

Energy Efficiency in New Home Construction

A comparison of various energy efficiency standards for developers. ECO recommends **ENERGY STAR NextGen** for new construction.

Category	Building Component	Efficiency Rating or Standard	WI Uniform Dwelling Code	2024 International Energy Code Council (IECC) recommendation	ENERGY STAR v3.3 (IECC 2024)	ENERGY STAR NextGen	Department of Energy's Efficient New Homes Program (Formerly Zero-Energy Ready Home)	Passive House (PHIUS**)
Building Enclosure (Building Envelope)	Windows*	U-value (lower number = higher efficiency) [1]	0.35 (double pane)	0.28 (double pane)			0.3 (double pane)	0.15 (triple pane)
		Solar Heat Gain Coefficient [2]		NR			0.4	NR
	Ceiling*	R-value (higher number = higher efficiency)		49			60	72
	Walls (Options)*	Exterior (R-value) [3]	NR	5				41, including at least R-10 CI
		Interior (R-value) [4]	20	20				
		Exterior (R-value) [5]	5	10				
		Interior (R-value) [6]	13	13				
		Exterior (R-value) [7]		20				
		Interior (R-value) [8]		0				
	Framed Floors	(R-Value)		30				
	Foundation Wall*	Exterior (R-value) or		15				22
		Interior (R-value)		19				22
	Slab*	Below Grade (R-value)	10	10 (3ft and R-5 full)			10 (4 ft)	20
		On grade (R-value)	15	10 (3ft and R-5 full)			10 (4 ft)	10 (4 ft)
	Air Leakage	ACH50 [9]	7 ACH50	3 ACH50			2 ACH50	0.04 CFM50/ft2 shell (ref - typ ~ 0.6 ACH50)
Mechanical Systems	HVAC [10]	Furnace %AFUE [11]	90	95		Can't be Installed	95	Can't be Installed
		Air Conditioner SEER2 [12]	NR	13.4	13.3		13.3	
		Boiler %AFUE [13]	NR	84	95		95	
		HP SEER2 [14]	NR	14.3		15.2		15
		HSPF2 [15]	NR	7.5		8		1.75 (COP)
		Capability		NR		Cold Climate	Ready - future heat pump [20]	No resistance <50% capacity
		Compressor		NR		2 speed or variable	Variable recommended	
		Blower		NR				
	Ducts	General	NR	Designed and sized per ACCA Manual D	Ducts can be unconditioned - sealed and insulated		Ducts inside thermal and air barrier	Ducts inside thermal and air barrier
		Total Duct Leakage (CFM25) [16]	NR	Cavities not to be used as ducts			Calculated based on Conditioned Floor Area	
		Leakage to Outside (CFM25) [17]	NR	Calculated based on CFA [19]			(the area conditioned by HVAC)	

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Mechanical Systems	HVAC Grading [18]	Total Duct Leakage [21]		NR	Grade I or II		Grade I	
		Airflow [22]		NR	Grade I or II		Grade I	
		Blower Fan Watt Draw [23]		NR	Grade I or II		Grade I	
		Refrigerant [24]		NR	Grade I or II	Grade I	Grade III	
	Mech Ventilation***	Efficiency (CFM/W) [25]	NR	Minimum exhaust ventilation			1.2	1.2
		Heat Exchange (%ASRE) [26]		NR			65	82
	Heat Pump Water Heater (HPWH)	208/240V		NR		Yes	Future Heat Pump Water Heater Ready	
		Bedroom Reqs		NR		Capacity by # bedrooms	NR	Requirements are based on efficiency and installed room size
		Sound (dBA)		NR		55		
		UEF - Electric		NR		2.2	2.57	3
Other	Cooking Appliances	Type/Fuel		NR		Electric (induction recom.)	NR	Electric
		EV ready		NR				
	Electric Vehicle Charging	EV charger/capable		NR			2 space per dwelling unit	
		Solar Ready (Photovoltaic Energy System)		NR			One parking space with 208/240V, 30A recepticle and circuit labeled EV Charging	
				NR			Install 1" EMT conduit in attic to 8ft of subpanel	
Indoor Air Quality	Indoor airPLUS	Moisture Control		NR			Building envelope measures and interior water management measures	
		Radon		NR			Testing and mitigation of radon	
		Pest Barriers		NR			Penetrations and windows have screens	
		HVAC		NR			Humidity controls, filtration, ventilation reqs	
		Pollutant Control		NR			Combustion and liquid fuels reqs	
		Building Materials		NR			Finishes, carpet, adhesives, floors, drywall and insualtion meet VOC limits	
		Occupant Education		NR			Providing instruction manuals and education for occupants	

**Building Components have flexibility (trade-offs) when doing an energy model for the building, can increase or decrease individual values as long as the overall efficiency meets specific metric.*

***Values in the PHIUS column are for the prescriptive path so they are more stringent than if the performance path is chosen. Performance path requires PHIUS modeling to be done to ensure requirements are met for air, heat, and water/moisture movement.*

****There are two main types of mechanical ventilation in WI, exhaust and balanced: Exhaust uses a bathroom exhaust fan to create a negative pressure in the house and pull air in through the building envelope. A Balanced system has approximately the same amount of air brought in as exhausted from the home so it does not create a pressure diffence in the house.*

