DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

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Firm/Association affiliation, if any: New Buildings Institute

Date: 2/10/2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: 3.2., 5.4.3.1, 12

Code or rule section to be changed: 3.2., 5.4.3.1, 12

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code TAG MR 1323

General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).
   Section 5.4.3.1

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☒ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Section 3.2, Add definition as follows:

High-rise building: A building with an occupied floor located more than 75 feet (23 m) above the lowest level of fire department vehicle access.

Section 5.4.3.1, Revise text as follows:

5.4.3.1 Continuous Air Barrier

The *exterior building envelope* and the *semiexterior building envelope* shall have a *continuous air barrier* complying with Sections 5.4.3.1.1 and 5.4.3.1.2.

Exceptions to 5.4.3.1

1. *Semiheated spaces* in Climate Zones 0 through 6, except as required to complete the *continuous air barrier* of an adjacent *conditioned space*.
2. Single wythe concrete masonry *buildings* in Climate Zone 2B.

5.4.3.1.1 Whole-Building Air Leakage

Whole-building pressurization testing shall be conducted in accordance with ASTM E779, ANSI/RESNET/ICC 380, or ASTM E1827 by an independent third party. The measured air leakage rate of the *building envelope* shall not exceed 0.25 ~~0.40~~ cfm/ft2 under a pressure differential of 0.3 in. of water, with this air leakage rate normalized by the sum of the above-grade and below-grade *building envelope* areas of the *conditioned space* and *semiheated space.* Where a *building* contains both *conditioned space* and *semiheated space*, compliance shall be shown

a. separately for the *conditioned space* and for the *semiheated space*, with the air leakage rate for the *conditioned space* normalized by the *exterior building envelope* area of the *conditioned space* and the air leakage rate for the *semiheated space* normalized by the *semiexterior building envelope* area of the *semiheated space*; or

b. for the *conditioned space* and for the *semiheated space* together, with the air leakage rate for the overall *space* normalized by the sum of the *exterior building envelope* area and the *semiexterior building envelope* area minus the *semiexterior building envelope* area that separates the *conditioned space* from the *semiheated space*.

Reporting shall be in compliance with Section 4.2.5.1.2.

Exceptions to 5.4.3.1.1

1. For *buildings* having over 50,000 ft2 of *gross conditioned floor area*, air leakage testing shall be permitted to be conducted on less than the whole *building*, provided the following portions of the *building* are tested and their measured air leakage is area-weighted by the surface areas of the *building envelope*:
   a. The entire *floor* area of all *stories* that have any *spaces* directly under a *roof.*
   b. The entire *floor* area of all *stories* that have a *building entrance* or loading dock.
   c. Representative *above-grade wall* sections of the *building* totaling at least 25% of the *wall* area enclosing the remaining *conditioned space*. Floor area tested per (a) and (b) shall not be included in the 25%.
2. Where the measured air leakage rate exceeds 0.25 ~~0.40~~ cfm/ft2 but does not exceed 0.40 ~~0.60~~ cfm/ft2, a diagnostic evaluation, such as a smoke tracer or infrared imaging shall be conducted while the *building* is pressurized, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. In addition, a visual inspection of the air barrier shall be conducted, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the *code official* and the *building* owner and shall be deemed to satisfy the requirements of this section.

3. For *high-rise buildings* and buildings greater than 100,000 ft² of gross conditioned floor area, an *approved* third party shall verify the design and installation of the ~~C~~*continuous air barrier* ~~design and installation verification program~~ in accordance with Section 5.9.1.2.
4. For buildings or portions of buildings enclosing Group R or Group I occupancies, the measured air leakage shall not exceed 0.30 cfm/ft^2 (1.5 L/s m^2) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit, and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's enclosure area. Units shall be tested separately with an unguarded blower door test as follows:
    a. Where buildings have fewer than eight testing units, each testing unit shall be tested.
    b. For buildings with eight or more testing units, the greater of seven units or 20 percent of the testing units in the building shall be tested, including a top floor unit, a ground floor unit and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, an additional two units shall be tested, including a mixture of testing unit types and locations.

Add new language to Chapter 12 Normative Reference:

Reference	Title
ANSI/RESNET/ICC 380	Standard for Testing Airtightness of Building Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

   No.

Need and Reason

1. Why is the proposed code change needed?

   This amendment requires air leakage testing for all commercial buildings less than 100,000 square feet and includes specific air leakage testing guidance for multifamily buildings. These changes align the Minnesota commercial energy code more closely with changes to air infiltration testing requirements considered in ASHRAE 189.1 and with the multifamily testing requirements in the 2021 IECC.

   Air leakage can be a significant source of energy waste in buildings, contributing to higher heating and cooling costs for building owners and occupants, and increasing risk related to comfort and durability. Air tightness testing can result in more attention to envelope assembly air barrier sealing and significantly reduced building leakage. Adequate control over air leakage can provide many benefits, including reduced HVAC equipment sizing, better building pressurization, and energy savings due to reduced heating and cooling of infiltrated outside air. In moist climates, ensuring lower air leakage through whole-building testing can also result in better humidity control and reduced risk of durability issues. While it is important that the materials and assemblies have limited leakage, that alone does not guarantee a low leakage building. Recent research shows that 40% of buildings constructed without an envelope consultant have air leakage exceeding the currently optional test standard requirements, while buildings with envelope consultants all had leakage below 0.25 cfm/ft.[1] Testing is the most reliable means of ensuring that the intent of this code

[1] Wiss J. 2014. *ASHRAE 1478-RP Measuring Airtightness of Mid- and High-Rise Non-Residential Buildings*. Elstner Associates, Inc. for ASHRAE. https://www.ashrae.org/resources--publications/periodicals/enewsletters/esociety/2014-12-10-articles/completed-research-december-2014.

section—limiting unintended energy waste in buildings due to air infiltration—will be achieved. Durston and Heron's review (2012) of the 0.25cfm/ft^2 requirement by the U.S. Department of Defense (DOD) shows that without testing, the range of building leakage can exceed the requirement by more than double (0.9 cfm/ft). However, with testing included as part of the construction process, the average leakage of buildings was determined to be below the 0.25 cfm/ft limit and in many cases lower leakage levels in the range of 0.15 cfm/ft^2 can be achieved.[2] Therefore, a test limit of 0.25 cfm/ft is considered to be both a realistic and achievable goal and would align the Minnesota state code with the testing requirements under consideration in ASHRAE 189.1.

This amendment proposes exempting testing for high-rise buildings and buildings of 100,000 ft^2 because of the technical and practical issues with testing these large buildings. This amendment also proposes different test procedures and thresholds for multifamily structures (Group R and I occupancies) that align with the test procedures and thresholds outlined in the 2021 IECC to reflect current industry practice in blower door testing for the multifamily market.

2. Why is the proposed code change a reasonable solution?

   This code amendment aligns Minnesota state code with testing requirements in the 2021 IECC and those under consideration in 189.1. In colder climate zones, the importance of air barrier tightness is critical to the performance of building heating systems. Ensuring the air barrier for new construction in MN will increase occupant comfort and reduce energy use across all commercial building types.

3. What other considerations should the TAG consider?

   None.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   The code change proposal will increase the cost of construction
   This measure will increase the cost of construction of new commercial buildings as whole building air leakage testing will be required except for primarily residential buildings (Group R and I building occupancies). Based on a national survey of professional commercial building air barrier testing companies, it was determined that the cost of air leakage testing fell into three ranges:

   · $350 or $0.12 to $0.07 per square foot for buildings up to 5000 square feet

   · $0.50 to $0.15 per square foot for buildings between 5000 and 50,000 square feet

   · $0.15 to $0.09 per square foot for buildings between 50,000 and 100,000 square feet, with decreasing costs for larger buildings.

   As demand for air leakage testing in commercial buildings increases, more companies will enter the market to provide these services. Therefore, a gradual decrease in cost is expected as more companies are available to do the testing.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.

[2] Durston JL and M Heron. 2012. *Summary and Analysis of Large Building Air Leakage Testing for the U.S. Department of Defense*. Atlanta, GA. https://cdn.ymaws.com/www.nibs.org/resource/resmgr/BEST/best3_durston.2.9.pdf.

An analysis of energy impact shows that annual energy savings from air barrier improvement resulting from testing due to the measure ranges from $5.07 to $71.88 per thousand square feet of floor area in offices in climate zones where testing is recommended. Testing was highly recommended in colder climate zones like Minnesota and found to be not as cost effective in warmer climate zones.

Pacific Northwest National Laboratory performed a cost-effectiveness analysis using the established DOE methodology.[3] Results of the analysis indicate that the average savings-to-investment ratio (SIR) and simple payback period (SPP) for commercial building testing with a limit of 0.40 cfm/ft^2 (1.5 L/s · m^2) at a pressure differential of 0.3 inch w.g. (50 Pa) in office buildings vary by size, as shown in the table below. If buildings meet a threshold of 0.25 cfm/ft^2 instead of 0.4 cfm/ft^2, cost effectiveness will only improve. We expect the SIR will increase and the SPP will decrease at this higher threshold because of increased energy savings with a minor or non-existent addition to cost.

Building size range, floor area square feet	**<5000**	**5000 to 50,000**	**>50,000**
Average SIR	7.3	2.2	3.2
Average SPP (years)	7.1	13.1	10.2

A measure is cost-effective when the SIR is greater than 1.0, indicating that the present value of savings is greater than the incremental cost. Under ASHRAE 90.1 criteria, cost-effectiveness is proven when the simple payback is shorter than the scalar threshold of 22.2 years. Based on the cost-effectiveness analysis results, air barrier testing is specified for buildings that have both an SIR greater than 1 and a simple payback that is less than the 90.1 scalar threshold based on climate zone and building size.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

   No. Air-barrier testing is already an option in the energy code.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No. There should be no impact as air-barrier testing is already an option in the energy code.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change? Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

   All parties will be affected by this proposed code change.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

   No.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?

[3] Hart R and B Liu. 2015. *Methodology for Evaluating Cost-effectiveness of Commercial Energy Code Changes.* Pacific Northwest National Laboratory for U.S. Department of Energy; Energy Efficiency & Renewable Energy. PNNL-23923, Rev. 1. https://www.energycodes.gov/development/commercial/methodology.

No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.

   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   See answer in cost/benefit analysis above.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Building owners will pay increased utility bills if this amendment is not accepted. Building occupants will have reduced comfort. Increased consumption of fossil fuels for heating will impact statewide air quality and reduce likelihood of achieving Minnesota's climate goals outlined in the Next Generation Energy Act of 2007.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

   There is no additional cumulative effect of the rule when accounting for other federal and state regulations.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Greg Metz

Email address: Greg.Metz@State.MN.US

Telephone number: 651-284-5884

Firm/Association affiliation, if any: DLI/CCLD

Code or rule section to be changed: MR 1323

Date: 1/4/2020

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Modify Section 5.5.3.1 Roof Insulation

Intended for Technical Advisory Group ("TAG"): 1323 Minnesota Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).
   5.5.3.1 Roof Insulation

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Modify 5.5.3.1 Roof Insulation as follows:

   5.5.3.1 Roof Insulation
   All roofs shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8. Skylight curbs, mechanical curbs, and other roof curbs shall be insulated to the level of roofs with insulation entirely above deck or ~~R-5.0~~ R-10, whichever is less.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   Skylight and equipment curbs are a major thermal bridge/heat loss location costing energy resources and contributing to interior condensation and microbial growth. Equipment curbs are currently not even addressed in the code. Increasing the thermal resistance will significantly mitigate both the heat loss and the condensation development.

2. Why is the proposed code change a reasonable solution?

   Equipment curbs insulated to R-10 are readily fabricated, and prefabricated curbs to the same insulation level are available. Ducts from rooftop units that pass through curbs are not required to be insulated, but ducts that are exposed to the exterior are required to be insulated to a minimum R-12. Were there no curb, the duct would be insulated to R-12 instead of R-5. It is reasonable to require at least R-10 which is available with 2 inches of extruded polystyrene foam insulation.

3. What other considerations should the TAG consider? Ductwork from rooftop units typically pass through the curb area with minimal insulation, yet the curb is directly exposed to the exterior. Increasing the thermal resistance to R-10 more closely approximates the R-12 required for ducts exposed to the exterior as found in Table 6.8.2. Curbs for flues and kitchen exhaust would be exempted.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   Minimal cost increase.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   The increased costs are easily offset by the energy savings. The additional insulation will keep the inside of the curbs dry during cold weather and reduce moisture related microbial growth and wetting of other building materials.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has

less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   Cost of an insulated curb is minimal.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Continued perpetuation of moisture related damage within buildings due to condensation build-up during cold weather, and continued energy losses through under-insulated curbs.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Greg Metz

Email address: Greg.Metz@State.MN.US

Telephone number: 651-284-5884

Date: 1/4/2020

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Modify Section 5.5.3.2 Above Grade Wall Insulation

Firm/Association affiliation, if any: DLI/CCLD

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): 1323 Minnesota Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).
   5.5.3.2 Above Grade Wall Insulation

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Modify 5.5.3.2 Above Grade Wall Insulation as follows:

   5.5.3.2 Above Grade Wall Insulation
   All above-grade walls shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8.

   Exception to 5.5.3.2
   Alternatively, for mass walls, where the requirement in Tables 5.5-0 through 5.5-8 is for a maximum assembly U-0.151 followed by footnote "b," ASTM C90 concrete block walls, un-grouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally shall have un-grouted cores filled with material having a thermal conductivity of 0.44 Btu in./h ft2 F. Other mass walls with integral insulation shall meet the criteria when their U-factors are equal to or less than those for the appropriate thickness and density in the "Partly Grouted, Cells Insulated" Column of Table A3.1-3.

   When a wall consists of both above-grade and below-grade portions, the entire wall for that story shall be insulated on either the exterior ~~or the interior~~ or be integral.
   ~~a. If insulated on the interior, the wall shall be insulated to the above-grade wall requirements.~~
   b. ~~If insulation is on the exterior or integral,~~ The below-grade wall portion shall be insulated to the below-grade wall requirements, and the above-grade wall portion shall be insulated to the above-grade wall requirements

   ~~In addition, for Climate Zone 0, above-grade walls shall comply with one of the following:~~
   ~~a. Fore east and west walls, a minimum of 75% of the opaque wall area shall have a minimum SRI of 29. For the portion of the opaque wall that is glass spandrel area, a minimum solar reflectance of 29% determined in accordance with NFRC 300 or ISO 9050 shall be permitted. Each wall is allowed to be considered separately.~~
   ~~b. For east and west walls, a minimum of 30% of the above-grade wall area shall be shaded through the use of shade providing plants, man-made structures, existing buildings, hillsides, permanent building projections, on-site renewable energy systems, or a combination of these. Shade coverage shall be calculated at 10 a.m. for the east walls and 3 p.m. for the west walls on the summer solstice.~~
   ~~The building is allowed to be rotated up to 45 degrees to the nearest cardinal orientation for purposes of calculations and showing compliance.~~

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   There is typically a significant thermal short circuit that occurs at the top of a foundation wall when transitioning to the above grade construction condition. Moving the insulation to be on the exterior side or integral to the wall will reduce or eliminate this thermal short circuit. In addition, moving the insulation to either the exterior or an integral part of the exterior wall will significantly reduce the likelihood of condensation on the interior surfaces thereby ensuring better indoor air quality.

2. Why is the proposed code change a reasonable solution?

Insulation on either the exterior or the interior requires a finish. Moving the insulation toward the exterior reduces or eliminates the thermal short circuit at the top of the foundation wall.

3. What other considerations should the TAG consider? Moisture control, microbial growth mitigation, potential complexity in exterior finish treatment at grade.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   Minimal cost increase due to potential for additional exterior insulation protection at grade.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. The increased costs are easily offset by the energy savings and reduction in moisture damage to building materials.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   Potential incremental cost of exterior insulation protection at grade.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

Continued perpetuation of moisture related damage within buildings due to condensation build-up during cold weather, and continued energy losses through thermal short circuits at foundation wall to floor/exterior wall transition.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

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(Must be submitted electronically)

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Email address: Greg.Metz@State.MN.US

Telephone number: 651-284-5884

Date: 1/4/2020

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Modify Section 5.5.3.3 Below-grade Wall Insulation

Firm/Association affiliation, if any: DLI/CCLD

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): 1323 Minnesota Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).
   5.5.3.3 Below Grade Wall Insulation

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Modify 5.5.3.3 Below-grade Wall Insulation as follows:

   5.5.3.3 Below Grade Wall Insulation
   Below-grade walls shall have a rated R-value of insulation no less than the insulation values specified in Tables 5.5-0 though 5.5-8. Walls shall be insulated on the exterior side of the wall or integral to the wall.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   There is typically a significant thermal short circuit that occurs at the top of a foundation wall when transitioning to the above grade construction condition. Moving the insulation to be on the exterior side or integral to the wall will reduce or eliminate this thermal short circuit. In addition, moving the insulation to either the exterior or an integral part of the exterior wall will significantly reduce the likelihood of condensation on the interior surfaces thereby ensuring better indoor air quality.

2. Why is the proposed code change a reasonable solution?

   Insulation on either the exterior or the interior requires a finish. Moving the insulation toward the exterior reduces or eliminates the thermal short circuit at the top of the foundation wall.

3. What other considerations should the TAG consider? No

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   Minimal cost increase.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   The increased costs are easily offset by the energy savings. The additional insulation will keep the inside of the curbs dry during cold weather and reduce moisture related microbial growth and wetting of other building materials.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   Potential incremental cost of exterior insulation protection at grade.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Continued perpetuation of moisture related damage within buildings due to condensation build-up during cold weather, and continued energy losses through thermal short circuits at foundation wall to floor/exterior wall transition.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Greg Metz

Email address: Greg.Metz@State.MN.US

Telephone number: 651-284-5884

Date: 1/4/2020

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Modify Section 5.5.3.5 Slab-on-grade Floor Insulation

Firm/Association affiliation, if any: DLI/CCLD

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): 1323 Minnesota Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).
   5.5.3.5 Slab-on-Grade Floor Insulation

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Modify 5.5.3.5 Slab-on-grade floor Insulation as follows:

   5.5.3.5 Slab-on-Grade Floor Insulation
   All slab-on-grade floors including heated slab-on-grade floors and unheated slab-on-grade floors, shall comply with the insulation values specified in Tables 5.5-0 though 5.5-8. Perimeters shall be insulated on the exterior side of the slab foundation wall. All slab-on-grade floors in conditioned spaces shall have minimum R-5 continuous insulation under the slab in Climate Zone 6 and minimum R-10 insulation in Climate Zone 7.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   There is typically a significant thermal short circuit that occurs at the top of a foundation wall/slab edge when transitioning to the above grade construction condition. Moving the insulation to be on the exterior side will eliminate this thermal short circuit.

2. Why is the proposed code change a reasonable solution?

   Moving the insulation toward the exterior eliminates the thermal short circuit at the top of the foundation wall/ slab edge. It is an easy low-tech solution.

3. What other considerations should the TAG consider? Requiring a minimum of R-5 under all slab-on-grade conditions. Ground temperatures are low enough that the slab condition even mid-building can represent a significant heat loss.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   Potential minimal cost increase to protect exterior insulation from ultraviolet exposure.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   The increased costs are easily offset by the energy savings.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   Potential incremental cost of exterior insulation protection at grade.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Continued significant energy loss at the building perimeter foundation connection. Perpetuation of moisture related damage at the base of wall due to condensation build-up during cold weather.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Greg Metz

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Telephone number: 651-284-5884

Date: 1/27/21

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Modify Section 5.5.3.7 Below Grade Slab-on-Ground Insulation

Firm/Association affiliation, if any: DLI/CCLD

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): 1323 Minnesota Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

☐ change language contained the model code book? If so, list section(s).

☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☐ delete language contained in the model code book? If so, list section(s).

☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☒ add new language that is not found in the model code book or in Minnesota Rule.

5.5.3.7 Below Grade Slab-on-Ground Floor Insulation

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   5.5.3.7 Below Grade Slab-on-Ground Floor Insulation
   All slab-on-ground floors more than 24 inches below finished grade shall have a minimum R-5 continuous insulation below the slab.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   Soil temperatures in Minnesota average approximately 45 degrees throughout the year. This represents a significant source of heat loss during the heating season. In addition, during the summer months, the uncontrolled cooling effect is accompanied by uncontrolled condensation leading to dampness and potential microbial growth.

2. Why is the proposed code change a reasonable solution?

   Insulating floor slabs below ground will mitigate energy loss through the slab during the heating season and allow the slab to stay warmer in the summer, thereby mitigating dampness below grade.

3. What other considerations should the TAG consider? Increasing the R-value to R-10 in Zone 7 where soil temperatures are even colder.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   R-5 insulation is approximately $0.62/sf and R-10 insulation costs approximately $0.81/sf.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.

   The increased costs are easily offset by the energy savings.
   - With R-5 insulation, the annual energy savings for a 1000 sf basement is $350 with a return on investment for the insulation in 3.5 years.
   - With R-10 insulation, the annual energy savings for a 1000 sf basement is $375 with a return on investment for the insulation in 4.3 years.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   Potential incremental cost of exterior insulation protection at grade.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Continued significant energy loss at the building perimeter foundation connection. Perpetuation of moisture related damage at the base of wall due to condensation build-up during cold weather.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Greg Metz

Email address: Greg.Metz@State.MN.US

Telephone number: 651-284-5884

Date: 12/30/2020 Revised 1/26/2021; 2/15/21

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: 6.1.1.4 Prohibition of Conditioning Commercial Parking

Firm/Association affiliation, if any: DLI/CCLD

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): IBC and IBC/IFC Coordination

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☒	☐
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).
   Add: **6.1.1.4 Prohibition of Conditioning Public Commercial Parking**

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☒ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s). **MR 1323.0100, Subpart 7. Prohibition of Conditioning Public Commercial Parking**

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Delete Minnesota Rule 1323.0401, Subpart 2 Section C401.3 in its entirety.

   Add ANSI/ASHRAE/IEC Standard 90.1, Section 6.1.1.4 to read as follows:

   6.1.1.4 Prohibition of Heating Public Commercial Parking.

   Heating commercial parking facilities is prohibited in accordance with Minnesota Statute 216C.20, subdivision 3. Commercial parking facility as applied to this section means a parking facility that includes three or more motor vehicle parking stalls.

   Exception:

   1. Parking facilities exclusively for private motor vehicles appurtenant to non-transient multi-family housing.
   2. Parking facilities exclusively for emergency response vehicles.
   3. Parking facilities exclusively for private motor vehicle sales.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   To ensure continued compliance with the ban on public commercial parking heating and to clarify the scope of the prohibition for more uniform enforcement.

2. Why is the proposed code change a reasonable solution?

   It inserts the current rule language into the body of the model code where it is more likely to be found and followed. It clarifies exactly where the prohibition applies.

3. What other considerations should the TAG consider? None

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   No cost change. The modification carries forward an existing requirement.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   N/A

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   None

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   The requirement could be missed, heating equipment installed in public commercial parking garages at a waste of taxpayer dollars.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: John G. Smith, P.E.

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Telephone number: 612 -867-3145

Firm/Association affiliation, if any:

Date: February 13, 2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: 6.4.2 Calculations

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☒	☐
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Add the following new subsection:

6.4.2.1.1 Climatic Data Design Conditions

Climatic data design conditions to be used for the calculation of heating and cooling loads shall be determined by either of the following methods:
Method 1: Use weather conditions identified in Table C6.4.1. Where the building city location is not listed, use the listed city that is the nearest.
Method 2: Use weather data published as a part of ASHRAE Standard 169-2020 for the nearest city. This data is available at www.ASHRAE-meteo.info. Design temperatures shall be rounded to the nearest whole number. Winter design conditions shall be the mean extreme annual temperature. Summer conditions shall be the 1% annual cooling design conditions.

Table C6.4.1
CLIMATIC DATA DESIGN CONDITIONS

City	Winter Design db ºF	Summer db ºF/coincident wb ºF
Aitkin	-24	82/72
Albert Lea	-15	85/72
Alexandria AP	-21	86/70
Bemidji AP	-24	84/68
Cloquet	-20	82/68
Crookston	-27	84/70
Duluth AP	-20	81/67
Ely	-29	82/68
Eveleth	-26	82/68
Faribault	-16	86/73
Fergus Falls	-21	86/71
Grand Rapids	-23	81/67
Hibbing	-19	82/68
International Falls AP	-28	83/67
Litchfield	-18	85/71
Little Falls	-20	86/71
Mankato	-15	86/72
Mpls/St. Paul AP	-15	88/72
Montivedeo	-17	86/72
Mora	-21	84/70
Morris	-21	84/72
New Ulm	-15	87/73
Owatonna	-16	86/73
Pequot Lakes	-23	84/68
Pipestone	-15	85/73

Redwood Falls	-17	89/73
Rochester AP	-17	85/72
Roseau	-29	82/70
St. Cloud AP	-20	86/71
Thief River Falls	-25	82/68
Tofte	-14	75/61
Warroad	-29	83/67
Wheaton	-20	84/71
Willmar	-20	85/71
Winona	-13	88/74
Worthington	-14	84/71

Need and Reason

1. Why is the proposed code change needed?

   The above table is currently in the 2020 Energy Code and was in the version previous to the current code. ASHRAE 90.1 includes no information of what design conditions to use, and the reference to Standard 183 similarly does not. It is important to have the outdoor design conditions for uniformity in design and to help assure that HVAC systems will perform as expected. Using Method 2 identified above provides very similar results as using the table, however, the data for many more cities is available at the ASHRAE site. Method 2 clearly identifies which weather data conditions to use for the heating and cooling conditions as the data includes many different statistical data points.

2. Why is the proposed code change a reasonable solution?

   Maintains design conditions which have been used for many years in Minnesota. Provides a standard method of determining the design conditions.

3. What other considerations should the TAG consider? None

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   No cost change. The modification carries forward an existing requirement.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. N/A

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials, Owners and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   None

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   There would be no uniformity of how heating and cooling loads are calculated.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

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Telephone number: 612 -867-3145

Date: February 27, 2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: 6.4.3.4 Ventilation System Controls

Firm/Association affiliation, if any:

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☒	☐
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Exceptions to 6.4.3.4.2

   1. ~~Nonmotorized (gravity back draft) dampers are acceptable for exhaust and relief in *buildings* less than three stories in height and for *outdoor air* intakes and exhaust and relief dampers in *buildings* of any height located in Climate Zones 0, 1, 2, and 3.~~ Nonmotorized dampers for *outdoor air* intakes must be protected from direct exposure to wind.
   2. Nonmotorized dampers are acceptable in *systems* with a design *outdoor air* intake or relief/exhaust capacity of 300 cfm or less.
   3. Dampers are not required in *ventilation* or exhaust *systems* serving unconditioned spaces.
   4. Dampers are not required in exhaust *systems* serving Type 1 kitchen exhaust hoods.
   5. Dampers are not required in systems intended to operate continuously.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   As currently written in 90.1, it is confusing exactly where non motorized dampers are allowed. This proposed change will also result in less building air leakage during unoccupied periods for systems requiring greater than 300 cfm of outdoor intake or exhaust/relief.

2. Why is the proposed code change a reasonable solution?

   It clarifies where the non motorized dampers can be used.

3. What other considerations should the TAG consider? None

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   No cost change. It clarifies an existing code requirement. It also still allows the use of non motorized dampers for applications such as condominiums where it is common practice to use small toilet exhaust fans with backdraft dampers.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   N/A

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   None

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Confusion of where the non motorized dampers can be used.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: John G. Smith, P.E.

Email address: jsmith@michaudcooley.com

Telephone number: 612 -867-3145

Date: February 27, 2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: 6.4.4.1.2 Duct and Plenum Insulation

Firm/Association affiliation, if any:

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☒	☐
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Section 6.4.4.1.2 Duct and Plenum Insulation
   Delete the following exception to 6.4.4.1.2:

   ~~2. Ducts or plenums located in *heated spaces, semiheated spaces*, or *cooled spaces.*~~

Need and Reason

1. Why is the proposed code change needed?

   The 90.1 User Manual for this items states that "Ducts or plenums located in heated spaces, semiheated spaces, or cooled spaces are not required to be insulated. Heat losses and gains from these ducts usually have little or no energy impact." The result of this exception is that little if any ductwork would be required to be insulated, as most ductwork is distributed through these types of spaces. The heat gains or losses from these ducts does have an impact on energy and space comfort because the conditioning of spaces is dependent upon supplying the required supply air temperature to the space. If the supply air temperature increases due to duct heat gains, more air is required to satisfy the space conditions. Similarly for supply air temperature decreases. This has proven to be a problem with uninsulated ductwork in buildings resulting in excessive air distribution requirements or not satisfying the space requirements.

   The insulation tables provide exceptions to insulating ducts where it makes more sense.

2. Why is the proposed code change a reasonable solution?

   The proposal eliminates potential confusion of which ductwork should be insulated.

3. What other considerations should the TAG consider? None

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   No cost change. The modification carries forward an existing requirement of the current Energy Code.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. N/A

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   None

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Increased energy costs to the building and inability to properly condition spaces for occupant comfort.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Diana Burk

Email address: diana@newbuildings.org

Telephone number: 404-290-5442

Firm/Association affiliation, if any: New Buildings Institute

Date: 2/10/2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: Section 3, 6.4.8

Code or rule section to be changed: 6.4.8

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code TAG MR 1323

General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

   ☐ change language contained the model code book? If so, list section(s).

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☒ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Modify language in Section 3:

DX-dedicated outdoor air system units (DX-DOAS units): a type of air-cooled, water-cooled, or water-source factory assembled product that dehumidifies 100% *outdoor air* to a low dew point and includes *reheat* that is capable of controlling the supply dry-bulb temperature of the dehumidified air to the designed supply air temperature. This conditioned *outdoor air* is then delivered directly or indirectly via an independent ventilation system to the *conditioned spaces*. It may precondition *outdoor air* by containing an enthalpy wheel, sensible wheel, desiccant wheel, plate heat exchanger, heat pipes, or other heat or mass transfer apparatus.

Add new language in Section 6.4 (Mandatory Provisions):

6.4.8 Dedicated outdoor air systems (DOAS)

Buildings with occupancies as shown in Table 6.4.8 shall be equipped with an independent ventilation system meeting the requirements of this section and designed to provide not less than the minimum 100-percent outdoor air to each individual occupied space, as specified by the International Mechanical Code. The ventilation system shall meet the requirements for total energy recovery in Section 6.4.9.

Exceptions:

1. Occupied spaces that are not ventilated by a mechanical ventilation system and are only ventilated by a natural ventilation system in accordance with Section 402 of the International Mechanical Code.
2. Buildings where the primary heating equipment efficiency exceeds the minimum heating efficiency requirements in Section 6.8 by 10 percent
3. Buildings where the primary cooling or heat rejection equipment exceeds the minimum cooling and heat rejection efficiency requirements in Section 6.8 by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Table 6.4.8 Occupancy Classifications Requiring *DX-DOAS*

IBC Occupancy Classification	Inclusions	Exempted
A-1	All occupancies not specifically exempted	Television and radio studios
A-2	Casinos (gaming area)	All other A-2 occupancies
A-3	Lecture halls, community halls, exhibition halls, gymnasiums, courtrooms, libraries, places of religious worship	All other A-3 occupancies
A-4, A-5		All occupancies excluded
B	All occupancies not specifically exempted	Food processing establishments including commercial kitchens, restaurants, cafeterias; laboratories for testing and research; data processing facilities and telephone

		exchanges; air traffic control towers; animal hospitals, kennels, pounds; ambulatory care facilities.
F, H, I, R, S, U		All occupancies excluded
E, M	All occupancies included	

6.4.8.1 Controls. The HVAC system shall include supply-air temperature controls that automatically reset the supply-air temperature in response to representative building loads or to outdoor air temperatures. The controls shall reset the supply air temperature not less than 25 percent of the difference between the design supply-air temperature and the design room-air temperature.

6.4.8.2 Energy recovery ventilation with DOAS. The DOAS shall include energy recovery ventilation. The energy recovery system shall have a 50 percent *enthalpy recovery ratio* in accordance with Section 6.5.6.1. For DOAS having a total fan system motor nameplate hp less than 5 hp, total combined fan power shall not exceed 1 W/cfm of outdoor air. For DOAS having a total fan system motor hp greater than 5 hp, refer to fan power limitations of Section 6.5.3.1. The airflow rate thresholds for energy recovery requirements in Tables 6.5.6.1.2-1 and 6.5.6.1.2-2 do not apply.

Exceptions:

1. Occupied spaces with all of the following characteristics: complying with Section 6.5.6.1, served by less than 5000 cfm, with an average occupant load greater than 25 people per 1000 square feet (93 m^2) of floor area (as established in Table 403.3.1.1 of the International Mechanical Code) that include demand control ventilation configured to reduce outdoor air by at least 50% below design minimum ventilation rates when the actual occupancy of the space served by the system is less than the design occupancy.
2. Systems installed for the sole purpose of providing makeup air for systems exhausting toxic, flammable, paint, or corrosive fumes or dust, dryer exhaust, or commercial kitchen hoods used for collecting and removing grease vapors and smoke.

6.4.8.3 Heating/cooling system fan controls. Heating and cooling equipment fans, heating and cooling circulation pumps, and terminal unit fans shall cycle off and terminal unit primary cooling air shall be shut off when there is no call for heating or cooling in the zone.

Exception: Fans used for heating and cooling using less than 0.12 watts per cfm may operate when space temperatures are within the set point dead band (Section 6.4.3.1.2) to provide destratification and air mixing in the space.

6.4.3 Decoupled DOAS supply air. The DOAS supply air shall be delivered directly to occupied space or downstream of the terminal heating and/or cooling units.

Exceptions:

1. Active chilled beam systems.
2. Sensible only cooling terminal units with pressure independent variable airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements.
3. Terminal heating and/or cooling units that comply with the low fan power allowance requirements in the exception of Section 6.4.8.2

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

   No. This proposed code change will not impact other sections.

Need and Reason

1. Why is the proposed code change needed?

   The majority of commercial HVAC systems are based around a central air handling delivery system. This system typically provides heating, cooling and ventilation air from a single source. Since cooling is typically the largest instantaneous load, the fans must be sized large enough to deliver enough air to meet the peak cooling requirements. When the ventilation is integrated, these large fans must operate during all occupied hours to deliver ventilation effectively to the space. This leads to very high fan energy use. With ventilation separated from the heating and cooling delivery, the large heating/cooling fans can be shut off unless there is a call for heating or cooling and the much smaller ventilation-only fans can operate to deliver fresh air to the space. Furthermore, when the ventilation air is delivered using either Energy Recovery Ventilation (ERV) the heating energy requirements associated with tempering the ventilation air are significantly reduced or eliminated. Compliance with this proposed code amendments requires the following:

   A. 100% ventilation air delivered directly to each zone separate from the heating/cooling system.
   B. Ventilation air delivered using an ERV
   C. Run heating and cooling equipment (fans and pumps) only when there is a call for conditioning in the zone.

   Note that designs based around a DOAS is not new and it has long been established that this design direction leads to more energy efficient buildings. The General Services Administration has required DOAS as the baseline design for all new GSA buildings unless otherwise directed by design programming since 1998.[1] The specifications require perimeter and interior systems have 100 percent outside air ventilation systems which are completely independent of any other air distribution system. Enthalpy heat recovery must be included if the outside air required or equipment capacity exceeds a stated amount.[2]

   This proposed code change is similar to the requirements currently adopted in the Washington State Energy Code which requires buildings of only certain occupancy types to have a DOAS system. A DOAS would be required in buildings whose occupancy is intended for Mercantile (Group M), and Educational (Group E). A DOAS would also be required in most Business's (Group B) except those exempted, certain Assembly occupancies (Group A) for performing arts or motion pictures (except for television and radio studios), casinos, and lecture halls, community halls, exhibition halls, gymnasiums, courtrooms, libraries, and places of religious worship. A DOAS would not be required in buildings where the cooling or heating system is 10 percent more efficient than code requirements.

   A DOAS would also not be required in the building for occupancies for Residential (Group R), Factory and Industrial (Group F), High Hazard (Group H), Institutional (Group I), Storage (Group S), and Utility and Miscellaneous (Group U).

2. Why is the proposed code change a reasonable solution?

   Requiring DOAS for the majority of commercial buildings in Minnesota will yield significant energy and cost savings for building owners in the state.

3. What other considerations should the TAG consider?

[1] Mumma, Stanley A. "Designing Dedicated Outdoor Air Systems." *ASHRAE Journal* (May 2001) 28-31.
[2] General Services Administration. GSA 2003 Facilities Standards (P100), 5.5 HVAC Baseline Systems. Accessed September 27, 2014. http://www.gbci.org/Files/References/GSA-2003-facilities-standards.pdf

None.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   The proposed code change will increase costs. On average the incremental cost of adding a DOAS for several building prototypes (small, medium and large office, retail, and schools) was found to be $0.88 per square foot.[3]

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.

   The increased cost of requiring DOAS systems is more than offset by operating cost savings. When compared to a code-minimum system upgrade, very high efficiency DOAS can reduce commercial building energy use by an average of 36%, and HVAC energy use by an average of 65%.[4] In California, installing a DOAS was found to save on average $4-$5 in operating costs for every additional dollar spent to install a DOAS in a building.[3] Buildings with DOAS systems not only save energy but also exhibit improved indoor air quality which is especially important in businesses and schools.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

   No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change? Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

   All parties will be affected by this proposed code change.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

   There are no additional costs.

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[3] *Nonresidential HVAC Controls*, Codes and Standards Enhancement (CASE) Initiative 2022 California Energy Code, Sept. 2020, title24stakeholders.com/wp-content/uploads/2020/10/2022-T24-Final-CASE-Report-HVAC-Controls.pdf.

[4] Very High Efficiency Dedicated Outside Air Systems, Northwest Energy Efficiency Alliance, betterbricks.com/solutions/hvac/dedicated-outside-air-system-doas.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?

   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.

   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   The probable costs ($0.88 per square foot) are outlined in the cost/benefit analysis section above.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   The operational cost savings ($4-$5 of operational cost savings for every $1 spent in incremental costs) would be lost if this rule were not adopted.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

   There is no additional cumulative effect of the rule when accounting for other federal and state regulations.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Diana Burk

Email address: diana@newbuildings.org

Telephone number: 404-290-5442

Firm/Association affiliation, if any: New Buildings Institute

Date: 2/10/2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: 6.5.3.7

Code or rule section to be changed: 6.5.3.7, 6.5.3.8

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code TAG MR 1323

General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒
C. Will the proposed change encourage more uniform enforcement?	☐	☒
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

   ☐ change language contained the model code book? If so, list section(s).

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   X add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Add new Section 6.5.3.7 as shown (I-P units).

