Index (ERI) of a dwelling unit and a Prescriptive Path are available. While limited to certain states in MFHR, the MFNC Prescriptive Path is currently available in states that have adopted the 2012, 2015, and 2018 IECC.
   f. While MRO's continue to provide verification & oversight for the Prescriptive and ASHRAE Paths, if following the ERI Path, the oversight is provided by a VOO (ie. RESNET).
   g. In the ERI Path, similar to the ASHRAE Path, there is a Baseline that the Proposed Design is compared to. This Baseline is called the ENERGY STAR MF Reference Design and is also the basis of the Prescriptive Path. Rather than requiring savings above the ASHRAE Baseline Building, the software automatically calculates the ERI for the ENERGY STAR MF Reference Design, which then becomes the ERI Target for the Proposed Design.

2. **ERI Target Procedures**
    a. Similar to the ASHRAE Path, there are specific modeling protocols that must be followed in order to create consistent ERI's across users and software. Unlike the ASHRAE Path, software approved to calculate the ERI, automate the ENERGY STAR MF Reference Design and the calculation of the ERI Target. This document is similar to the Simulation Guidelines, as it describes in detail how the Baseline and Proposed Design (ie. Rated Home) must be modeled. While the Simulation Guidelines supplement the protocols of ASHRAE 90.1 Appendix G and the audience is the ASHRAE modeler, the ERI Target Procedures supplement the modeling protocols of ANSI/RESNET/ICC 301 and the audience is energy rating software developers.
3. **Simulation Guidelines, Performance Path Calculators, and Photo Documentation**
    a. Premise is the same as MFHR, with only minor modifications made to accommodate slight changes to program requirements.
    b. MFNC does not use the Testing & Verification Protocols, and instead references other Standards as needed for those procedures.
4. **Multifamily Workbook**
    a. This Excel-based file replaces the MFHR Testing & Verification Worksheets and is required for ASHRAE and Prescriptive Path. It is not required for use in the ERI Path.

The following 5 documents contain the mandatory technical requirements of the MFNC Program.

5. **Rater Design Review Checklist (2 pages of Checklist items, 5 sections, and 22 footnotes)**
    a. In MFHR, during the Proposed Design Submittal, a project's design was verified to be in compliance with all program requirements by the MRO, by reviewing the Performance Path Calculator and the T&V Worksheets. The MFNC Rater Design Checklist instead focuses on just 3 key areas: fenestration, insulation, and HVAC Design, and provides a PDF checklist format for the Rater to verify that these specific items have been confirmed during the design review. There is also an Excel version of the checklist, contained within the Multifamily Workbook.
    b. Unlike MFHR, an HVAC Design Report is a formal program document that must be completed by the HVAC Designer (see #7) and then key items must be reviewed by the Rater in this Design Review Checklist.
    c. Similar to the Plan Review columns throughout the T&V Worksheets, there is an optional, but recommended Section 5, that prompts the Rater to review specific requirements during the construction document review.

6. **Rater Field Checklist (5 pages of Checklist items, 14 sections, and 72 footnotes)**
    d. In MFHR, the following items were verified and documented through the T&V Worksheets. In MFNC, they are verified through the PDF Checklist or the Excel version of the checklist, contained within the Multifamily Workbook.

    <u>Thermal Enclosure System (Sections 1, 2, 3, & 4)</u>
    Section 1
    e. Minimum performance requirements for fenestration and insulation.
    f. Allows heated plenums and garages without a modeled energy penalty, but with added insulation requirements.

Section 2

g. Requires fully-aligned air barriers and specific items to field-verify.

Section 3

h. Requires slab-on-grade in CZ 4-8 to have a minimum of R-5 slab edge insulation.
i. Requires R-5 on elevated slabs, like garage podiums and projected balconies, with a UA option for balconies without a thermal break.
j. For continuous insulation, clarifies what specifically can be exempted (e.g., fasteners, projected balconies, PTAC openings), and what portions of the walls cannot (e.g., intermediate floor perimeters, steel columns).
k. For calculating total UA, clarifies how fasteners and other interruptions in continuous insulation must be calculated.
l. For continuous insulation requirement, R-5 is the requirement for CZ 5-8, not R-3. Expands requirement to wood-frame buildings, but also provides some other alternatives to reduce thermal bridging. While interior insulation is no longer an option for mass or masonry walls, it is an option for gut rehabs, where exterior insulation is not feasible.
m. Added requirement that dwelling unit entry doors have a doorsweep, weatherstripping, or equivalent gasket.

Section 4

n. Provides specific list of mandatory air-sealing items that must be field-verified.

<u>HVAC System (Sect 5: Heating & Cooling Equipment & Sect 6: Duct Quality Installation)</u>

Section 5

o. Rater has to confirm installed equipment matches HVAC Design Report.
p. Rater has to measure external static pressure in forced air systems in dwelling units.
q. Rater has to check the Functional Testing agent's credentials and confirm they have taken the mandatory online orientation.
r. If Prescriptive Path, Rater checks that dwelling unit thermostats are programmable.

