Summary of Suggested Change

All comments are based on adopting and amending 2009 IECC.

Summary of main energy saving changes for residential energy code:

Leakage:
- Building envelope air tightness is increased and must be tested.
- Duct air tightness is increased (or ducts are in conditioned space).
- Use of framing cavities as return ducts is discouraged, as it triggers a duct test.
- Air handlers are tested for air tightness.

Equipment:
- Furnaces must be at least 92 AFUE for gas, 85 AFUE for other fuels.
- Air conditioner must be at least 15 SEER.
- Ventilation fan efficiency is required to be at levels equivalent to Energy Star.
- Energy used by ventilation is limited by requiring power vented equipment or sealed combustion for combustion appliances. Discharge of combustion products is better than dilution with more air.
- New homes are too tight for unvented room heaters, which are prohibited.

Lighting:
- Fraction of lighting required to be high efficiency (CFL or better) increased from 50 to 75%.

Water heating:
- Efficient distribution of service hot water or pipe insulation is required

Windows and skylights:
- Window, skylight, and door U-factors decrease.

Two sections should be treated separately from the rest of the energy code:

Sealed air handler:
- Sealed air handler test should be adopted after the required test is approved. The new Section 403.2.2 references ASHRAE 193, which should be finalized soon.

NAECA law:
- State code staff should first determine that the equipment efficiency requirements comply with the National Appliance Energy Conservation Act (new Section 403.8). Alternately, this section could be considered after the ICC hearings. A number of parties, including DOE, will propose how to accomplish higher equipment efficiency requirements in the energy code and comply with NAECA.

Suggested Change

[Orange comments are informational and would not be part of the code. Changes are in blue. Items underlined in blue are added. Items ~~struck out in blue~~ are deleted. Where new sections of code are included, renumbering of code sections would be needed. Changes are ordered by section number rather than topic.]

CHAPTER 2
DEFINITIONS

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service water heating with heated water when triggered by a manual button or switch, or by sensing the presence of a person where the heated water is used. [This new definition is used in describing options for efficient distribution of service hot water.]

CHAPTER 4
RESIDENTIAL ENERGY EFFICIENCY

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	Skylight *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
5 and Marine 4	~~0.35~~ 0.32	0.50 ~~0.60~~	NR	38	20 or 13+5[g]	13 / 17	30[f]	10/13	10,2ft	10/13

[Fenestration (window and skylights) U-factors are lowered.]

TABLE 402.1.3
EQUIVALENT *U*-FACTORS

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTORb	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.50	0.030	0.057	0.082	0.033	0.059	0.065

402.2 Specific insulation requirements.

402.2.2 Wind wash baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic insulation inward until it is at least 4 inches vertically above the insulation at full height. The baffle shall be permitted to be any solid material such as cardboard or thin rigid insulating sheathing. [New section. Wind blowing through insulation lowers its effectiveness. The baffle also keeps the wind from blowing insulation off parts of the ceiling directly next to the vents.]

402.2.2 Opaque Door U-factor. Doors with more than 50% opaque area shall have a U-factor no greater than 0.25.

[New section. This separates door requirements from the rest of the fenestration requirements, allowing a more efficient requirement for doors. Wood doors have trouble with both this and the existing requirement. A companion change in section 402.3.4 allows a single large wood door, such as the front door to a residence, to be exempt.]

TABLE 402.2.4
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT *R*-VALUE
	Steel Truss Ceilings
R-30	R -38 or R-30+3 or R-26+5
R-38	R -49 or R-38+3
R-49	R-38+5
	Steel Joist Ceilings
R-30	R-38 in 2×4 or 2×6 or 2×8 R - 49 in any framing
R-38	R -49 in 2×4 or 2×6 or 2×8 or 2×10
	Steel Framed Wall
R-13	R -13+5 o rR-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

[Updates table for the R-20 wall R-value now in the code.]

402.3 Fenestration.

402.3.4 Opaque door exemption. One side-hinged opaque door assembly ~~up to 24 square feet (22 m^2)~~ is exempted from the *U*-factor requirement in Section 402.1.1. This exemption shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4. [The door requirements were made more stringent, such that solid wood doors cannot meet them. Removing the area allows one full size wood front door to be exempt.]

402.4 Air leakage.

402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections 402.4.1.1 and 402.4.1.2. ~~be durably sealed to limit infiltration.~~ The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

[Delete this list as it is redundant. This, and more, is covered in the existing air barrier and insulation inspection table.]