6.5.3.7 Low Power Fans. Fans that are not covered by Section 6.5.3.6 and having a *fan nameplate electrical input power* of less than 180 W or having a motor *nameplate horsepower* less than 1/12 hp shall meet the fan efficacy requirements of Table 6.5.3.7 at one or more rating points.

Exceptions to 6.5.3.7:

1. Fans in *space*-conditioning *equipment*.
2. Intermittently operating dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans.
3. Fans in radon mitigation systems.
4. Fans not covered within the scope of the test methods referenced in Table 6.5.3.7.5. Ceiling fans regulated under 10 CFR 430 Appendix U.

Modify Section 6.5.3.8 as shown (I-P).

6.5.3.~~7~~8 Ventilation Design. The required minimum *outdoor air* rate is the larger of the minimum *outdoor air* rate or the minimum exhaust air rate required by Standard 62.1, Standard 62.2, Standard 170, or applicable codes or accreditation standards. *Outdoor air ventilation systems* shall comply with one of the following:

a. Design minimum *system outdoor air* provided shall not exceed 135% of the required minimum *outdoor air* rate.

b. Dampers, *ductwork*, and *controls* shall be provided that allow the *system* to supply no more than the required minimum *outdoor air* rate with a single *set-point* adjustment.

c. The *system* includes exhaust air *energy* recovery complying with Section 6.5.6.1.

Table 6.5.3.7 Minimum Fan Efficacy for Low-Power Fans

System Type	Minimum Fan Efficacy[a,b], cfm/W	Test Method and Rating Conditions
HRV[c], ERV[d], or other system with exhaust air energy recovery	1.2	CAN/CSA 439-18
Transfer fans; in-line [e] supply or exhaust fan	3.8	ASHRAE Standard 51
Other exhaust fan, <90 cfm	2.8	
Other exhaust fan, ≥90 cfm and ≤200 cfm	3.5	
Other exhaust fan, >200 cfm	4.0	

a. Fan efficacy is the volumetric fan airflow rate divided by total fan motor electrical input power at a specified static pressure difference.
b. Fans shall be tested in accordance with the referenced test method. Fan efficacy shall be reported in the product listing or shall be derived from the fan motor electrical input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV or ERV, balanced, and in-line fans shall be determined at a static pressure difference not less than 0.2 in. of water for each airstream. Fan efficacy for other ducted fan systems shall be determined at a static pressure difference not less than 0.1 in. of water.
c. A heat recovery ventilator (HRV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the sensible energy, heat, from one airstream to the other.
d. An energy recovery ventilator (ERV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the total energy, heat and moisture, from one airstream to the other.
e. An in-line fan is an exhaust or supply fan installed with ductwork on both the fan inlet and outlet.

Table 6.5.3.7 Minimum Fan Efficacy for Low-Power Fans

System Type	Minimum Fan Efficacy [a, b], cfm/W (L/s/W)	Test Method and Rating Conditions
HRV [c], ERV [d], or other system with exhaust air energy recovery	.57	CAN/CSA 439-18
Transfer fans; in-line [e] supply or exhaust fan	1.8	ASHRAE Standard 51
Other exhaust fan, <42.5 L/s	1.3	
Other exhaust fan, ≥42.5 L/s and ≤94.4 L/s	1.7	
Other exhaust fan, >94.4 L/s	1.9	

a. Fan efficacy is the volumetric fan airflow rate divided by total fan motor electrical input power at a specified static pressure difference.
b. Fans shall be tested in accordance with the referenced test method. Fan efficacy shall be reported in the product listing or shall be derived from the fan motor electrical input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV or ERV, balanced, and in-line fans shall be determined at a static pressure difference not less than 50 Pa for each airstream. Fan efficacy for other ducted fan systems shall be determined at a static pressure difference not less than 25 Pa.

c. A heat recovery ventilator (HRV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the sensible energy, heat, from one airstream to the other.
d. An energy recovery ventilator (ERV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the total energy, heat and moisture, from one airstream to the other.
e. An in-line fan is an exhaust or supply fan installed with ductwork on both the fan inlet and outlet.

Renumber section 6.5.3.8:

6.5.3.8~~9~~ Occupied-Standby Controls

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

   No.

Need and Reason

1. Why is the proposed code change needed?

   This code proposal change is based on ASHRAE addendum a to Standard 90.1-2019.[1] Standard 90.1 is developed under ANSI-approved consensus procedures, and is under continuous maintenance. ASHRAE publishes changes to Standard 90.1 as individual addenda to the preceding Standard, and then bundles them together to form the next published edition. Because addenda are typically not recognized as part of Minnesota's energy code, it is important to incorporate the most crucial addenda to the Minnesota commercial energy code during the adoption process. This addenda establishes minimum fan efficacy requirements for low-power ventilation fans. It also establishes Standard 62.2 as the reference for determining the minimum ventilation rates for non transient dwelling units.

   Efficacy requirements for low-power ventilation fans were introduced in the 2012 IECC for whole-house ventilation in low-rise residential buildings. Both mid-rise residential and small commercial buildings often use small ventilation fans which has left a loophole in the code for common energy loads. These fans are often used for point-of-source contaminant exhaust and ventilation in multifamily buildings making them a common and potentially significant energy load. A large number of products on the market can meet these requirements and in fact, the requirement is far below the market average efficiency for bath vans and close to the market average for in-line fans.

2. Why is the proposed code change a reasonable solution?

   Exhaust fan efficacies were introduced in the code in 2012 IECC for whole-house ventilation in low-rise residential buildings, but have never been included in the commercial provisions of the IECC. Mid-rise residential occupancies and small commercial buildings often utilize the same small ventilation fans leaving a loophole for a common energy load. These fans are used for point-of-source contaminant exhaust and are frequently utilized as part of a ventilation strategy in multifamily buildings. These fans are also smaller than the threshold for fan size (1/12 HP) that is attached to the other commercial fan requirements. This makes them a common load, and a potentially significant load in multifamily buildings, that is completely unregulated in commercial buildings.

   This proposal adopts the table approach already utilized for these fans in the residential section of the code. However, it updates the efficiency requirements. The current residential IECC fan efficacies are from an older version of Energy Star (Version 2.0), so these have been updated to align the latest

[1] *ANSI/ASHRAE/IES Addendum a to ANSI/ASHRAE/IES Standards 90.1-2019*, ASHRAE Standards Committee, 7 Oct. 2020, https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_a_20201030.pdf

Energy Star requirement Version 4.0. These fan efficacy values are very conservative based on what is currently on the market.

It sets the efficiency requirement at a level that can reasonably be met by a large number of products available on the market. According to the HVI database of fans, the average efficiency of bath fans is around 7 CFM/W, and the average efficiency of in-line fans is 3.1. This proposal, therefore, places the requirement far below the market average efficiency for bath fans and close to the market average for in-line fans, making this a reasonable requirement.

3. What other considerations should the TAG consider?

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   According to a similar amendment (CE140-19) to the 2018 IECC, increasing fan efficacy could increase the cost of construction. The amendment states: "Cost for the kinds of fans covered by this requirement are not driven solely by efficacy. Cost is also a function of flow rate, finishes, design and noise and whether they include other features like lights, sensors, or heaters. In some cases, fans that meet this requirement can be obtained for less other fans that do not. Nevertheless, a comparison of the low-cost exhaust fans shows that this proposal can result in no incremental first costs or short simple paybacks where incremental costs are incurred."

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.

   If a cost is incurred, it will be offset by energy savings.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

   No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

   All segments of the industry will be affected by this code change. Architects and engineers will have to specify fans that meet this code requirement. Construction contractors will have to install that fan and building officials and inspectors will have to ensure the fans meet the requirement in code.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

   None.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?

No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.

   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   As stated above, the incremental costs associated with this change are either negligible or very small resulting in very short payback periods. Building owners and individuals paying utility bills will be the parties who are most affected by this code requirement.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Not adopting this code requirement would result in increased utility bills for individuals living in mid-rise multifamily housing and small commercial business owners.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

   There is no additional cumulative effect of the rule when accounting for other federal and state regulations.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Chris Rosival

Date: 2-26-21

Email address: chris.rosival@state.mn.us

Model Code:
ANSI/ASHRAE/IES Standard 90.1-2019

Telephone number: 651-284-5510

Code or Rule Section:
Replace Table 6.8.2 Minimum Duct Insulation R-Value

Firm/Association affiliation, if any: DLI/CCLD

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): 1323 Minnesota Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   X change language contained the model code book? If so, list section(s).
   Table 6.8.2 Minimum Duct Insulation R-Value

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.

No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Replace ASHRAE 90.1-2019 Table 6.8.2 Minimum Duct Insulation R-Value with Minnesota Amendment to IECC Table C403.11.1 with added footnote “g”.

MINIMUM REQUIRED DUCT AND PLENUM INSULATION

DUCTS FOR OTHER THANDWELLING UNITS[a, b]	**SUPPLY DUCT REQUIREMENTS[c, d]**	**RETURN DUCT REQUIREMENTS[c, d]**	**EXHAUST DUCT AND RELIEF DUCT REQUIREMENTS[c, d, e] g.**
Exterior of building	R-12, V and W	R-12, V and W	R-12, V and W
Attics, garages, and ventilated crawl spaces	R-12 and V	R-12 and V	R-6 and V
TD greater than 40°F	R-5 and V	None	R-5 and V
TD greater than 15°F and less than or equal to 40°F	R-3.3 and V	None	R-3.3 and V
Within concrete slab or within ground	R-3.5 and V	R-3.5 and V	None
Within conditioned spaces	None[f]	None	None
TD less than or equal to 15°F	None	None	None

°C = [(°F) - 32]/1.8

a. Ducts located within the building thermal envelope shall be located completely on the conditioned side of the air barrier.

b.TD = Design temperature difference between the air in the duct and the ambient temperature outside of the duct, unless the duct type and location are specifically identified above.

c. V = Vapor retarder required in accordance with the IMC. When a vapor retarder is required, duct insulation required by this section shall be installed without respect to other building envelope insulation.

D .W = Approved weatherproof barrier.

e. Insulation is only required in the conditioned space for a distance of 3 feet (914 mm) from the exterior or unconditioned space.

f. If the temperature rise is greater than 3°F from the supply air connection of the air handling unit to the furthest outlet, duct insulation shall be required for the entire length or for sufficient length to limit the temperature rise to 3°F.

g. Insulation is not required on the exterior if low leak dampers are installed at roof or wall line or the exhaust is designed to be operated continuously.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?
   The current insulation requirements in the Minnesota Energy Code (IECC – Table C403.11.1) are the result of much discussion in past code committees and are more stringent and easier to understand than the ASHRAE 90.1-2019 requirements. Those past insulation discussions included insulation thickness and identifying more clearly where the insulation is required. The ASHRAE 90.1-2019 table can also be confusing in how to apply the table to duct systems..

   The ASHRAE 90.1-2019 document does not address exhaust duct insulation.

   The reason for the recommended addition of subparagraph “g” is to provide better clarity to the extent of insulating the exhaust ductwork.

2. Why is the proposed code change a reasonable solution?
   This change brings forward the current duct insulation requirements which have been thoroughly vetted by past code committees and clarifies requirements for insulating exhaust ductwork which is not currently addressed. Energy savings is not addressed in ASHRAE 90.1-2019 for exhaust duct. Adding this table addresses the energy loss that could happen without insulation on exhaust ducts.

3. What other considerations should the TAG consider?

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.
   Increase compared to ASHRAE 90.1-2019 but no change compared to current Minnesota Energy Code. Compared to ASHRAE 90.1-2019, insulating the exhaust ductwork could minimally increase costs because of time and material for insulation but energy savings will minimize the increase. Not all exhaust ductwork will be required to be insulated, and subparagraph “g” helps to clarify where the requirements apply.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   The cost of insulating will be offset by the energy savings from heat loss and protection of the building from condensation by the exhaust duct.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   None. This proposed change will help to clarify insulation requirements.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.
   No

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?
   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?
   None

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   Not insulating the exhaust duct could cause energy loss and building damage through condensation leaking on the exterior of the exhaust duct.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.
   No

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.
   N/A

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: John G. Smith, P.E.

Email address: jsmith@michaudcooley.com

Telephone number: 612 -867-3145

Date: February 27, 2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: Table 6.8.3-1 Heating Pipe Insulation

Firm/Association affiliation, if any:

Code or rule section to be changed: MR 1323

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Table 6.8.3-1 Minimum Piping Insulation Thickness Heating and Hot Water Systems

   Add the following subparagraph:

   > f. Insulation requirements do not apply to those sections of piping used as the radiant heat source for radiant heating systems.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?

   This addition carries forward an existing statement in the current Minnesota Energy Code. Insulating the described piping would be counterproductive to the pipes intended purpose- provide radiant heat.

2. Why is the proposed code change a reasonable solution?

   It inserts the current rule language into the 90.1 requirements.

3. What other considerations should the TAG consider? None

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   No cost change. The modification carries forward an existing exception.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   N/A

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain. No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   None

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   If the radiant heating piping is insulated, it will not provide its intended purpose – provide heat.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

N/A

Addenda to ASHRAE 90.1-2019

Addenda and associated SONAR can be found at: Addenda to Standard 90.1-2019 (ashrae.org)

Addendum a to Standard 90.1-2019

Add new Section 6.5.3.7 as shown (I-P units).

6.5.3.7 Low Power Fans. Fans that are not covered by Section 6.5.3.6 and having a *fan nameplate electrical input power* of less than 180 W or having a motor *nameplate horsepower* less than 1/12 hp shall meet the fan efficacy requirements of Table 6.5.3.7 at one or more rating points.

Exceptions to 6.5.3.7:

1. Fans in *space*-conditioning *equipment*.
2. Intermittently operating dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans.
3. Fans in radon mitigation systems.
4. Fans not covered within the scope of the test methods referenced in Table 6.5.3.7.5. Ceiling fans regulated under 10 CFR 430 Appendix U.

[. . .]

Add new Section 6.5.3.7 (SI units).

6.5.3.7 Low Power Fans. Fans that are not covered by Section 6.5.3.6 and having a *fan nameplate electrical input power* of less than 180 W, or having a motor *nameplate horsepower* less than 62.1 W, shall meet the fan efficacy requirements of Table 6.5.3.7 at one or more rating points.

Exceptions to 6.5.3.7:

1. Fans in *space*-conditioning *equipment*.
2. Intermittently operating dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans.
3. Fans in radon mitigation systems.
4. Fans not covered within the scope of the test methods referenced in Table 6.5.3.7.5. Ceiling fans regulated under 10 CFR 430 Appendix U.

[. . .]

Modify Section 6.5.3.8 as shown (I-P and SI units).

6.5.3.~~7~~8 Ventilation Design. The required minimum *outdoor air* rate is the larger of the minimum *outdoor air* rate or the minimum exhaust air rate required by Standard 62.1, Standard 62.2, Standard 170, or applicable codes or accreditation standards. *Outdoor air ventilation systems* shall comply with one of the following:

a. Design minimum *system outdoor air* provided shall not exceed 135% of the required minimum *outdoor air* rate.
b. Dampers, *ductwork*, and *controls* shall be provided that allow the *system* to supply no more than the required minimum *outdoor air* rate with a single *set-point* adjustment.
c. The *system* includes exhaust air *energy* recovery complying with Section 6.5.6.1.

Table 6.5.3.7 Minimum Fan Efficacy for Low-Power Fans

System Type	Minimum Fan Efficacy[a, b], cfm/W	Test Method and Rating Conditions
HRV[c], ERV[d], or other system with exhaust air energy recovery	1.2	CAN/CSA 439-18
Transfer fans; in-line[e] supply or exhaust fan	3.8	ASHRAE Standard 51
Other exhaust fan, <90 cfm	2.8	
Other exhaust fan, ≥90 cfm and ≤200 cfm	3.5	
Other exhaust fan, >200 cfm	4.0	

a. Fan efficacy is the volumetric fan airflow rate divided by total fan motor electrical input power at a specified static pressure difference.
b. Fans shall be tested in accordance with the referenced test method. Fan efficacy shall be reported in the product listing or shall be derived from the fan motor electrical input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV or ERV, balanced, and in-line fans shall be determined at a static pressure difference not less than 0.2 in. of water for each airstream. Fan efficacy for other ducted fan systems shall be determined at a static pressure difference not less than 0.1 in. of water.
c. A heat recovery ventilator (HRV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the sensible energy, heat, from one airstream to the other.
d. An energy recovery ventilator (ERV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the total energy, heat and moisture, from one airstream to the other.
e. An in-line fan is an exhaust or supply fan installed with ductwork on both the fan inlet and outlet.

Table 6.5.3.7 Minimum Fan Efficacy for Low-Power Fans

System Type	Minimum Fan Efficacy[a, b], cfm/W (L/s/W)	Test Method and Rating Conditions
HRV[c], ERV[d], or other system with exhaust air energy recovery	0.57	CAN/CSA 439-18
Transfer fans; in-line[e] supply or exhaust fan	1.8	ASHRAE Standard 51
Other exhaust fan, <42.5 L/s	1.3	
Other exhaust fan, ≥42.5 L/s and ≤94.4 L/s	1.7	
Other exhaust fan, >94.4 L/s	1.9	

a. Fan efficacy is the volumetric fan airflow rate divided by total fan motor electrical input power at a specified static pressure difference.
b. Fans shall be tested in accordance with the referenced test method. Fan efficacy shall be reported in the product listing or shall be derived from the fan motor electrical input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV or ERV, balanced, and in-line fans shall be determined at a static pressure difference not less than 50 Pa for each airstream. Fan efficacy for other ducted fan systems shall be determined at a static pressure difference not less than 25 Pa.
c. A heat recovery ventilator (HRV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the sensible energy, heat, from one airstream to the other.
d. An energy recovery ventilator (ERV) is a mechanically powered ventilating device with separate intake and exhaust airstreams and a heat exchanger to transfer a portion of the total energy, heat and moisture, from one airstream to the other.
e. An in-line fan is an exhaust or supply fan installed with ductwork on both the fan inlet and outlet.

Modify Section 12 as shown (I-P and SI units).

12. NORMATIVE REFERENCES

Reference	Title
ASHRAE **~~1791 Tullie Circle, NE, Atlanta, GA 30329~~** **180 Technology Parkway NW** **Peachtree Corners, GA 30092**	
ANSI/ASHRAE Standard 51-2016	Laboratory Methods Of Testing Fans For Certified Aerodynamic Performance Rating
ANSI/ASHRAE Standard 62.2-2019	Ventilation and Acceptable Indoor Air Quality in Residential Buildings

Modify references to old section numbering as follows (I-P and SI units).

6.3.2 Criteria [. . .]

r. The system shall comply with the demand control ventilation requirements in Section 6.4.3.8 and the ventilation design requirements in Section 6.5.3.~~7~~8.

[. . .]

Exceptions to 11.5.2(d):

1. [. . .]
2. Where the minimum *outdoor air* intake flow in the proposed design is provided in excess of the amount required by Section 6.5.3.~~7~~8, the baseline building design shall be modeled to reflect the minimum amount required by Section 6.5.3.~~7~~8.

Addendum c to Standard 90.1-2019

Revise Sections 6.3.2 and 6.4.3.3 of the Standard as shown (I-P and SI).