Section 6

s. Bedroom pressure-balancing test required if design airflow is 150 cfm or greater.
t. Reduced TOTAL duct leakage allowances for dwelling unit systems without ducted returns AND added a pressure differential test, where the allowance increases with system tonnage.
    - If using non-ducted returns with AHU closet on exterior wall, 5 Pa pressure differential test also required.
u. Requires DLTO test for Townhouses, but not for other MF units.
v. No duct testing required if total SUPPLY length is <10 ft and contained within conditioned space.
w. Central exhaust ducts (serving 4 or more units) must be tested for leakage, but the metric is different from MFHR.

<u>Outdoor Air Ventilation Systems (Section 7)</u>

x. Measured ventilation airflows are to be within 15% or 15 cfm of values in HVAC Design Report.
y. Changed the requirements for outdoor air intakes and establishes requirements on air inlets.
z. Establishes a maximum sone level for certain systems.

Local Mechanical Exhaust Ventilation Systems (Section 8)

aa. Requires garages to have CO/NO2 sensors, regardless of Path.

Filtration (Section 9)

bb. Requires MERV 6 on dwelling unit forced air systems, with some sealing to prevent filter bypass.

Combustion Appliances (Section 10)

cc. Different restrictions on the use of unvented heating/DHW equipment and appliances compared to MFHR.

DHW (Section 11)

dd. Added a heat trap requirement for in-unit storage water heaters.

ee. Changed to an R-3 DHW piping insulation requirement.

Lighting (Section 12)

ff. Efficacy requirement is not based on lm/W and is 90% of fixtures, but depends on Path chosen.

Appliances, Ceiling Fans, and Plumbing Fixtures (Section 13)

gg. ENERGY STAR appliances not required in all Paths, but where required does extend to clothes dryers.

hh. WaterSense plumbing fixtures also not required for all Paths and no longer includes toilets.

Whole-Building Data (Section 14)

ii. For large MF buildings, a strategy to obtain whole-building data must be confirmed prior to certification. Strategy can include no-cost measures such as lease agreements where resident agrees to release data or at-cost measures, like whole-building energy monitors or agreement with utility to access whole-building data annually.

7. HVAC Design Report (5 pages of Checklist items, 6 sections, and 42 footnotes)

jj. Entirely new reporting document compared to MFHR.

kk. Used by HVAC Designer to document ventilation, HVAC design and system selection in dwelling units and common areas.

ll. Appendix of tables to document extra spaces or systems as needed.

8. HVAC Functional Testing Checklist (4 pages of Checklist items, 9 sections, and 7 footnotes)

mm. Entirely new reporting document compared to MFHR.

nn. Not all Sections will apply to the project.

oo. Used by Functional Testing Agent to document functional testing of in-unit equipment as well as specific tests for central systems, as applicable.

9. Water Management System Requirements (1 page of Checklist items, 4 sections, and 19 footnotes

a. Entirely new document compared to MFHR.

b. While not a checklist to be completed or verified by the Rater, the Builder/Developer is required to meet the listed requirements, which seek to reduce water infiltration.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

ENERGY STAR MFHR Performance Path Requirements:

To earn the ENERGY STAR using this performance approach, a building must meet the requirements specified below, Performance Target, and be verified and field-tested in accordance with the *ENERGY STAR MFHR Testing and Verifica Protocols*. Note that compliance with these guidelines is not intended to imply compliance with all local code requiremen may be applicable to the building to be built.[1]

To meet the certification guidelines, the developer of a project participating in the program must provide EPA or its desi agent with program specific submittals. These submittals, which must be validated by a licensed professional (registere architect or professional engineer), are used to demonstrate that the program's performance target has been met, that a prerequisites are included, and that each energy conservation measure chosen by the design team is installed to specification.

Performance Target:

The Performance Target is 15% energy cost savings over the ASHRAE 90.1 Standard (2007 or 2010) equivalent to the energy code under which the building is permitted, using the Appendix G protocols and the *ENERGY STAR MFHR Sim Guidelines*. Energy cost savings associated with on-site power generation, including cogeneration, photovoltaics, and w turbines, may not be used to meet the Performance Target of 15%.

ENERGY STAR MFHR Simulation Guidelines (Simulation Guidelines):

The *Simulation Guidelines* is a companion document to ASHRAE 90.1-2007/2010 and ASHRAE 90.1 - Appendix G and contains program guidance to assist energy modelers in developing the Baseline Building, Proposed Design, and As-Bu models for each project. The intent of these guidelines is to:

- Facilitate consistent modeling among different modelers;
- Facilitate consistent modeling of baseline components not mentioned in Appendix G;
- Establish modeling protocols for measures that ASHRAE 90.1 leaves to the rating authority to determine; and
- Ensure that modeling results are used to drive the energy-efficient design process.

If an energy conservation measure is included in the model that is not addressed in the *Simulation Guidelines* or ASHRAE 90.1-2007/2010 - Appendix G, the energy modeler is required to clearly document their assumptions and calculations. Each measure not included in the guidelines is subject to approval by EPA or its designated agent.

ENERGY STAR MFHR Testing and Verification Protocols (T&V Protocols):

The *T&V Protocols* are mandatory requirements for the inspection, testing, and verification of components related to the building's energy performance. All inspections and diagnostic tests described within these protocols are required for ea the energy-related components and systems that exist in the participating building. Results of inspections must be documented and kept on record with the building file by a licensed professional and submitted to EPA, or its designated agent, at the completion of construction. These inspections shall be conducted throughout the project construction phase at a time that is best suited to determine whether the energy efficiency element is installed to specification.

