U.S. DEPARTMENT of ENERGY | Office of Energy Efficiency and Renewable Energy

How DOE Efficient New Homes Can Leverage High-Performance Windows to Meet Envelope Requirements and Provide Design Flexibility

September 2025

Background

The DOE Efficient New Homes program supports the use of high-performance windows to achieve a thermally sound, comfortable building envelope. These examples show how high-performance windows, usually meeting ENERGY STAR Version 7 window specifications, can help to achieve this goal. Tradeoffs increase design flexibility and allow builders to select the most cost-effective construction approach for their projects.

Examples presented here are based on prototype building designs and should not be considered prescriptive compliance solutions for DOE Efficient New Homes. Each example shows how high-performance windows can be traded off with a single other envelope component. **In practice, further flexibility can be achieved by trading off performance between multiple envelope components simultaneously.**

ENERGY STAR Version 7 Window Specifications

Climate Zone	U-Factor[1]	SHGC[2]	
Northern	≤ 0.22	≥ 0.17	Prescriptive
	= 0.23	≥ 0.35	Equivalent Energy Performance
	= 0.24		
	= 0.25	≥ 0.40	
	= 0.26		
North-Central	≤ 0.25	≤ 0.40	
South-Central	≤ 0.28	≤ 0.23	
Southern	≤ 0.32	≤ 0.23	

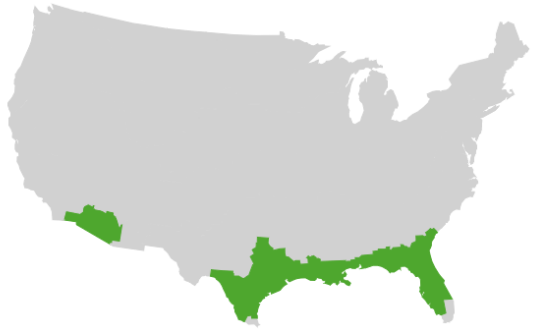
Air Leakage for windows ≤ 0.3 cfm/ft^2

[1] Btu/h ft$^{2\cdot}$°F

[2] Solar Heat Gain Coefficient

2021 IECC Envelope Tradeoffs

Climate Zone 2



2021 IECC Levels	
Windows	**U 0.40**
Ceiling	**U 0.026**
AG Wall	U 0.084
Slab	*No reqt.*

Total UA: 504.9

With ENERGY STAR Version 7 Windows	
Windows	**U 0.32**
Ceiling	**U 0.050**
AG Wall	U 0.084
Slab	*No reqt.*

Total UA: 504.9

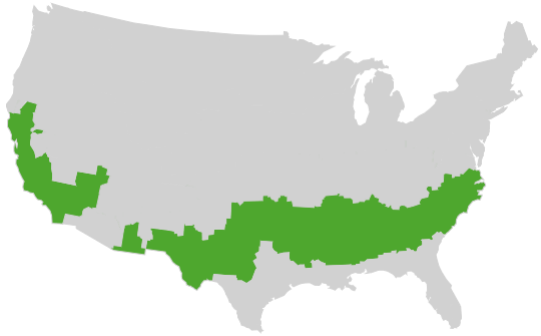
☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

Ceiling insulation can decrease from R-49 to R-22.

The reduced attic insulation requirement opens possibilities for reduced insulation thickness in both vented and unvented designs.

Climate Zone 3



2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	U 0.026
AG Wall	U 0.060
Slab	R-10, 2′

Total UA: 340.4

With High Performance Windows	
Windows	**U 0.22**
Ceiling	U 0.026
AG Wall	U 0.060
Slab	**None**

Total UA: 340.4

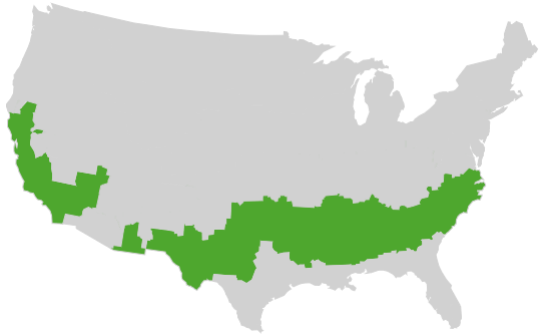
☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

Slab edge insulation can be eliminated.

* In climate zone 3, the difference between code level (0.30) and ES v7 windows (0.28) is small, so this example uses windows with a lower U than required by ES V7.

Climate Zone 3



2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	**U 0.026**
AG Wall	U 0.060
Slab	R-10, 2′

Total UA: 340.4

With ENERGY STAR Version 7 Windows	
Windows	**U 0.28**
Ceiling	**U 0.032**
AG Wall	U 0.060
Slab	R-10, 2′

Total UA: 340.4

☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

Ceiling insulation can decrease from R-49 to R-38.

The reduced attic insulation requirement opens possibilities for reduced insulation thickness in both vented and unvented designs.