6.3.2 Criteria. The *HVAC system* must meet all of the following criteria:

[. . .]

j. *Systems* serving *spaces* other than ~~hotel/motel guest rooms~~*residential spaces*, ~~and other than those~~ that do not require~~ing~~ continuous operation~~, which have both~~ with a cooling or heating capacity greater than ~~15,000~~ 7000 Btu/h (2.1 kW) ~~and a supply fan motor power greater than 0.75 hp, shall be provided with a time clock that (1) can start and stop the *system* under different schedules for seven different day types per week, (2) is capable of retaining programming and time setting during a loss of power for a period of at least ten hours, (3) includes an accessible *manual* override that allows temporary operation of the *system* for up to two hours, (4) is capable of and configured with temperature *setback* down to 55°F during off hours, and (5) is capable of capable of and configured with temperature setup to 90°F during off hours.~~ shall comply with Sections 6.4.3.3.1 and 6.4.3.3.2.

k. *Systems* serving *residential spaces* other than hotel/motel guest rooms shall comply with Section 6.4.3.3.1 and 6.4.3.3.2 except for electric resistance heaters rated at 1.5 kW or less with a *readily accessible manual control* that lowers the *set point* or turns the unit off.

l. *Systems* serving hotel/motel guest rooms shall comply with Section 6.4.3.3.5.

[. . .]

6.4.3.3 Off-Hour Controls. *HVAC systems* shall have the off-hour *controls* required by Sections 6.4.3.3.1 through 6.4.3.3.5.

Exceptions to 6.4.3.3:

1. *HVAC systems* intended to operate continuously.

2. *HVAC systems* not serving *residential spaces* and having a design heating capacity and cooling capacity less than ~~15,000~~ 7000 Btu/h (2.1 kW) that are equipped with a *readily accessible manual* on/off *controls*~~.~~

6.4.3.3.1 Automatic Shutdown. *HVAC systems* shall be equipped with at least one of the following:

a. *Controls* that can start and stop the *system* under different time schedules for seven different day types per week, are capable of retaining programming and time setting during loss of power for a period of at least ten hours, and include an accessible *manual* override or equivalent function that allows temporary operation of the *system* for up to two hours.
b. An *occupancy sensor* that is capable of shutting the *system* off when no occupant is sensed for a period of up to 30 minutes.
c. A manually operated timer capable of being adjusted to operate the *system* for up to two hours.
d. An interlock to a security *system* that shuts the *system* off when the security *system* is activated.

Exceptions to 6.4.3.3.1:

1. *Systems* serving ~~*R*~~*residential* occupancies with ~~may use~~ *controls* that can start and stop the *system* under at least two different time schedules per week.
2. *Systems* serving non-*residential* occupancies where heating or cooling capacity is less than 15,000 Btu/h (4.4 kW) with controls that can start and stop the *system* under at least two different time schedules per week.

6.4.3.3.2 Setback Controls. Heating *systems* shall be equipped with *controls* capable of and configured to *automatically* restart and temporarily operate the *system* as required to maintain zone temperatures above an adjustable heating *set point* at least 10°F below the occupied heating *set point*. Cooling *systems* shall be equipped with *controls* capable of and configured to *automatically* restart and temporarily operate the *mechanical cooling system* as required to maintain zone temperatures below an adjustable cooling *set point* at least 5°F above the occupied cooling *set point* or to prevent high *space* humidity levels.

Exception to 6.4.3.3.2: *Radiant heating systems* capable of and configured with a *setback* heating *set point* at least 4°F below the occupied heating *set point*.

Addendum d to Standard 90.1-2019

Add new definition to Section 3.2 as shown (I-P and SI units).

3.2 Definitions

[. . .]

parking garage section: a part of a parking garage where airflow is restricted from other parts of the garage by solid walls.

[. . .]

Modify Section 6.4.3.4.5 as shown (I-P and SI units).

6.4.3.4.5 ~~Enclosed~~ Parking Garage Ventilation Systems. ~~Enclosed p~~Parking garage *ventilation systems* shall meet all of the following:

a. Separate *ventilation systems* and *control systems* shall be provided for each *parking garage section*.

b. *Control systems* for each *parking garage section* shall *automatically* detect and control contaminant levels and ~~stage fans or modulate~~ shall be capable of and configured to reduce fan airflow ~~rates~~ to ~~50%~~ 20% or less of *design capacity*~~, provided acceptable contaminant levels are maintained~~.

c. The *ventilation system* for each *parking garage section* shall have *controls* and devices that result in fan motor *demand* of no more than 30% of design wattage at 50% of the design airflow.

Exceptions to 6.4.3.4.5:

~~1.~~ Garages *ventilation systems* serving a single *parking garage section* having a total *ventilation system motor nameplate horsepower* (*ventilation system motor nameplate kilowatt*) not exceeding 5 hp (3.7 kW) at *fan system design conditions* ~~less than 30,000 ft2 (2800 m^2) with *ventilation systems that do not use*~~ and where the *parking garage section* has no *mechanical cooling* or *mechanical heating*.

~~2. Garages that have a garage area to *ventilation system motor nameplate horsepower* ratio that exceeds 1500 ft2/hp and do not utilize *mechanical cooling* or mechanical heating.~~

~~3. Where not permitted by the authority having jurisdiction.~~

Addendum f to Standard 90.1-2019

Modify the standard as follows (I-P units).

Table 6.5.1-2 Eliminate Required Economizer for Comfort Cooling by Increasing Cooling *Efficiency*

Climate Zone	*Efficiency* Improvement[a]
2A	17%
2B	21%
3A	27%
3B	32%
3C	65%
4A	42%
4B	49%
4C	64%
5A	49%
5B	59%
5C	74%
6A	56%
6B	65%
7	72%
8	77%

a. If a unit is rated with an annualized or part-load metric ~~*IPLV*, *IEER*, or *SEER*~~, then to eliminate the required economizer, only the annualized or part-load minimum cooling *efficiency* of the ~~HVAC~~ unit must be increased by the percentage shown. If the ~~HVAC~~ unit is only rated with a full-load metric like *EER* cooling then these must be increased by the percentage shown. To determine the *efficiency* required to eliminate the economizer when the unit *equipment efficiency* is rated with an energy-input divided by a thermal-output metric, the metric shall first be converted to COP by the *efficiency* improvement percentage shown. The COP shall then be converted back to the original rated metric to establish the *efficiency* required to eliminate the economizer.

Informative Note: Some examples of annualized or part-load metrics are: IPLV.IP, IEER, and SEER.

Modify the standard as follows (SI units).

Table 6.5.1-2 Eliminate Required Economizer for Comfort Cooling by Increasing Cooling *Efficiency*

Climate Zone	*Efficiency* Improvement[a]
2A	17%
2B	21%
3A	27%
3B	32%
3C	65%
4A	42%
4B	49%
4C	64%
5A	49%
5B	59%
5C	74%
6A	56%
6B	65%
7	72%
8	77%

a. If a unit is rated with an annualized or part-load metric ~~*IPLV*, *ICOP*, or *ISCOP*~~, then to eliminate the required economizer, only the annualized or part-load minimum cooling *efficiency* of the ~~HVAC~~ unit must be increased by the percentage shown. If the ~~HVAC~~ unit is only rated with a full-load metric like *COP* cooling then these must be increased by the percentage shown.

Informative Note: Some examples of annualized or part-load metrics are: IPLV.SI, $ISCOP_C$, and $SCOP_C$.

Addendum g to Standard 90.1-2019

Modify Section 6.5.1.1.5 as shown (I-P and SI).

6.5.1.1.5 Relief of Excess Outdoor Air

a. *Systems* shall provide ~~a~~ one of the following means to relieve excess *outdoor air* during *air economizer* operation to prevent over pressurizing the *building*~~.~~:

1. Return or relief fan(s) meeting the requirements of Section 6.5.3.2.4.
2. Barometric or motorized damper relief path with a total pressure drop at design relief airflow rate less than 0.10 in. of water (25 Pa) from the occupied *space* to outdoors. Design relief airflow rate shall be the design supply airflow rate minus any continuous exhaust flows, such as toilet exhaust fans, whose makeup is provided by the economizer *system*.

b. The relief air outlet shall be located so as to avoid recirculation into the *building*.

Addendum h to Standard 90.1-2019

Revise Section 4.2.1.1 as shown (I-P and SI units)

4.2.1.1 New Buildings

[. . .]

BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1. use "All others." Where a *building* has multiple *building* area types, the required BPF shall be equal to the area- weighted average of the *building* area types based on their *gross floor area*.

Addendum i to Standard 90.1-2019

Modify the standard as shown (I-P and SI units).

G3.1.2.10 Exhaust Air Energy Recovery. Individual fan *systems* that have both a design supply air capacity of 5000 cfm (2400 L/s) or greater and have a minimum design *outdoor air* supply of 70% or greater shall have an *energy* recovery *system* with at least 50% *enthalpy recovery ratio*. Fifty percent *enthalpy recovery ratio* shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and return air at *design conditions*. Provision shall be made to bypass or *control* the heat recovery *system* to permit *air economizer* operation, where applicable.

Exceptions to G3.1.2.10: If any of these exceptions apply, exhaust air *energy* recovery shall not be included in the *baseline building design*:

1. *Systems* serving *spaces* that are not cooled and that are heated to less than 60°F (16°C).
2. *Systems* exhausting toxic, flammable, or corrosive fumes or paint or dust. This exception shall only be used if exhaust air *energy* recovery is not used in the *proposed design*.
3. Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96. This exception shall only be used if exhaust air *energy* recovery is not used in the *proposed design*.
4. Heating *systems* in Climate Zones 0 through 3.
5. Cooling *systems* in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
6. Where the largest exhaust source is less than 75% of the design *outdoor airflow*. This exception shall only be used if exhaust air *energy* recovery is not used in the *proposed design*.
7. *Systems* requiring dehumidification that employ *energy* recovery in series with the cooling coil. This exception shall only be used if exhaust air *energy* recovery and series-style *energy* recovery coils are not used in the *proposed design*.
8. Systems serving laboratory HVAC zones with a total laboratory exhaust volume greater than 15,000 cfm (7100 L/s).

Addendum k to Standard 90.1-2019

Modify Section 11.5.2 as shown (I-P and SI).

11.5.2 HVAC Systems. The *HVAC system* type and related performance parameters for the *budget building design* shall be determined from Figure 11.5.2, the *system* descriptions in Table 11.5.2-1 and accompanying notes, and the following rules:

a. **Budget *Building Systems* not Listed.** Components and parameters not listed in Figure 11.5.2 and Table 11.5.2-1 or otherwise specifically addressed in this subsection shall be identical to those in the *proposed design*.

[. . .]

h. **Fan *System Efficiency*.** Fan *system efficiency* (bhp per cfm (input kW per L/s) of supply air, including the effect of belt losses but excluding motor and motor drive losses) shall be the same as the *proposed design* or up to the limit prescribed in Section 6.5.3.1, whichever is smaller. If this limit is reached, each fan shall be proportionally reduced in brake horsepower (input kW) until the limit is met. Fan electrical power shall then be determined by adjusting the calculated fan hp (kW) by the minimum motor *efficiency* prescribed by Section 10.4.1 for the appropriate motor size for each fan.

Exception to 11.5.2(h): When a *proposed design* includes *energy* recovery but it is not required in the *budget building design* per Section 11.5.2(d), the fan power of those baseline *systems* shall be equal to either the *proposed design system* or the fan power limit in Section 6.5.3.1 calculated without fan power credit for *energy* recovery, whichever is less.

Addendum l to Standard 90.1-2019

Revise the Standard as follows (I-P and SI units).

Table G3.1 Modeling Requirements for Calculating Proposed and *Baseline Building Performance*

No.	*Proposed Building Performance*	*Baseline Building Performance*
5. *Building Envelope*		
[. . .]		[. . .] c. ***Vertical Fenestration Areas.*** For *building* area types included in Table G3.1.1-1, *vertical fenestration areas* for new *buildings* and additions shall equal the percentage ~~that~~ in Table G3.1.1-1 ~~based on the area~~ multiplied by the gross area of ~~gross~~ *above-grade walls* that separate *conditioned spaces* and *semiheated spaces* from the exterior. Where a *building* has multiple *building* area types, each type shall use the values in the table. ~~The *vertical fenestration* shall be distributed on each face of the *building* in the same proportion as in the *proposed design*.~~ For *building* areas not shown in Table G3.1.1-1, *vertical fenestration areas* for new *buildings* and additions shall equal that in the *proposed design* or 40% of gross *above-grade wall* area, whichever is smaller, and shall be distributed on each face of the *building* in the same proportions in the *proposed design*. The *vertical fenestration* shall be distributed on each face of the *building* in the same proportion as in the *proposed design*. If this would cause the combined *vertical fenestration* and *opaque door* area on a given face to exceed the *gross above-grade wall* area on that face, then the *vertical fenestration area* on other faces shall be increased in proportion to the *gross above-grade wall* area of these faces such that the total baseline *building vertical fenestration area* is equal to that calculated following Table G3.1.1-1. The *fenestration area* for an *existing building* shall equal the existing *fenestration area* prior to the proposed work and shall be distributed on each face of the *building* in the same proportions as the *existing building*.

Table G3.1.1-1 Baseline *Building Vertical Fenestration* ~~Percentage of Gross *Above-Grade Wall*~~ Area

Building Area Types[a]	Baseline *Building* *Vertical Fenestration* Area as a Percentage of Gross *Above-Grade Wall* Area
[. . .]	[. . .]

Addendum m to Standard 90.1-2019

Modify the standard as follows (I-P and SI units).

6.4.3.4.1 Stair and Elevator Shaft Vent Dampers. Where s~~S~~tair and elevator shafts have vents, they shall be equipped with motorized dampers that are capable of and configured to *automatically* close during normal *building* operation and are interlocked to only open as required by fire and smoke detection systems, or by *thermostatic control systems*.

Exception to 6.4.3.4.1: Nonmotorized gravity back draft dampers are acceptable in *buildings* less than three stories in height and for *buildings* of any height located in Climate Zones 0, 1, 2, and 3.

Addendum n to Standard 90.1-2019

Modify the standard as shown (I-P and SI units).

6.5.2.6 Ventilation Air Heating Control. Units that provide *ventilation* air to multiple zones and operate in conjunction with zone heating and cooling *systems* shall not use heating or heat recovery to warm supply air above 60°F (16°C) when representative *building* loads or *outdoor air* temperature indicate that the majority of zones require cooling.

Exception to 6.5.2.6: Units that heat the airstream using only series *energy recovery* when representative *building* loads or *outdoor air* temperature indicate that the majority of zones require cooling in Climate Zones 0A, 1A, 2A, 3A, and 4A.

Addendum p to Standard 90.1-2019

Modify the standard as follows (I-P and SI units).

3.2 Definitions

[. . .]

lighting power allowance (LPA), exterior: the maximum lighting power in watts allowed for the exterior of a *building*.

lighting power allowance (LPA), interior: the maximum lighting power in watts allowed for the interior of a *building*.

[. . .]

3.3 Abbreviations and Acronyms

[. . .]

LPA	maximum lighting power allowed in watts (W)

[. . .]

9.1.2 Lighting Alterations. ~~For the *alteration* of any *lighting system* in an interior *space*, that *space* shall comply with the *lighting power density* (*LPD*) allowances of Section 9.5.1 or 9.6.1 and the *control* requirements of Section 9.4.1.1 (a), (b), (c), (d), (g), (h), and (i), as applicable to that *space*.~~

~~For the *alteration* of any *lighting system* for the exterior of a *building* application, that *lighting system* shall comply with the *lighting power density* (*LPD*) allowances of Section 9.4.2 applicable to the area illuminated by that *lighting system* and the applicable *control* requirements of Sections 9.4.1.4 and 9.4.2.~~

The *alteration* of a *lighting system* in an interior *space* shall comply with Section 9.1.2.1. The *alteration* of a *lighting system* in an exterior area shall comply with Section 9.1.2.2.

~~**Exceptions to 9.1.2:**~~

1. ~~*Alterations* that involve 20% or less of the connected lighting load in a *space* or area need not comply with these requirements, provided that such *alterations* do not increase the installed lighting power.~~
2. ~~Lighting *alterations* that only involve replacement of *lamps* plus *ballasts*/*drivers* or only involve one-for-one *luminaire* replacement need only comply with *LPD* requirement and Section 9.4.1.1(h) or 9.4.1.1(i).~~
3. ~~Routine maintenance or *repair* situations.~~

The maintenance of an existing *lighting system* to return it to working order shall not be considered an *alteration*. Retrofitting a *luminaire* for which the original *lamps* and *ballast/driver* are replaced with a new *lamp/light source* and *driver*/*ballast* that was not a component of the original *luminaire* shall be considered an *alteration*.

9.1.2.1 Lighting Alterations for Interior Building Spaces. The *alteration* of a *lighting system* in an interior *space* shall meet one of the following requirements:

a. The *alteration* shall comply with Section 9.2 when the total wattage of all new and retrofitted *luminaires* is greater than 2000 W.
b. When the total wattage of all new and retrofitted *luminaires* is 2000 W or less, each altered *space* shall comply with the *LPA* of Table 9.6.1 and Section 9.6.2, or the *alteration* shall result in a new wattage at least 50% below the original wattage of each altered *lighting system*. Additionally, the new and retrofitted lighting shall comply with the control requirements of Sections 9.4.1.1(a), 9.4.1.1(h), 9.4.1.1(i) as applicable to each altered *space* as shown in Table 9.6.1 and Section 9.6.2.

9.1.2.2 Lighting Alterations for Exterior Building Areas. The *alteration* of a *lighting system* for an exterior area shall use only the area-specific allowances in Table 9.4.2-2 and shall not use the base site allowances to determine the *LPA*. Additionally, the exterior alteration shall meet one of the following:

a. The *alteration* shall comply with Section 9.2 when the total number of new and retrofitted *luminaires* is greater than 10 or where the combined length of new and retrofitted linear *luminaires* is greater than 20 linear feet (6.1 linear metres).
b. Where the total number of new and retrofitted *luminaires* is not greater than 10 or where the combined length of new and retrofitted linear *luminaires* is not greater than 20 linear feet (6.1 linear metres) of linear *luminaires*, the total wattage of the *alteration* shall be no greater than the maximum *LPA* permitted by Table 9.4.2-2, or the total new wattage shall be at least 50% below the total original wattage of that *lighting system*. Additionally, the new and retrofitted lighting shall comply with the control requirements of Section 9.4.1.4(a).

[. . .]

9.1.4 Interior and Exterior Luminaire Wattage

[. . .]

f. The wattage of a retrofitted *luminaire* shall be the *manufacturer's labeled* input power of the new *light source* plus *driver*.
~~f~~g. The wattage of all other miscellaneous lighting *equipment* shall be the specified wattage of the lighting *equipment*.

Addendum q to Standard 90.1-2019

Modify Table G3.7 as shown (I-P and SI units).

Table G3.7 *Performance Rating Method Lighting Power Density* Allowances and *Occupancy Sensor* Reductions Using the Space-by-Space Method (I-P)

Common *Space* Types[a]	*Lighting Power Density*, W/ft^2	*Occupancy Sensor* Reduction[b]
[. . .]		
Laboratory		
~~In or as a classroom~~	~~1.40~~	~~None~~
All ~~other~~ laboratory except in or as a classroom	1.40	10%
[. . .]		

[. . .]

Table G3.7 *Performance Rating Method Lighting Power Density* Allowances and *Occupancy Sensor* Reductions Using the Space-by-Space Method (SI)

Common *Space* Types[a]	*Lighting Power Density*, W/m^2	*Occupancy Sensor* Reduction[b]
[. . .]		
Laboratory		
~~In or as a classroom~~	~~15.07~~	~~None~~
All ~~other~~ laboratory except in or as a classroom	15.07	10%
[. . .]		

