Residential Energy Conservation Code of Maine

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Agenda
- Title 16 Department of Public Safety
- 636 (new) Bureau of Building Codes and Standards
- Course time 6 hours
- Overview of the Residential Energy Code
- Certification Process
- Timeline
- Enforcement
- Resources for Information
- U.S. DOE Residential Requirements of the 2009 IECC
- Navigating the Code
- Revisions to the IECC
- The "New School" of Building Science

Oh yeah... Those pesky cell phones!

The New Standard

Title 16 Department of Public Safety
Chapter 6 Energy Conservation Code of Maine

Residential Energy Code

Establishes Residential Energy code component of the Maine Uniform Building and Energy Code (MUBEC)

The provisions of this chapter are based on a nationally recognized model building code published by the International Code Council, Inc., and is made part of the MUBEC through incorporation by reference.

This chapter also contains requirements for the enforcement of the Energy Conservation code by local building officials in municipalities with a population of more than 4,000 residents.
Purpose and Scope

- All building construction in Maine, with some exceptions, is governed by the MUBEC, which is adopted by the Technical Building Codes and Standards Board pursuant to 10 M.R.S. Chapter 1103.

The primary objective of the Board is to establish a uniform building code throughout the State of Maine.

Purpose and Scope

- Chapter 6 sets forth the regulation of the design and construction of buildings for the effective use of energy and is applicable to both residential and commercial buildings.

Authority

- The authority for this Chapter is 10 M.R.S. 9722, which provides that the Maine Technical Building Codes and Standards Board shall promulgate rules which adopt, amend, and maintain the Maine Uniform Building and Energy Code.

Adopted Codes and Standards

The Residential Energy Conservation Code of Maine has adopted the following:

- International Energy Conservation Code - 2006 (reference residential basement wall Insulation only)

To download rules that detail the amendments to the codes, go to www.mainegov/dps/becs

Incorporation by Reference

The following Chapters of the 2009 International Energy Conservation Code, published by the International Code Council, Inc., are hereby adopted and incorporated by reference and are an enforceable part of the MUBEC:

Chapter 1 Administration
Chapter 2 Definitions
Chapter 3 General Requirements
Chapter 4 Residential Energy Efficiency (Abol ECIC 2000 for basement wall insulation)
Chapter 5 Commercial Energy Efficiency
Chapter 6 Referenced Standards

Excluded from Adoption

At this time, none of the content contained in the 2009 International Energy Conservation Code has been excluded from adoption.

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Certification Standards

Certification Standards

For Building Officials and Third Party Inspectors

The training and certification committee of the Technical Building Codes and Standards Board shall determine the standards for certifying building officials and third-party inspectors.

Standards shall enumerate the knowledge and training required to ensure that building officials and third-party inspectors have the basic understanding needed to apply the MUBEC and the ongoing education needed to stay current with code changes and amendments.

Advisory Rulings and Technical Support

The interpretation and enforcement of this Code are the responsibility of the local municipality.

However, the Bureau is available to provide advisory rulings and technical support for the administration of this Code, amendments, conflict resolutions, and interpretations. This support includes but is not limited to:

- Specific identification of the subject code or codes with a description of the questioned application or perceived conflict.
- Relevant construction documents to fully illustrate the issue upon which an advisory interpretation is sought.
- The Bureau may request additional documentation or information required to issue an advisory interpretation or to provide technical support. All requested information shall be provided within 30 days of request, or the request for advisory interpretation or support may be deemed abandoned.

Written Request Shall Include:

1. Specific identification of the subject code or codes with a description of the questioned application or perceived conflict.
2. Relevant construction documents to fully illustrate the issue upon which an advisory interpretation is sought.
3. Additional documentation or information required to issue an advisory interpretation or to provide technical support. All requested information shall be provided within 30 days of request, or the request for advisory interpretation or support may be deemed abandoned.

Advisory Rulings and Technical Support

Written Request

Upon written request of any interested person or entity, the Bureau may provide a nonbinding advisory interpretation with respect to the applicability of any statute, rule or code administered by the Bureau, on that person or entity, or the property of that person or entity, or actual state of facts.