~~1. All joints, seams and penetrations.~~

~~2. Site-built windows, doors and skylights.~~

~~3. Openings between window and door assemblies and their respective jambs and framing.~~

~~4. Utility penetrations.~~

~~5. Dropped ceilings or chases adjacent to the thermal envelope.~~

~~6. Knee walls.~~

~~7. Walls and ceilings separating a garage from conditioned spaces.~~

~~8. Behind tubs and showers on exterior walls.~~

~~9. Common walls between dwelling units.~~

~~10. Attic access openings.~~

~~11. Rim joist junction.~~

~~12. Other sources of infiltration.~~

402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table 402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table 402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.

Table 402.4.~~2~~1.1
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA
[Most changes to the table are to improve the code language, rather than change the requirements.]

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls ~~is~~ shall be installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier ~~are~~ shall be filled or ~~repaired~~ sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Air permeable insulation ~~is~~ shall be ~~inside of~~ enclosed in an air barrier*. [Clarifying language. For c cavity the enclosure on a wall is provided by the gypsum board, outside wall sheathing, and wall fr
Ceiling / attic	The air barrier in any dropped ceiling / soffit ~~is substantially~~ shall be aligned with the insulation and any gaps ~~are~~ in the air barrier sealed. ~~Attic access (except unvented attic), knee wall door, or drop down stair is sealed.~~ Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers ~~are~~ shall be insulated. Junction of the foundation and sill plate ~~is~~ shall be sealed. Junction of the top plate and the interior wall shall be sealed. [Adds an important source of air leakage]
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing ~~is~~ shall be sealed.
Rim joists	Rim joists ~~are~~ shall be insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. Air barrier ~~is~~ shall be installed at any exposed edge of insulation.
Crawlspace walls	Where provided in lieu of floor insulation, insulation ~~is~~ shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawlspaces ~~is~~ shall be covered with a class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space ~~are~~ shall be sealed.
Narrow cavities	~~Batts in narrow cavities are cut to fit, or narrow cavities are filled by spayed/blown insulation.~~ Insulation to be installed in non-standard framing cavity spaced shall be cut to fit the cavity or the cavity shall be insulated with insulation that will readily conform to the cavity.
Garage separation	Air sealing ~~is~~ shall be provided ~~between the~~ for the assemblies separating the garage ~~and~~ from conditioned spaces.
Recessed lighting	Recessed light fixtures that penetrate the building envelope ~~are~~ shall be airtight, IC rated, and sealed to the drywall. ~~Exception--fixtures in conditioned space.~~
Plumbing and Wiring	~~Insulation is placed between outside and pipes.~~ Batt insulation ~~is~~ shall be cut to fit around wiring and plumbing without compression in exterior walls, or sprayed/blown insulation shall extend~~s~~ behind piping and wiring.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs ~~on exterior walls~~ shall be ~~have~~ insulati~~on~~ed and an air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The required air barrier ~~extends~~ shall be installed behind electrical or communication boxes or ~~an~~ air sealed ~~type~~ boxes ~~are~~ shall be installed.
Common wall	An air barrier ~~is~~ shall be installed in the common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building thermal envelope ~~are~~ shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. ~~include an air barrier.~~

~~**402.4.2 Air sealing and insulation.** Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section 402.4.2.1 or 402.4.2.2.~~

~~**402.4.2.1 Testing option.** Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is no greater less than seven four air changes per hour (ACH) in zones 1 to 3 and three ACH in zones 4 to 8 when tested with a blower door at a pressure of 33.5 psf 50 Pascals(50 Pa) using ASHRAE 119. Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances. Where required by the *code official*, an *approved* independent party shall perform the building envelope air leakage testing.~~

402.4.1.2 Testing. The dwelling shall be tested and found to have an air leakage rate not exceeding five air changes per hour (ACH) in climate zones 1 to 3 and four ACH in climate zones 4 to 8. Testing shall be conducted with a blower door at a pressure of 50 Pascals (50 Pa) in accordance with ASHRAE 119 by an approved party. Testing shall be performed any time after rough in and creation of all penetrations of the *building thermal envelope*. [Envelope air tightness testing would be required rather than being an alternative as in the 2009 code.]

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed~~;~~ beyond the infiltration control measures;
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed, ~~including exhaust, intake, makeup air, backdraft and flue dampers~~ beyond the infiltration control measures;
3. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;

If installed at the time of the test:

~~3~~ 4. Interior doors shall be open;

~~4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;~~

5. Heating and cooling system(s) shall be turned off; and

~~6. HVAC ducts shall not be sealed; and~~

~~7~~ 6. Supply and return registers shall ~~not~~ be ~~sealed~~ fully open.