ENERGY STAR MFHR Submittal Requirements:

To meet the certification guidelines, EPA or its designated agent must approve a complete Proposed Design Submittal complete As-Built Submittal. EPA or its designated agent will not approve incomplete submittals, but will communicate w Developer Partners and licensed professionals on which requirements must be met to bring the submittal into compliance with program requirements.

Commented [ES1]: While the MFHR Performance Path is most similar to the ASHRAE Path in the MFNC Program, key areas that were changed are noted below, not just for the ASHRAE Path, but also where applicable for the ERI and Prescriptive Path.

Commented [ES2]: For all Paths, mandatory requirements (MFHR 'prerequisites') now live within the Rater Design Review Checklist, Rater Field Checklist, HVAC Design Report, HVAC Functional Testing Checklist, and Water Management System Requirements.

Commented [ES3]: This T&V Protocols document does not apply to the MFNC program. As needed, references are instead made to other standards, such as ANSI/RESNET/ICC 380.

Commented [ES4]: In MFNC, a Licensed Professional is no longer required to validate submittals. Instead, Raters and Rating Field Inspectors that are ENERGY STAR Partners and have completed ENERGY STAR MF Rater Training are required to provide the MFNC submittals to the MRO (or VOO for ERI Path). Other qualifications may be accepted by the MRO.

Commented [ES5]: The ASHRAE Path Performance Target information now resides within the National Program Requirements document but in general remains the same as MFHR, 15% savings above the state code.

Commented [ES6]: The Simulation Guidelines is slightly revised for the MFNC program, but continues to serve the same purpose as in MFHR: a supplement to ASHRAE 90.1 Appendix G.

Commented [ES7]: As mentioned above, the T&V Protocols document is not used in the MFNC program.

Commented [ES8]: Submittal requirements are similar to the current MFHR submittal requirements, except must be submitted to an MRO and some of the submitted documentation is different. Details can be found in the National Program Requirements and MRO's have some flexibility in the review process.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

Proposed Design Submittal (Submitted prior to construction)

The Proposed Design Submittal is used to ensure that the project design meets the Performance Target and that the mandatory requirements of the program have been included in the construction documents. The licensed professional is responsible for submitting a Proposed Design Submittal, with an *ENERGY STAR MFHR Submittal Validation Form* to E its designated agent for approval, prior to beginning construction. The Proposed Design Submittal includes the following:

- Proposed Design Performance Path Calculator[2]
  The *Proposed Design Performance Path Calculator* summarizes the modeling results of the proposed building de and is used to demonstrate achievement of the Performance Target.

- Testing and Verification Worksheets
  A full review of all construction documents must be conducted prior to construction and documented using the *T&V Worksheets*. The *Prerequisites Checklist* is used at this stage to demonstrate that prerequisites and energy conservation measures chosen by the design team have been properly specified within the construction documents. The checklist is included as part of the *T&V Worksheets* and is automatically completed if the other *T&V Workshe* are used to document the review process.

Developer partners may not promote the units within their project as ENERGY STAR until all program requirements are met and confirmed by EPA or their designated agent. Eligible projects may use the Designed to Earn the ENERGY STAR mark after the design phase of the project if they have an approved Proposed Design Submittal and the design receives a score of 75 or higher, using EPA's Portfolio Manager. More information is available in the *Designed to Earn the ENERGY STAR MFHR* document available on the Guidance Documents page.

Commented [ES9]: For ASHRAE Path, submit the MFNC version of the Performance Path Calculator, the Multifamily Workbook, the HVAC Design Report, construction documents, and either the modeling file or input/output files must also be submitted.

Commented [ES11]: For ASHRAE Path, a slightly revised version is still used in MFNC.

Commented [ES12]: While the 'T&V Worksheets' is no longer required in MFNC, an Excel-based 'Multifamily Workbook' is required and contains a subset of the information once documented in the 'T&V Worksheets'.

Commented [ES13]: Eligible projects may pursue Designed to Earn ENERY STAR (DEES), but are not required to submit the Statement of Energy Design Intent (SEDI), as they did in MFHR.

As-Built Submittal (Submitted post construction)

The As-Built Submittal is used to ensure that the energy conservation measures chosen by the design team are installe specification. After the final inspection, the licensed professional is responsible for submitting an As-Built Submittal, with *ENERGY STAR MFHR Submittal Validation Form* to EPA, or its designated agent for approval. Once EPA has determi that the project has fulfilled all of the program requirements, the Developer Partner will be notified that the building has earned the ENERGY STAR and that it can be marketed and promoted per the *ENERGY STAR Logo Identity Guidelines*. The As-Built Submittal includes the following:

- As-Built Performance Path Calculator
  The *As-Built Performance Path Calculator* summarizes the modeling results of the completed building, and is used to demonstrate achievement of the Performance Target. Any modifications to the project's energy conservation measures during construction must be reflected in the *As-Built Performance Path Calculator*.

- Testing and Verification Worksheets and Photo Template
  The *T&V Worksheets* and *Photo Template* are used to demonstrate that prerequisites and energy conservation measures chosen by the design team are included in the completed building and meet all requirements of the *ENERGY STAR MFHR Testing and Verification Protocols*. (Note, once a licensed professional or Developer Partner has successfully certified 3 buildings, submission of a Photo Template as a component of the Testing and Verification Protocols is no longer required.)