How to Use this Matrix

Terms	Definition
ACCA Manual D	Air Conditioning Contractors of America Manual for designing the duct systems of an HVAC system
ACH50	Air Changes per Hour at 50 Pascal of pressure - metric used to describe how much a home leaks air, the
AFUE	Annual Fuel Utilization Efficiency, often used to describe the efficiency of a furnace or boiler to turn natural
Balanced Ventilation	Approximately the same amount of air brought in as exhausted from the home so it does not create a pressure difference in the home, benefit of this is being able to know where this air is coming from and being able to filter the incoming air
CFM	Cubic Feet per Minute, measure of how much volume of air is moved per minute (example: an fan exhausts
CFM50/ft2 shell	Air leakage measured in CFM at 50 Pascal of pressure per square foot of the exterior shell of the building (above grade and foundation walls, ceiling, and slab)
CI	Continuous Insulation, any insulation that is not interrupted by framing
Efficiency (CFM/W)	Efficiency metric for how much CFM is blown per Watt of electricity used, higher is more efficient
Exhaust Ventilation	Typically utilizes a bathroom exhaust fan to remove air from the house, creating a negative pressure which causes air to be pulled through the building envelope wherever air leakage points exist
Exterior (R-value)	The insulation on the exterior of the home, for example foam board
Heat Exchange (%ASRE)	Percent Adjusted Sensible Recovery Efficiency, what percent of heat or cooling in conditioned air is recovered in a mechanical ventilation system
HP Ready	If a non-heat pump system is installed during construction, ensure there is conduit and electrical box, the
HSPF	Heating Seasonal Performance Factor, measurement of heating efficiency of air source heat pumps, higher
HVAC Grading	A standardized process for verifying the installation quality of an HVAC system and ductwork to ensure comfort for the occupants and energy efficiency for the system
Interior (R-value)	The insulation on the interior of the home, often installed in the stud cavities of a wall, example fiberglass batts
Leakage to Outside (CFM25)	Leakage of the entire duct system that is outside of conditioned space
NR	Not rated or not required by this certification
PHIUS	Passive House Institute United States, body that develops and certifies passive houses
SEER	Seasonal Energy Efficiency Ratio, measurement of the cooling efficiency of an air conditioner or heat pump, higher is more efficient
SHGC	Solar Heat Gain Coefficient, how much radiant heat from the sun passes through the window, the closer to 1 the number is the more solar heat is blocked from entering the home
Total Duct Leakage (CFM25)	Leakage of the entire duct system (including the air handler) tested at 25 Pascal of pressure
U-value	Measures heat transmission through a building component, often the measure of window performance for
UEF	Uniform Energy Factor, used to define the efficiency of a water heater (EF is the old metric)
CFA	Conditioned Floor Area, the floor area of the home that is directly heated and cooled by the HVAC system
HVAC - ENERGY STAR Credentialed	For ENERGY STAR, the HVAC contractor has to be an ENERGY STAR Credentialed HVAC contractor or the HERS rater verifying the home has to perform HVAC Grading

Color Code
NR = Not Required
Can't be Installed
Cells having the same values of Efficiency Rating or Standard for Building Enclosure (Building Envelope) building components across the different codes or requirements.
Cells having the same values of Efficiency Rating or Standard for Mechanical Systems building components across the different codes or requirements.
Cells having the same values of Efficiency Rating or Standard for Other building components across the different codes or requirements.
Cells having the same values of Efficiency Rating or Standard for Indoor Air Quality building components across the different codes or requirements.

Note	Description
1	Measures heat transmission through a building component, often the measure of window performance for temperature (inverse of R-value)
2	Solar Heat Gain Coefficient (SHGC), how much radiant heat from the sun passes through the window, the closer to 1 the number is the more solar
3	The insulation on the exterior of the home, for example foam board
4	The insulation on the interior of the home, often installed in the stud cavities of a wall, example fiberglass batts
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8	The insulation on the interior of the home, often installed in the stud cavities of a wall, example fiberglass batts
9	Air Changes per Hour at 50 Pascal of pressure - metric used to describe how much a home leaks air, the number of times the total volume of air
10	For ENERGY STAR, the HVAC contractor has to be an ENERGY STAR Credentialed HVAC contractor or the HERS rater verifying the home has to
11	Annual Fuel Utilization Efficiency, often used to describe the efficiency of a furnace or boiler to turn natural gas or propane into heat for the home
12	Seasonal Energy Efficiency Ratio, measurement of the cooling efficiency of an air conditioner or heat pump, higher is more efficient
13	Annual Fuel Utilization Efficiency, often used to describe the efficiency of a furnace or boiler to turn natural gas or propane into heat for the home
14	Seasonal Energy Efficiency Ratio, measurement of the cooling efficiency of an air conditioner or heat pump, higher is more efficient
15	Heating Seasonal Performance Factor, measurement of heating efficiency of air source heat pumps, higher is more efficient
16	Leakage of the entire duct system (including the air handler) tested at 25 Pascal of pressure
17	Leakage of the entire duct system that is outside of conditioned space
18	A standardized process for verifying the installation quality of an HVAC system and ductwork to ensure comfort for the occupants and energy
19	Conditioned Floor Area, the floor area of the home that is directly heated and cooled by the HVAC system
20	If a non-heat pump system is installed during construction, ensure there is conduit and electrical box, the appropriate physical space, and necessary
21	Leakage of the overall duct system to the inside of the home, limits are based on CFA
22	Airflow grade is based on the calculated deviation from the designed airflow of the system
23	Measured acceptable ranges of Watt/CFM of the blower fan
24	Since the refrigerant is what moves the heat between the inside and outside of the building, the amount of refrigerant plays an important role
25	Efficiency metric for how much CFM is blown per Watt of electricity used, higher is more efficient
26	Percent Adjusted Sensible Recovery Efficiency, what percent of heat or cooling in conditioned air is recovered in a mechanical ventilation system
27	Already has solar PV system