The written request shall be made on the official Bureau form and shall include the following information:

Certification Standards

There are six new standards in which building officials may be certified:
- International Residential Code (IRC)
- International Building Code (IBC)
- Residential Energy Code (IECC)
- Commercial Energy Code (IECC)
- Residential Ventilation Code
- Commercial Ventilation Code

- Radon – Registration now required
Advisory Rulings and Technical Support

The technical support shall also include:

- Written, non-binding advisory interpretation

Other Considerations

- Procedure for code amendment
- Procedures for identifying and resolving conflicts between the Code and the Fire Safety Codes and standards.
- Experimental buildings
- Native lumber

MUBEC does not apply to

- Log homes or manufactured homes defined in Chapter 951.
- Post and beam or timber frame construction.
- Warehouses or silos used to store crops.
- Seasonally restricted cottages.

Timeline

On December 1, 2010, this code shall be applicable statewide.

The MUBEC must be enforced in a municipality with a population of 4,000 residents or more that had previously adopted any building code on or before August 1, 2008.

Timeline

No later than July 1, 2012, this Code must be enforced in a municipality with a population of 4,000 residents or more that had not adopted any building code on or before August 1, 2008.
Timeline

The provisions of the MUBEC do not apply to municipalities with a population of less than 4,000 residents, except to the extent that the municipality has adopted that code.

MUBEC Components

Maine Uniform Building Code -- That portion of the MUBEC that does not contain energy code requirements as determined by the board pursuant to section 9722, subsection 6, paragraph L.

Maine Uniform Energy Code -- That portion of the MUBEC that contains only energy code requirements as determined by the board pursuant to section 9722, subsection 6, paragraph L.

Municipalities Under 4,000

Effective September 2011, all towns under 4,000 in population have the following options:
1. Choose to adopt and enforce the MUBEC.
2. Choose to adopt and enforce MUBEC only.
3. Choose to adopt and enforce MUEC only.
4. Choose to have no code.

Timeline

Effective December 1, 2010, except as provided in 10 M.R.S. 9724(4) and 9725, any ordinance regarding any building code of any political subdivision of the State that is inconsistent with the MUBEC is void, with the following exception:

This provision does not apply to any adopted fire & life safety code, fire safety ordinance or any land use ordinance, including Land Use Regulatory Commission rules.

Enforcement

Subject to 26 M.R.S. 2373, in municipalities with a population over 4,000, enforcement of the provisions of the MUBEC shall be the responsibility of the municipality and shall be accomplished by one or more of the following means:

Enforcement
Enforcement
Building Officials
Inspections performed by building officials certified pursuant to 30 A.M.R.S. 4451.

Enforcement
Inspections by Virtue of Inter-local Agreements
Inspections performed by virtue of inter-local agreements with other municipalities, that share the use of building officials, certified in building standards pursuant to 30 A.M.R.S. 4451.

Enforcement
Contractual Agreements
Inspections performed by virtue of contractual agreements with one or more municipalities, or county or regional authorities, that share the use of building officials certified in building standards pursuant to 10 M.R.S. 6723.

Enforcement
Third Party Inspection by Report
Inspections performed and verified by reports from a TPI, certified pursuant to 10 M.R.S. 6723.

Enforcement

If the municipality does not erect one or more of the buildings listed above, then the applicant shall be required to have an inspection performed by a TPI at their own cost.

Suggested Inspections
104.1 General
Construction or work for which a permit is required shall be subject to inspection by the code official.

See Commentary
**Suggested Inspections**

Some suggested inspection areas...

**Envelope**

- Foundation
  - Perimeter slab insulation
  - Below grade wall insulation

**IECC 2006 Provisions**

402.2.6 Basement Walls.

Walls associated with conditioned basements shall be insulated from the top of the basement wall down to 10 feet below grade or to the basement floor, whichever is less.

Wall associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated IAW sections 402.1.1 and 402.2.6.

**Suggested Inspections**

Some suggested inspection areas...