Commented [ES14]: Similar to the MFHR As-Built Submittal, but uses the MFNC Performance Path Calculator and Multifamily Workbook, and will require submission of the MFNC Checklists, photo documentation, construction documents and either the As-Built modeling file or As-Built input/output files, unless otherwise instructed by the MRO.

Commented [ES15]: This photo documentation waiver is not available in the MFNC program, and photo documentation must be submitted for each MFNC project.

ENERGY STAR MFHR Prerequisites[3]:

Appliances	When provided in common areas and/or apartments, refrigerators, dishwashers, clothes

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

	washers, ceiling fans and vending machines must be ENERGY STAR certified.
Heating and Cooling Equipment	▪ The heating and cooling systems must comply with ASHRAE 90.1-2007, Section 6.4. ▪ Load sizing calculations must reflect the design[4]. The installed capacity cannot exceed d by more than 20%, except when smaller sizes are not available. ▪ Atmospherically vented gas furnaces and boilers shall not be specified.
Heating and Cooling Distribution[5,6,7,8,9,10,11,12]	▪ Total duct leakage for in-unit systems shall be ≤8 CFM25 per 100 ft^2 of conditioned floor area[6]. Sampling procedures and tolerances are described in the *T&V Protocols*. ▪ Heating and cooling supply and return ductwork shall be insulated to a minimum R-6 in unconditioned space.
Envelope[13,14,15]	▪ The envelope components must comply with ASHRAE 90.1-2007, Section 5.4. Assemb value determinations must follow ASHRAE 90.1-2007, Appendix A[16]. ▪ The building plans shall demonstrate a continuous, unbroken air barrier separating the conditioned space of the building from the following spaces: - the exterior, - unconditioned spaces within the building, - commercial spaces, - mechanical rooms vented with unconditioned air, - mechanical chases opening to unconditioned spaces, - elevator shafts, and - garages or other vehicle/equipment storage facilities. ▪ All roof, wall, floor, and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces that contain a layer of continuous, air impermeable insulation (≥R-3 in CZ 1-4 and ≥R-5 in CZ 5-8). ▪ For steel-framed and metal building walls, continuous exterior insulation (≥R-3) is required on above grade walls[17]. For mass or masonry walls with metal framing, continuous interior or exterior insulation (≥R-3) is required on above grade walls. ▪ Specified windows must be double or triple-pane, with low-emissivity glass or coatings
Garages and Sidewalks[18,19]	Attached garages shall be fully compartmentalized from the rest of the building through air sealing. All pipe and conduit penetrations shall be sealed with material compatible with the surface and resilient to temperature fluctuations.
Ventilation and Infiltration[20]	▪ Apartments shall be sealed to reduce air exchange between the apartment and outside as well as the apartment and other adjacent spaces. A maximum air leakage rate of 0.30 CFM50 per square feet of enclosure is allowed. Sampling procedures and tolerances are

Commented [ES16]: See Rater Field Checklist, Section 13. ASHRAE Path: No longer required
Prescriptive Path: Required and clothes dryer have been added.
ERI Path: Not required but the MF Reference Design that is used as the "Baseline" has ENERGY STAR certified appliances.

Commented [ES17]: Not explicitly required, but some requirements from Section 6.4 have been adopted and are explicit checklist items in MFNC Rater Field Checklist, HVAC Design Report and HVAC Functional Testing Checklist.

Commented [ES18]: Load calculations must still reflect the design. The MFNC HVAC Design Report is to be completed by the HVAC Designer to clearly document sizing and system selection.

Commented [ES19]: See Rater Field Checklist, Section 10 for slight changes to this requirement to address other combustion appliances.

Commented [ES20]: See Rater Field Checklist, Section 6.4. Rough-in testing allowances and alternative allowances depending on the number and type of returns are part of the MFNC program.

Commented [ES21]: Sampling is per RESNET Standards.

Commented [ES22]: Not explicitly required, but some requirements from Section 5.4 have been adopted and are explicit checklist items in MFNC Rater Field Checklist (Section 1 - 4)

Commented [ES23]: See Rater Field Checklist, Section 3 for changes. Wood-frame buildings are also subject to reduced thermal bridging requirements, but alternative compliance options may be available.

Commented [ES24]: See Rater Design Checklist, Section 2 for specific performance (U-factor, SHGC) requirements.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

