APPENDIX E

Supportive Housing Development Program
Energy Efficiency Standards

NEW CONSTRUCTION PROJECTS

CERTIFICATION:

At a minimum, all new construction projects must comply at minimum with Advanced Energy Corporation's **SystemVision™ Residential Supportive Housing Standards** (see Appendix F for standards) or to the standards of an Agency approved energy-related building certification program as verified by an independent, third-party expert who assists with project design, verifies construction quality, and tests completed units. Adaptive re-use and rehabilitation projects must comply to the extent that doing so is economically feasible and, if applicable, as allowed by historic preservation rules.

Applicants are encouraged to attain higher levels of energy efficiency, sustainability and indoor air quality as certified by one of the following nationally recognized building certification programs. NCHFA must review and approve the contract between the applicant and verifier before it will issue a final commitment letter for the project and must receive and approve a Certification from the selected energy efficiency program prior to Loan Closing.

Acceptable programs include:

3.4.1. SystemVision™ for Supportive Housing by Advanced Energy (see Appendix F for standards),
3.4.2. Home Performance with Energy Star by Advanced Energy (for rehab only),
3.4.3. EarthCraft by Southface,
3.4.4. Enterprise Green Communities,
3.4.5. NGBS Green National Green Building Standard Program,
3.4.6. EnergyStar 3.0 Certification (or current standard if different),
3.4.7. NCECC HERO Standards Program by Duke Energy Progress,
3.4.8. LEED by US Green Building Council.

Programs with project selected standards must document every standard the project will attain, must receive approval from NCHFA, and must reference SystemVision™ as a baseline in designing their certification strategy.

If the applicant wishes to participate in a different energy efficiency certification program, the program must be reviewed and approved by the Agency prior to the issuance of a Final Commitment Letter.

Please Note: Projects using non-commercial HVAC systems should use one of the four options below for the HVAC system. Alternative options should be evaluated by the Energy Consultant and approved by NCHFA.

HVAC	OPTIONS			
	A	B	C	D
Equipment	Package Terminal Heat Pump (PTHP)	Air source Variable Refrigerant Flow (VRF) Heat Pump with built-in humidity control	Air source Heat Pump (conventional) with variable air speed handler and thermidistat	Air source Heat Pump (conventional) with ENERGY STAR dehumidifier with humidistat
Controls	Digital non-programmable thermostat. Must include outdoor thermostat to restrict electric resistance heating when outdoor air temperature are above 40° F.	User-friendly, wall-mounted thermidistat, e.g. Mitsubishi hardwired MHK1 control.	Thermidistat, e.g. *Carrier* TP-PRH Edge. Must also include outdoor thermostat to restrict electric resistance heating when outdoor air temperatures are above 40° F	Digital non-programmable thermostat. Must also include outdoor thermostat to restrict electric resistance heating when outdoor air temperatures are above 40° F. Dehumidifier should include built-in humidistat set at 50%.
Manufacturer Examples	First Company, Magic Pak	Mitsubishi, Daikin	Carrier, Tempstar, Goodman	Carrier, Tempstar, Goodman
Recommended Square Footage	450 sq ft up to 1,200 sq ft of conditioned space (Note: final sizing must be based on load calculations)	300 sq ft and up of conditioned space (Note: final sizing must be based on load calculations)	750 sq ft and up of conditioned space (Note: final sizing must be based on load calculations)	750 sq ft and up of conditioned space (Note: final sizing must be based on load calculations)
Design Adjustments	Need space on exterior wall for mechanical closet to allow installation of exterior louver/grill	For ducted or cassette version: dropped ceiling. For wall-hung version: space if mounted above windows. To avoid need for radiation dampers: soffits/furrdowns.	Need to size mechanical closet to accommodate air handler and ducted return.	Need to locate & size mechanical closet to accommodate de-humidifier & its drain.
Suggested methods to supply units with outside air for required ventilation	Use outside air dampers that are a part of the combination unit.	A. Use ducted outside air system with high/low outside air temperature controls and air cycler/mixed air controls. (Example: *Aprilaire* outside air system model #8126) B. Use intermittent bath exhaust fan controlled by a	A. Use ducted outside air system/l with high/low outside air temperature controls and air cycler/mixed air controls. (Example: *Aprilaire* outside air system model #8126) B. Use intermittent bath exhaust fan controlled by a	A. Use ducted outside air system with high/low outside air temperature controls and air cycler/mixed air controls. (Example: *Aprilaire* outside air system model #8126) B. Use intermittent bath exhaust fan controlled by a