**Framing**

- Foundation discrepancies corrected
- Fenestration requirements
- Air leakage of windows, skylights, doors, etc
- Envelope air leakage
- Skylight U-factors
- Door U-factors

**Suggested Inspections**

Insulation

- Framing discrepancies corrected
- Vapor retarders
- Roof R-values
- Type IG light fixtures
- Interior wall R-values (adjacent to unconditioned space)
- Floor R-values
- R-values – below grade walls
- Protection of below grade insulation
- Thermal barriers of above/below grade combo walls
- R-values of exterior walls
- Inform contractor of missing items or corrections needed
- Final Inspection

**Suggested Inspections**

Other inspection areas with similar suggested lists include...

**Mechanical**

**Service water heating**

**Electrical power and lighting**
Required Inspections

104.5 Inspection Agencies

The building official is authorized to accept reports of approved agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

104.6 Inspection Requests

It shall be the duty of the permit holder or their agent to notify the building official that such work is ready for inspection.

It shall be the duty of the person requesting any inspections required by this code to provide access to and means for inspection of such work.

104.7 Reinspection and testing

Discusses that deficiencies noted by inspection must be corrected and reinspected.

104.8 Approval

After the prescribed tests and inspections indicate that the work complies in all respects with the code, a notice of approval shall be issued by the code official.

Required Inspections

Remember... the aforementioned suggested inspections are those listed by the ICC, and published in the IECC and Commentary.

Those are only suggestions!

You have a handout from the U.S. DOE that may be used by building officials as a model to develop your own inspection checklist.

Resources for Information
Resources for Information

International Code Council

400 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001
1-888-ICC-SAFE (422-7233)

www.iccsafe.org

U.S. Department of Energy
Residential Requirements of the 2000 IECC

Navigating the Code

Navigating the Code

The IRC codes and ASHRAE standards contain a substantial amount of information and updates for the new building code program.

We can break it down into manageable parts, and show you how to find the information that you need.

Quickly!
Chapters

The book is broken down into chapters to discuss major categories of information.

Please note that all chapters of the ISDG are included in the MBEC.

General Comments

Each chapter starts with some general comments about the material that will be covered.

This information can be helpful to when interpreting code or trying to explain details to others.

The comments also provide a briefing on each section in the chapter.

This gives you a speedy snapshot of what is covered in each section.

General Comments

Finally, a purpose statement is provided to give specific meaning and importance of the chapter.

Sections

Section and further breakdown of the chapter.
Commentary

The commentary follows many of the code references

Revisions to the IECC

Not all of the text in all sections are adopted by the State of Maine.

Revisions to the IECC

For up to date listings of all changes to the MUBEC, go to

www.main.gov/dps/bbcs
Revisions to the IECC

The following additions, insertions, deletions, and other changes are hereby made to the 2009 International Energy Conservation Code:

- Generally all sections
  - Delete "International Mechanical Code"
  - Insert "applicable state codes and statues"
- Except for the specific Sections below where references to International Mechanical Code are specifically deleted and/or altered.

Revisions to the IECC

Sections 103, 104, and 108, and any amendments thereto shall only be applicable:

A. In a municipality with a population of 4,000 or more residents, beginning:
   - (1) No later than December 1, 2010, if the municipality had previously adopted any building code on or before August 1, 2008; or
   - (2) No later than July 1, 2012, if the municipality had not adopted any building code on or before August 1, 2008.
B. In a municipality with a population of less than 4,000 residents, if the municipality voluntarily elects to enforce the MUBEC.

Revisions to the IECC

Section 101.4.7
Insert "No provisions of the MUBEC shall be construed to prohibit the adoption or enforcement of an ordinance of any political subdivision that sets forth provisions for local enforcement of building codes.

Such ordinances may include items such as permits, fees, boards of appeals and violations."

Revisions to the IECC

Section 107
Delete Section R107 "Fees" in its entirety, without substitution.

Revisions to the IECC

Section 109
Delete Section 109 "Board of Appeals" in its entirety, without substitution.
Revisions to the IECC

Section 402.4.2.1
Delete "33.6 psf (90 Pa)" at the end of the first sentence and insert "50 Pa (1 psf)" in its place.

Revisions to the IECC

Section 403.9.1
Insert "or LPC" after "natural gas".