	described in the *T&V Protocols*. Specific apartment air leakage paths to be sealed are listed in the *T&V Worksheets*. ▪ Common area ventilation systems shall be designed and tested to satisfy minimum requirements of ASHRAE 62.1-2007. Apartment ventilation and local exhaust systems shall be designed and tested to satisfy minimum requirements of ASHRAE 62.2-2007, without reliance on natural ventilation[21]. ▪ Apartment in-line and ceiling exhaust fans must be ENERGY STAR certified.
Domestic Water Heating[22,23]	▪ Domestic water heating systems must comply with ASHRAE 90.1-2007, Section 7.4. ▪ Atmospherically vented gas water heaters, tankless coils and side-arm water heaters shall not be specified. Indirect water heaters, with or without storage, are acceptable. If storage is provided, the maximum storage tank capacity shall be specified based on occupancy. ▪ The average flow rate for all faucets must be ≤ 2.0 gallons per minute (as rated at 80 psi ▪ All showerheads must be WaterSense® labeled ▪ All tank-type toilets must be WaterSense® labeled.
Lighting[25,26]	Occupancy Controls All non-apartment spaces, except those intended for 24-hour operation or where automatic shutoff would endanger the safety of occupants, must have occupancy sensors or automatic bi-level lighting controls. Common Space Lighting 80% of installed light fixtures in common spaces must be ENERGY STAR certified or have ENERGY STAR certified lamps installed. Alternatively, 100% of installed light fixtures in common spaces must have high-efficacy lamps installed, as defined in Appendix B. Total specified lighting power for the combined common spaces must not exceed ASHRAE 2007 allowances for those combined spaces by more than 20%.

Commented [ES25]: Sampling is per RESNET Standards and air-sealing recommendations are specified in the Rater Design Review Checklist, Section 5.1.

Commented [ES26]: Updated to ASHRAE 62.2-2010, but 2013 and 2016 would be permitted.

Commented [ES27]: Not required if it's a fan that is not part of the dwelling-unit ventilation system, such as an intermittent local bath or kitchen exhaust fan.

Commented [ES28]: See Rater Field Checklist, Section 10 & 11 for limitations.

Commented [ES29]: Not a requirement in MFNC

Commented [ES30]: See Rater Field Checklist, Section 13. Only required in Prescriptive Path and if present in common spaces in the ERI Path.

Commented [ES31]: Not a requirement in MFNC.

Commented [ES32]: See Rater Field Checklist, Item 12.1. For ASHRAE Path, this requirement is similar to MFHR, but for ERI and Prescriptive Path, it is more stringent.

Commented [ES33]: See Rater Field Checklist, Item 12.5 & 12.6.
ASHRAE Path: no efficacy requirement
ERI and Prescriptive Path: 90%, but can be ENERGY STAR, CFL, FL, or LED, without a lm/W requirement.

Commented [ES34]: See Rater Field Checklist, Item 12.2. For ASHRAE Path, this requirement is same as MFHR, but for ERI and Prescriptive Path, it is more stringent (doesn't allow the extra 20%). Parking garages are also separated into Item 12.3.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

	In-Unit Lighting 80% of installed light fixtures within apartments must be ENERGY STAR certified or have ENERGY STAR certified lamps installed. Alternatively, 100% of installed light fixtures within apartments must have high-efficacy lamps installed, as defined in Appendix B.
	Exterior Lighting ▪ 80% of outdoor lighting fixtures shall be ENERGY STAR certified or have ENERGY STAR certified lamps installed. Alternatively, 100% of outdoor lighting fixtures must have high-efficacy lamps installed, as defined in Appendix B. ▪ Fixtures must include automatic switching on timers or photocell controls except fixture intended for 24-hour operation, required for security, or located on apartment balconie
	Exit Signs All exit signs shall be specified as LED (not to exceed 5W per face) or photo-luminescent and shall conform to local building code; fixtures located above stairwell doors and other forms of egress shall contain a battery back-up feature.
Pump Motor Efficiency[27]	All three-phase pump motors 1 horse-power or larger shall meet or exceed efficiency standards for NEMA Premium™ motors, where available.

Commented [ES35]: See Rater Field Checklist, Item 12.6. Only dwelling units in the Prescriptive Path have this lighting efficacy requirement and it's 90%, but can be ENERGY STAR, CFL, FL, or LED, without a lm/W requirement. Also, in the Prescriptive Path, Item 12.7 sets a 0.75 W/ft2 maximum LPD in the dwelling units.

Commented [ES36]: See Rater Field Checklist, Item 12.5 & 12.6.
ASHRAE Path: no efficacy requirement
ERI and Prescriptive Path: 90%, but can be ENERGY STAR, CFL, FL, or LED, without a lm/W requirement. Only applies to exterior light fixtures attached to the building and does not apply to landscape or parking lot fixtures.

Commented [ES37]: Not a requirement in MFNC.

Commented [ES38]: See Rater Field Checklist, Item 5.14. Limited to hydronic heating or cooling systems, and VFD required if 5 hp or larger.

Commented [ES39]: See Rater Field Checklist, Item 14.1. The MFHR commitment to benchmarking has been replaced with a Rater-verified strategy to enable whole-building energy data collection for buildings 50,000 ft2 and larger.

ENERGY STAR MFHR Benchmarking:

Although eligible units in a multifamily high rise building may earn the ENERGY STAR based on the mandatory requirer listed above at completion of construction, building performance is as much a function of proper building management a energy conservation measure incorporated into the structure. Therefore, after earning the ENERGY STAR, the developer/owner must commit to benchmarking their building in Portfolio Manager for a period of at least two years.

Portfolio Manager is a free, online, interactive energy management tool that allows developer/owner to measure and track their building's energy and water consumption, identify investment priorities, and verify improvements over time. Developers/owners can use Portfolio Manager to track weather-normalized energy use intensity (EUI), energy costs, greenhouse gas emissions, and water consumption. For more information on how to use Portfolio Manager, see the Portfolio Manager - Multifamily Housing Quick Reference Guide document.