[. . .]

Addendum r to Standard 90.1-2019

Modify Section 6.4.3.3.3 as shown (I-P and SI units).

6.4.3.3.3 Optimum Start Controls. Individual heating and cooling *systems* with *setback controls* and *DDC* shall have *optimum start controls*. The *control* algorithm shall, as a minimum, be a function of the difference between *space* temperature and occupied *set point*, the outdoor temperature, and the amount of time prior to scheduled occupancy. Mass radiant *floor* slab *systems* shall incorporate *floor* temperature into the optimum start algorithm.

Exception to 6.4.3.3.3: *Residential spaces* are not required to have *optimum start controls*.

Addendum s to Standard 90.1-2019

Modify Section 3.2 as shown (I-P and SI units).

3.2 Definitions

[. . .]

north-oriented: facing within ~~45~~67.5 degrees of true north in the northern hemisphere~~; (however,~~ facing within 67.5 degrees of true south in the southern hemisphere.~~)~~

south-oriented: facing within 45 degrees of true south in the northern hemisphere; facing within 45 degrees of true north in the southern hemisphere.

east-oriented: facing within 45 degrees of true east to the south and within less than 22.5 degrees of true east to the north in the northern hemisphere; facing within 45 degrees of true east to the north and within less than 22.5 degrees of true east to the south in the southern hemisphere.

west-oriented: facing within 45 degrees of true west to the south and within less than 22.5 degrees of true west to the north in the northern hemisphere; facing within 45 degrees of true west to the north and within less than 22.5 degrees of true west to the south in the southern hemisphere.

~~***reflectance:*** the ratio of the light reflected by a surface to the light incident upon it.~~

[. . .]

Modify Section 5.5.3.1.1 as shown (I-P and SI units).

5.5.3.1.1 Roof Solar Reflectance and Thermal Emittance. *Roofs* in Climate Zones 0 through 3 shall have one of the following:

a. A minimum three-year-aged solar ~~*reflectance*~~reflectance of 0.55 and a minimum three-year-aged thermal *emittance* of 0.75 when tested in accordance with CRRC S100.
b. A minimum Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 Btu/h·ft^2·°F (12 W/m^2·K), based on three-year-aged solar ~~*reflectance*~~reflectance and three-year-aged thermal *emittance* tested in accordance with CRRC S100.
c. Increased *roof* insulation levels found in Table 5.5.3.1.1.

The values for three-year-aged solar ~~*reflectance*~~reflectance and three-year-aged thermal *emittance* shall be determined by a laboratory accredited by a nationally recognized accreditation organization and shall be *labeled* and certified by the *manufacturer*.

[. . .]

Modify Section 5.53.2 as shown (I-P and SI units).

5.5.3.2 Above-Grade Wall Insulation. All *above-grade* walls shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8.

Exception to 5.5.3.2: Alternatively, for *mass walls* [. . .]

5.5.3.2.1 Walls That Are Both above and below Grade. When a *wall* consists of both *above-grade* and *below-grade* portions [. . .]

5.5.3.2.2 Wall Solar Reflectance and Thermal Emittance. ~~In addition, f~~For Climate Zone 0, *above-grade east-oriented*, *south-oriented*, and *west-oriented walls* ~~*above-grade walls*~~ shall comply with ~~one of the following~~ subparagraph (a) or (b):

a. ~~For east and west *walls*, a~~A minimum of 75% of the *opaque wall* area shall have a minimum ~~SRI of 29~~ area-weighted initial solar reflectance of 0.30 when tested in accordance with ASTM C1549 with AM1.5GV output, or ASTM E903 with the AM1.5GV output, or determined in accordance with *generally accepted engineering standards*, and a minimum *emittance* or emissivity of 0.75 when tested in accordance with ASTM C835, C1371, E408, or determined in accordance with *generally accepted engineering standards.* For the portion of the *opaque wall* that is glass spandrel area, a minimum solar ~~*reflectance*~~ reflectance of 0.29 determined in accordance with NFRC 300 or ISO 9050 shall be permitted. ~~Each *wall* is allowed to be considered separately.~~ Area-weighting is permitted only between the *south-*, *east-*, and *west-oriented walls* and only between *walls* of the same *space conditioning category*.

b. ~~b.~~ ~~For east and west *walls*, a~~A minimum of 30% of the *above-grade wall* area shall be shaded through the use of ~~shade providing plants,~~ manmade structures, *existing buildings*, hillsides, permanent *building* projections, *on-site renewable energy systems*, or a combination of these. Shade coverage shall be calculated by projecting the shading surface downward on the *wall* at an angle of 45 degrees. ~~at 10 a.m. for the east oriented *walls* and 3 p.m. for the west oriented *walls* on the summer solstice.~~

~~The *building* is allowed to be rotated up to 45 degrees to the nearest cardinal *orientation* for purposes of calculations and showing compliance.~~

Exception to 5.5.3.2.2: *Exterior walls* of *semiheated spaces*.

[. . .]

Modify Section 5.5.4.5 as shown (I-P and SI units).

5.5.4.5 Fenestration Orientation

[. . .]

where

A_w = west-oriented *vertical fenestration area* ~~(oriented within 45 degrees of true west to the south and within 22.5 degrees of true west to the north in the northern hemisphere; oriented within 45 degrees of true west to the north and within 22.5 degrees of true west to the south in the southern hemisphere)~~

A_e = east-oriented *vertical fenestration area* ~~(oriented within 45 degrees of true east to the south and within 22.5 degrees of true east to the north in the northern hemisphere; oriented within 45 degrees of true east to the north and within 22.5 degrees of true east to the south in the southern hemisphere)~~

[. . .]

Modify Table 11.5.1 as shown (I-P and SI units).

Table 11.5.1 Modeling Requirements for Calculating *Design Energy Cost* and *Energy Cost Budget*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
5. *Building Envelope*	
All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as built for *existing building envelopes*. **Exceptions:** The following *building* elements are permitted to differ from architectural drawings. 1. Any *building envelope* assembly that covers less than 5% of the total area of that assembly type (e.g., *exterior walls*) need not be separately described. If not separately described, the area of a *building envelope* assembly must be added to the area of the adjacent assembly of that same type. 2. Exterior surfaces whose azimuth *orientation* and tilt differ by less than 45 degrees and are otherwise the same shall be described as either a single surface or by using multipliers. 3. The exterior *roof* surface shall be modeled using the aged solar ~~*reflectance*~~reflectance and thermal *emittance* determined in accordance with Section 5.5.3.1.1(a). Where aged test data are unavailable, the *roof* surface shall be modeled with a solar ~~*reflectance*~~reflectance of 0.30 and a thermal *emittance* of 0.90. The *above-grade wall* surfaces of *buildings* shall be modeled with an initial solar reflectance and thermal *emittance* determined in accordance with the test methods identified in Section 5.5.3.2.2(a). Where initial test data are unavailable, the *above-grade wall* surfaces shall be modeled with a solar reflectance of 0.25 and a thermal *emittance* of 0.90. 4. Manually operated *fenestration* shading devices, such as blinds or shades, shall not be modeled. Permanent shading devices, such as fins, overhangs, and lightshelves, shall be modeled.	The *budget building design* shall have identical *conditioned floor area* and identical exterior dimensions and orientations as the *proposed design*, except as follows: a. *Opaque* assemblies, such as *roof*, *floors*, *doors*, and *walls*, shall be modeled as having the same *heat capacity* as the *proposed design* but with the minimum *U-factor* required in Section 5.5 for new *buildings* or additions and Section 5.1.3 for *alterations*. b. The exterior *roof* surfaces shall be modeled with a solar ~~*reflectance*~~reflectance and thermal *emittance* as required in Section 5.5.3.1.1(a). All other *roofs*, including *roofs* exempted from the requirements in Section 5.5.3.1.1, shall be modeled the same as the *proposed design*. The *above-grade wall* surfaces of *buildings* shall be modeled with a solar reflectance and thermal *emittance* as required in Section 5.5.3.2.2 and 5.5.3.2.2(a). All other *above-grade walls*, including those exempt from the requirements in Section 5.5.3.2.2, shall be modeled the same as the *proposed design*. c. No shading projections are to be modeled; *fenestration* shall be assumed to be flush with the *wall* or *roof*. If the *fenestration area* for new *buildings* or additions exceeds the maximum allowed by Section 5.5.4.2, the area shall be reduced proportionally along each exposure until the limit set in Section 5.5.4.2 is met. If the *vertical fenestration area* facing west or east of the *proposed design* exceeds the area limit set in Section 5.5.4.5 then the *energy cost budget* shall be generated by simulating the *budget building design* with its actual *orientation* and again after rotating the entire *budget building design* 90, 180, and 270 degrees and then averaging the results. *Fenestration U-factor* shall be equal to the criteria from Tables 5.5-0 through 5.5-8 for the appropriate climate, and the *SHGC* shall be equal to the criteria from Tables 5.5-0 through 5.5-8 for the appropriate climate. For portions of those tables where there are no *SHGC* requirements, the *SHGC* shall be equal to that determined in accordance with Section C3.6(c). The *VT* shall be equal to that determined in accordance with Section C3.6(c). The *fenestration* model for *building envelope alterations* shall reflect the limitations on area, *U-factor*, and *SHGC* as described in Section 5.1.3. [. . .]

12. NORMATIVE REFERENCES

Reference	Title
ASTM International **100 Barr Harbor Dr., West Conshohocken, PA 19428-2959**	
[. . .]	
ASTM C1363-11	Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus
ASTM C1371-15	Standard Test Method for Determination of Emittance of Materials Near Room Temperature using Portable Emissometers.
ASTM C1549-16	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM E408-13	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
[. . .]	

Modify Appendix C as shown (I-P and SI units).

C1.2.1 For Roofs. The *class of construction*, *opaque* area, *U-factor*, *HC*, and insulation position shall be specified. Where three-year-aged test data for the solar ~~*reflectance*~~reflectance and three-year-aged thermal *emittance* of the exterior *roof* surface are available, the three-year-aged solar ~~*reflectance*~~reflectance and three-year-aged thermal *emittance* shall be specified.

[. . .]

C3.5.5 Building Envelope. The *building envelope* shall reflect the information specified in Section C1.

Exception to C3.5.5: Where three-year-aged test data for the solar ~~*reflectance*~~reflectance and three-year-aged thermal *emittance* of the exterior *roof* surface are unavailable, the exterior *roof* surface shall be modeled with a solar ~~*reflectance*~~reflectance of 0.30 and a thermal *emittance* of 0.90.

C3.5.5.1 Shading. Manually operated interior shades shall be modeled on all *vertical fenestration*. Shades shall be modeled to be in the lowered position when either the transmitted luminance is greater than 200 cd/ft^2 (2000 cd/m^2) or the direct solar transmitted *energy* exceeds 30 Btu/h·ft^2 (95 W/m^2) and then remain lowered for rest of the day. Shades shall be modeled with visible light transmittance of 0.10, visible light ~~*reflectance*~~reflectance of 0.40, solar transmittance of 0.21, and solar ~~*reflectance*~~reflectance of 0.23. Permanent shading devices such as fins and overhangs shall be modeled.

[. . .]

C3.6 Calculation of Base Envelope Performance Factor

a. [. . .]

b. The exterior *roof* surfaces shall be modeled with a solar ~~*reflectance*~~reflectance and thermal *emittance* as required in Section 5.5.3.1.1(a). All other *roofs*, including *roofs* exempted from the requirements in Section 5.5.3.1.1, shall be modeled the same as in the *proposed design*. The *above-grade wall* surfaces of *buildings* shall be modeled with a solar reflectance and thermal *emittance* as required in Section 5.5.3.2.2 and Section 5.5.3.2.2(a). All other *above-grade walls*, including those exempt from the requirements in Section 5.5.3.2.2, shall be modeled the same as the *proposed design*.

Modify Table G3.1 as shown (I-P and SI units).

Table G3.1 Modeling Requirements for Calculating Proposed and *Baseline Building Performance*

No.	Proposed Building Performance	Baseline Building Performance
5. *Building Envelope*		
	a. All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as built for *existing building envelopes*. **Exceptions:** The following *building* elements are permitted to differ from architectural drawings: 1. All uninsulated assemblies (e.g., projecting balconies, perimeter edges of intermediate *floor* stabs, concrete *floor* beams over parking garages, *roof* parapet) shall be separately modeled using either of the following techniques: a. Separate model of each of these assemblies within the *energy* simulation model. b. Separate calculation of the *U-factor* for each of these assemblies. The *U-factors* of these assemblies are then averaged with larger adjacent surfaces using an area-weighted average method. This average *U-factor* is modeled within the *energy* simulation model. Any other *building envelope* assembly that covers less than 5% of the total area of that assembly type (e.g., *exterior walls*) need not be separately described, provided that it is similar to an assembly being modeled. If not separately described, the area of a *building envelope* assembly shall be added to the area of an assembly of that same type with the same *orientation* and thermal properties. 2. Exterior surfaces whose azimuth *orientation* and tilt differ by less than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers. 3. The exterior *roof* surface shall be modeled using the aged solar *reflectance* and thermal *emittance* determined in accordance with Section 5.5.3.1.1(a). Where aged test data are unavailable, the *roof* surface may be modeled with a ~~*reflectance*~~reflectance of 0.30 and a thermal *emittance* of 0.90. 4. *Manual fenestration* shading devices, such as blinds or shades, shall be modeled or not modeled the same as in the *baseline building design*. *Automatically* controlled *fenestration* shades or blinds shall be modeled. Permanent shading devices, such as fins, overhangs, and light shelves shall be modeled. 5. *Automatically* controlled *dynamic glazing* may be modeled. Manually controlled *dynamic glazing* shall use the average of the minimum and maximum *SHGC* and *VT*. 6. The *above-grade wall* surface shall be modeled using the initial solar reflectance and thermal *emittance* determined in accordance with the test methods identified in Section 5.5.3.2.2(a). Where initial test data are unavailable, the *wall* surface may be modeled with a solar reflectance of 0.25 and a thermal *emittance* of 0.90. [. . .]	Equivalent dimensions shall be assumed for each *building envelope* component type as in the *proposed design*; i.e., the total gross area of *walls* shall be the same in the *proposed design* and *baseline building design*. The same shall be true for the areas of roofs, *floors*, and *doors*, and the exposed perimeters of concrete slabs on *grade* shall also be the same in the *proposed design* and *baseline building design*. The following additional requirements shall apply to the modeling of the *baseline building design*: a. ***Orientation.*** The *baseline building performance* shall be generated by simulating the *building* with its actual *orientation* and again after rotating the entire *building* 90, 180, and 270 degrees, then averaging the results. The *building* shall be modeled so that it does not shade itself. **Exceptions:** 1. If it can be demonstrated to the satisfaction of the *rating authority* that the *building orientation* is dictated by site considerations. 2. *Buildings* where the *vertical fenestration area* on each *orientation* varies by less than 5%. b. ***Opaque* Assemblies.** *Opaque* assemblies used for new *buildings*, *existing buildings*, or additions shall conform with assemblies detailed in Normative Appendix A and shall match the appropriate assembly maximum *U-factors* in Tables G3.4-1 through G3.4-8: • Roofs—Insulation entirely above deck (A2.2). • *Above-grade walls—Steel-framed* (A3.3). • *Below-grade walls*—Concrete block (A4). • *Floors—Steel-joist* (A5.3). • *Slab-on-grade floors* shall match the *F-factor* for unheated slabs from the same tables (A6). [. . .] f. **Roof Solar ~~*Reflectance*~~Reflectance and Thermal Emittance.** The exterior *roof* surfaces shall be modeled using a solar ~~*reflectance*~~reflectance of 0.30 and a thermal *emittance* of 0.90. [. . .] i. **Wall Solar Reflectance and Thermal Emittance.** *Above-grade wall* surfaces shall be modeled with a solar reflectance of 0.25 and a thermal *emittance* of 0.90.

Addendum w to Standard 90.1-2019

Modify Section G3.1.3.7 and Table G3.1.3.7 as shown (I-P and SI units)

G3.1.3.7 Type and Number of Chillers (Systems 7, 8, 11, 12, and 13). Electric chillers shall be used in the *baseline building design* regardless of the cooling *energy* source, e.g. direct-fired absorption or absorption from purchased steam. The *baseline building design*'s chiller plant shall be modeled with chillers having the number and type as indicated in Table G3.1.3.7 ~~as a function of *building*~~ based on the peak coincident cooling load of baseline *HVAC systems* using chilled water.

Exception to G3.1.3.7: *Systems* using purchased chilled water shall be modeled in accordance with Section G3.1.1.3.

Table G3.1.3.7 Type and Number of Chillers

~~*Building*~~ **Peak Coincident Cooling Loads of Baseline HVAC *Systems* Using Chilled Water**	**Number and Type of Chillers**
≤300 tons (1055 *kW*)	1 water-cooled screw chiller
>300 tons (1055 *kW*), <600 tons (2110 *kW*)	2 water-cooled screw chillers sized equally
≥600 tons (2110 *kW*)	2 water-cooled centrifugal chillers minimum with chillers added so that no chiller is larger than 800 tons (2813 *kW*), all sized equally

Addendum af to Standard 90.1-2019

Revise Table G3.1 as shown (I-P and SI units).

Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance

No.	Proposed Building Performance	Baseline Building Performance
6. Lighting		
	Lighting power in the *proposed design* shall be determined as follows: a. Where a complete *lighting system* exists, the actual lighting power for each *thermal block* shall be used in the model. b. Where a complete *lighting system* has been designed and submitted with design documents, lighting power shall be determined in accordance with Sections 9.1.3 and 9.1.4. c. Where lighting neither exists nor is submitted with design documents, lighting shall comply with but not exceed the requirements of Section 9. Where *space* types are known, lighting power shall be determined in accordance with the Space-by-Space Method. Where *space* types are not known, lighting ~~Lighting~~ power shall be determined in accordance with the *Building* Area Method. d. *Lighting system* power shall include all *lighting system* components shown or provided for on the plans (including *lamps* and *ballasts* and task and furniture-mounted *fixtures*). e. For *dwelling units*, hotel/motel guest rooms, and other *spaces* in which lighting systems are connected via receptacles and are not shown on design documents, lighting power used in the simulation shall be equal to the lighting power allowance in Table 9.6.1 for the appropriate space type or as designed, whichever is greater. For the dwelling units, lighting power used in the simulation shall be equal to 0.60 W/ft^2 (6.5 W/m^2) or as designed, whichever is greater. **Exception:** Lighting use can be reduced for the portion of the space illuminated by the specified fixtures provided that they maintain the same illuminance level as in the baseline. Such reduction shall be demonstrated by calculations. f. Exterior lighting power and lighting ~~Lighting~~ power for parking garages ~~and building façades~~ shall be modeled. g. For lighting controls, at a minimum, the proposed design shall contain the mandatory automatic lighting controls specified in Section 9.4.1 (e.g., automatic daylight responsive controls, occupancy sensors, programmable controls, etc.). These controls shall be modeled in accordance with (g) and (h). h. Automatic daylighting responsive controls shall be modeled directly in the proposed design or through schedule adjustments determined by a separate daylighting analysis approved by the rating authority. Modeling and schedule adjustments shall separately account for primary sidelighted areas, secondary sidelighted areas, and toplighted areas. i. Other automatic lighting controls included in the proposed design shall be modeled directly in the building simulation by reducing the lighting schedule each hour by the occupancy sensor reduction factors in Table G3.7 for the applicable space type. This reduction shall be taken only for lighting controlled by the occupancy sensors. Credit for other programmable lighting control in buildings less than 5000 ft^2 (500 m^2) can be taken by reducing the lighting schedule each hour by 10%.	Interior lighting power in the *baseline building design* shall be determined using the values in Table G3.7. However, where lighting neither exists nor is submitted with design documents, and the *proposed design* lighting power is determined in accordance with the *Building* Area Method, the *baseline building design* lighting power shall be determined in accordance with Table G3.8. Where retail display lighting is included in the *proposed building design* in accordance with Section 9.6.2(b), the *baseline building design* retail display lighting additional power shall be equal to the limits established by Section 9.6.2(b) or same as proposed, which ever less. Lighting shall be modeled having the automatic shutoff controls in buildings >5000 ft^2 (500 m^2) and occupancy sensors in employee lunch and break rooms, conference/meeting rooms, and classrooms (not including shop classrooms, laboratory classrooms, and preschool through 12th-grade classrooms). These *controls* shall be reflected in the *baseline building design* lighting schedules. No additional *automatic* lighting *controls,* e.g., *automatic controls* for daylight utilization and *occupancy sensors* in *space* types not listed above, shall be modeled in the *baseline building design*. Exterior lighting in areas that are designed to be illuminated and identified as "Tradable Surfaces" in Table G3.6 shall be modeled with the baseline lighting power shown in Table G3.6. Other exterior lighting shall be modeled the same in the *baseline building design* as in the *proposed design*.

