Christopher Hine, September 9, 2025

Energy Code Compliance Options in PA

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Pennsylvania Housing Research Center

- The Pennsylvania Housing Research Center (PHRC) provides and facilitates education, training, innovation, research, and dissemination to the residential construction industry for the purpose of improving the quality and affordability of housing.
- Educational programs and publications by the PHRC address a wide range of topics relevant to the home building industry and are designed to reach a diverse audience: builders, code officials, remodelers, architects, developers, engineers, planners, landscape architects, local government officials, educators, etc. to provide professional development and continuing education.

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Description

Understanding the 2021 IRC and IECC energy codes is challenging enough—but when you factor in Pennsylvania's unique modifications under the Uniform Construction Code (UCC), it becomes even more complex. This webinar will walk you through the residential energy compliance options available in Pennsylvania, including the Prescriptive path, Total Building Performance, Energy Rating Index (ERI), and the new 2025 Pennsylvania Alternative Residential Energy Provisions. Join us to gain clarity on these paths and learn how to choose the right one for your project.

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Learning Objectives

- Identify the residential energy code compliance paths recognized under the 2021 IRC/IECC and Pennsylvania Uniform Construction Code, and explain the specifics of each.
- Evaluate how different compliance strategies - Prescriptive, Total Building Performance, and Energy Rating Index (ERI) have different compliance metrics and choosing the metrics that best fit the design and consumer's goals can help choose the correct compliance path.
- Analyze the key updates introduced in the 2025 Pennsylvania Alternative Residential Energy Provisions and assess their potential to enhance energy efficiency.
- Apply compliance knowledge to real-world residential design and construction projects to ensure that buildings meet or exceed minimum code requirements, thereby promoting safer, healthier, and more sustainable living environments.

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Previous Webinars in Support of this Presentation

- **Navigating the Ever-Changing Energy Code Landscape, the 2021 IRC/IECC Edition**
  - https://youtu.be/oww4IsR5Usk?si=XEUWMAOVITAeZdWk
- **2025 Pennsylvania Alternative Residential Energy Provisions Update**
  - https://youtu.be/r4Ls9yXpGNY?si=QfU-tcAyfT8I38vE

PHRC YouTube Channel
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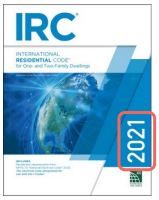
New "Base" Code



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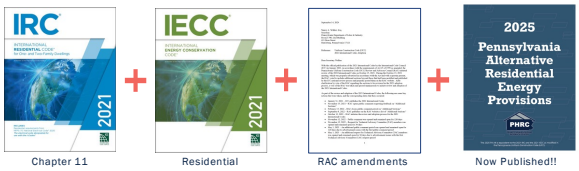
PA UCC Residential Energy Code Summary



Chapter 11 + Residential Provisions + RAC amendments + Now Published!!

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2021 IRC/IECC as Modified by the PA UCC

- This information can be found in the RAC Report
  - https://www.pa.gov/content/dam/copapwp-pagov/en/dli/documents/ucc/documents/2021%20icc%20code%20adoption%20final%20report.pdf
- Examples of modified text (not limited to):
  - New R-values in Table N1102.1.3
  - Did not adopt N1101.13.5 Additional Energy Efficiency and all references
  - Not requiring N1108.2 Additional Efficiency Package Options

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When Is It Changing?

- Anticipated effective date for PA UCC code changes:

~~July 13, 2025~~

New Date TBD

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What are our Options for Energy Code Compliance?

- Above code programs
- Prescriptive compliance path
- Performance compliance path
- 2025 Pennsylvania Alternative Residential Energy Provisions

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Above Code Program

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N1101.4 (R102.1.1) Above Code Programs

- The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency program shall be considered to be in compliance with this code. The requirements identified in Table N1105.2 *(requirements for total building performance)*, as applicable, shall be met and the building thermal envelope is greater than or equal to levels of efficiency and solar heat gain coefficients (SHGC) in Tables 402.1.1 and 402.1.3 of the 2009 International Energy Conservation Code.

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

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Table N1105.2 (R405.2) Requirements for Total Building Performance

SECTION[a]	TITLE
General	
~~N1101.13.5~~	~~Additional energy efficiency~~
N1101.14	Certificate
Building Thermal Envelope	
N1102.1.1	Vapor retarder
N1102.2.3	Eave baffle
N1102.2.4.1	Access hatches and doors
N1102.2.10.1	Crawl space wall insulation installation
N1102.4.1.1	Installation
N1102.4.1.2	Testing
N1102.5	Maximum fenestration *U*-factor and SHGC
Mechanical	
N1103.1	Controls
N1103.3, including N1103.3.1, except Sections N1103.3.2, N1103.3.3 and N1103.3.6	Ducts
N1103.4	Mechanical system piping insulation
N1103.5.1	Heated water circulation and temperature maintenance systems
N1103.5.3	Drain water heat recovery units
N1103.6	Mechanical ventilation
N1103.7	Equipment sizing and efficiency rating
N1103.8	Systems serving multiple dwelling units
N1103.9	Snow melt system controls
N1103.10	Energy consumption of pools and spas
N1103.11	Portable spas
N1103.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
N1104.1	Lighting equipment
N1104.2	Interior lighting controls

a. Reference to a code section includes all the relative subsections except as indicated in the table.