To accomplish this goal, the developer/owner or an entity working on their behalf, must be capable of evaluating the utility consumption of the residential-associated spaces independent of any commercial/retail space. These nonresidential associated parts of the building shall be separately metered (or sub-metered) for electricity, gas, fuel oil, water, steam, and hot water for domestic and/or space heating purposes. Also, they should work with tenants to secure consumption information. If the building is direct-metered for utilities to the apartments, the building owner may need signed releases from individual apartment occupants to allow for benchmarking or find alternative methods to assessing whole building energy consumption such as a whole-building meter or asking the utility for aggregated data.

All data uploaded to Portfolio Manager is strictly confidential and only used to estimate the energy performance of the building as a whole, not of individual apartments.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

Footnotes:

1. Where requirements of the local codes, manufacturers' installation instructions, engineering documents, or regional ENERGY STAR programs overlap with the requirements of these guidelines, EPA offers the following guidance:

   a. In cases where the overlapping requirements exceed the ENERGY STAR guidelines, these overlapping requirements shall be met;

   b. In cases where overlapping requirements conflict with a requirement of these ENERGY STAR guidelines (e.g., slab insulation is prohibited to allow visual access for termite inspections), then the conflicting requirement within these guidelines shall not be met. Qualification shall only be allowed if the licensed professional has determined that no equivalent option is available that could meet the intent of the conflicting requirement of these ENERGY STAR guidelines (e.g., switching from exterior to interior slab edge insulation).

2. The *Performance Path Calculator* is a set of worksheets in an Excel file designed to provide consistency among energy modelers by providing the exact calculations described in the Simulation Guidelines. It also provides a consistent format for reporting the results of the Performance Rating. Many of these worksheets are optional, however, submission of the Excel file, with Basic Info and Reporting Summary worksheets completed, is mandatory.

3. Each building that participates in the program, regardless if it chooses the Performance Path or the Prescriptive Path, must meet certain mandatory program requirements. These requirements are listed within this document and outlined in the *Prerequisites Checklist*, a worksheet within the *ENERGY STAR MFHR Testing and Verification Worksheets*. Th prerequisites establish the minimum program requirements within which the design team may make performance trade-offs in the design of an ENERGY STAR certified building. While these prerequisites can contribute to the achievement of the Performance Target, these requirements alone are not sufficient to earn the ENERGY STAR. As used in this document, the word 'shall' means that the action specified is mandatory and must be accomplished.

<u>Heating and Cooling Equipment</u>

4. Heating and cooling loads shall be calculated, equipment capacity shall be selected, and duct systems shall be sized according to the latest editions of ACCA Manual J, S, & D, respectively, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure. Indoor temperatures shall be 70°F for heating and 75°F for cooling. Outdoor temperatures shall be the 1.0% and 99.0% design temperatures, respectively, as published by the ASHRAE Handbook of Fundamentals.

Commented [ES41]: Similar requirements and additional ones are outlined in the MFNC HVAC Design Report.

<u>Heating and Cooling Distribution</u>

5. Terminal heating and cooling distribution equipment serving an apartment shall be controlled by a thermostat(s) within the same apartment.

Commented [ES42]: See Rater Field Checklist, Item 5.7

6. Heating and cooling ductwork shall be sealed at all transverse joints and connections, including ductwork connections through drywall or other finish materials, using UL-181 compliant methods and materials. Construction documents shall specify that ductwork must be inspected before access is covered up. As an alternative to meeting total duct leakage requirements post-construction, total duct leakage measured at rough-in, ≤4 CFM25 per 100ft^2, with air handler and all ductwork installed, is accepted.

7. Heating and cooling ductwork that is specified as flex duct shall follow the Sheet Metal and Air Conditioning Contractors' (SMACNA) installation standards for flex ducts (see *Appendix A*).

Commented [ES43]: See Rater Field Checklist, Item 6.1

8. For hydronic distribution systems, all terminal heating and cooling distribution equipment must be separated from the riser or distribution loop by a control valve or terminal distribution pump, so that heated or cooled fluid is not delivered to the apartment distribution equipment when there is no call from the apartment thermostats.

Commented [ES44]: Rater Field Checklist Item 5.11 adopted this requirement

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

9. Piping carrying fluid or steam with temperatures greater than 105°F must have a minimum of 1" of insulation; pipes 1.5" in diameter and greater must have a minimum of 1.5" of insulation. Piping carrying fluid (chilled water or refrigerant) w temperatures less than 60°F must have a minimum of 0.5" of insulation; pipes 1.5" in diameter and greater must ha minimum of 1.0" of insulation. Construction documents must account for piping total thickness including required insulation when passing through planks or any other penetrations. For PTACs or any other heating/cooling systems that require branch pipe insulation, the insulation thickness must be considered when designing room dimensions and access chases. Construction documents shall specify that the piping must be inspected before access is covered up. Extent and location to be determined by ASHRAE 90.1-2007 Section 6.4.4.1.3 or local code.

10. For systems designed with outdoor-air supplied to the heating, cooling, or ventilation distribution system, provide motorized dampers that will automatically shut when systems or spaces are not in use.