Revisions to the IECC

Section 503.2.5
Delete "Chapter 4 of the International Mechanical Code" and insert "ASHRAE 62.1 - 2007" in its place for both occurrences.

Revisions to the IECC

Section 503.2.6.1
Delete "as established in Table 403.3 of the International Mechanical Code", without substitution.

Revisions to the IECC

Section 503.2.6
Delete Exception 1 "Where energy recovery systems are prohibited by the International Mechanical Code", with no substitution.

Revisions to the IECC

Section 503.2.7.1
Delete "the International Mechanical Code" and insert "NFPA 80A" in its place.
Revisions to the IECC

Section 603.29.1
Delete "in accordance with the requirements of Chapter 6 of the International Mechanical Code" without substitution.

Section 603.3.1 Exception 2
Delete Exception 2 "in order to meet the minimum ventilation requirements of Chapter 4 of the International Mechanical Code" without substitution.

Revisions to the IECC

Section 603.4.5, Item 3
Delete "Chapter 4 of the International Mechanical Code" and insert "ASHRAE 90.1-2007" in its place.

Chapter 6, First Paragraph
Delete "107" from the end of the last sentence and insert "108" in its place.

Tables and Figures

There are many tables and figures, conveniently numbered by the sub-sections they apply to.

Some tables contain numerous notes and conditions which must be considered to arrive at an accurate determination of the data.

be careful and double check all notes and conditions as required.
Using Tables and Figures

Let's take a look at Table 402.1.1

- What is the required R value for a heated slab in Zone 2?

Using Tables and Figures

Let's take a look at Table 402.1.1

- What is the required slab edge R value and insulation depth for a heated slab in Zone 6?

Using Tables and Figures

Let's take a look at Table 402.1.1

- What is the required ceiling (attic) R value in Zone 6?

Using Tables and Figures

Let's take a look at Figure 402.2.1(1)

Please note the (1) indicates this is the first table in a series in Sub-section 402.2.1.

How would the applicant comply with the requirement for R-49 insulation in the portion of the attic near the eave, where the R value is not possible to achieve the full thickness of the insulation?

Using Tables and Figures

Let's take a look at Table 402.2.1(2)

Please note the (2) indicates this is the second table in a series in Sub-section 402.2.1.

Notice the advantage of the raised floor truss system from an energy perspective.

Consider the increased R value near the eave, where the R value is typically very low.

Using Tables and Figures

Let's take a look at Table 402.4.2

What is the requirement for air barrier and insulation inspection?

Component criteria for ceilings/attics?
Let's flip over to Chapter 3

The first part of Chapter 3 defines climate zones for the United States.

These serve to establish exterior design conditions and provide general requirements for
- Interior design conditions
- Materials
- Systems
- Equipment

Let's flip over to Chapter 3

The climate zones are referred to throughout the codes to help you determine
- Required wall and roof insulation R-values
- Window and door thermal transmittance requirements (U-factors)
- Provisions that affect mechanical systems

Let's flip over to Chapter 3

If you are using a code book that is older than 2006, you will notice many changes in the climate zone map.

A thorough discussion of the zones development can be found at
www.energycodes.gov/implementations/climate_paper_review_draft_rev.pdf

Climate Classification for Building Energy Codes and Standards

Let's take a look at Figure 301.1

CLIMATE ZONE MAP

CLIMATE ZONE MAP

Notice that all of Maine except for Aroostook County is in Climate Zone 6A

Energy Compliance Certificate

401.3 requires a certificate of compliance be posted on or in the electrical distribution panel.

Energy Compliance Certificate

Your handout illustrates the minimum listing requirements for the certificate.
Additional Training Materials

Additional training materials and... your homework assignment are available at
www.energycodes.gov

- Recertification credit can be obtained for REScheck Basics Webcast

Homework?? Yikes!


The “New School” of Building Science

Now... before we talk about Energy Code...

Let's talk about some "new school" energy fundamentals!

This will also help you to understand where all of this energy code came from.

Goals of the Energy Industry

- Create safe indoor environment
- Increase occupant comfort
- Save money and energy
- Extend dwelling life
- Conserve natural resources
But my Dad did it this way!