Climate Zone 4

2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	**U 0.024**
AG Wall	U 0.045
BG Wall	U 0.059
Slab	R-10, 4′

Total UA: 313.7

With ENERGY STAR Version 7 Windows	
Windows	**U 0.25**
Ceiling	**U 0.039**
AG Wall	U 0.045
BG Wall	U 0.059
Slab	R-10, 4′

Total UA: 313.7

☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

Ceiling insulation can decrease from R-60 to R-28.

The reduced attic insulation requirement opens possibilities for reduced insulation thickness in both vented and unvented designs.

Climate Zone 4

2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	U 0.024
AG Wall	**U 0.045 (R-20+5ci)**
BG Wall	U 0.059
Slab	R-10, 4′

Total UA: 313.7

With ENERGY STAR Version 7 Windows	
Windows	**U 0.25**
Ceiling	U 0.024
AG Wall	**U 0.054**
BG Wall	U 0.059
Slab	R-10, 4′

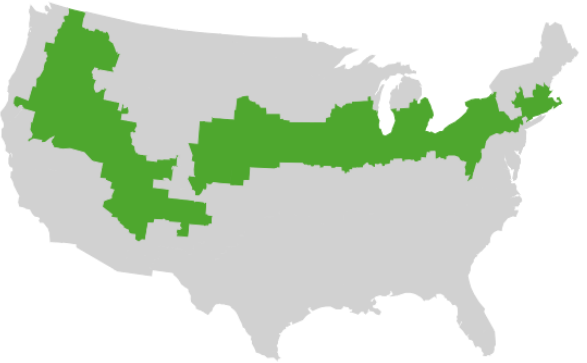
Total UA: 313.7

☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

Exterior continuous wall insulation can be eliminated.
Compliant assemblies include 2x6 walls with advanced framing (framing factor of 19%) and R-21 batts.

Climate Zone 5



2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	**U 0.024**
AG Wall	U 0.045
BG Wall	U 0.050
Slab	R-10, 4′

Total UA: 303.0

With ENERGY STAR Version 7 Windows	
Windows	**U 0.23**
Ceiling	**U 0.050**
AG Wall	U 0.045
BG Wall	U 0.050
Slab	R-10, 4′

Total UA: 303.0

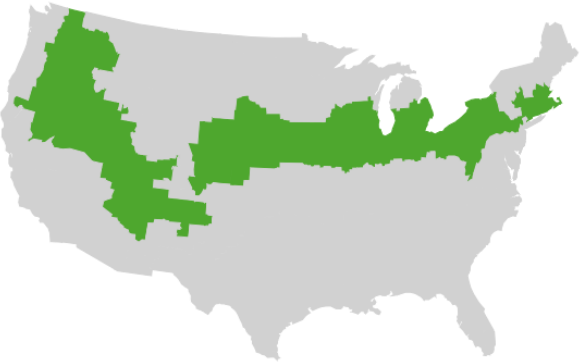
☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

Ceiling insulation can decrease from R-60 to R-22.

The reduced attic insulation requirement opens possibilities for reduced insulation thickness in both vented and unvented designs.

Climate Zone 5



2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	U 0.024
AG Wall	**U 0.045 (R-20+5ci)**
BG Wall	U 0.050
Slab	R-10, 4’

Total UA: 303.0

With ENERGY STAR Version 7 Windows	
Windows	**U 0.23**
Ceiling	U 0.024
AG Wall	**U 0.060**
BG Wall	U 0.050
Slab	R-10, 4’

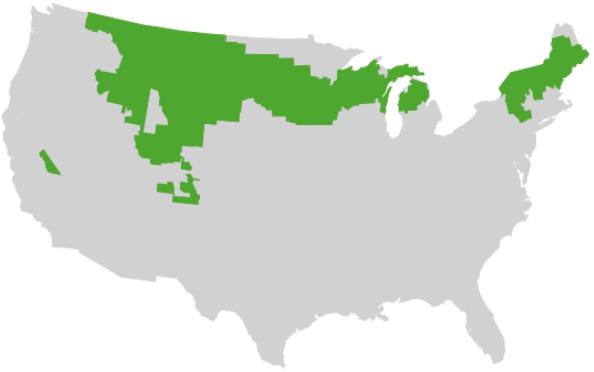
Total UA: 303.0

☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

Exterior continuous wall insulation can be eliminated.
Compliant assemblies include traditional 2x6 walls with R-21 batts.

Climate Zone 6



2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	**U 0.024**
AG Wall	U 0.045
BG Wall	U 0.050
Slab	R-10, 4′

Total UA: 303.0

With ENERGY STAR Version 7 Windows	
Windows	**U 0.23**
Ceiling	**U 0.035**
AG Wall	U 0.045
BG Wall	U 0.050
Slab	R-10, 4′

Total UA: 286.2

☑ *Meets 2021 IECC UA*

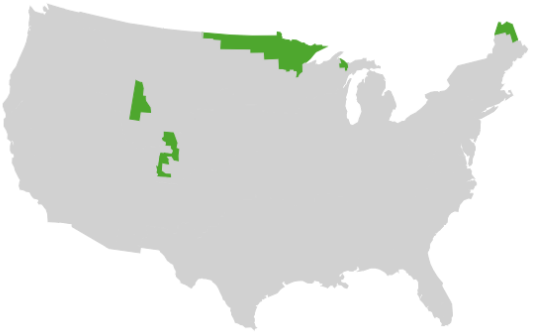
☑ *Meets DOE Efficient New Homes Target ERI score*

* There is more flexibility to reduce envelope insulation and achieve the UA backstop, but it is limited by the ERI Target.