Technical code changes from previou of the I-Codes are shown in blue text

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Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Ill.

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Example: Energy Star

Exhibit 1: Applicable ENERGY STAR SFNH Program Requirements, Versions, and Revisions for All Locations Except California

Home Is Built in This State Or Territory:	Home Is Permitted [1,2] On or After This Date:	For Homes Meeting the Adjacent Criteria, These Are the Applicable Program Requirements, Including Minimum Version ("v") & Revision ("Rev.")	
AL, AK, AZ, AR, CO, IN, ID, KS, KY, LA, MS, MO, NH, NC, ND, OH, OK, SC, SD, TN, WV, WI, WY	01-01-2023	SFNH National v3.1	Rev. 11
	01-01-2024	SFNH National v3.1	Rev. 12
	01-01-2025	SFNH National v3.1	Rev. 13
	01-01-2026	SFNH National v3.1	Rev. 14
DC, DE, IA, MA, MI, MN, MT, NE, NV, NY, PA, RI, TX	01-01-2022	SFNH National v3.1	Rev. 11
	01-01-2024	SFNH National v3.1	Rev. 12
	01-01-2025	SFNH National v3.1	Rev. 13
	01-01-2026	SFNH National v3.1	Rev. 14

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Source: https://www.energystar.gov/sites/default/files/2025-01/SFNH%20Program%20Versions_Rev%2014.pdf

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Prescriptive Compliance Path

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N1101.13 (R401.2) Application

- Residential buildings shall comply with Section:
  - ~~N1101.13.5 (Additional Energy Efficiency) and~~:
  - N1101.13.1 (Prescriptive Compliance Path),
    - Insulation and Fenestration Criteria
    - R-Value Alternative
    - R-Value Computation
    - Total UA Alternative
  - N1101.13.2 (Total Building Performance Option),
  - N1101.13.3 (Energy Rating Index Option) or
  - ~~N1101.13.4 (Tropical Climate Region Option).~~
  - Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Section N1109.

16 Source: International Code Council (ICC), (2020), 2021 International Residential Code, Country Club Hill, Ill.

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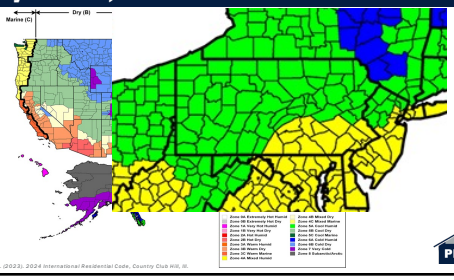
2021 Climate Zone Map (2 Climate Zones in Pennsylvania)



17 Source: International Code Council (ICC), (2023), 2024 International Residential Code, Country Club Hill, Ill.

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N1101.13.1 Prescriptive Compliance Option

- The Prescriptive Compliance Option requires compliance with Sections N1101 through N1104.
  - N1101 – General
  - N1102 – Building Thermal Envelope
  - N1103 – Systems
  - N1104 – Electrical Power and Lighting Systems

18 Source: International Code Council (ICC), (2020), 2021 International Residential Code, Country Club Hill, Ill.

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Building Thermal Envelope (N1102)

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N1102.1 (R402.1) General:

- The building thermal envelope shall comply with the requirements of Sections N1102.1.1 through N1102.1.5.
  - N1102.1.1 – Vapor Retarder
  - N1102.1.2 – Insulation and Fenestration Criteria
  - N1102.1.3 – R-Value Alternative
  - N1102.1.4 – R-Value Computation
  - N1102.1.5 – Total UA Alternative

20

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

20

N1102.1.2 (R402.1.2) Insulation and Fenestration Criteria:

- The building thermal envelope shall meet the requirements of Table N1102.1.2 *(Maximum Assembly U-Factors and Fenestration Requirements)* based on the climate zone specified in Section N1101.7. Assemblies shall have a U-factor equal to or less than that specified in Table N1102.1.2. Fenestration shall have a U-factor and glazed fenestration SHGC equal to or less than that specified in Table N1102.1.2.