11. For hydronic distribution systems without automatic balancing valves, all supply/return headers must be designed in a "reverse return" configuration (i.e. first riser supplied is the last returned, etc.) and/or sized based on a water velocity of less than 4 ft/s. Total pressure drop of terminal unit branch piping and fittings between a supply and return riser must be significantly greater than the total pressure drop from the top to the bottom of these risers. Calculations and assump for sizing circulating pumps must meet Chapter 43 of the ASHRAE Handbook, HVAC Systems and Equipment or equivalent industry accepted standard.

12. For in-unit forced air distribution systems, perform design calculations (using ACCA Manuals J and D, the ASHRAE Handbook of Fundamentals, or an equivalent procedure) and install ducts accordingly. Bedrooms must be pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors.

Envelope

13. When required by local building code, entranceways shall be designed with vestibules with weather-stripping hard-fastened to the door or frame.

14. If installing sleeves for through-wall AC units, insulated covers must be provided by the building for use during heating season and when AC units are not installed.

15. Ductwork penetrating the building envelope shall be sealed to prevent air leakage through the duct system and/or the building envelope. This includes, but is not limited to, roof curbs and exterior wall exhaust/intake vents.

16. An area weighted average of the U-factors of the wall and floor perimeter assemblies is acceptable in the energy model. When calculating the wall U-factor, the full R-value for any exterior wall insulation can only be used for portions of the assembly where shelf angles or other continuous metal fastened to the wall are not used. For portions of this assembly where shelf angles or other continuous metal fastened to the wall are used, the exterior insulation cannot contribute to the assembly R-value and an overall U-value shall be calculated based on an area weighted ratio.

17. Where specific details cannot meet this continuous insulation requirement, the Licensed Professional shall provide the detail to EPA to request an exemption prior to the building's certification. Projected balconies are currently exempt, however EPA recommends that they be thermally broken.

Garages and Sidewalks

18. Garages, including plenums and dropped ceilings within the garage, shall not be heated for comfort or to prevent pi from freezing. Piping design and layout shall locate piping within conditioned spaces or grouped and properly insul prevent freezing. If heat tracing is used for freeze protection, it must be activated based on pipe wall temperature, ra than air temperature, and the energy consumption must be modeled in the As-Built (but excluded in the Baseline). heat tracing thermostat set point must be no higher than 40°F and the set point must be confirmed by a field inspec

Commented [ES45]: See Rater Field Checklist, Item 5.13 for changes

Commented [ES46]: See Rater Field Checklist, Item 7.4 for changes

Commented [ES47]: See Rater Field Checklist, Item 5.12 for modified version of this requirement

Commented [ES48]: Not required in MFNC

Commented [ES49]: See Rater Field Checklist, Item 6.2. Bedrooms with supply airflow equal or greater than 150 cfm must be tested within 5 Pa of main body of dwelling unit when doors are closed.

Commented [ES50]: Not required in MFNC.

Commented [ES51]: See Rater Field Checklist, Item 3.5 for revisions to how projected balconies are addressed.

Commented [ES52]: See Rater Field Checklist, Item 1.5 and 1.6, which allow this strategy, but sets minimum insulation requirements.

Commented [ES53]: No longer a requirement in MFNC to model as a penalty, but must be modeled in Baseline and Proposed (see Rater Field Checklist, footnote 9).

Commented [ES54]: See Rater Field Checklist, Item 5.9 and 5.9.1 for changes.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

19. Radiant heating (i.e. infrared), either wall or ceiling-mounted, or heating within the garage floor (or sidewalks) may be used to prevent ice formation on the ground as a safety feature only and temperature-based controls must comply v ASHRAE 90.1-2007 Section 6.4.3.8. Energy consumption associated with these systems must be modeled in the A (but excluded in the Baseline).

Commented [ES56]: No longer a requirement in MFNC to model as a penalty, and can be modeled the same in Baseline and Proposed.

Ventilation and Infiltration

20. Ventilation system ductwork shall be sealed at all transverse joints and connections including boot to wall/ceiling connections through drywall using UL-181 compliant materials and methods. Central exhaust systems that serve one or more apartments must be tested for duct leakage, where the maximum leakage allowance is calculated as 5 CFM per register per shaft plus 5 CFM per floor per shaft. See *T&V Protocols* for details.

changes

21. Compliance with ASHRAE 62.2-2007 Sections 4.3 and 5.3.1 is recommended, but not required. Providing outdoor air to each unit directly from the outdoors is recommended, but not required. For kitchen exhaust fans, prescriptive duct sizing requirements described at www.energystar.gov/newhomesresources may be used in lieu of measuring the actual air flow rate.

Domestic Water Heating

22. The temperature setting of in-unit storage water heaters must not exceed 140°F. For both in-unit and central DHW systems, temperatures measured at faucets and showerheads must not exceed 125°F. Domestic hot water piping carrying liquid with temperatures greater than 105°F must have a minimum of 1" insulation. Pipes over 1.5" in diameter must have a minimum of 1.5" of insulation. Extent and location to be determined by ASHRAE 90.1-2007 Section 7.4 local code.

Commented [ES58]: No longer a requirement in MFNC.

Commented [ES59]: See Rater Field Checklist, Item 11.4 for changes.

23. Self-contained or electronic mixing valves shall be used to control hot water temperature for central domestic water heating systems serving apartments.

24. If flow ratings at 80 psi are not available, WaterSense® labeled faucets or aerators may be used to meet this prerequisite.