Construction training has always been essentially a guild system where people learn on the job from someone who learned the same way.

Essential skills are transferred primarily by observation, trial & error, and traditional "best practices".

Energy professionals are being trained in a new skill set, beginning with a new way to look at buildings.

Albert Einstein had a great and well fitting analogy...

“The problems we face cannot be solved with the same thinking that created them.”

Why those old methods do not work anymore

Houses are:
- Smaller
- Tighter
- Have more exhaust appliances
- Have weaker natural draft combustion appliances
- Have less drying potential

We have to look at the entire building as a system

Everything in a house has the potential to effect everything else.

Including the people
**Moisture**

- Moisture can be a pollutant when weatherizing
- Wet basements & crawlspaces are particularly troublesome
- 99% of moisture is transported into the house from outside
- When moisture finds its way in, so do other contaminants and toxins

**Fans and Exhausting Appliances**

- Bathroom fans
- Range hoods
- Dryer vents
- Air conditioners
- Air handlers

**Ducting**
- Heat Loss
- Minimum Ventilation Req.
- Managing Ventilation

**The Three States of Water**

As water changes from one physical state to another, an exchange of heat takes place.

**Fans and Exhausting Appliances**

All fans must be ducted to the building exterior, preferably through the gable end.

**Fans and Exhausting Appliances**

All duct joints must be sealed with appropriate sealant.
Fans and Exhausting Appliances

All ducted appliances should have a flap to prevent heat loss through the duct.

 Fans and Exhausting Appliances

Your energy auditor will recommend correctly sizing for proper airflow and sound levels.

If you can't vent through the gable end, you can go through the eave soffit

Bad choice for duct material

Soffit vents should be continuous

X

If you are going to vent through the soffits, you must block the vent holes 2 feet either side of the vent stack.
If you don't block the holes...

Let's talk about indoor air quality

What are some of the elements that affect indoor air quality?

Moisture

Aldehydes? Yes!

CO? Gotta check!
Depressurization and Back Drafting

carbonmonoxidekills

Furnace backdrafting combined with return duct leaks

Let's just gas the attic...

Anything wrong here?

Out the window and up the eves

Weatherizing Single Family Homes

- Air seal
- Insulate attic
- Insulate walls
- Insulate basements
- Typical savings 20%

Weatherizing your Home
Involves understanding and attacking

- Air transported Heat Loss
- Conductive Heat Loss
Let's look at

Air Transported Heat Loss

The Three(?) Air Leak Drivers

1. Stack Effect
2. Wind
3. Mechanical Ventilation
4. And sometimes Duct Leaks

Sometimes, stack effect is quite obvious

We must also understand that...

- Stack Effect
- Wind
- Mechanical Ventilation and Duct leaks
- Are all in a constant state of change
- All happen simultaneously
Wind

Positive Pressure

Negative Pressure

Fan

House to
Neutral Pressure Plate

Consistently
changing locations and
intensity

Bathroom Fan

Dryer

Central Vac

Furnace

Range Hood

Air Conditioning

Duct Leaks

There is no
Neutral Pressure Plate

Leaky ducts can also
bring soil gases,
moisture and
pollutants into the
heating system

Duct Leaks

Leaky ducts can also
bring soil gases,
moisture and
pollutants into the
heating system

Return air takes the
path of least resistance

If a window is
open with the
heating system
running...

It may be easier
for the heated air
to go out the
window than to
the return ducts

Stack, Wind, Fans and Leaks

In reality, all of
these effects
happen all at
the same time

Main Effect

Dryer

Central Vac

Duct Leaks

Furnace

Range Hood

Air Conditioning

Wind

Vane

Vane
Some holes will leak in
Some holes will leak out
Sealing the building to prevent unwanted leaks in the key to saving energy.

Now that we know about
Air transported heat loss
Let's shift gears...

Heat moves by three methods
- Conduction
- Convection
- Radiation

Conduction
The movement of heat through a solid.
Conduction requires physical contact
The pans are in contact with the burners. Heat is conducted from the burners to the bottom of the pans via solid surface contact.
If you touch the pot, conductive heat will burn your hand.