21

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

21

Table N1102.1.2 Maximum Assembly U-Factors and Fenestration Requirements

TABLE R1102.1.2 (R402.1.2)
MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT U-FACTOR	GLAZED FENESTRATION SHGC[d,e]	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.25	0.030	0.060	0.098	0.047	0.091	0.136
4 except Marine	0.30	0.55	0.40	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	NR	0.026	0.051	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.026	0.045	0.057	0.028	0.050	0.055

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Source: https://www.pa.gov/content/dam/copapwp-pagov/en/dli/documents/ucc/documents/2021%20icc%20code%20adoption%20final%20report.pdf

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R-Value, U-Factor Conversion

- **Thermal resistance (R-Value)**
  - Higher R-Value = better insulating value
- **Thermal transmittance (U-Factor)**
- **U-Factor = 1 / (R-Value); U-.30 = R-3.33 or R-20 = U-.05**
  - R-Value = Insulation
  - U-Factor = Fenestration
  - Lower U-Factor = better insulating value

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N1102.1.3 (R402.1.3) R-value Alternative

- Assemblies with R-value of insulation materials equal to or greater than that specified in Table N1102.1.3 *(Insulation Minimum R-Values and Fenestration Requirements by Component)* shall be an alternative to the U-factor in Table N1102.1.2.

24

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Ill.

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Table N1102.1.3 Insulation Minimum R-Values and Fenestration Requirements by Component

TABLE N1102.1.3 (R402.1.3)
INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b,e]	CEILING R-FACTOR	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13 + 5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13 + 5[h]	8/13	19	10/13	10, 2ft	10/13
5 and Marine 4	0.30	0.55	NR	49	23 or 13 + 7.5[h] or 20 + 3.8[h]	13/17	30[g]	15/19	10, 4ft or 15, 3ft	15/19
6	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Source: https://www.pa.gov/content/dam/copapwp-pagov/en/dli/documents/ucc/documents/2021%20icc%20code%20adoption%20final%20report.pdf

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N1102.1.4 (R402.1.4) R-value Computation.

- Cavity insulation alone shall be used to determine compliance with the cavity insulation R-value requirements in Table N1102.1.3. Where cavity insulation is installed in multiple layers, the R-values of the cavity insulation layers shall be summed to determine compliance with the cavity insulation R-value requirements. The manufacturer's settled R-value shall be used for blown-in insulation. Continuous insulation (ci) alone shall be used to determine compliance with the continuous insulation R-value requirements in Table N1102.1.3. Where continuous insulation is installed in multiple layers, the R-values of the continuous insulation layers shall be summed to determine compliance with the continuous insulation R-value requirements. Cavity insulation R-values shall not be used to determine compliance with the continuous insulation R-value requirements in Table N1102.1.3. Computed R-values shall not include an R-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Table N1102.1.3, the manufacturer's labeled R-value for insulated siding shall be reduced by R-0.6.

26

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Ill.

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N1102.1.5 (R402.1.5) Total UA Alternative

- Where the total building thermal envelope UA, the sum of U-factor times assembly area, is less than or equal to the total UA resulting from multiplying the U-factors in Table N1102.1.2 by the same assembly area as in the proposed building, the building shall be considered to be incompliance with Table N1102.1.2. The UA calculation shall be performed using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. In addition to UA compliance, the SHGC requirements of Table N1102.1.2 and the maximum fenestration U-factors of Section N1102.5 shall be met.

27

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Ill.

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Total UA Alternative Calculator

- The total UA Alternative is a calculation, not a simulation
  - REScheck: https://www.energycodes.gov/rescheck


Generated by REScheck-Web Software
Compliance Certificate

Project A Sample Project

Energy Code: 2018 IECC
Location: Eugene, Oregon
Construction Type: Single-family
Project Type: New Construction
Orientation: Bldg. faces 180 deg. from North
Conditioned Floor Area: 3,000 ft2
Glazing Area 2%
Climate Zone: 4 (4546 HDD)
Permit Date:
Permit Number:

Construction Site: 123 Main St. Dogtown, WA 99352

Owner/Agent: R. Franklin 321 W. Tenth Dogtown, WA 99532 509.888.7777

Designer/Contractor: Anne Hatchet Acme Home Designers 555 Poore Ridge Dogtown, WA 99532 509.888.999

Compliance: Passes using UA trade-off

Compliance: 17.8% Better Than Code Maximum UA: 545 Your UA: 448

Building Energy Codes Program

Verify energy code, location, construction type, and conditioned floor area

https://www.energycodes.gov/sites/default/files/2022-07/NECC2022_Bootcamp_RESCheck-Basics.pdf

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RESCheck & the 2021 IRC as Modified by the PA UCC

- Currently there is not an option to show compliance to the 2021 IRC as modified by the PA UCC.
- Other options?

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Total Building Performance Option (N1105)

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N1101.13.2 (R401.2.2) Total Building Performance Option

- The Total Building Performance Compliance Path requires compliance with Section N1105.
  - N1105 (R405) – Total Building Performance

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Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

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N1105.1 (R405.1) Scope

This section establishes criteria for compliance using total building performance analysis. Such analysis shall include heating, cooling, mechanical ventilation and service water-heating energy only.

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Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

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N1105.2 (R405.2) Performance-based Compliance.