Modify Table G3.6 as shown (I-P units).

Table G3.6 *Performance Rating Method Lighting Power Densities* for *Building* Exteriors

Tradable Surfaces (*Lighting power densities* for uncovered parking areas, *building* grounds, *building entrances* and exits, canopies and overhangs and outdoor sales areas may be traded.)	Uncovered Parking Areas	
	Parking lots and drives	0.15 W/ft^2
	Building Grounds	
	Walkways less than 10 ft wide	1.0 W/linear foot
	Walkways 10 ft wide or greater Plaza areas Special feature areas	0.2 W/ft^2
	Stairways	1.0 W/ft^2
	Building Entrances and Exits	
	Main entries	30 W/linear foot of *door* width
	Other *doors*	20 W/linear foot of *door* width
	Canopies and Overhangs	
	Canopies (free standing and attached and overhangs)	1.25 W/ft^2
	Outdoor Sales	
	Open areas (including vehicle sales lots)	0.5 W/ft^2
	Street frontage for vehicle sales lots in addition to open-area allowance	20 W/linear foot
~~**Nontradable Surfaces (*Lighting power density* calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "Tradable Surfaces" section of this table.)**~~	~~*Building* Façades~~	~~0.2 W/ft^2 for each illuminated wall or surface or 5.0 W/linear foot) for each illuminated wall or surface length~~
	~~Automated Teller Machines (ATMs) and Night Depositories~~	~~270 W per location plus 90 W per additional ATM per location~~
	~~Entrances and Gatehouse Inspection Stations at Guarded Facilities~~	~~1.25 W/ft^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")~~
	~~Loading Areas for Law Enforcement, Fire, Ambulance and Other Emergency *Service* Vehicles~~	~~0.5 W/ft^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")~~
	~~Drive-up Windows at Fast-Food Restaurants~~	~~400 W per drive-through~~
	~~Parking Near 24-Hour Retail Entrances~~	~~800 W per main entry~~

Modify Table G3.6 as shown (SI units).

Table G3.6 *Performance Rating Method Lighting Power Densities* for *Building* Exteriors

Tradable Surfaces (*Lighting power densities* for uncovered parking areas, *building* grounds, *building entrances* and exits, canopies and overhangs and outdoor sales areas may be traded.)	Uncovered Parking Areas	
	Parking lots and drives	1.6 W/m^2
	Building Grounds	
	Walkways less than 3 m wide	3.3 W/linear metre
	Walkways 3 m wide or greater	
	Plaza areas	2.2 W/m^2
	Special feature areas	
	Stairways	10.8 W/m^2
	Building Entrances and Exits	
	Main entries	98 W/linear metre of *door* width
	Other *doors*	66 W/linear metre of *door* width
	Canopies and Overhangs	
	Canopies (free standing and attached and overhangs)	13.5 W/m^2
	Outdoor Sales	
	Open areas (including vehicle sales lots)	5.4 W/m^2
	Street frontage for vehicle sales lots in addition to open-area allowance	66 W/linear metre
~~**Nontradable Surfaces (*Lighting power density* calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "Tradable Surfaces" section of this table.)**~~	~~*Building* Façades~~	~~2.2 W/m^2 for each illuminated wall or surface or 5.0W/linear metre for each illuminated wall or surface length~~
	~~Automated Teller Machines (ATMs) and Night Depositories~~	~~270 W per location plus 90 W per additional ATM per location~~
	~~Entrances and Gatehouse Inspection Stations at Guarded Facilities~~	~~13.5 W/m^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")~~
	~~Loading Areas for Law Enforcement, Fire, Ambulance and Other Emergency *Service* Vehicless~~	~~5.4 W/m^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")~~
	~~Drive-up Windows at Fast-Food Restaurants~~	~~400 W per drive-through~~
	~~Parking Near 24-Hour Retail Entrances~~	~~800 W per main entry~~

Addendum bc to Standard 90.1-2019

Add new Section 6.5.4.8 (I-P and SI units).

6.5.4.8 Buildings with High-Capacity Space-Heating Gas Boiler Systems. New buildings with gas hot-water *boiler systems* for space heating with a total *system* input of at least 1,000,000 Btu/h (290 kW) but not more than 10,000,000 Btu/h (2900 kW) shall comply with Sections 6.5.4.8.1 and 6.5.4.8.2.

Exceptions to 6.5.4.8:

1. Where 25% of the annual space heating requirement is provided by on-site renewable energy, *site-recovered energy*, or heat recovery chillers.
2. *Space heating boilers* installed in individual dwelling units.
3. Where 50% or more of the design heating load is served using perimeter convective heating, radiant ceiling panels, or both.
4. Individual gas boilers with input capacity less than 300,000 Btu/h (87 kW) shall not be included in the calculations of the total system input or total system efficiency.

6.5.4.8.1 Boiler Efficiency. Gas hot-water *boilers* shall have a minimum thermal *efficiency* (E_t) of 90% when rated in accordance with the test procedures in Table 6.8.1-6. Systems with multiple boilers are allowed to meet this requirement if the space heating input provided by equipment with thermal *efficiency* (E_t) above and below 90% provides an input capacity-weighted average thermal *efficiency* of at least 90%. For boilers rated only for combustion *efficiency*, the calculation for the input capacity-weighted average thermal *efficiency* shall use the combustion *efficiency* value.

6.5.4.8.2 Hot-Water Distribution System Design. The hot-water distribution system shall be designed to meet all of the following:

a. Coils and other heat exchangers shall be selected so that at design conditions the hot-water return temperature entering the *boilers* is 120°F (49°C) or less.
b. Under all operating conditions, the water temperature entering the boiler is 120°F (49°C) or less, or the flow rate of supply hot water that recirculates directly into the return system, such as by three-way valves or minimum flow bypass controls, shall be no greater than 20% of the design flow of the operating boilers.

Addendum cd to Standard 90.1-2019

Modify Sections 6.5.6.1.2 as shown (I-P and SI).

6.5.6.1.2 Spaces Other than Nontransient Dwelling Units Each fan *system* serving spaces other than *nontransient dwelling units* shall have an *energy* recovery *system* where the design supply fan airflow rate exceeds the value listed in Tables 6.5.6.1.2-1 and 6.5.6.1.2-2, based on the climate zone and percentage of *outdoor air* at design airflow conditions. Table 6.5.6.1.2-1 shall be used for all *ventilation systems* that operate less than 8000 hours per year, and Table 6.5.6.1.2-1 shall be used for all *ventilation systems* that operate 8000 or more hours per year.

~~For spaces other than *nontransient dwelling units*, *energy* recovery *systems* shall result in an *enthalpy recovery ratio* of at least 50%. The *energy* recovery *system* shall provide the required *enthalpy recovery ratio* at both heating and cooling *design conditions*, unless one mode is not required for the climate zone by the exceptions below. Provision shall be made to bypass or *control* the *energy* recovery *system* to permit *air economizer* operation as required by Section 6.5.1.1.~~

Exceptions to 6.5.6.1.2:

1. Laboratory *systems* meeting Section 6.5.7.3.
2. *Systems* serving *spaces* that are not cooled and that are heated to less than 60°F.
3. Where more than 60% of the *outdoor air* heating *energy* is provided from *site-recovered energy* or *site-solar energy*.
4. *Enthalpy recovery ratio* requirements at heating design condition in Climate Zones 0, 1, and 2.
5. *Enthalpy recovery ratio* requirements at cooling design condition in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
6. Where the sum of the airflow rates exhausted and relieved within 20 ft of each other is less than 75% of the design outdoor airflow rate, excluding exhaust air that is
   a. used for another *energy* recovery *system*,
   b. not allowed by ASHRAE Standard 170 for use in *energy* recovery *systems* with leakage potential, or
   c. of Class 4 as defined in ASHRAE Standard 62.1.
7. Systems in Climate Zones 0 through 4 requiring dehumidification that employ *series energy recovery* and have a minimum SERR of 0.40.
8. *Systems* expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table 6.5.6.1.2-1.
9. *Indoor pool dehumidifiers* meeting Section 6.5.6.4.

6.5.6.1.2.1 Minimum Enthalpy Recovery Ratio. *Energy* recovery *systems* required by this section shall result in an *enthalpy recovery ratio* of at least 50%. A 50% *enthalpy recovery ratio* shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and entering exhaust air enthalpies at *design conditions*. The

energy recovery *system* shall provide the required *enthalpy recovery ratio* at both heating and cooling *design conditions* unless one mode is not required for the climate zone by Exception 6.5.6.1.2.2.

6.5.6.1.2.2 Provision for Air Economizer or Bypass Operation. Provision shall be made for both *outdoor air* and exhaust air to bypass or control the *energy* recovery *system* to enable *economizer* operation as required by Section 6.5.1.1. The bypass or *control* shall meet the following criteria:

a. For *energy* recovery *systems* where the transfer of *energy* cannot be stopped, bypass provision shall prevent the total airflow rate of either *outdoor air* or exhaust air through the *energy* recovery exchanger from exceeding 10% of the full design airflow rate.
b. The pressure drop of the *outdoor air* through the energy recovery exchanger shall not exceed 0.4 in. of water (100 Pa); the pressure drop of the exhaust air through the energy recovery exchanger shall not exceed 0.4 in. of water (100 Pa).

Exception to 6.5.6.1.2.2: *Energy* recovery *systems* with 80% or more *outdoor air* at full design airflow rate and not exceeding 10,000 cfm (4.72 m^3/s).

Revise Table G3.1 as shown (I-P and SI units).

Table G3.1 Modeling Requirements for Calculating Proposed and *Baseline Building Performance*

No.	Proposed *Building* Performance	*Baseline Building* Performance
5. *Building Envelope*		
a.	All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as built for *existing building envelopes*. **Exceptions:** The following *building* elements are permitted to differ from architectural drawings: 1. All uninsulated assemblies (e.g., projecting balconies, perimeter edges of intermediate *floor* stabs, concrete *floor* beams over parking garages, *roof* parapet) shall be separately modeled using either of the following techniques: a. Separate model of each of these assemblies within the *energy* simulation model. b. Separate calculation of the *U-factor* for each of these assemblies. The *U-factors* of these assemblies are then averaged with larger adjacent surfaces using an area-weighted average method. This average *U-factor* is modeled within the *energy* simulation model. Any other *building envelope* assembly that covers less than 5% of the total area of that assembly type (e.g., *exterior walls*) need not be separately described, provided that it is similar to an assembly being modeled. If not separately described, the area of a *building envelope* assembly shall be added to the area of an assembly of that same type with the same *orientation* and thermal properties. 3. Exterior surfaces whose azimuth *orientation* and tilt differ by less than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers.	Equivalent dimensions shall be assumed for each *building envelope* component type as in the *proposed design*; i.e., the total gross area of *walls* shall be the same in the *proposed design* and *baseline building design*. The same shall be true for the areas of roofs, *floors*, and *doors*, and the exposed perimeters of concrete slabs on *grade* shall also be the same in the *proposed design* and *baseline building design*. The following additional requirements shall apply to the modeling of the *baseline building design*: a. ***Orientation.*** The *baseline building performance* shall be generated by simulating the *building* with its actual *orientation* and again after rotating the entire *building* 90, 180, and 270 degrees, then averaging the results. The *building* shall be modeled so that it does not shade itself. **Exceptions:** 1. If it can be demonstrated to the satisfaction of the *rating authority* that the *building orientation* is dictated by site considerations. 2. *Buildings* where the *vertical fenestration area* on each *orientation* varies by less than 5%. b. ***Space Conditioning Categories.*** *Space conditioning categories* used to determine applicability of the envelope requirements in Tables G3.4-1 through G3.4-8 shall be the same as in the proposed design. **Exception:** Envelope components, of the HVAC zones that are semi-heated in the proposed design must meet conditioned envelope requirements in Tables G3.4-1 to G3.4-8 if, based on the sizing runs, these zones are served by a baseline system with sensible cooling output capacity ≥5 Btu/h·ft^2 (15 W/m^2) of floor area, or with heating output capacity greater than or equal to the criteria in Table G3.4-9, or that are *indirectly conditioned* spaces. c. ***Opaque* Assemblies.** *Opaque* assemblies used for new *buildings*, *existing buildings*, or additions shall conform with assemblies detailed in Normative Appendix A and shall match the appropriate assembly maximum *U-factors* in Tables G3.4-1 through G3.4-8: • Roofs—Insulation entirely above deck (A2.2). • *Above-grade walls—Steel-framed* (A3.3). • *Below-grade walls*—Concrete block (A4). • *Floors—Steel-joist* (A5.3). • *Slab-on-grade floors* shall match the *F-factor* for unheated slabs from the same tables (A6).

Add new Table G3.4-9 as shown (I-P and SI).

Table G3.4-9 Heated Space Criteria

Climate Zone	Heating Output, Btu/h·ft^2 (W/m^2)
0, 1, 2	≥5 (15)
3	≥10 (30)
4, 5	≥15 (45)
6,7	≥20 (60)
8	≥25 (75)

Addendum by to Standard 90.1-2019

Modify Section 3.2 as shown (I-P and SI units).

3.2 Definitions

on-site renewable energy: *energy* ~~generated~~ from *renewable energy resources* ~~produced~~ harvested at the *building* site.

renewable energy resources: *energy* from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth.

~~***site-solar energy:*** thermal, chemical, or electrical *energy* derived from direct conversion of incident solar radiation at the *building* site and used to offset consumption of purchased *fuel* or electrical *energy* supplies. For the purposes of applying this standard, *site-solar energy* shall not include passive heat gain through *fenestration systems*~~.

Modify Section 6 as shown (I-P and SI units).

[. . .]

Exceptions to 6.5.2.1:

[. . .]

4. Zones where at least 75% of the *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*site-solar energy*~~ *on-site renewable energy.*

[. . .]

Exceptions to 6.5.2.3:

[. . .]

4. *Systems* serving *spaces* where specific humidity levels are required to satisfy process needs, such as a vivarium; museum; surgical suite; pharmacy; and *buildings* with refrigerating *systems*, such as supermarkets, refrigerated warehouses, and ice arenas, and where the *building* includes *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy* that provide *energy* equal to at least 75% of the annual *energy* for *reheating* or for providing warm air in mixing *systems*. This exception does not apply to *computer rooms*.
5. At least 90% of the annual *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*site-solar energy*~~ *on-site renewable energy.*

[. . .]

Exceptions to 6.5.3.5:

[. . .]

5. *Systems* in which at least 75% of the *energy* for *reheating* (on an annual basis) is from *site recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 6.5.6.1.2:

[. . .]

3. Heating energy recovery where more than 60% of the *outdoor air* heating *energy* is provided from *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 6.5.6.2.2:

[. . .]

2. Facilities that provide 60% of their *service water heating* from ~~*site-solar energy*~~ *on-site renewable energy* or *site-recovered energy* or from other sources

[. . .]

Modify Section 7 as shown (I-P and SI units).

Exception to 7.4.5.2: *Pools* deriving over 60% of the *energy* for heating from *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 7.5.3:

1. Where 25% of the annual *service water-heating* requirement is provided by ~~*site-solar energy*~~ *on-site renewable energy* or *site-recovered energy*.

[. . .]

Modify Section 10 as shown (I-P and SI units).

10. OTHER EQUIPMENT

10.1 General

10.1.1 Scope. This section applies only to the *equipment* described below.

[. . .]

10.2 Compliance Paths. Other equipment shall comply with Section 10.2.1 and Section 10.2.2.

10.2.1 Requirements for All Compliance Paths. Other equipment shall comply with Section 10.1, "General"; Section 10.4, "Mandatory Provisions"; Section 10.5, "Prescriptive Path" and Section 10.8, "Product Information."

[. . .]

10.5 Prescriptive Compliance Path ~~(Not Used)~~

10.5.1 *Renewable Energy Resources*. *Buildings* shall be served by *renewable energy resources* complying with Section 10.5.1.1.

10.5.1.1 On-Site Renewable Energy. The *building* site shall have *equipment* for *on-site renewable energy* with a rated capacity of not less than 0.25 W/ft² or 0.85 Btu/ft^2 (2.7W/m^2) multiplied by the sum of the *gross conditioned floor area* for all floors up to the three (3) largest floors.

Exceptions to 10.5.1.1:

1. Any *building* located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m^2·day (1.1 kBtu/ft^2·day).
2. Any *building* where more than 80% of the *roof* area is covered by any combination of *equipment* other than for *on-site renewable energy systems*, planters, vegetated space, *skylights*, or occupied *roof* deck.

3. Any *building* where more than 50% of *roof* area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the *building* for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
4. New construction or *additions* in which the sum of the *gross conditioned floor area* of the three largest floors of the new construction or *addition* is less than 10,000 ft^2 (1000 m^2).
5. *Alterations* that do not include *additions*.

Addendum ck to Standard 90.1-2019

Revise Section 11 as shown (I-P and SI units).

11.4 Simulation General Requirements

11.4.1 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings*. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section 11.4.5 shall be used.

Exception to 11.4.1: When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Informative Note: ASHRAE Standing Standard Project Committee 90.1 recommends that the *simulation program* implement the rules of Section 11 that control simulation inputs and outputs be adopted for the purposes of easier use and simpler compliance.

[. . .]

11.4.3 Renewable, Recovered, and Purchased Energy

11.4.3.1 On-Site Renewable Energy and Site-Recovered Energy. *Site-recovered energy* shall not be considered *purchased energy* and shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost*. *On-site renewable energy* shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost* provided that the building owner

a. owns the *on-site renewable energy system*,
b. has signed a lease agreement for the *on-site renewable energy system* for at least 15 years or
c. has signed a contractual agreement to purchase *energy* generated by the *on-site renewable energy system* for at least 15 years.