[Changes to clarify the testing requirements, not meant to change the requirements.]

Exceptions:

1. Multi-family residences with more than four dwelling units provided they comply with Section 402.1.1
2. Additions less than 1,000 square feet

[Exceptions for situations where a test may not be practical.]

402.4.1.3 Sampling. The code official shall be permitted to require testing of an approved sample of residences constructed by a specific builder in lieu of requiring testing of all residences.

[Allowing approved sampling, as is done by Energy Star, greatly lowers the cost of testing.]

~~**402.4.2.2 Visual inspection for buildings other than one- and two family dwellings option.** Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.~~

~~**402.6 Maximum fenestration *U* factor and SHGC. (Mandatory).** The area weighted average maximum fenestration *U* factor permitted using trade offs from Section 402.1.4 or Section 404 shall be 0.48 in zones 4 and 5 and 0.40 in zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade offs from Section 404 in Zones 1 through 3 shall be 0.50.~~ [This "hard limit" is confused with the actual requirements for U-factor and SHGC. These limits do not save energy, but rather limit flexibility. The was removed from the 2009 IRC.]

SECTION 403
SYSTEMS

403.2.2 Sealing (Mandatory). All ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

~~Duct tightness shall be verified by either of the following:~~

~~1. Postconstruction test: Leakage to outdoors shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area* or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.~~
~~2. Rough-in test:~~ Total duct leakage shall be less than or equal to ~~6~~ 4 cfm (169.9 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the ~~roughed-in~~ system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~4~~ 3 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area*. Testing shall be permitted to occur any time after rough in.
Exceptions: Duct tightness test is not required if the air handler and all ducts are located within conditioned space, and framing cavities are not used as part of the duct system.
[This simplifies the duct test requirement as well as further limiting the allowed duct leakage.]

403.2.2 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested accordance with ASHRAE 193.
[The requirement to "seal" the air handler is already in the IECC. Because the air handler is under high pressure, even small leaks cause considerable air loss. Most manufacturers are already test some or all of their air handlers. ASHRAE 193 should be completed soon. This should not be added to the code before ASHRAE 193 is completed.]

403.4 Service hot water systems.
[Efficient hot-water pipe layout usually saves more energy than pipe insulation. Hot water use is intermittent with long idle periods between uses, such that the hot water usually cools between uses even with pipe insulation. Think of the idle period between uses of the shower or clothes washer. Efficient piping minimizes the water volume left in the pipes between uses. Piping should be short and skinny. Some high use pipes justify insulation because multiple uses travel down the same pipe; for example, pipes to the kitchen. Another efficient strategy delivers hot water on demand and recaptures partly warmed water instead of putting it down the drain, which is demand recirculation. Interestingly systems that save energy usually save water.]

403.4.1 Circulating ~~hot water~~ system~~s~~ controls. ~~All circulating service hot water piping shall be insulated to at least R-2.~~ Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when not in use.

403.4.2 Hot water pipe insulation. At least R-3 insulation shall be applied to the following pipes carrying service hot water:
1. piping larger than 3/4 in. outside diameter
2. piping serving more than one dwelling unit
3. piping outside conditioned space
4. piping in a floor slab or in the ground
5. piping in a recirculation system
   exception: demand recirculation systems
6. entire pipe run from water heater to kitchen sink
7. entire pipe run from water heater to a distribution manifold with more than 3 branches or twigs

The remaining piping shall be insulated to at least R-3 where it exceeds the maximum lengths in Table 403.4.2.

TABLE 403.4.2 Maximum Pipe Length (feet)[1]

Nominal Pipe Diameter (in.)	3/8	½	3/4
Maximum pipe length	30	20	10

1. Length of each branch from the distribution manifold or water heater to the point of use

403.5 Mechanical ventilation.
All combustion equipment in new residences shall be direct vent or sealed combustion. Exception: stoves and ovens in kitchens with vents and fireplaces that meet the requirements of Section 402.5.3. [As residences get tighter the control of combustion products becomes an important health issue. This section helps limit the need for mechanical ventilation. An exception could be added that allows a design professional to approve the air quality in the design.]

403.5 Ventilation fan efficiency. Ventilation fans shall be tested and listed by an approved third party and shall meet the requirements of table 403.5.
Exception: Fans integral to tested and listed HVAC equipment.