Compliance based on total building performance requires that a proposed design meets all of the following:

1. The requirements of the sections indicated within Table N1105.2.
2. The building thermal envelope shall be greater than or equal to levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 International Energy Conservation Code.

33

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

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Table N1105.2 (R405.2) Requirements for Total Building Performance

SECTION*	TITLE
General	
~~N1101.13.2~~	~~Additional energy efficiency~~
N1101.14	Certificate
Building Thermal Envelope	
N1102.1.1	Vapor retarder
N1102.2.3	Eave baffle
N1102.2.4.1	Access hatches and doors
N1102.2.10.1	Crawl space wall insulation installation
N1102.4.1.1	Installation
N1102.4.1.2	Testing
N1102.5	Maximum fenestration *U*-factor and SHGC

Mechanical	
N1103.1	Controls
N1103.3, including N1103.3.1, except Sections N1103.3.2, N1103.3.3 and N1103.3.6	Ducts
N1103.4	Mechanical system piping insulation
N1103.5.1	Heated water circulation and temperature maintenance systems
N1103.5.3	Drain water heat recovery units
N1103.6	Mechanical ventilation
N1103.7	Equipment sizing and efficiency rating
N1103.8	Systems serving multiple dwelling units
N1103.9	Snow melt system controls
N1103.10	Energy consumption of pools and spas
N1103.11	Portable spas
N1103.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
N1104.1	Lighting equipment
N1104.2	Interior lighting controls

Technical code changes from previous of the I-Codes are shown in blue text

a. Reference to a code section includes all the relative subsections except as indicated in the table.

Source: International Code Council (ICC), (2020), 2021 International Residential Code, Country Club Hill, Ill.

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N1105.2 (R405.2) Performance-based Compliance. (cont.)

Compliance based on total building performance requires that a proposed design meets all of the following:

1. The requirements of the sections indicated within Table N1105.2.
2. The building thermal envelope shall be greater than or equal to levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 International Energy Conservation Code.

Source: International Code Council (ICC), (2020), 2021 International Residential Code, Country Club Hill, Ill.

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N1105.2 (R405.2) Performance-based Compliance. (cont.)

Compliance based on total building performance requires that a proposed design meets all of the following:

3. An annual energy cost that is less than or equal to the annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.
   - Exception: The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.

Source: International Code Council (ICC), (2020), 2021 International Residential Code, Country Club Hill, Ill.

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N1105.3.2 (R405.3.2) Compliance Report

Compliance software tools shall generate a report that documents that the proposed design complies with Section N1105.2. A compliance report on the proposed design shall be submitted with the application for the building permit. Upon completion of the building, a confirmed compliance report based on the confirmed condition of the building shall be submitted to the code official before a certificate of occupancy is issued.

- Compliance reports shall include information in accordance with Sections N1105.3.2.1 and N1105.3.2.2.

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Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

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Example Reports

- **Ekotrope**
  - Total Building Performance
- **REMRate**

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IECC 2021 Performance Compliance

Property	Organization	Inspection Status
123 Fake Street New Castle, PA 16101	Harmony Home Energy Michael Ambaster	Results are projected
PHRC EXAMPLE REPORT-REM-RATE_2021IECC.xml	**Builder** PHRC Example	

This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost

Design	IECC 2021 Performance	As Designed
Heating	$1,068	$957
Cooling	$106	$103
Water Heating	$267	$267
Mechanical Ventilation	$32	$29
SubTotal - Used to determine compliance	**$1,473**	**$1,357**
Lights & Appliances w/out Ventilation	$950	$950
Onsite generation	$0	$0
Total	**$2,423**	**$2,307**

R405.2 Source Energy Exception: The proposed home uses 9.01 MBtu LESS source energy than the reference home.

Requirements

✓	R405.2	Performance-based compliance passes by 7.9%	The proposed house meets the IECC 2021 Performance reference energy bill requirement by $151.00 (637 MBtu).
✓	R405.2 Item 2 (IECC 2009)	Total UA alternative compliance passes by 11.1%.	The proposed home meets the UA requirement by 11.1%
✓	R405.2 Item 2 (IECC 2009)	Glazed fenestration SHGC	
✓	R402.4.1.2	Air Leakage Testing	Air sealing is 1.63 ACH at 50 Pa and 0.14 CFM50 / ft² Shell Area. It must not exceed 5.00 ACH at 50 Pa or 0.28 CFM50 / ft² Shell Area.
✓	R403.3.1	Duct Insulation	All ducts are inside the thermal envelope or outside and insulated to at least R6.0.
✓	R403.3.3	Duct Testing	
⚠	R403.6	Mechanical Ventilation	Rated home must have at least one mechanical ventilation system, and it should be IRC M1505.4 compliant. Please refer to the 'Codes & Programs' tab.
✓	R404.1	Lighting Equipment	
⚠	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	2021 IECC Required Items must be checked as complete.
⚠	R403.6.2	Mechanical Ventilation Efficacy	Please specify whether the mechanical ventilation is an inline fan.
✓	R403.6.3	Mechanical Ventilation Energy Recovery	
✓	R402.5	Area-weighted average fenestration SHGC	Area-weighted average fenestration SHGC is 0.281. The maximum allowed value is (No Limit).
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R401.2.5 Option 2	Additional energy efficiency	R401.2.5: 2.2 - 10% Threshold Met.