The reduction in *design energy cost* associated with *on-site renewable energy* that exceeds the *on-site renewable energy* required by Section 10.5.1.1 shall be no more than 5% of the calculated *energy cost budget.*

On-site renewable energy included in the *budget building design* shall be subtracted from the *budget building design* energy consumption prior to calculating the *energy cost budget.*

11.4.3.2 Annual Energy Costs. The *design energy cost* and *energy cost budget* shall be determined using rates for *purchased energy* (such as electricity, gas, oil, propane, steam, and chilled water) that are approved by the *adopting authority*. Where *on-site renewable energy* or *site-recovered energy* is ~~used~~ in excess of what is required in the *budget building design* by Table 11.5.1, the *budget building design* shall be based on the *energy* source used as the backup

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
15. On-Site Renewable Energy	
On-site renewable energy in the *proposed design* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall be included in the *budget building design* when required by Section 10.5.1, and shall be determined as follows: a. Where a *system* providing *on-site renewable energy* has been modeled in the *proposed design*, the same *system* shall be modeled identically in the *budget building design*, except the rated capacity shall meet the requirements of Section 10.5.1.1. Where more than one type of *on-site renewable* energy system is modeled, the total capacities shall be allocated in the same proportion as in the *proposed design*. b. Where no *system* exists or is specified to provide *on-site renewable energy* in the *proposed design*, *on-site renewable energy* shall be modeled as an unshaded photovoltaic system with the following physical characteristics: • Size: Rated capacity per Section 10.5.1.1 • Module Type: Crystalline silicon panel with a glass cover, 19.1% nominal efficiency and temperature coefficient of –0.47%/°C; performance shall be based on a reference temperature of 77°F (25°C) and irradiance of 317 Btu/ft^2·h (1000 W/m^2). • Array Type: Rack-mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C) • Total system losses (DC output to AC output): 11.3% • Tilt: 0-degrees (mounted horizontally) • Azimuth:180 degrees If the *on-site renewable energy system* cannot be modeled in the *simulation program*, Section 11.4.5 shall be used.

energy source, or electricity if no backup *energy* source has been specified. Where the proposed design includes *on-site electricity generation systems* other than *on-site renewable energy systems*, the baseline design shall include the same generation systems excluding its *site-recovered energy*.

Addendum cp to Standard 90.1-2019

Modify Section 4.2.1.1 as shown (I-P and SI units).

4.2.1.1 New Buildings. New *buildings* shall comply with Sections 4.2.2 through 4.2.5 and either the provisions of

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other *Equipment*," or
b. Section 11, "*Energy Cost Budget* Method," or
c. Normative Appendix G, "*Performance Rating Method*."

When using Normative Appendix G, the Performance Cost Index (PCI) of new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall be less than or equal to the Performance Cost Index target (PCI_t) when calculated in accordance with the following:

$$PCI_t = [BBUEC + (BPF \times BBREC) \underline{- PRE}]/BBP$$

where

PCI = Performance Cost Index calculated in accordance with Section G1.2.

BBUEC = baseline *building* unregulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *unregulated energy use*.

BBREC = baseline *building* regulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *regulated energy use*.

BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 use "All others." Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types.

BBP = *baseline building performance*.

PBP = *proposed building performance*, including the reduced, annual purchased energy cost associated with all *on-site renewable energy* generation systems.

PBP_{nre} = *proposed building performance* without any credit for reduced annual energy costs from on-site renewable energy generation systems.

$\underline{PBP_{pre}}$ = *proposed building performance*, excluding any renewable energy system in the proposed design and including an *on-site renewable energy system* that meets but

does not exceed the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 11.5.1.

PRE ≡ $PBP_{nre} - PBP_{pre}$.

When $(PBP_{pre} - PBP)/BBP > 0.05$, new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall comply with the following:

$$PCI + [(PBP_{pre} - PBP)/BBP] - 0.05 < PCI_t$$

Informative Notes:

1. PBP_{nre} ≡ *proposed building performance*, no renewable energy
2. PBP_{pre} ≡ *proposed building performance*, prescriptive renewable energy
3. PRE ≡ prescriptive renewable energy

Modify Section G2.2 as shown (I-P and SI units).

G2.2 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings* (a program such as, but not limited to, DOE-2, BLAST, or EnergyPlus). The *simulation program* shall include calculation methodologies for the *building* components being modeled. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section shall be used.

Exception to G2.2: When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Modify Table G3.1 as shown (I-P and SI units).

Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance

No.	*Proposed Building Performance*	*Baseline Building Performance*
18. ***On-Site Renewable Energy***		
	On-site renewable energy in the *proposed building performance* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall not be included in the *baseline building performance*.

Addendum cr to Standard 90.1-2019

Revise Section 11.2 as shown (I-P and SI units).

11.2 Compliance. The *proposed building design* shall comply with all of the following:

a. Sections 5.2.1, 6.2.1, 7.2.1., 8.2.1, 9.2.1, and 10.2.1.
b. The *design energy cost*, as calculated in Section 11.5, does not exceed the *energy cost budget* as calculated by the *simulation program* described in Section 11.4.
c. The *energy efficiency* level of installed components and systems that meets or exceeds the *efficiency* levels used to calculate the *design energy cost*.
d. For new buildings, one of the following is met:
   1. The *building envelope* complies with Section 5.5, "Prescriptive Building Envelope Compliance Path."
   2. Using Section 5.6, "Building Envelope Trade-Off Option," the *proposed envelope performance factor* shall not exceed the *base envelope performance factor* by more than 15% in multifamily residential, hotel/motel, and dormitory *building* area types. For all other *building* area types, the limit shall be 7%. For buildings with both *residential* and *nonresidential* occupancies, the limit shall be based on the area-weighted average of the *gross conditioned floor area*.

~~d~~e. Verification, testing, and *commissioning* requirements of Section 4.2.5 shall be met.
~~e~~f. Proposed *building systems*, controls, or *building envelope* documented in Section 11.7(b) that do not have criteria in Sections 5 through 10 shall have verification or testing to document proper installation and operation in accordance with Section 4.2.5.

Revise Section G1.2.1 as shown (I-P and SI units).

G1.2.1 Mandatory Provisions. The *proposed building design* shall comply with all of the following:

a. Sections 5.2.1, 6.2.1, 7.2.1., 8.2.1, 9.2.1, and 10.2.1.
b. The interior lighting power shall not exceed the *interior lighting power allowance* determined using either Tables G3.7 or G3.8 and the methodology described in Sections 9.5.1 and 9.6.1.
   1. Table G3.7 and the methodology described in Section 9.6.1, or
   2. Table G3.8 and the methodology described in Section 9.5.1.
c. For new buildings, one of the following is met:
   1. The *building envelope* complies with Section 5.5, "Prescriptive Building Envelope Compliance Path."
   2. Using Section 5.6, "Building Envelope Trade-Off Option," the *proposed envelope performance factor* shall not exceed the *base envelope performance factor* by more than 15% in multifamily residential, hotel/motel, and dormitory *building* area types. For all other *building* area types, the limit shall be 7%. For buildings with both *residential* and *nonresidential* occupancies, the limit shall be based on the area-weighted average of the *gross conditioned floor area*.

~~c~~d. Energy efficiency levels of installed components and *systems* that meet or exceed the efficiency levels used to calculate the *proposed building performance*.
~~d~~e. Verification, testing, and *commissioning* requirements of Section 4.2.5 shall be met.
~~e~~f. Proposed building systems, controls or building envelope documented in Section G1.3(c) that do not have criteria in Sections 5 through 10 shall have verification or testing to document proper installation and operation in accordance with Section 4.2.5.

Addendum da to Standard 90.1-2019

Modify Section G1.3.2 as shown (I-P and SI units).

G1.3.2 Application Documentation. ~~Simulated performance shall be documented, and documentation shall be submitted to the *rating authority*. The information shall be submitted in a report and shall include the following:~~ The following documentation shall be submitted to the *rating authority:*

a. ~~A brief description of the project, the key *energy efficiency* improvements compared with the requirements in Sections 5 through 10, t~~The *simulation program* used, the version of the *simulation program*, and the results of the *energy* analysis, including~~. This summary shall contain~~ the calculated values for the baseline building unregulated energy cost (BBUEC), baseline building regulated energy cost (BBREC), building performance factor (BPF), *baseline building performance*, *proposed building performance*, ~~and the percentage improvement~~Performance Cost Index (PCI), and Performance Cost Index Target (PCI_t).
b. An overview of the project that includes the number of stories (above and below *grade*), the typical *floor* size, the uses in the *building* (e.g., office, cafeteria, retail, parking, etc.), the gross area of each use, and whether each use is *conditioned space*.
c. A list of the *energy*-related features that are included in the design and on which the performance rating is based. This list shall document all *energy* features that differ between the models used in the *baseline building performance* and *proposed building performance* calculations.
d. A list showing compliance for the *proposed design* with all the requirements of Sections 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4 (mandatory provisions).
e. A list identifying those aspects of the *proposed design* that are less stringent than the requirements of 5.5, 6.5, 7.5,9.5, and 9.6 (prescriptive provisions).
f. A list identifying those aspects of the *proposed design* that are more stringent than the requirements of Sections 5 through 10.
~~f~~g. A table with a summary by end use of the ~~*energy* cost savings in the~~ *proposed building performance* and *baseline building performance*, with each end use separated into regulated and unregulated components.
~~g~~h. A site plan showing all adjacent *buildings* and topography that may shade the proposed *building* (with estimated height or number of stories).
~~h~~i. *Building* elevations and *floor* plans ~~(schematic is acceptable)~~.

[. . .]

Modify Section G2 as shown (I-P and SI units).

G2.2 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings* ~~(a program such as, but not limited to, DOE-2, BLAST, or EnergyPlus). The *simulation program* shall include calculation methodologies for the *building* components being modeled~~. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section G2.5 shall be used.

Exception to G2.2: When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Informative Note: For the ease of use and consistent application, the *simulation program* should automatically implement the requirements of this appendix to generate the baseline design and *proposed design* models based on the user model of the *proposed design*.

[. . .]

G2.2.2 The *simulation program* shall have the ability to either directly determine the *proposed building performance* and *baseline building performance* or produce hourly reports of *energy* use by an *energy* source suitable for determining the *proposed building performance* and *baseline building performance* using a separate calculation ~~engine~~.

G2.2.3 The *simulation program* shall be capable of performing design load calculations to determine required HVAC *equipment* capacities and air and water flow rates in accordance with ~~*generally accepted engineering standards* and handbooks (for example, *ASHRAE Handbook—Fundamentals*)~~ Section 6.4.2.1 for both the *proposed design* and *baseline building design*.

[. . .]

G2.3 Climatic Data. The *simulation program* shall perform the simulation using hourly values of climatic data, ~~such as~~ including temperature, ~~and~~ humidity, solar radiation, and wind speed and direction from representative climatic data, for the site in which the *proposed design* is to be located. ~~For cities or urban regions with several climatic data entries,~~ For locations for which several climatic data sources are available or ~~and for locations where~~ weather data are not available, the designer shall select available weather data that best represent the climate at the *construction* site. The selected weather data shall be approved by the *rating authority*.

[. . .]

G2.4.2 Annual Energy Costs. The *design energy cost* and baseline *energy* cost shall be determined using either actual rates for *purchased energy* or state average *energy* prices published by DOE's Energy Information Administration (EIA) for commercial *building* customers, but rates from different sources may not be mixed in the same project. Where *on- site renewable energy* or *site-recovered energy* is used, the *baseline building design* shall be based on the *energy* source used as the backup *energy* source, or the baseline *system energy* source in that category if no backup *energy* source has been specified~~.~~, except where the baseline *energy* source is prescribed in Tables G3.1.1-2 and G3.1.1-3.

[. . .]

G2.5 Exceptional Calculation Methods. When the *simulation program* does not model a design, material, or device of the *proposed design*, an exceptional calculation method shall be used as approved by the *rating authority*. Where there are multiple designs, materials, or devices that the *simulation program* does not model, each shall be calculated separately and exceptional savings determined for each. At no time shall the total exceptional savings constitute more than half of the difference between the *baseline building performance* and the *proposed building performance*. All applications for approval of an exceptional method shall include the following:

a. Theoretical and empirical information verifying the method's accuracy, and ~~S~~step-by-step documentation of the exceptional calculation method performed, detailed enough to reproduce the results.
b. Copies of all spreadsheets used to perform the calculations.
c. A sensitivity analysis of *energy* consumption when each of the input parameters that are estimated is varied from half to double the value assumed.
d. The calculations shall be performed on a time-step basis consistent with the *simulation program* used.
e. The ~~performance rating~~ Performance Cost Index calculated with and without the exceptional calculation method.

[. . .]

Table G3.1 Modeling Requirements for Calculating Proposed and *Baseline Building Performance*

No.	Proposed Building Performance	Baseline Building Performance
[. . .]		
4. Schedule	Schedules capable of modeling hourly variations in occupancy, lighting power, miscellaneous *equipment* power, *thermostat set points*, and *HVAC system* operation shall be used. The schedules shall be typical of the proposed *building* type as determined by the designer and approved by the *rating authority*. **Temperature and Humidity Schedules.** Temperature and humidity *control set points* and schedules as well as *temperature control throttling range* shall be the same for *proposed design* and *baseline building design*. **HVAC Fan Schedules.** Schedules for HVAC fans that provide *outdoor air* for *ventilation* shall run continuously whenever *spaces* are occupied and shall be cycled ON and OFF to meet heating and cooling loads during unoccupied hours. **Exceptions:** 1. Where no heating and/or cooling *system* is to be installed, and a heating or cooling *system* is being simulated only to meet the requirements described in this table, heating and/or cooling *system* fans shall not be simulated as running continuously during occupied hours but shall be cycled ON and OFF to meet heating and cooling loads during all hours. 2. HVAC fans shall remain on during occupied and unoccupied hours in *spaces* that have health- and safety-mandated minimum *ventilation* requirements during unoccupied hours. 3. HVAC fans shall remain on during occupied and unoccupied hours in *systems* primarily serving *computer rooms*. 4. Dedicated outdoor air supply fans shall stay off during unoccupied hours.	Same as proposed design. **Exceptions:** 1. *Set points* and schedules for *HVAC systems* that *automatically* provide occupant thermal comfort via means other than directly controlling the air dry-bulb and wet-bulb temperature may be allowed to differ, provided that equivalent levels of occupant thermal comfort are demonstrated via the methodology in ASHRAE Standard 55, Section 5.3.3, "Elevated Air Speed," or Standard 55, Appendix B, "Computer Program for Calculation of PMV-PPD." 2. Schedules may be allowed to differ between *proposed design* and *baseline building design* when necessary to model nonstandard *efficiency* measures, provided that the revised schedules have been approved by the *rating authority*. Measures that may warrant use of different schedules include but are not limited to *automatic* lighting controls, *automatic* natural *ventilation controls*, *automatic demand control ventilation controls*, and *automatic controls* that reduce *service water-heating loads*. In no case shall schedules differ where the *controls* are *manual* (e.g., *manual* operation of light switches or *manual* operation of windows). 3. Fan schedules may be allowed to differ when Section G3.1.1(c) applies.
[. . .]		

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Diana Burk

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Firm/Association affiliation, if any: New Buildings Institute

Date: 2/4/2021

Model Code:

ANSI/ASHRAE/IES Standard 90.1-2019

Code or Rule Section: 3.2, 4, 6, 7, 10, 11, Appendix G

Code or rule section to be changed: 3.2, 4, 6, 7, 10, 11, Appendix G

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code TAG MR 1323

General Information	**Yes**	**No**	
A. Is the proposed change unique to the State of Minnesota?	☐	☒	
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒	
C. Will the proposed change encourage more uniform enforcement?	☐	☒	
○ Will the proposed change remedy a problem?		☒	☐
D. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒	
E. Would this proposed change be appropriate through the ICC code development process?	☒	☐	

Proposed Language

1. The proposed code change is meant to:

   X change language contained the model code book? If so, list section(s). Section 6, Section 7, Section 10

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   X add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation. No.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Modify Section 3.2 as shown (I-P and SI units).

3.2 Definitions

on-site renewable energy: *energy* ~~generated~~ from *renewable energy resources* ~~produced~~ harvested at the *building* site.

renewable energy resources: *energy* from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth.

~~***site-solar energy:*** thermal, chemical, or electrical *energy* derived from direct conversion of incident solar radiation at the *building* site and used to offset consumption of purchased *fuel* or electrical *energy* supplies. For the purposes of applying this standard, *site-solar energy* shall not include passive heat gain through *fenestration systems*.~~

Modify Section 6 as shown (I-P and SI units).

[. . .]

Exceptions to 6.5.2.1:

[. . .]

4. Zones where at least 75% of the *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 6.5.2.3:

[. . .]

4. *Systems* serving *spaces* where specific humidity levels are required to satisfy process needs, such as a vivarium; museum; surgical suite; pharmacy; and *buildings* with refrigerating *systems*, such as supermarkets, refrigerated warehouses, and ice arenas, and where the *building* includes *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy* that provide *energy* equal to at least 75% of the annual *energy* for *reheating* or for providing warm air in mixing *systems*. This exception does not apply to *computer rooms*.

5. At least 90% of the annual *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*sitesolar energy*~~ *on-site renewable energy.*

[. . .]

Exceptions to 6.5.3.5:

[. . .]

5. *Systems* in which at least 75% of the *energy* for *reheating* (on an annual basis) is from *site recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 6.5.6.1.2:

[. . .]

3. Heating energy recovery where more than 60% of the *outdoor air* heating *energy* is provided from *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 6.5.6.2.2:

[. . .]

2. Facilities that provide 60% of their *service water heating* from ~~*site-solar energy*~~ *onsite renewable energy* or *site-recovered energy* or from other sources

[. . .]

Modify Section 7 as shown (I-P and SI units).

Exception to 7.4.5.2: *Pools* deriving over 60% of the *energy* for heating from *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 7.5.3:

1. Where 25% of the annual *service water-heating* requirement is provided by ~~*site-solar energy*~~ *on-site renewable energy* or *site-recovered energy*.

[. . .]

Modify Section 10 as shown (I-P and SI units).

10. OTHER EQUIPMENT

10.1 General

10.1.1 Scope. This section applies only to the *equipment* described below.

[. . .]

10.2 Compliance Paths. Other equipment shall comply with Section 10.2.1 and Section 10.2.2.

10.2.1 Requirements for All Compliance Paths. Other equipment shall comply with Section 10.1, "General"; Section 10.4, "Mandatory Provisions"; Section 10.5, "Prescriptive Path" and Section 10.8, "Product Information."

[. . .]

10.5 Prescriptive Compliance Path ~~(Not Used)~~

10.5.1 *Renewable Energy Resources*. *Buildings* shall be served by *renewable energy resources* complying with Section 10.5.1.1.

10.5.1.1 On-Site Renewable Energy. The *building* site shall have *equipment* for *on-site renewable energy* with a rated capacity of not less than 0.25 W/ft² or 0.85 Btu/ft2 (2.7W/m2) multiplied by the sum of the *gross conditioned floor area* for all floors up to the three (3) largest floors.

Exceptions to 10.5.1.1:

1. Any *building* located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m2·day (1.1 kBtu/ft2·day).
2. Any *building* where more than 80% of the *roof* area is covered by any combination of *equipment* other than for *on-site renewable energy systems*, planters, vegetated space, *skylights*, or occupied *roof* deck.
3. Any *building* where more than 50% of *roof* area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the *building* for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
4. New construction or *additions* in which the sum of the *gross conditioned floor area* of the three largest floors of the new construction or *addition* is less than 10,000 ft2 (1000 2). *Alterations* that do not include *additions*.

Revise Section 11 as shown (I-P and SI units).

11.4 Simulation General Requirements

11.4.1 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings*. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section 11.4.5 shall be used.