Lighting

25. ASHRAE 90.1-2007, Section 9.1.4a, requires that light fixtures be modeled with the maximum labeled wattage of the fixture. EPA will allow light fixtures to be modeled based on the installed wattage of the lamps. Ex: A fixture with a 13 W screw-in CFL can be modeled as 13 W, plus any associated ballast power. See Appendix B to determine input power.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

26. Lighting must comply with ASHRAE 90.1-2007, Section 9.4. At a minimum, interior lighting must be designed or measured to meet light levels (footcandles) by space type as recommended by the Illumination Engineering Society (IESNA) Lighting Handbook, 9th edition. Values for commonly used spaces are listed below. For senior housing, minimum illumination requirements may follow recommendations in IESNA's 2007 Lighting and the Visual Environment for Senior Living, and an increase in lighting power densities and allowances corresponding to the increase in footcandles, is permitted. See Appendix B to determine lamp lumens.

Commented [ES61]: No longer a requirement in MFNC.

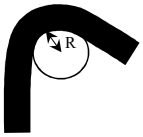
ASHRAE Space Type	Lighting Power Densities (W/ft^2)	Recommended Light Levels (Weighted Avg. Footcandles)	ASHRAE Space Type	Lighting Power Densities (W/ft^2)	Recommended Light Levels (Weighted Avg. Footcandles)
Apartments	1.1	10	Stairs - Active	0.6	15
Storage, active	0.8	20	Restroom	0.9	12
Storage, inactive	0.3	8	Office	1.1	35
Food Preparation	1.2	40	Conference/meeting/ multipurpose	1.3	30
Dining Area - For Family Dining	2.1	23	Electrical/Mechanical	1.5	30
Lobby/Elevator	1.3	16	Workshop	1.9	50
Corridor/Transition	0.5	10	Parking garage	0.2	7

Motors

27. Many motors are NEMA labeled and this label alone, does not ensure that a motor is energy-efficient. This requirement refers specifically to the **NEMA Premium** energy efficient motors program. Participating companies may be found at http://www.nema.org/Policy/Energy/Efficiency/Documents/NEMA_Premium_Partners.pdf. Motors for fire pumps and booster pumps are exempt from this requirement.

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

Appendix A: Specifications for Flexible Duct Installation

Component/Location	Standard
Duct length	Limit duct length to no more than 25' per run for flex duct, not to exceed the manufacturer's recommended limit
Excess ductwork	Runs should be as direct as possible. Excess ductwork should be no more than 5% for any given section of flexible duct.
Supports	Suspended horizontal ducts should be supported at least every 5'.
Hangers	Hanger material should be at least 1-1/2" in width and hangers should not crimp the ductwork, causing the interior dimension of the duct to be less than specified
Sag	Suspended ductwork should be allowed to sag no more than ½" for every 1' of run
Trunk and boot connections	Flexible duct should be allowed to run straight out of any connection at least 12" before taking a turn
Bends	The radius at the centerline of a bend must be a minimum of one duct diameter as shown in the diagram (R = 1 duct diameter): 
Connections	Connections to boots, collars, and trunks must be substantially airtight
Sealants	Sealants and tapes used to make ductwork airtight must be compliant with UL=181 standards and installed according to the manufacturer's specifications

Reference: Sheet Metal and Air Conditioning Contractor's National Association

Appendix A: ENERGY STAR Multifamily High Rise Performance Path Compared to MFNC Program

Appendix B: Typical lamp lumens and input power for installed lighting

Efficacy: Lumens per Watt = Measured Lamp Lumens [Lumens]/Measured Input Power [Watts]

High Efficacy Lamps: Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps or lamps with a minimum efficacy of 60 lumens/W for lamps over 40W; 50 lumens/W for lamps over 15W to 40W; and 40 lumens/W for lamps 15W or less

defined by ANSI/RESNET/ICC 301-2014 or 2019

Footcandle: one lumen per square foot.

Lamp Lumens: Lamp lumens must be measured using the lamp and ballast that are shipped with the fixture, using the tables on the ENERGY STAR website, or by using the charts below.

Input Power: Input power must be measured with the lamp and ballast that are shipped with the fixture, by using Tables 9-E through 9-H in the User's Manual for ASHRAE 90.1-2007, or the charts below.

Standard Metal Halide			
Lamp Watts	Lumens	Input Power	Efficacy
150	13,500	186	73
175	15,000	205	73
250	23,000	295	78
360	36,000	388	93
400	40,000	461	87

Typical T-8 (Electronic Ballast)			
Lamp Watts	Lumens	Input Power	Efficacy
17	1400	22	64
25	2225	27	82
32	3100	32	97
40	3725	46	81
86	8200	88	93

Compact Fluorescent					
Lamp Watts	Lumens	Input Power	Ballast	Efficacy	Minimum Lumens Needed
9	280-680	13	Electro-magnetic	22*-52	650
9	280-680	10	Electronic	28*-68	500
13	600-950	17	Electro-magnetic	35*-56	850
13	600-950	14	Electronic	43*-68	700
26	1200-1900	37	Electro-magnetic	32*-51	1850
26	1200-1900	28	Electronic	43*-68	1400

*may not meet current ENERGY STAR specifications, check lamp lumens on ENERGY STAR website.