Design exceeds the performance requirement for IECC 2021 Performance compliance by 7.9% but fails the mandatory requirements.

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REMRate and Ekotrope & the 2021 IRC as Modified by the PA UCC

- **Currently there is not an option to show compliance to the 2021 IRC as modified by the PA UCC.**
- **Will they update?**
  - REMRate
  - Ekotrope
- **Other options?**

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Energy Rating Index Option (N1106)

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N1101.13.3 (R401.2.3) Energy Rating Index Option

- The Energy Rating Index (ERI) option requires compliance with Section N1106.
  - N1106 (R406) – Energy Rating Index Compliance Alternative

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

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N1106.2 (R406.2) ERI Compliance

Compliance based on the Energy Rating Index (ERI) requires that the rated design meet all of the following:

1. The requirements of the sections indicated within Table N1106.2.
2. Maximum ERI of Table N1106.5.

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Il.

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Table N1106.2 (R406.2) Requirements for Energy Rating Index

SECTION*	TITLE
General	
~~N1101.13.2~~	~~Additional efficiency packages~~
N1101.14	Certificate
Building Thermal Envelope	
N1102.1.1	Vapor retarder
N1102.2.2	Eave baffle
N1102.2.4.1	Access hatches and doors
N1102.2.10.1	Crawl space wall insulation installation
N1102.4.1.1	Installation
N1102.4.1.2	Testing

Mechanical	
N1103.1	Controls
N1103.3 except Sections N1103.3.2, N1103.3.3 and N1103.3.6	Ducts
N1103.4	Mechanical system piping insulation
N1103.5.1	Heated water circulation and temperature maintenance systems
N1103.5.3	Drain water heat recovery units
N1103.6	Mechanical ventilation
N1103.7	Equipment sizing and efficiency rating
N1103.8	Systems serving multiple dwelling units
N1103.9	Snow melt system controls
N1103.10	Energy consumption of pools and spas
N1103.11	Portable spas
N1103.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
N1104.1	Lighting equipment
N1104.2	Interior lighting controls
N1105.3	Building thermal envelope

a. Reference to a code section includes all of the relative subsections except as indicated in the table.

43

Source: International Code Council (ICC). (2020). 2021 International Residential Code, Country Club Hill, Ill.

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N1106.4 (R406.4) Energy Rating Index - 2021 Not Adopted per RAC Report Remains; 2018 Language

The Energy Rating Index (ERI) shall be a numerical integer value that is based on a linear scale constructed such that the ERI reference design has an Index value of 100 and a residential building that uses no net purchased energy has an Index value of 0. Each integer value on the scale shall represent a 1 percent change in the total energy use of the rated design relative to the total energy use of the ERI reference design. The ERI shall consider all energy used in the residential building.

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Table N1106.4 (R406.4) Maximum Energy Rating Index (modified table from 2015 review)

TABLE N1106.4 (R406.4)MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX[a]
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of R406.2 and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.3.

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N1106.2 (R406.2) R406.2 Mandatory Requirements - 2018 Language (2015 IECC)

... The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code .

- **Exception**: Supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-6.

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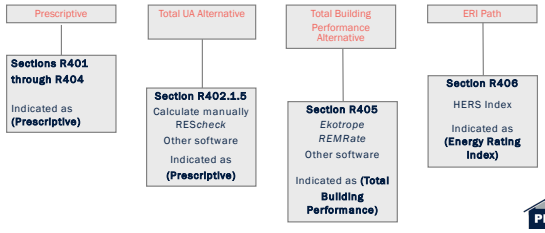
Summary: 2021 IECC Energy Compliance Options in Pennsylvania



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2025 Pennsylvania Alternative Residential Energy Provisions

Per the PA Department of Labor & Industry, the PA-Alt is named by its publication year, which does not correspond with adopted I-Codes

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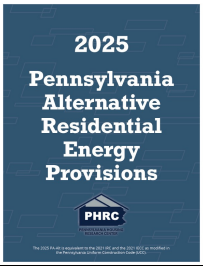
2025 Pennsylvania Alternative Residential Energy Provisions



- Based on the 2021 IECC and UCC Amendments
- Compliance allowed by UCC Title 34, Chapter 403
- Created and published by the Pennsylvania Housing Research Center
- Allows trade-offs

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Pennsylvania Alternative Residential Energy Provisions

- Compliance allowed by UCC Title 34, Chapter 403 (d)(1)
  - The prescriptive methods for detached residential buildings contained in the ''International Energy Conservation Code of [2021]'' compliance guide containing State maps, prescriptive energy packages and related software published by the United States Department of Energy, Building Standards and Guidelines Program (REScheckTM) or ''Pennsylvania's Alternative Residential Energy Provisions.''(Prescriptive vs. requiring modeling)

Source:

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Mandate for the PA-Alt

- The PHRC developed the PA-Alt for consideration by DLI to meet their legislative mandate. The PA-Alt was developed with the intent of being:
  - Simpler to build to and easier to enforce;
  - more rational and flexible;
  - Focused on PA in terms of climatic and other considerations; and
  - equivalent to the provisions of the International Energy Conservation Code (IECC) as amended in the PA UCC.

