



SUPPORTING DOCUMENT RESIDENTIAL ENERGY CODE WORKSHEET



The Residential Energy Code Worksheet is a tool to help you plan your energy code needs for new or remodeled homes, to ensure compliance with code requirements. For more resources, and to obtain a copy of the energy code, optional worksheets and glazing forms; go to:
<http://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx>

This document will cover the following features:

- **Heating, Ventilation and Air Conditioning (HVAC):** Requirements for efficiency of heating and cooling equipment for your house.
- **Building Envelope:** Requirements and options for roofs, walls, windows- these control heat loss and leakage.
- **Water Heating:** Equipment efficiency and controls

All of the details of your energy plan must be clearly shown on your construction plans in order for application to be approved.

→ Step 1: Select Proposed Heating System-Check one box and show on construction plans

<input type="checkbox"/> Electric Cadet or Baseboard heaters-	<input type="checkbox"/> Radiant Heat-	<input type="checkbox"/> Forced Air System-	<input type="checkbox"/> Forced Air with Heat Pump-	<input type="checkbox"/> Ductless Heat System-	<input type="checkbox"/> Other:
Heaters on the wall that use convection to circulate air and heat	These systems supply heat directly to the floor or panels in the wall or ceiling to heat the house.	Forced air systems use air as its heat transfer medium, relying on ductwork and vents to distribute.	Same as forced air, but absorbs heat from outdoor source and heats it and releases it as warmer air.	Ductless system that delivers heated and cooled air directly into zones.	_____ _____ _____

→ **Step 2: Prescriptive Whole House Ventilation-Check one box for system type**

Select the whole house ventilation system you would like to use. The tables on the following page provide airflow rate requirements, and run-time calculations; which are based on square footage and number of bedrooms. Airflow is measured in CFM= Cubic feet per minute.

<input type="checkbox"/> Continuous exhaust fan <input type="checkbox"/> Intermittent exhaust fan Fan runs _____% of time at _____ CFM (Table M1507.3.3(1) on the following page, provides calculation and minimum requirements)	<input type="checkbox"/> Integrated with Forced-Air System- (Ducted furnace option)	<input type="checkbox"/> Whole House Ventilation using Supply Fan:	<input type="checkbox"/> Whole House Ventilation using Heat Recovery:
<p>Explanation: One or more exhaust fans to be installed in central locations. The fans remove pollutants and moisture and pulls in fresh air from outside.</p> <p>*This option requires intro of fresh air. Window vents or wall ports can be installed to accomplish this.</p>	<p>Explanation: Your ventilation system is integrated into central heating and cooling system. It pulls in fresh air, mixes it and delivers it through the house</p>	<p>Explanation: Supply Ventilation systems have a fan and duct system that introduces fresh air into room(s) most occupied</p>	<p>Explanation: Two small fans, one to draw in fresh air, one to remove indoor air. The two air streams pass separately through the unit's exchange core, heat is recovered from one and transferred to the other.</p>

All options noted above for whole house ventilation shall provide outdoor air at a continuous rate of not less than that determined in accordance with Table M1507.3.3(1).

Exception: The whole house mechanical ventilation system is permitted to operate intermittently where the system has control that enables operation for not less than 25% of each 4 hour segment and the ventilation rate prescribed in Table M1507.3.3(1) is multiplied by the factor determined in accordance with Table 1507.3.3(2).

→ **Step 3: Airflow Rate**

In table M1507.3.3(1) below, the left column represents the square footage of your home, and across the top are the number of bedroom(s). Use these numbers to locate the compliant Airflow for your home. Airflow numbers are in CFM- Cubic Feet per Minute.

**TABLE M1507.3.3(1)
CONTINUOUS WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW RATE REQUIREMENTS**

Square Feet of Structure	Number of Bedrooms				
	0-1	2-3	4-5	6-7	>7
	Airflow in CFM				
<1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 7,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
>7,501	105	120	135	150	165

For S1: 1 square foot = 0.0929 m², 1 cubic foot perm minute = 0.0004719 m³/s

→ **Airflow CFM #:** _____ (fill yours in based on chart above and label on your construction plan)

Example: House with a square footage of **1,700** with **3 bedrooms**= **60 CFM**

→ **Step 4: Ventilation Rate – Only if you selected intermittent exhaust fan option for whole house ventilation**

**TABLE M1507.3.3(2)
INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS ^{a,b}**

RUN-TIME PRECENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor ^a	4	3	2	1.5	1.3	1.0

- a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
- b. Extrapolation beyond the table is prohibited.
- c. The larger the fan, the less time you have to run it

25% is the minimum run-time segment, you may pick any of the other percentages listed. To calculate fan size, use the calculation below.