Convection
The movement of heat through a fluid.
Air is a fluid (Bernoulli's Principle)
Heat rises as cooler fluid moves in to fill the void. The circulation of the water in the pot is a convective flow.
RADIATION
The movement of heat in the form of rays sent through space.
Radiation does not need physical contact or a medium.

Heat is radiating from this burner, warming any adjacent matter.

Everything radiates or absorbs heat all the time.

Insulation reduces conductive and convective movement by trapping small pockets of air.

Reflective insulation slows radiation?

All three mechanisms can happen concurrently
Radiation is warming the air adjacent to the burner. The warmed air is rising due to convection. If the ceiling is shiny, some heat may be radiated back into the room.
The brackets supporting the burner are being heated by conduction, in turn heating the metal stove top.

Keeping heat in requires
Reducing conduction, convection & radiation
Stopping air movement

Why in the same plane?
- Heat has the potential to escape by any of the three mechanisms at any given time. Stopping one without dealing with the others is pointless.
- Dealing with surface heat loss without considering air transported heat loss is also pointless.
- Insulation does not effect air sealing nor can it perform as designed without air sealing.
- Beyond that, it is necessary that insulation & air sealing occur at the same plane and be in contact with each other.
So what is the building envelope?

Pressure Boundary (structure)
Thermal Boundary (insulation)
Vapor Barrier (moisture shield)

The three together make up the building envelope

The building envelope

Insulation (Thermal Boundary)
Drywall (Pressure Boundary)
Paint (Vapor Boundary)

All barriers & boundaries have to be in contact with each other

Why in contact?

Air tight plaster ceiling
Non air tight suspended ceiling

Air transported heat loss
By convection (stack effect), room air freely moves through the ceiling & insulation, warming the area between the ceilings to the same temperature as the room below.

The heat is then lost to the attic via conduction through the un-insulated ceiling.

This configuration slows heat transfer, but, given enough time, the same amount of heat is lost as would be without the insulation!

Let's reverse the situation

Conductive Heat Loss
Broken/failing plaster ceiling

Room heat conduct/leaks through the air tight ceiling, warming the space between the ceilings to the same temperature as the room below.

By convection (stack effect), air above the drywall ceiling freely moves through the broken plaster & insulation, warming the attic to the same temperature as the area between the ceilings.

This configuration also slows heat transfer, but again, over time, the same amount of heat is lost as would be without the insulation!

#1 The First Rule of Boundaries

All barriers & boundaries have to be in contact with each other!

- Ideally, the pressure boundary, the thermal boundary and the vapor boundary (or retarder) should be one & the same.
- If that isn't possible (it often isn't) they must be in physical contact with each other.
- The three together make up the building envelope.

Some things that need to be done in most houses

Recessed lights
- Plumbing chase
- Chimney chase
- Bullhead doors
- Electrical chase

Oil fill / utility penetrations
All of those features penetrate the building envelope and contribute to Air Transported Heat Loss

Chimney chase

This is what stack effect looks like!

Framing in your chimney seal

Cover with 22g steel and seal to chimney with high temperature sealant

Lay a bead of high temp (2000° plus) sealant on the framing
Make a steel insulation dam to keep insulation away from chimney block or pipe.

Roof decking tells the story!

So does the insulation!

And there is NEVER just one of them!

If Not IC Rated, fabricate an insulation dam around them, using rigid metal.

Remember, insulation does not stop air movement!

Make sure the dam is rugged enough so it won’t collapse.

Make sure to comply with manufacturers required clearance or local fire code, whichever is greater.
Some people have tried to enclose the fixtures...

This may violate fire codes or create fire hazards. It will almost certainly cause the thermal protection to shut the fixture down.

Don't forget to seal the receptacles and switch boxes

Plug unused receptacles

And seal holes and penetrations in junction boxes

The building envelope must be sealed on all sides, top and bottom.

The top might include fold down stairs or hatches

These need an upper “coffin” for the stairs to fold up into

2 pieces of 2” blueboard

Hook and Eye

Must be air sealed, gasketed and hooked for a good seal

Under construction

Well done

The retrofit

Knee wall hatch
What can we improve on these?