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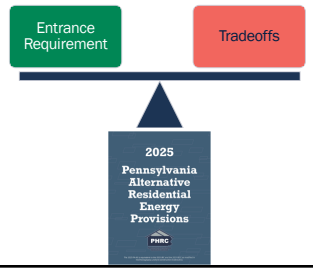
Pennsylvania Alternative Residential Energy Provisions



- Choose one Entrance Requirement
  - "Energy Enhancement Options"
- Receive ALL tradeoffs
- Energy modeling completed (BEopt) to ensure equivalent energy usage

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Scope Clarification

SECTION PA100

GENERAL

PA101 Scope. The provisions of this document regulate energy efficiency for the design and construction of buildings regulated by the 2021 International Residential Code (IRC) as modified in the Pennsylvania Uniform Construction Code (UCC) in the Commonwealth of Pennsylvania. In addition, the provisions of this document only apply to new construction of one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures not more than three stories above grade plane in height and are not applicable to alteration, repair, addition, and change of occupancy of existing buildings and structures.

Exception: Portions of the building envelope that do not enclose conditioned space.

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Source: https://www.ahcpa.gov/pages/docs/Publications/2025-Pennsylvania-Alternative-Residential-Energy-Provisions.pdf

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Energy Enhancement Options

Table PA104
Energy Enhancement Options

Option	Description		Minimum efficiency by climate zone	
			4	5
1	Ductless heat pumps[a]		8.6 HSPF2 and 18 SEER2	8.6 HSPF2 and 18 SEER2
2	All air ducts located inside the thermal envelope		Compliant	Compliant
3	Geothermal or water source heat pump installed[a]		Compliant (COP 3.6)	Compliant (COP 3.6)
4	Improved efficiency air source heat pump installed[a]		7.7 HSPF2 and 16.2 SEER2	8.4 HSPF2 and 18.1 SEER2
5	Improved efficiency condensing furnace installed[a]		92.5 AFUE	92.5 AFUE
6	Exterior continuous insulation		R20+10	R20+15
7	Improved efficiency windows		U-factor = 0.21	U-factor = 0.19
8	Package: Improved efficiency windows and higher attic R-value with raised heel truss[b]	Windows	U-factor = 0.25	U-factor = 0.21
		Attic	R-value = 60	R-value = 60
9	Package: Improved efficiency windows and heat pump water heater	Windows	U-factor = 0.25	U-factor = 0.21
		Heat Pump Water Heater	UEF = 3.5	UEF = 3.5

Notes:
a. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.
b. Full height of uncompressed insulation shall extend over the top plate at the eaves.

Source: https://www.ahcpa.gov/pages/docs/Publications/2025-Pennsylvania-Alternative-Residential-Energy-Provisions.pdf

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Energy Tradeoffs

- ALL of the following are allowed as a reduction when at least one energy enhancement option has been met.

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Energy Tradeoffs

- Attic Hatches: R-20 instead of insulating to the surrounding area

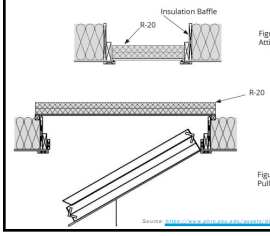

Figure PA302.3 (1)
Attic Hatch

PA302.4 Access hatches and doors. Access hatches and doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped. Both vertical and horizontal access hatches shall be insulated to a minimum of R-20 with rigid foam permanently attached to the access hatch. This is not intended to restrict the use of proprietary products meeting the intent of this provision. Side-hinged access doors shall meet the fenestration requirements of Table PA301.

Where loose-fill insulation is installed, a wood-framed or equivalent baffle or retainer, or dam shall be installed to prevent loose-fill insulation from spilling into living spaces, from higher to lower sections of the attic, and from attics covering conditioned spaces to unconditioned spaces. The baffle or retainer shall provide a permanent means of maintaining the installed R-value of the loose-fill insulation. Areas around access hatches required to service equipment shall provide a permanent means of maintaining the installed R-value of the insulation.

Exception: Vertical doors that provide access from conditioned to unconditioned spaces shall be permitted to meet the fenestration requirements of Table PA301 based on the applicable climate zone specified in Section PA201.1.

