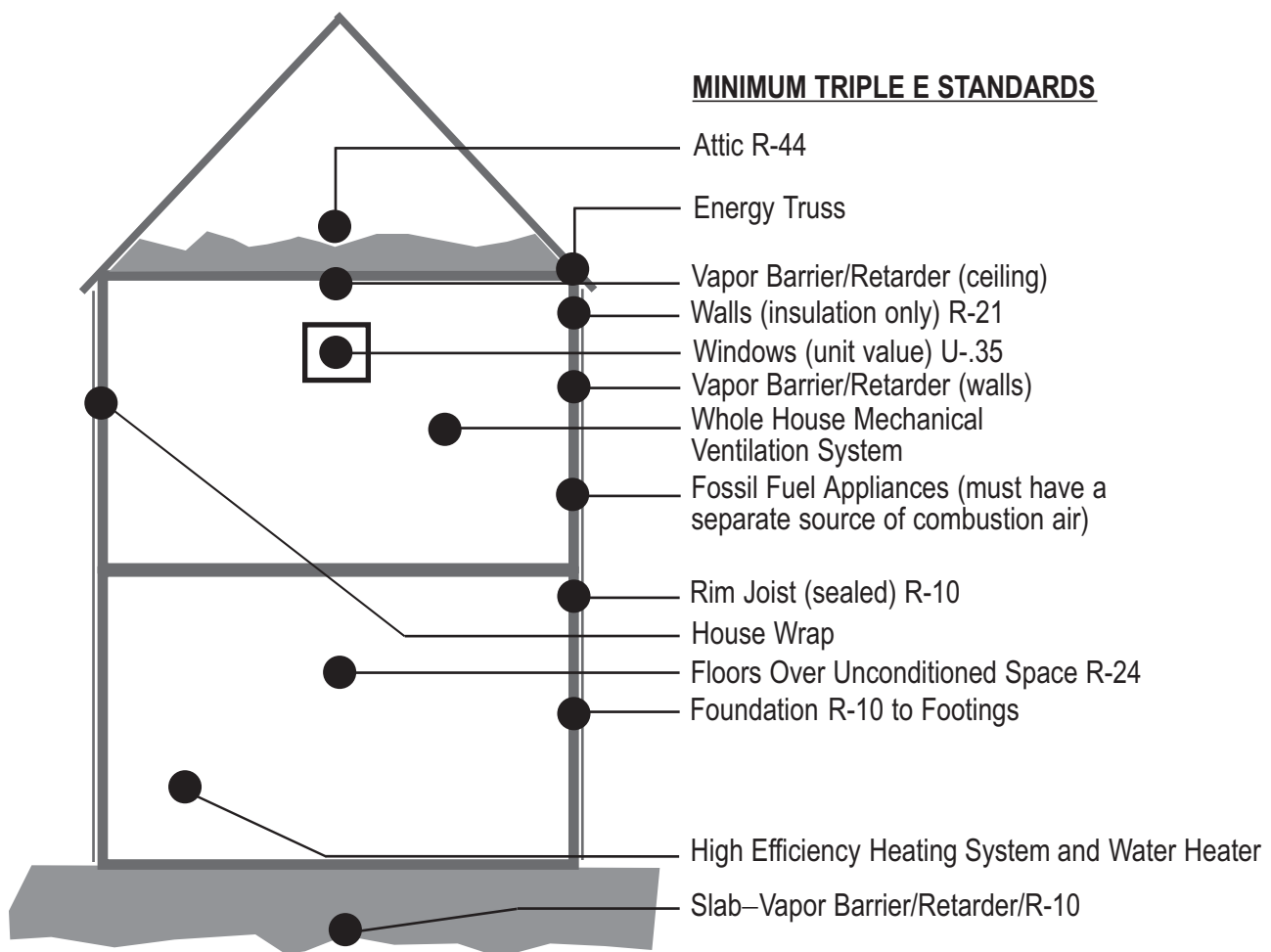


# New Construction Guide to Triple E and ENERGY STAR® Homes



The **New Construction Guide to Triple E and ENERGY STAR® Homes** is a resource for licensed builders, owner-builders, designers and new homeowners. It sets standards for building energy-efficient, comfortable, healthy and durable new homes. These standards include both prescriptive (i.e., thermal efficiency, moisture control, air quality, heating and domestic hot water) and performance (i.e., heating and air-tightness) measures. Although the Triple E program provides flexibility from a design perspective, these standards ensure consistency in the Triple E home(s) performance. Based on builder and homeowner input and Minnesota Power's desire to continuously improve building practices; the Triple E Program includes optional Tier II and Tier III levels of standards. The higher Tiers requires builders to upgrade specific thermal efficiency specifications and to meet increased air-tightness and heating performance standards. To encourage builders to achieve higher Tier standards, Minnesota Power is offering increased incentives.

Minnesota Power has become an **EPA ENERGY STAR Homes Ally**. Each home built to meet or exceed the Tier II Triple E prescriptive and performance guidelines qualifies for EPA Energy Star Home certification. EPA Energy Star Homes are built to be at least 30% more efficient than the model energy code.