		combination timer/light switch. Set to required CFM to meet ventilation requirements.	combination timer/light switch. Set to required CFM to meet ventilation requirements.	combination timer/light switch. Set to required CFM to meet ventilation requirements.
Pros	The smaller capacity of these units is appropriate for smaller apartments. The location of the condenser within the unit is a benefit in projects where units cannot be ground-or roof mounted. The systems may be installed with built-in adjustable fresh air dampers. Simple controls.	Wide range of capacities are available. Wide range of installation types are available (ducted, wall-hung and cassette versions). Highly efficient (from SEER 14.5 to 22). These condensing units ar smaller than those in conventional systems. Multiple indoor units can be tied to one outdoor unit. Ability to set humidity and temperature set points independently.	Not available with SEER lower than 13. Ability to set humidity and temperature set points independently.	Not available with SEER lower than 13. Simple controls. Ability to set humidity and temperature set points independently.
Cons	Low efficiencies (EER ratings from 9.0 – 10.0). Mechanical closets must be sealed to eliminate air leakage. A second condensate drain is required. Exterior louvers may not be aesthetically pleasing. Limited static for air flow performance.	Price. Thermostats still being developed to be more user friendly. Low static.	Larger air handler closet required as compared to traditional system. Need careful thermidistat selection (ideally temperature and humidity controls are user friendly).	Dehumidifier may require extra space for installation, require extra maintenance, and produce extra noise.
Estimated Costs	$5,400 per system and up with efficiency of 9.0 EER and 3.0 COP	$7,800 per system and up with efficiency of 15-22 SEER	$5,800 per system and up with efficiency of 13 SEER and 7.7 HSPF	$5,800 per system and up with efficiency of 13 SEER and 7.7 HSPF

REHABILITATION PROJECTS

Rehabilitation projects shall incorporate energy efficiency components to the extent that doing so is economically feasible and, if applicable, as allowed by historic preservation rules.

At a minimum, any component of the building which is replaced, must meet the following standards:

All Appliances	Energy Star
Windows	Insulated, double pane, U-factor of 0.35 or below and a SHGC of 0.30
Shingles	Algae resistant (AR) with a minimum 30-year warranty
Faucets, Shower heads and Toilets	EPA "Watersense" labeled
Light Fixtures	Initially installed light bulbs in all fixtures must be fluorescent, LED, or pin-based lighting
Cooling	AC w/furnace: SEER 13 Heat Pump: 15 SEER/8.8 HPSF
Heat	Gas: 90% Efficiency or Greater, Heat Pump: 15 SEER/8.8 HPSF
Insulation	Meet IBC 2012 if framing allows
Insulation – Attic	Meet IBC 2012 if framing allows
Insulation - Floor	Meet IBC 2012 if framing allows
Electric Tank Hot Water Heater	UEF Value of at least 0.93

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U-FACTOR*[b]	SKYLIGHT[b] *U-FACTOR*	*GLAZED FENESTRATION SHGC*[b, e]	CEILING *R-VALUE*	*WOOD FRAME WALL R-VALUE*	*MASS WALL R-VALUE*[i]	FLOOR *R-VALUE*	*BASEMENT*[c] WALL *R-VALUE*	*SLAB*[d] *R-VALUE & DEPTH*	*CRAWL SPACE*[c] WALL *R-VALUE*
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	>0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U-factor colu*mn excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

From 2012 IBC Section 402.1.1

1. General

1.1. Where feasible and applicable, the Department of Energy Single Family Work Specifications (see Standard Work Specifications at https://sws.nrel.gov/) shall be referenced.

1.2. All major structural and durability concerns must be addressed.

2. Attic- Ceiling & Knee Walls

When made easily accessible by rehabilitation and when applicable or when a related building component is replaced it shall be replaced according to this standard:

2.1. There shall be a continuous, durable air barrier enclosing the conditioned space. This includes features such as chases, knee walls, soffits, garage interfaces, intersecting walls and dropped ceilings.