→ **Airflow CFM x Factor= Ventilation Rate**

Example: House with a square footage of **1,700** with **3 bedrooms**= **60 CFM**, customer chooses run-time % of **33%**. **Formula= 60 x 3= 180**

$$\frac{\text{CFM}}{\text{Factor}} \times \text{Factor} = \text{Fan Size}$$

→ **Step 5: Energy Credits- Options & Criteria for your Energy Plan**

Check the box below based on the square footage of your home. This will determine the **MINIMUM** credits you will need to reach in order to be energy compliant, can elect to exceed.

Conditioned Floor Area: The floor area of enclosed conditioned spaces on all floors measured from the interior walls.

- 1. SMALL DWELLING UNIT:**Need to reach **0.5 POINTS**
Dwelling units less than 1,500 square feet in conditioned floor area with less than 300 square feet of fenestration (windows) area. Additions to existing building that are less than 750 square feet of heated floor area.

- 2. MEDIUM DWELLING UNIT:** ... Need to reach **1.5 POINTS**
All dwelling units between 1,500 square feet and 5,000 square feet of conditioned floor area.

- 3. LARGE DWELLING UNIT:** Need to reach **2.5 POINTS**
Dwelling units exceeding 5000 square feet of conditioned floor area.

→ Once you know how many credits are required, the Energy Credit table beginning on the next page provides you with options to reach the required credits. There are five categories in the table, you may select a combination in order to reach the minimum credit amount. All selected options with efficiency rating must be shown on the construction plans. As credits increase, your home becomes more energy efficient.

→ **Selected Energy Credit Options:**

Option: _____	Credit: _____

TOTAL: _____

(Must be = or > required credits specified above)

Key Terms used in the Energy Credit Table:

- **R-Value**= Thermal Resistance, time rate of heat flow through a body
- **U- Factor**= Thermal Transmittance, heat transmission (air to air) through a building component, equal to the time rate of heat flow per unit area and unit temperature
- **Fenestration**= Fenestration windows and other products with glass and non-glass glazing materials
- **Glazing**= Glass part of windows.

ENERGY CREDIT TABLE- OPTIONS AND CRITERIA

Option	WATER HEATING OPTIONS	Credit(s)
<input type="checkbox"/>	<p>EFFICIENCY WATER HEATING 5a: Water heating system shall include one of the following: <input type="checkbox"/> Gas, propane or oil water heater with a minimum EF of 0.62 <input type="checkbox"/> OR Electric water heater with a minimum EF of 0.93. AND FOR BOTH CASES: All showerhead and kitchen sink faucets installed in the house shall be rated at 1.75 GPM or less. All other lavatory faucets shall be rated at 1.0 GPM or less. ^b</p>	0.5
<input type="checkbox"/>	<p>EFFICIENCY WATER HEATING 5b: Water heating system shall include one of the following: <input type="checkbox"/> Gas, propane or oil water heater with a minimum EF of 0.82 <input type="checkbox"/> OR Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems. <input type="checkbox"/> OR Electric heat pump water heater with a minimum EF of 2.0 and meeting the standards of NEES's Northern Climate Specifications for Heat Pump Water Heaters. <input type="checkbox"/> OR Water heater heated by ground source heat pump meeting the requirement of Option 3c.</p>	1.5
Option	HVAC EQUIPMENT	Credit(s)
<input type="checkbox"/>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3a: Gas, propane or oil-fired furnace with a minimum AFUE of 95%</p>	.5
<input type="checkbox"/>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3b: Air-source heat pump with a minimum HSPF of 8.5.</p>	1.0
<input type="checkbox"/>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3c: <input type="checkbox"/> Closed-loop ground source heat pump; with a minimum COP of 3.3 <input type="checkbox"/> OR Open-loop water source heat pump with a maximum pumping hydraulic head of 150 feet and a minimum COP of 3.6.</p>	2.0
<input type="checkbox"/>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3d: DUCTLESS SPLIT SYSTEM HEAT PUMPS, ZONAL CONTROL: In homes where the primary space heating system is zonal electric heating, a ductless heat pump system shall be installed and provide heating to at least one zone of the housing unit.</p>	1.0
<input type="checkbox"/>	<p>HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM 4: a</p> <ul style="list-style-type: none"> • All heating and cooling system components shall be installed inside the conditioned space. • All combustion equipment shall be direct vent or sealed combustion. 	1.0