Ceiling insulation can decrease from R-60 to R-30.

The reduced attic insulation requirement opens possibilities for reduced insulation thickness in both vented and unvented designs.

Climate Zone 7



2021 IECC U-Factors	
Windows	**U 0.30**
Ceiling	**U 0.024**
AG Wall	U 0.045
BG Wall	U 0.050
Slab	R-10, 4′

Total UA: 303.0

With ENERGY STAR Version 7 Windows	
Windows	**U 0.23**
Ceiling	**U 0.030**
AG Wall	U 0.045
BG Wall	U 0.050
Slab	R-10, 4′

Total UA: 279.7

☑ *Meets 2021 IECC UA*

☑ *Meets DOE Efficient New Homes Target ERI score*

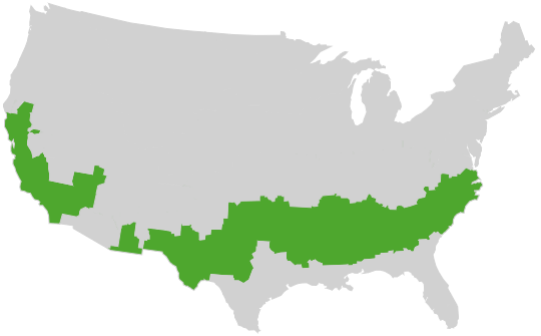
* There is more flexibility to reduce envelope insulation and achieve the UA backstop, but it is limited by the ERI Target.

Ceiling insulation can decrease from R-60 to R-39.

The reduced attic insulation requirement opens possibilities for reduced insulation thickness in both vented and unvented designs.

2024 IECC Envelope Tradeoffs

Climate Zone 3



2024 IECC Levels	
Windows	**U 0.30**
Ceiling	U 0.030
AG Wall	U 0.060
Slab	**R-10, 2' (F 0.54)**

Total TC: 356.5

With High Performance Windows	
Windows	**U 0.23**
Ceiling	U 0.030
AG Wall	U 0.060
Slab	**None**

Total TC: 356.5

☑ *Meets 2024 IECC TC*

☑ *Meets DOE Efficient New Homes Target ERI score*

Slab edge insulation can be eliminated.

(2021 IECC analysis requires U 0.22 windows to completely trade off slab edge insulation)

* In climate zone 3, the difference between code level (0.30) and ES v7 windows (0.28) is small, so this example uses windows with a lower U than required by ES V7.

Climate Zone 4

2024 IECC U-Factors	
Windows	**U 0.30**
Ceiling	U 0.026
AG Wall	**U 0.045 (R-20+5ci)**
BG Wall	U 0.059
Slab	R-10, 3′ (F 0.51)

Total TC: 316.1

With ENERGY STAR Version 7 Windows	
Windows	**U 0.25**
Ceiling	U 0.026
AG Wall	**U 0.054**
BG Wall	U 0.059
Slab	R-10, 4′

Total TC: 316.1

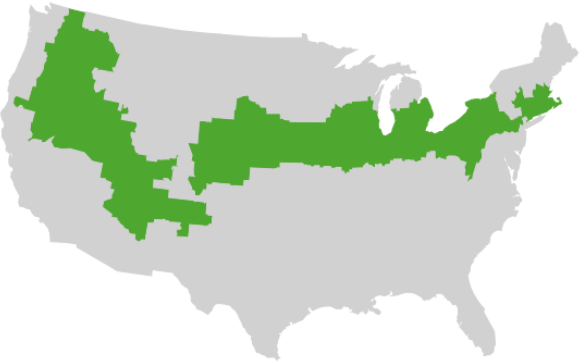
☑ *Meets 2024 IECC TC*

☑ *Meets DOE Efficient New Homes Target ERI score*

Exterior continuous wall insulation can be eliminated.

(2021 IECC analysis results in the same tradeoff options)

Climate Zone 5



2024 IECC U-Factors	
Windows	**U 0.28**
Ceiling	U 0.026
AG Wall	**U 0.045 (R-20+5ci)**
BG Wall	U 0.050
Slab	R-10, 4′

Total TC: 297.4

With ENERGY STAR Version 7 Windows	
Windows	**U 0.23**
Ceiling	U 0.046
AG Wall	**U 0.057**
BG Wall	U 0.050
Slab	R-10, 4′

Total TC: 297.4

☑ *Meets 2024 IECC TC*

☑ *Meets DOE Efficient New Homes Target ERI score*

Exterior continuous wall insulation can be eliminated.

(2021 IECC analysis results in the same tradeoff options)