2.2. Air sealing shall be required at the attic plane - Any visible hole or crack leading from the attic into the building or building cavities shall be sealed (e.g., plumbing penetrations, electrical penetrations, chases, dropped soffits, chimney penetrations, top plate-to-drywall connections, bonus room floors, balloon framing).

2.3. Insulation shall be installed at walls and ceilings to manufacturer specifications with no gaps, voids, compression or wind intrusion.

2.4. Insulation and the air barrier shall be installed in physical contact with each other.

2.5. Accessible attics shall be insulated to R-38 or greater.

2.6. Knee walls shall be insulated and backed with support material.

2.7. Attic accesses will be insulated to a minimum of R-30. This will require an insulated box be constructed for attic pull-down stairs.

3. Exterior Walls - Including Windows & Doors

When made easily accessible by rehabilitation and when applicable or when a related building component is replaced it shall be replaced according to this standard:

3.1. There shall be a continuous, durable air barrier enclosing the conditioned space. This includes features at garage & storage interfaces and attached porches.

3.2. Air sealing shall be required at the exterior walls - Windows, doors, and any visible hole or crack leading from the building to the exterior shall be weather-stripped or sealed.

3.3. When installed insulation shall be to manufacturer specifications with no gaps, voids, compression or wind intrusion. Insulation shall be insulated to R5 or greater.

3.4. When installed, insulation and the air barrier shall be in physical contact with each other.

3.5. Replacement windows, if installed, shall be ENERGY STAR labeled. At a minimum, replacement windows shall be insulated, double pane, U-factor of 0.35 or below and a SHGC of 0.30.

4. Foundation- Crawl Space and Basement

When made easily accessible by rehabilitation and when applicable or when a related building component is replaced it shall be replaced according to this standard:

4.1. There shall be a continuous, durable air barrier enclosing the conditioned space.

4.2. Air sealing shall be required at the subfloor - All penetrations between conditioned and unconditioned space shall be sealed.

4.3. Insulation shall be installed and/or fixed in floors to manufacturer specifications with no gaps, voids, or compression.

4.4. For vented crawls, floors must be insulated to meet code. For closed crawl spaces, foundation wall or floors shall be insulated to code.

4.5. Insulation and the subfloor shall be installed and/or fixed to be in physical contact with each other.

4.6. All crawl spaces shall have a 100 percent ground cover as required by the NC building code.

4.7. Buildings with crawl spaces that show signs of standing water shall not be included in the program unless drainage is a part of the scope of work.

5. Heating & Cooling- Equipment & Ductwork

When made easily accessible by other rehabilitation or when a related building component is replaced it shall be replaced according to this standard:

5.1. All accessible duct connections shall be sealed with a UL-listed bucket mastic product.

5.2. All uninsulated ductwork outside the conditioned envelope shall be insulated to R-8.

5.3. Replacement heating and cooling systems shall be rated at or above the following efficiencies:

Furnace	90%
AC (w/furnace)	15 SEER
Heat Pumps	15 EER/8.8 HSP

6. Lighting and Appliances

6.1. All light fixtures shall utilize fluorescent lamps (CFLs), light emitting diodes (LEDs) or Pin bulbs.

6.2. Appliances (e.g. refrigerator, dishwasher, clothes washer), if installed, shall be ENERGY STAR labeled.

6.3. New water heaters shall have a Minimum UEF as indicated in the table:

Water Heater Type:	Minimum UEF Value
Electric Tank	.93
Gas Tank	.60
Gas Tankless	.61
Heat Pump	Any

7. Combustion Safety

7.1. If existing gas equipment will remain atmospherically vented and scope of work includes air-sealing of the building envelope, BPI protocol or other combustion safety testing protocol must be completed to verify appliances are not backdrafting into the building.

7.2. Buildings containing vent-free gas logs or gas/kerosene space heaters shall not be retrofitted until units are permanently removed.

7.3. If gas equipment is replaced and gas appliances are installed inside of the conditioned space, other than gas ranges, the new appliances shall be direct-vent or power-vented.

7.4. If any gas appliances remain inside the building envelope, one carbon monoxide (CO) detector shall be installed outside of each bedroom or sleeping area and according to manufacturer specifications.