	Locating system components in conditioned crawl spaces is not permitted under this option. Electric resistant heat is not permitted under this option direct combustion heating equipment with AFUE less than 80% is not permitted with this option.	
Option	WHOLE HOUSE AIR LEAKAGE CONTROL AND EFFICIENCY	Credit(s)
<input type="checkbox"/>	<p>AIR LEAKAGE CONTROL AND EFFICIENCY VENTILATION 2a:</p> <ul style="list-style-type: none"> Compliance is based on Table R402.4.1.2; Reduce the tested air leakage to 4.0 air changes per hour maximum <p>AND All whole house ventilation requirements as determined by IRC Section M1507.3 shall be met with a high efficiency fan (max 0.35 watts/cfm), not interlocked with the furnace fan ventilation systems using a furnace including an ECM motor are allowed, provided that they are controlled to operate at low speed in ventilation only mode.</p>	.5
<input type="checkbox"/>	<p>AIR LEAKAGE CONTROL AND EFFICIENCY VENTILATION 2b:</p> <ul style="list-style-type: none"> Compliance is based on Table R402.4.1.2; Reduce the tested air leakage to 2.0 air changes per hour maximum <p>AND All whole house ventilation requirements as determined by IRC Section M1507.3 shall be met with a heat recovery ventilation system with a minimum sensible heat recovery efficiency of 0.70.</p>	1.0
<input type="checkbox"/>	<p>AIR LEAKAGE CONTROL AND EFFICIENCY VENTILATION 2c:</p> <ul style="list-style-type: none"> Compliance is based on Table R402.4.1.2; Reduce the tested air leakage to 1.5 air changes per hour maximum <p>AND All whole house ventilation requirements as determined by IRC Section M1507.3 shall be met with a heat recovery ventilation system with a minimum sensible heat recovery efficiency of 0.85.</p>	1.5
Option	BUILDING ENVELOPE (RELATING TO WINDOWS, WALLS, AND FLOORS ETC.)	Credit(s)
<input type="checkbox"/>	<p>EFFICIENCY BUILDING ENVELOPE 1a:</p> <p>Prescriptive compliance is based on Table R402.1.1</p> <ul style="list-style-type: none"> Fenestration- U-Factor= 0.28 Skylight- U-Factor = .50 Ceiling- R-Value= 49 Wood Frame Wall- R-Value= 21 int Mass Wall R-Value= R-value= 21/21 Floor- R-Value= 38 Slab- on grade R-10 perimeter and entire slab Below grade slab- R-10, perimeter and under entire slab OR Compliance based on section R402.4; Reduced the Total UA by 5% <p>This option also requires you to fill out the Glazing Schedule, which can be found half way down the page at http://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx</p>	0.5
<input type="checkbox"/>	<p>EFFICIENCY BUILDING ENVELOPE 1b:</p> <p>Prescriptive compliance is based on Table R402.1.1</p> <ul style="list-style-type: none"> Fenestration- U-Factor= 0.25 Skylight- U-Factor = .50 Ceiling- R-Value= 49 Wood Frame Wall- R-Value= 21 plus R-4 	1.0