Table 403.5 Ventilation Fan Efficiency

Fan location	Air flow rate (cfm)	Minimum efficiency[1]	Air flow rate (cfm)	Maximum sone rating[2]
Range hoods	any	2.8 cfm/watt	Any	2
In-line fan	any	2.8 cfm/watt	Any	NR
Bathroom, utility room	<= 80	1.4 cfm/watt	<140 cfm	2
Bathroom, utility room	>80	2.8 cfm/watt	>= 140 cfm	3

1. When tested in accordance with HVI Standard 916
2. When tested in accordance with HVI Standard 915

[These are most of the requirements for Energy Star ventilation fans. “Sone” ratings determine how loud a fan is. Loud fans tend to be turned of, so a relatively quiet fan is important to avoid the fan being turned off.]

403.8 Equipment Efficiency.
[This section requires higher equipment efficiency for heating and cooling equipment. To comply with the NAECA law the intent is to have a choice of 1) higher efficiency equipment or 2) an equal energy savings achieved with NAECA-minimum efficiency equipment plus increased air tightness in the thermal envelope and ducts. The equipment efficiency section of the code (Section 403.8) should be handled separately so that code staff can determine that NAECA compliance is achieved.]

403.8.1 Heating equipment. For new residences with gas furnaces the efficiency shall be at least 92 AFUE. For new residences with gas boilers, oil boilers, or oil furnaces the efficiency shall be at least 85 AFUE. For new residences with heat pumps the efficiencies shall be at least 8.5 HSPF.

403.8.2 Cooling Equipment. Vapor compression air conditioning shall have at least a 15.0 SEER and 12.5 EER. Room air conditioners shall have at least an 11 EER, or a 10 EER if ≥ 20,000 Btu/h.

403.8.3 Efficiency alternative. As an alternative to Sections 403.8.1 and 403.8.2 Federal minimum heating and cooling efficiency shall be permitted, provided the air tightness achieved in Section 402.4.1.2 is no more than 2 ACH50, and the ducts are tested as specified in 403.2.2. Ducts shall be tested as specified in Section 403.2.2, even if within conditioned space.

SECTION 404
ELECTRICAL POWER AND LIGHTING SYSTEMS

404.2 Lighting equipment. A minimum of ~~fifty~~ seventy five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps. Exception: Low voltage lighting.
Alternately, the minimum shall be permitted to be calculated as a percentage of total permanently installed fixtures with high efficacy lamps. [Allowing lamp or fixture count gets around the "chandler problem" where one fixture has many small bulbs. The remaining 25% is needed to accommodate lights with dimming or 3-way switches.]

SECTION 405
SIMULATED PERFORMANCE ALTERNATIVE

405.1 Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, and service water heating energy only.
405.1.1 Performance level. Compliance with this section shall require the Proposed Design to be 10% more efficient than the Standard Reference Design. [Because the performance section presumes NAECA minimum equipment efficiencies, compliance through performance calculations requires an increased energy efficiency above the overall base code.]

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

[Unless the ability to credit high efficiency equipment is restored, it is unclear how the performance section will be used.]

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems	~~As Proposed~~ Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with prevailing federal minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As proposed~~ As proposed As proposed As proposed
Cooling systems	~~As Proposed~~ Fuel type: Electric Efficiency: in accordance with prevailing federal minimum standards Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As Proposed~~ As proposed As proposed As proposed
Service Water Heating	~~As Proposed~~ Fuel type: same as proposed design Efficiency: in accordance with prevailing federal minimum standards Use: gal/day=30 + (10 x N_{or}) ~~Same as proposed design~~	~~As Proposed~~ As proposed As proposed Same as standard reference ~~Use: gal/day=30 + (10 x N_{or})~~

HVI
HVI 915-- HVI (Home Ventilating Institute) Procedure for Loudness Rating of Residential Fan Products [This procedure is used for testing and rating ventilating fan products for sound.]

HVI 916-- HVI Airflow Test Standards [This is an airflow test standard that establishes uniform methods for laboratory testing of powered residential ventilating equipment for airflow rate.]

Unvented heaters

Modify the Massachusetts version of IFGC and IRC to be similar to the following:

G2445.2 (621.2) Prohibited use. One or more unvented room heaters shall not be used as the sole source of comfort heating in a dwelling unit. Unvented room heaters shall not be installed in a manufactured home. Unvented room heaters shall not be installed in a residence.
[As the building envelop becomes tighter unvented heaters become more of a health / moisture threat. Vented room heaters are fine, unvented room heaters are not. Note that with the current code an unvented heater can be installed after the home in built, which creates problems for the newer, tighter homes.]