Figure PA302.3 (2)
Pull-Down Stairs

Source: https://www.phrc.psu.edu/assets/docs/Publications/2025-Pennsylvania-Alternative-Residential-Energy-Provisions.pdf

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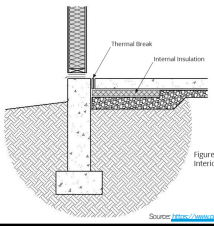
Energy Tradeoffs

- Slab Edge Insulation: Thermal break



PA302.9.2 Interior Insulation. Interior insulation shall be installed from the bottom of the slab and extend the distance provided in Table PA301 by any combination of vertical insulation or horizontal insulation extending under the slab. The slab edge shall be separated from the foundation wall by a continuous ½ inch thermal break as per Figure PA302.9.2. A thermal break shall be created by a material suitable for ground contact, which includes, but is not limited to, asphalt impregnated fiber board or extruded polystyrene. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.

Note: The provisions in Section PA302.9.2 only apply to unheated slabs. For heated slabs, refer to requirements in 2021 IRC Table N1102.1.3 (R402.1.3) as modified and 2021 IRC Section N1102.2.9 (R402.2.9).

Figure PA302.9.2
Interior Slab Insulation

Source: https://www.phrc.psu.edu/assets/docs/Publications/2025-Pennsylvania-Alternative-Residential-Energy-Provisions.pdf

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2021 Table N1102.1.3 – Insulation and Fenestration Table – RAC Report

TABLE R402.1.3 (N1102.1.3)
INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b,e]	CEILING R-FACTOR	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13 + 5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13 + 5[h]	8/13	19	10/13	10, 2ft	10/13
5 and Marine 4	0.30	0.55	NR	49	23 or 13 + 7.5[h] or 20 + 3.8[h]	13/17	30[g]	15/19	10, 4ft or 15, 3ft	15/19
6	0.30	0.55	NR	49	20 + 5" or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Source: https://www.pa.gov/content/dam/copapwp-pagov/en/dli/documents/ucc/documents/2021%20icc%20code%20adoption%20final%20report.pdf

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Energy Tradeoffs

- Wood Frame Wall R-Value: Cavity-Only Wall Insulation Option

Table PA301
Insulation Minimum R-values and Fenestration Requirements by Component[a]

Climate Zone	Fenestration[b] U-factor	Skylights[b] U-factor	Glazed Fenestration SHGC[b,e]	Ceiling R-value	Wood Frame Wall R-value	Mass Wall R-value[f]	Floor R-value	Basement[c] Wall R-value	Slab[d] R-value and depth	Crawlspace[c] Wall R-value
4	0.32	0.55	0.4	49	20[g] or 13+5[e]	8/13	19	10/13	10, 2 ft	10/13
5	0.30	0.55	NR	49	23[h], 20+3.8[e], or 13+7.5[e]	13/17	30	10/13	10, 4 ft or 15, 3 ft	10/13

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Source: https://www.phrc.psu.edu/assets/docs/Publications/2025-Pennsylvania-Alternative-Residential-Energy-Provisions.pdf

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Energy Tradeoffs

- Wood Frame Wall R-Value: Cavity-Only Wall Insulation Option

Notes:

a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall.
d. For heated slabs, refer to requirements in 2021 IRC Table N1102.1.3 (R402.1.3) as modified and 2021 IRC Section N1102.2.9 (R402.2.9).
e. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
f. Mass walls shall be in accordance with 2021 IRC Section N1102.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.
g. R-18 insulation shall be permitted in place of R-20 requirement provided the construction of the wall is of the advanced framing type, has a framing fraction of 19% and insulation is installed per ANSI/RESNET/ICC 301-2022 Section 4.2.2.1 and Table 4.2.2(6).
h. R-20 insulation shall be permitted in place of R-23 requirement provided the construction of the wall is of the advanced framing type, has a framing fraction of 19% and insulation is installed per ANSI/RESNET/ICC 301-2022 Section 4.2.2.1 and Table 4.2.2(6).

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Source: https://www.phrc.psu.edu/assets/docs/Publications/2025-Pennsylvania-Alternative-Residential-Energy-Provisions.pdf

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2022 ANSI/RESNET/ICC 301

TABLE 4.2.2(6)DEFAULT FRAMING FRACTIONS FOR WOOD-FRAMED ASSEMBLY COMPONENTS

ASSEMBLY COMPONENT	FRAMING SPACING (INCHES ON CENTER)	FRAMING TYPE	DEFAUT FRAMING FRACTIONS (% AREA)
Wall	16	Standard	25%
	16	Advanced	19%
	24	Standard	22%
	24	Advanced	16%
	n/a	Structured Insulated Panel	10%
Floor	16	n/a	13%
	24	n/a	10%
Ceiling	16	n/a	10%
	24	n/a	7%

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Source: https://codes.iccsafe.org/content/RESNET2022P1/chapter-4-energy-rating-index-procedure#RESNET2022P1_Ch04_Sec4.2.2.1