	<ul style="list-style-type: none"> Basement Wall R-21 int plus R-5 ci Mass Wall R-Value= R-value= 21/21 Floor- R-Value= 38 Slab- on grade R-10 perimeter and entire slab Below grade slab- R-10, perimeter and under entire slab OR Compliance based on section R402.1.4; Reduced the Total UA by 15% <p>This option also requires you to fill out the Glazing Schedule, which can be found half way down the page at http://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx</p>	
□	<p>EFFICIENCY BUILDING ENVELOPE 1c:</p> <p>Prescriptive compliance is based on Table R402.1.1</p> <ul style="list-style-type: none"> Fenestration- U-Factor= 0.22 Skylight- U-Factor = .50 Ceiling and single-rafter or joist - R-Value= 49 advanced Wood Frame Wall- R-Value= 21 plus R-12 ci Basement Wall R-21 int plus R-12 ci Mass Wall R-Value= R-value= 21/21 Floor- R-Value= 38 Slab- on grade R-10 perimeter and entire slab Below grade slab- R-10, perimeter and under entire slab OR Compliance based on section R402.1.1; Reduced the Total UA by 30% <p>This option also requires you to fill out the Glazing Schedule, which can be found half way down the page at http://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx</p>	2.0
Option	ELECTRIC ENERGY	Credit(s)
□	<p>RENEWABLE ELECTRIC ENERGY 6:</p> <p>For each 1200 kWh of electrical generation provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows:</p> <ul style="list-style-type: none"> □ For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTS. Documentation noting solar access shall be included on the plans. □ For wind generation projects designs shall document annual power generation based on the following factors: The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower. 	0.5

Footnotes: Plumbing Fixtures Flow ratings- Low flow plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following requirements:

1. Residential bathroom lavatory sink faucets: Maximum flow rate- 3.8 L/min (1.) gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.
2. Residential kitchen faucets: Maximum flow rate- 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18/CSA B125.1.
3. Residential showerheads: Maximum flow rate- 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.

Source Specific Ventilation System and requirements

Exhaust fans are required in any room where water vapor, or cooking odor is produced, i.e.; kitchen, bathroom, powder room, laundry room, indoor swimming pool, spa, etc. See Table M1507.4 for the minimum exhaust fan sizes. Minimum source specific ventilation- your proposed system shall not be less.

Table M1507.4

CFM=Cubic Feet per min.	Laundry rooms or Bathrooms	Kitchens
Intermittently Operating	50 cfm	100 cfm
Continuous Operation	20 cfm	25 cfm

Prescriptive Energy Compliance- Table 402.1.1.

Climate Zone	5 & Marine 4	
	R-Value ^a	U-Factor ^a
Fenestration U-Factor ^b	n/a	0.30
Skylight U-Factor	n/a	0.50
Glazed Fenestration SHGC ^{b e}	n/a	n/a
Ceiling	49	0.026
Wood Frame Wall ^{g k l}	21 int	0.056
Mass Wall R-Value ⁱ	21/21 ^h	0.056
Floor	30 ^g	0.029
Below Grade Wall ^{c k}	10/15/21 int + TB	0.042
Slab ^d R-Value & Depth	10, 2 ft	n/a

WSEC Chapter 4 Residential Energy Efficiency) This project will use the requirements of the Prescriptive Path in table R402.1.1 and incorporate the minimum values listed. In addition, based on the size of the structure, the appropriate number of additional credits.

Footnotes for Table R402.1.1:

1 foot. = 304.8 mm, ci .= continuous insulation, int. = intermediate framing.

a R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the compressed R-value of the insulation from Appendix Table A101.4 shall not be 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. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c "10/15/21.+TB" means R-10 continuous insulation on the exterior of the wall, or R-15 on the continuous insulation on the interior of the wall, or R-21 cavity insulation plus a thermal break between the slab and the basement wall at the interior of the basement wall.

"10/15/21.+TB" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the wall. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall. "TB" means thermal break between floor slab and basement wall.

d R-10 continuous insulation is required under heated slab on grade floors. See R402.2.9.1.

e There are no SHGC requirements in the Marine Zone.

f Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g Reserved.

h First value is cavity insulation, second is continuous insulation or insulated siding, so "13.+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used to maintain a consistent total sheathing thickness.

i The second R-value applies when more than half the insulation is on the interior of the mass wall.

j For single rafter- or joist-vaulted ceilings, the insulation may be reduced to R-38.

k Int. (intermediate framing) denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.

l Log and solid timber walls with a minimum average thickness of 3.5 inches are exempt from this insulation requirement.