Exception to 11.4.1: When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Informative Note: ASHRAE Standing Standard Project Committee 90.1 recommends that the *simulation program* implement the rules of Section 11 that control simulation inputs and outputs be adopted for the purposes of easier use and simpler compliance.

[. . .]

11.4.3 Renewable, Recovered, and Purchased Energy

11.4.3.1 On-Site Renewable Energy and Site-Recovered Energy. *Site-recovered energy* shall not be considered *purchased energy* and shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost*. *On-site renewable energy* shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost* provided that the building owner

a. owns the *on-site renewable energy system*,

b. has signed a lease agreement for the *on-site renewable energy system* for at least 15 years or

c. has signed a contractual agreement to purchase *energy* generated by the *on-site renewable energy system* for at least 15 years.

The reduction in *design energy cost* associated with *on-site renewable energy* that exceeds the *on-site renewable energy* required by Section 10.5.1.1 shall be no more than 5% of the calculated *energy cost budget.*

On-site renewable energy included in the *budget building design* shall be subtracted from the *budget building design* energy consumption prior to calculating the *energy cost budget.*

11.4.3.2 Annual Energy Costs. The *design energy cost* and *energy cost budget* shall be determined using rates for *purchased energy* (such as electricity, gas, oil, propane, steam, and

chilled water) that are approved by the *adopting authority*. Where *on-site renewable energy* or *site-recovered energy* is ~~used~~ in excess of what is required in the *budget building design* by Table 11.5.1, the *budget building design* shall be based on the *energy* source used as the backup

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
15. On-Site Renewable Energy	
On-site renewable energy in the *proposed design* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall be included in the *budget building design* when required by Section 10.5.1, and shall be determined as follows: a. Where a *system* providing *on-site renewable energy* has been modeled in the *proposed design*, the same *system* shall be modeled identically in the *budget building design*, except the rated capacity shall meet the requirements of Section 10.5.1.1. Where more than one type of *on-site renewable* energy system is modeled, the total capacities shall be allocated in the same proportion as in the *proposed design*. b. Where no *system* exists or is specified to provide *on-site renewable energy* in the *proposed design*, *on-site renewable energy* shall be modeled as an unshaded photovoltaic system with the following physical characteristics: • Size: Rated capacity per Section 10.5.1.1 • Module Type: Crystalline silicon panel with a glass cover, 19.1% nominal efficiency and temperature coefficient of –0.47%/°C; performance shall be based on a reference temperature of 77°F (25°C) and irradiance of 317 Btu/ft2·h (1000 W/m2). • Array Type: Rack-mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C) • Total system losses (DC output to AC output): 11.3% • Tilt: 0-degrees (mounted horizontally) • Azimuth:180 degrees If the *on-site renewable energy system* cannot be modeled in the *simulation program*, Section 11.4.5 shall be used.

energy source, or electricity if no backup *energy* source has been specified. Where the proposed design includes *on-site electricity generation systems* other than *on-site renewable energy systems*, the baseline design shall include the same generation systems excluding its *site-recovered energy*.

Modify Section 4.2.1.1 as shown (I-P and SI units).

4.2.1.1 New Buildings. New *buildings* shall comply with Sections 4.2.2 through 4.2.5 and either the provisions of

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other *Equipment*," or
b. Section 11, "*Energy Cost Budget* Method," or
c. Normative Appendix G, "*Performance Rating Method*."

When using Normative Appendix G, the Performance Cost Index (PCI) of new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall be less than or equal to the Performance Cost Index target (PCI_t) when calculated in accordance with the following:

$$PCI_t = [BBUEC + (BPF \times BBREC) \underline{- PRE}]/BBP$$

Where

PCI = Performance Cost Index calculated in accordance with Section G1.2.
BBUEC = baseline *building* unregulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *unregulated energy use*.
BBREC = baseline *building* regulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *regulated energy use*.
BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 use "All others." Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types.
BBP = *baseline building performance*.
PBP = *proposed building performance*, including the reduced, annual purchased energy cost associated with all *on-site renewable energy* generation systems.
PBP_{nre} = *proposed building performance* without any credit for reduced annual energy costs from on-site renewable energy generation systems.
PBP_{pre} = *proposed building performance*, excluding any renewable energy system in the proposed design and including an *on-site renewable energy system* that meets but does not exceed the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 11.5.1.

$PRE = PBP_{nre} - PBP_{pre}$.

When $(PBP_{pre} - PBP)/BBP > 0.05$, new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall comply with the following:

$$PCI + [(PBP_{pre} - PBP)/BBP] - 0.05 < PCI_t$$

Informative Notes:

1. PBP_{nre} = *proposed building performance*, no renewable energy
2. PBP_{pre} = *proposed building performance*, prescriptive renewable energy
3. PRE = prescriptive renewable energy

Modify Section G2.2 as shown (I-P and SI units).

G2.2 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings* (a program such as, but not limited to, DOE-2, BLAST, or EnergyPlus). The *simulation program* shall include calculation methodologies for the *building* components being modeled. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section shall be used.

Exception to G2.2: When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Modify Table G3.1 as shown (I-P and SI units).

No.	*Proposed Building Performance*	*Baseline Building Performance*
18. *On-Site Renewable Energy*		
	On-site renewable energy in the *proposed building performance* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall not be included in the *baseline building performance*.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

Need and Reason

1. Why is the proposed code change needed?

This code proposal change is based on approved ASHRAE addenda by, ck, and cp to Standard 90.1-2019.[1] Standard 90.1 is developed under ANSI-approved consensus procedures and is under continuous maintenance. ASHRAE publishes changes to Standard 90.1 as individual addenda to the preceding Standard, and then bundles them together to form the next published edition. Because addenda are typically not recognized as part of Minnesota's energy code, it is important to incorporate the most crucial approved addenda to the Minnesota commercial energy code during the adoption process. These addenda establish a prescriptive requirement for onsite renewable energy of 0.25W/s.f. of the three largest floors of all commercial buildings. The size of the required on-site renewable energy is small (on average 4.5% of building energy use) and is a more cost-effective way to require all new commercial buildings to be solar ready. Without this code requirement, it may either not be technically possible or it would be economically prohibitive to add solar to new commercial buildings in the future without this proposed code change.

In addition, this proposal will update and expand the definitions of renewable energy resources and onsite renewable energy to be consistent with the definitions that will be in Minnesota's next commercial code. Finally, this addenda clarifies how to treat renewable energy in the performance pathway

Addendum by adds a minimum prescriptive requirement for onsite renewable energy. The renewable energy resources are defined within the addendum; however, the specific resource to be used are left up to the designer or building owner. The listed capacity requirement, as well as the scalar evaluation, is based on photovoltaic generation, as that is the most ubiquitous and cost-effective renewable energy resource and equipment/system currently available across the industry. The renewable energy capacity component was determined through a comparative analysis exercise considering economics, (roof) space competition, annual energy production/ contribution to the building energy budget, and equivalences against other energy efficiency measures. The annual purchased energy reduction budget for this renewable energy proposal, based on the PI prototype models considered, is 4.5%. The building prototypes and solar zones evaluated passed the ASHRAE scalar assessment[2] for cost effectiveness.

Addendum ck adds language to Section 11 to address new renewable energy requirements in Addendum by. The approach allows a proposed design that does not include renewable energy required by Section 10.5.1 a trade-off against other prescriptive requirements in the standard. In that case, the renewable energy allowance included in the budget building design will be based on a horizontal photovoltaic array with a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1. For proposed designs that include an on-site renewable energy system, the budget building design allowance will be based on the proposed renewable energy system design with a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1. This addendum impacts an optional performance path in the standard designed to provide increased flexibility and therefore was not subjected to cost effectiveness analysis.

Addendum cp adds language to Normative Appendix G to address the new proposed renewable energy requirements in Addendum by. The approach allows a proposed design that does not include renewable energy required by Section 10.5.1 a method of trade off against other prescriptive requirements in the standard. In that case the renewable energy allowance included in the budget building design will be based on a horizontal photovoltaic array with a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1. For proposed designs that include an on-site renewable energy system, the budget building design allowance will be based on the proposed renewable energy system design with

[1] *ANSI/ASHRAE/IES Addendum by, ck, and cp to ANSI/ASHRAE/IES Standards 90.1-2019,* ASHRAE Standards Committee, 31 July 2020, https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_by_ck_cp_20200731.pdf

[2] The scalar ratio is used specifically for Scenario 3, the ASHRAE SSPC 90.1 Scalar Method. Using this approach, the payback is calculated as the sum of the first costs and present value of the replacement costs, divided by the difference of the energy cost savings and incremental maintenance cost.

a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1. This addendum impacts an optional performance path in the standard designed to provide increased flexibility and therefore was not subjected to cost effectiveness analysis.

2. Why is the proposed code change a reasonable solution?

   This proposed code change will ensure that new commercial buildings built in Minnesota will both have a nominal amount of renewable energy installed on-site and will ensure additions of renewable energy in the future will not be cost prohibitive or technically infeasible.

3. What other considerations should the TAG consider?

   None.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.

   This proposed code change will increase costs modestly. NBI and Steven Winter Associates received stakeholder feedback on three common commercial building types being built in Minnesota. The first is a 4-story multifamily building that is 3,040 s.f. The second is a 10-story multifamily high-rise that is 76,000 s.f. and the third is a 3-story office building that is 53,633 s.f. The following table lists the required amount of PV that would be required under this proposed code amendment, the approximate installed costs for solar on these buildings, annual energy cost savings in the first year of production and the simple payback period.

	PV (kW)	PV Cost	Annual Energy Cost Savings	Simple Payback Period
Multifamily Medium (4-story, 3,040 s.f.)	0.57	$ 1,140	$ 104	10.9
Multifamily High Rise (10-story, 76,000 s.f.)	5.7	$ 11,400	$ 1,,044	10.9
Office (3-story, 53,633 s.f.)	13.4	$ 26,817	$ 1,877	14.3

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.

   The increased costs will be offset by annual energy cost savings, and by preparing the building for future expansion of solar capacity.

3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

   No.

4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change? Architects, Engineers, Construction Contractors, Building Officials and Inspectors.

   All segments of the industry will be affected by this proposed code change.

2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?

   There should be no additional costs to state agencies.

   None.

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?

   No.

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.

   Some of the purpose of the proposed code change may be achieved by requiring buildings be solar ready. However, solar-readiness is not strictly cost-effective because there is no energy payback associated with making a commercial building solar ready.

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?

   The probable costs are listed in section 1 above.

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   By not adopting this requirement, commercial buildings may find it technically infeasible or cost prohibitive to install solar at their building in the future.

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.

   No.

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

   There is no additional cumulative effect of the rule when accounting for other federal and state regulations.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

ASHRAE 2017 Climate Data found at: http://ashrae-meteo.info/v2.0/p

	Summer Db/Wb °F							
	Current Code		0.40%		1%		2%	
	Db°F	Wb°F	Db°F	Wb°F	Db°F	Wb°F	Db°F	Wb°F
Aitkin	82	72	85.9	74.8	82.4	72.1	81	70.4
Albert Lea	85	72	89.6	73.9	86.1	72.2	83.5	70.9
Bemidji	84	68	86.4	70	82.4	67.3	80.7	65.9
Cloquet	82	68	84.2	70.8	81.6	68.2	79.1	66.2
Crookston	84	70	87.8	72.7	83.9	70.1	81.5	68
Duluth	81	67	84.2	69.7	81	67.1	78.2	65.3
Ely	82	68	84.3	69.2	81.6	67.4	79.1	65.2
Eveleth- Virginia	82	68	85.8	69.4	82	66.9	80.8	65.7
Faribault	86	73	90.1	74.3	87.6	72.7	83.9	70.7
Fergus Falls	86	71	88.5	72.5	84.5	70.2	82.1	68.6
Grand Rapids	81	67	84.2	69.8	81.6	67.4	79.2	65.4
International Falls	83	67	85.4	69.8	82.3	67.4	79.5	65.8
Litchfield	85	71	89.6	73.6	85.8	72	82.3	69.4
Little Falls	86	71	90	72.9	85.9	69.9	82.1	67.5
Mankato	86	72	89.9	73.7	86.3	71.9	83.5	70.6
Minneapolis/ St Paul	88	72	90.8	73.3	87.8	72	84.9	70.2
Montevideo	86	72	90.2	73.4	87.7	72.8	84	70.3
Mora	84	70	88.1	72.7	85.5	70.3	81.5	67.8
Morris	84	72	89.6	74.1	85.7	72	82.3	70.1
New Ulm	87	73	90.2	74.2	87.6	73	83.9	70.9
Owatonna	86	73	89.9	74.2	86.4	72.3	83.7	71
Pequot Lakes	84	68	88.9	69.8	85.4	68.3	81.8	66.2
Pipestone	85	73	89.6	73.7	86.2	72.7	83.6	71
Redwood Falls	89	73	91.3	74.2	88.4	72.6	85.6	70.8
Rochester	85	72	87.7	73.3	84.7	71.7	82.2	70.3
Roseau	82	70	87.6	74.6	83.6	71.5	81.2	69.6
St Cloud	86	71	89.4	72.5	86.3	70.7	83.4	68.7
Thief River Falls	82	68	85.8	70.9	82.2	68.4	80.8	67.1
Warroad	83	67	84.3	71.2	81.7	69.7	79.3	67.2
Wheaton	84	71	89.8	72.9	86.1	71.6	82.5	69.3
Willmar	85	71	89.8	72.4	86.3	71.6	83.7	70.2
Winona	88	74	90.8	73.2	88.4	72.6	84.2	70.4
Worthington	84	71	88.4	72.3	85.6	70.9	82.3	69
			4.35%	2.78%	0.49%	0.08%	-2.85%	-2.58%

laces.php?continent=North%20America

Winter Db °F			
Current Code	99.60%	99%	Extreme Mean
-24	-20	-14.8	-28.1
-15	-11.8	-7.7	-18.5
-24	-27.7	-25.2	-30.3
-20	-18	-12.7	-24.4
-27	-24.1	-18.1	-28.2
-20	-17.2	-12	-23.4
-29	-26.6	-20	-33.9
-26	-22.4	-17.1	-30.7
-16	-13.7	-8.4	-20.6
-21	-18.2	-15	-29
-23	-19.5	-15	-24.6
-28	-26.1	-20.5	-34.6
-18	-15	-9.1	-19.9
-20	-18.2	-12.8	-26.3
-15	-12.3	-8.2	-15.9
-15	-10.6	-5.8	-16.7
-17	-14.8	-9	-19.1
-21	-18	-11.8	-23.9
-21	-17.8	-12.9	-22.6
-15	-14	-8.6	-18.6
-16	-14.5	-8.6	-19.1
-23	-23.4	-17.2	-30.5
-15	-12.3	-8.2	-18.7
-17	-13.4	-8.7	-18.8
-17	-12.4	-7.6	-18.7
-29	-25.5	-19.5	-31.1
-20	-16.8	-11.3	-24.2
-25	-22.2	-17.5	-27.3
-29	-24.3	-18.4	-32.1
-20	-17.4	-11.3	-22.6
-20	-14.9	-9.3	-21.8
-13	-8.9	-4.3	-17.7
-14	-11.2	-7.6	-15.8
	-14.26%	-40.36%	17.45%

Winter Variation from Current Code		
99.60%	99.00%	Extreme Mean
-16.67%	-38.33%	17.08%
-21.33%	-48.67%	23.33%
15.42%	5.00%	26.25%
-10.00%	-36.50%	22.00%
-10.74%	-32.96%	4.44%
-14.00%	-40.00%	17.00%
-8.28%	-31.03%	16.90%
-13.85%	-34.23%	18.08%
-14.38%	-47.50%	28.75%
-13.33%	-28.57%	38.10%
-15.22%	-34.78%	6.96%
-6.79%	-26.79%	23.57%
-16.67%	-49.44%	10.56%
-9.00%	-36.00%	31.50%
-18.00%	-45.33%	6.00%
-29.33%	-61.33%	11.33%
-12.94%	-47.06%	12.35%
-14.29%	-43.81%	13.81%
-15.24%	-38.57%	7.62%
-6.67%	-42.67%	24.00%
-9.38%	-46.25%	19.38%
1.74%	-25.22%	32.61%
-18.00%	-45.33%	24.67%
-21.18%	-48.82%	10.59%
-27.06%	-55.29%	10.00%
-12.07%	-32.76%	7.24%
-16.00%	-43.50%	21.00%
-11.20%	-30.00%	9.20%
-16.21%	-36.55%	10.69%
-13.00%	-43.50%	13.00%
-25.50%	-53.50%	9.00%
-31.54%	-66.92%	36.15%
-20.00%	-45.71%	12.86%
-14.26%	-40.36%	17.45%

Summer Variation from Current Code					
0.40%		1%		2%	
Db°F	Wb°F	Db°F	Wb°F	Db°F	Wb°F
4.76%	3.89%	0.49%	0.14%	-1.22%	-2.22%
5.41%	2.64%	1.29%	0.28%	-1.76%	-1.53%
2.86%	2.94%	-1.90%	-1.03%	-3.93%	-3.09%
2.68%	4.12%	-0.49%	0.29%	-3.54%	-2.65%
4.52%	3.86%	-0.12%	0.14%	-2.98%	-2.86%
3.95%	4.03%	0.00%	0.15%	-3.46%	-2.54%
2.80%	1.76%	-0.49%	-0.88%	-3.54%	-4.12%
4.63%	2.06%	0.00%	-1.62%	-1.46%	-3.38%
4.77%	1.78%	1.86%	-0.41%	-2.44%	-3.15%
2.91%	2.11%	-1.74%	-1.13%	-4.53%	-3.38%
3.95%	4.18%	0.74%	0.60%	-2.22%	-2.39%
2.89%	4.18%	-0.84%	0.60%	-4.22%	-1.79%
5.41%	3.66%	0.94%	1.41%	-3.18%	-2.25%
4.65%	2.68%	-0.12%	-1.55%	-4.53%	-4.93%
4.53%	2.36%	0.35%	-0.14%	-2.91%	-1.94%
3.18%	1.81%	-0.23%	0.00%	-3.52%	-2.50%
4.88%	1.94%	1.98%	1.11%	-2.33%	-2.36%
4.88%	3.86%	1.79%	0.43%	-2.98%	-3.14%
6.67%	2.92%	2.02%	0.00%	-2.02%	-2.64%
3.68%	1.64%	0.69%	0.00%	-3.56%	-2.88%
4.53%	1.64%	0.47%	-0.96%	-2.67%	-2.74%
5.83%	2.65%	1.67%	0.44%	-2.62%	-2.65%
5.41%	0.96%	1.41%	-0.41%	-1.65%	-2.74%
2.58%	1.64%	-0.67%	-0.55%	-3.82%	-3.01%
3.18%	1.81%	-0.35%	-0.42%	-3.29%	-2.36%
6.83%	6.57%	1.95%	2.14%	-0.98%	-0.57%
3.95%	2.11%	0.35%	-0.42%	-3.02%	-3.24%
4.63%	4.26%	0.24%	0.59%	-1.46%	-1.32%
1.57%	6.27%	-1.57%	4.03%	-4.46%	0.30%
6.90%	2.68%	2.50%	0.85%	-1.79%	-2.39%
5.65%	1.97%	1.53%	0.85%	-1.53%	-1.13%
3.18%	-1.08%	0.45%	-1.89%	-4.32%	-4.86%
5.24%	1.83%	1.90%	-0.14%	-2.02%	-2.82%
4.35%	2.78%	0.49%	0.08%	-2.85%	-2.58%