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2022 ANSI/RESNET/ICC 301

- **4.2.2.1.1: The default framing fractions for the Advanced framing type are permitted to be used if the wall segment complies with all the following conditions:**
  - 4.2.2.1.1.1: Corners of cavities shall be completely filled with ≥ R-6 insulation.
  - 4.2.2.1.1.2: Intersections with interior walls shall be insulated to the same R-value as the remainder of the wall assembly.
  - 4.2.2.1.1.3: Headers of frame walls shall be insulated ≥ R-3 for 2x4 framing or equivalent cavity width, and ≥ R-5 for all other assemblies, where the R-value requirement refers to the manufacturer's nominal insulation value.
  - 4.2.2.1.1.4: The framing shall be limited at all windows and doors to one pair of king studs, plus one pair of jack studs per window opening to support the header and sill.
- **4.2.2.1.2: The assembly-specific framing fraction or 10%, whichever is larger, is permitted to be used if a framing plan with the design framing fraction and a professional engineer's stamp has been obtained and the framing plan has been verified to match the actual assembly in field.**

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Source: https://codes.iccsafe.org/content/RESNET2022P1/chapter-4-energy-rating-index-procedure#RESNET2022P1_Ch04_Sec4.2.2.1

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2025 PA-Alt Support Documents

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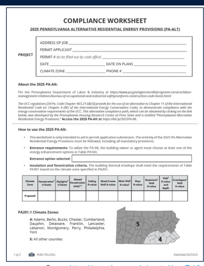
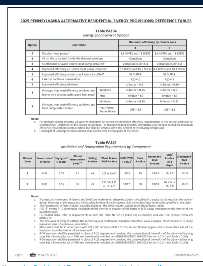
2025 PA-Alt Compliance Worksheet





Source: https://www.phrc.psu.edu/assets/docs/Publications/2025-Pennsylvania-Alternative-Residential-Energy-Provisions_Worksheet.pdf

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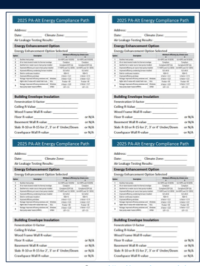
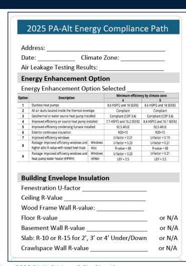
Stickers for the 2025 PA-Alt





2025 PA-Alt Energy Compliance Path

Address: ____________________

Date: __________ Climate Zone: __________

Air Leakage Testing Results: ____________

Energy Enhancement Option

Energy Enhancement Option Selected ________

Option	Description		Minimum efficiency by climate zone 4	5
1	Ductless heat pumps		8.6 HSPF2 and 18 SEER2	8.6 HSPF2 and 18 SEER2
2	All air ducts located inside the thermal envelope		Compliant	Compliant
3	Geothermal or water source heat pump installed		Compliant (COP 3.6)	Compliant (COP 3.6)
4	Improved efficiency air source heat pump installed		7.7 HSPF2 and 16.2 SEER2	8.4 HSPF2 and 18.1 SEER2
5	Improved efficiency condensing furnace installed		92.5 AFUE	92.5 AFUE
6	Exterior continuous insulation		R20+10	R20+15
7	Improved efficiency windows		U-factor = 0.21	U-factor = 0.19
8	Package: Improved efficiency windows and higher attic R-value with raised heel truss	Windows	U-factor = 0.25	U-factor = 0.21
		Attic	R-value = 60	R-value = 60
9	Package: Improved efficiency windows and heat pump water heater (HPWH)	Windows	U-factor = 0.25	U-factor = 0.21
		HPWH	UEF = 3.5	UEF = 3.5

Building Envelope Insulation

Fenestration U-factor ____________

Ceiling R-Value ____________

Wood Frame Wall R-value: ____________

Floor R-value ____________ or N/A

Basement Wall R-value ____________ or N/A

Slab: R-10 or R-15 for 2', 3' or 4' Under/Down or N/A

Crawlspace Wall R-value ____________ or N/A

Source: https://www.phrc.psu.edu/assets/docs/Publications/2025-PA-Alt-Stickers_3.5inx5in.pdf

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Links

- **2025 PA Alternative Residential Energy Provisions**
  - https://bit.ly/2025PA-Alt
- **2025 PA-Alt Worksheet**
  - https://bit.ly/2025PA-Alt_Worksheet
- **2025 PA-Alt Stickers**
  - https://bit.ly/2025PA-Alt_Stickers
- **Note: We recommend using these links if posting/linking the documents.**
  - This will ensure future revisions are automatically linked.

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Questions?

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Thank you for attending!

Check out the next webinar on:

Tuesday, October 14 @ 1pm ET

Advanced Framing Techniques for High-Performance Homes

Darrin Wright, PHRC

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Energy Code Compliance Options in PA

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