Locking better?

How about the bottom of the building envelope?

Do we insulate the inside door or the outside door?

Perimeter wrap and band joist cavity

Perimeter wrap and bulkhead well done!
Perimeter wrap and ground cover combo

Sealed to wall and ground cover

8 mil poly or EPDM roofing work well for ground covers
Overlap and seal all seams by 8 inches
Cover ground and wall, seal to perimeter wrap

Spray applied foam and ground cover combo

Before

Spraying two part foam

Some challenges in a tri-level home

The marriage wall looks more like balloon framing than platform framing.

Air Infiltration Damage

Mold

Dust, mold, moisture and...

Pollutants go where the air goes.
Common building envelope problems

1. Intrusion
2. Infiltration
3. Exfiltration
4. Wind-washing

Ceilings are no different!

If the attic is floored over, air circulates inside the closed cavity, carrying heat from the bottom to the top where it conducts radiates to the attic.

If it isn't, the heated air will rise out of the insulation & into the attic where it escapes through the attic venting.

Insulation type is critical!

Remember!

- Air intrusion, infiltration, exfiltration, wind-washing and looping all go on continuously, depending upon the strength of the drivers & size of the holes.
- Reducing the drivers is impractical.
- Your task is to locate & plug the holes!

Platform Framing

Upper story band joist or box sill issue

Solid Surface Heat Loss (R3)

Upper story band joist cavities have a similar R value with a greater delta temperature

Band or band joist insulation is easily heated from basement.

Platform Framing

Upper story band joist or box sill issue

Upper story band joist cavities have a similar R value with a greater delta temperature

2" Blue Board

Band or band joist insulation is easily heated from basement.
What's wrong with this picture?

Conductive heat loss is a function of Area x AT x Time.

Exposing the floor & ceiling to exterior air greatly increases the area the home's heating plant must warm.

Wind Washing

Wind Washing

What should be done?

1. block ends of joist bays to prevent wind washing
2. connect first floor ceiling drywall to second floor subfloor

Another method

Air seal & Insulate the roof deck!

Air sealed drywall

Air seal here and here (building envelope)
Finish with 2" of cellulose blown on top of fiberglass

Insulating floors
If possible, install a membrane under the floor joists and dense blow the floor cavities.

Subfloor
Floor joists
Dense packed cellulose
Membrane and support

Insulating floors
If fiberglass batts are used, the insulation must be in contact with the subfloor.

Subfloor
Floor joists
Fiberglass batts
Lightning rods, or other reliable support

Insulating attics
R-49 in Maine

R-30 or R-49 cavity
R-19 minimum

2" Cellulose = R7

Fiberglass batts
12" = R38

The cellulose protects the fiberglass from convective currents in the attic, called "looping"

Looping reduces effective R value

Looping reduces effective R value
Insulating pipes

Pipes lose a tremendous amount of heat

The larger the diameter, the more heat they lose per linear foot

All hot water pipes should be well insulated

Exposed joint INCORRECT

Miter joint CORRECT

Tape all joints

Bolt joint CORRECT

How can we tell how well we did with our weatherization efforts?

Weatherization Quality Control

- Blower door
- Infrared imagery
- Digital camera
- Core sampling

The blower door

- Creates negative pressure throughout the building envelope. Generally test at -50 pascals
- Very accurate tool to measure total aggregate hole size in building envelope
- Use with smoke or infrared imaging camera to find leaks in building envelope
- Use two-finger test to determine which rooms are leaky
- Find holes in attics and basements

How the blower door works

High Pressure Outside (-50 pascals)

Powerful fan blowing in outside

Fan depressurizes the building envelope to minus 50 pascals with reference to outside

The blower door test is done to airtightness of the envelope (402.4.2.1)

Or meet the visual inspection requirements of (402.4.2.2)
Inspectors can use the blower door and pressure diagnostics to determine if:

- Attics are connected to basements
- Chimney chases are connected to the house
- Plumbing or electrical chases leak to building envelope
- Some rooms leak more than others
- ...etc.

Pressure doesn't tie!