We encourage licensed builders, owner-builders and potential new homeowners to take advantage of the educational aspects of the program. Minnesota Power offers energy-efficient construction and design seminars, product exhibits and CD training programs designed to help you make informed decisions that affect the long-term operating costs, comfort, marketability and durability of your new home.

An energy-efficient home benefits you and your family directly through lower energy bills, enhanced building durability, improved resale value, and higher levels of comfort. It benefits society by saving energy and helping the environment.

For more information on any of the topics presented in this "Guide," please talk with your local Minnesota Power rep or call 1-800-228-4966 and ask for a Triple E program representative.

Your Energy Partner,

Minnesota Power

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## SIX REASONS TO BUILD AN ENERGY-EFFICIENT HOME

- Comfort** Triple E's high insulation requirements and air-tightening techniques can reduce heat loss and drafts, providing even temperatures throughout the home. High insulation levels and sealing air bypasses also provide a quieter living environment.
- Health** The latest in ventilation techniques and a continuous vapor barrier can enhance air quality and at the same time reduce excess moisture and indoor pollutants in your home.
- Energy Performance** Triple E Homes can use less energy for space heating than conventional homes. Triple E homes show an average of 35 percent reduction in space heating costs in comparison to conventional new construction. Lower heating requirements and more effective heating systems can reduce both first cost and operating cost of the system installed.
- Durability** In its effort to minimize heat loss, the program promotes tight-fitting, high-quality windows and doors with high R-values. Superior air-tightening techniques prevent warm moist air from entering and condensing in wall, ceiling and rim joist areas. The controlled ventilation and air-tightness requirements of the program can reduce the potential for moisture problems.
- Marketability** A home which provides the owner lower energy costs, improved comfort, health, and durability, will naturally increase in market value and resale potential. A Triple E and ENERGY STAR certification can provide an owner or builder greater recognition for the design and construction of a high performance home.
- Operating Economy and Financing** Better energy performance can also mean lower operating costs. Buyers wishing to stretch their mortgage (dollars) can take advantage of bank programs that reward energy-efficient construction.

## **MISSION**

Triple E seeks to promote building practices and applied technology that upgrades the energy efficiency, comfort, health and durability of the new construction market in and around Minnesota Power's service territory. It will do this by establishing energy-efficiency standards, conducting on-site inspections and completing home performance tests on all Triple E homes. The Triple E program also provides ongoing education and incentives, and building a network of industry professionals committed to energy-efficient new construction and design.

## **OBJECTIVES**

1. To work in partnership with the building industry to develop the capability to construct and market quality housing that is both energy-efficient and cost-effective.
2. To achieve average space heating requirements in new homes built to Triple E guidelines that are 35 percent lower than standard new homes in our area.
3. To monitor and evaluate Triple E homes over a period of time to identify optimum construction techniques, performance of heating and ventilation systems, indoor air quality, end-use energy consumption and homeowner satisfaction.
4. To incorporate building components in the Triple E home that address the issues of indoor air quality, moisture and mold.
5. To meet or exceed current Minnesota State Energy Code.
6. To offer education and training programs to building contractors, subcontractors, homeowners and industry support people (i.e., suppliers, code officials, bankers, realtors, architects, engineers) to meet continuing education requirements and assist all parties understand the long-term benefits of energy-efficient, environmentally sound home construction.

7. To continually improve the energy efficiency of Triple E homes via innovative products and practices, increased standards (i.e., Tier II and Tier III participation levels), ongoing training and evaluation, and research and development.
8. To work with manufacturers, builders, subcontractors, distributors and vendors to increase the market acceptance and availability of new products and building materials.

## **PROGRAM DESCRIPTION AND SCOPE**

The Triple E New Construction Program is voluntary. It is designed to identify advanced building practices and techniques and new innovative technologies that result in cost-effective, energy-efficient new home construction. The minimum specifications for Triple E homes are intended to meet or exceed Minnesota State Energy Code guidelines. In any case, where federal, state or local codes/regulations exceed the requirements herein, that code or regulation shall apply. Additional technical specifications related to thermal efficiency, moisture control, air quality, and space/water heating are incorporated into the program to improve the energy-efficiency, comfort, health and durability into a new home.

Triple E stands for **ENERGY-EFFICIENCY, EDUCATION AND EVALUATION**. Through the interaction of these components, Minnesota Power, in conjunction with building contractors and homeowners, will create a systematic approach to energy-efficiency in residential new construction (i.e., single-family and 2-4 unit dwellings) that optimize cost-effective construction.

The Triple E New Construction Program is based on the concept of the "House as a System." (How all building components interact and effect the overall energy usage and comfort of the new home). The program encourages efficiency through specific prescriptive and performance standards (see Appendix 1). Minnesota Power believes minimum thermal standards and specific performance standards will result in improved building practices, optimum energy-efficiency and greater customer satisfaction.

The Triple E program's emphasis on energy-efficiency standards, education, and ongoing evaluation result in continuous improvement in the quality and operating costs of homes built in our area.

## **REQUIREMENTS FOR PARTICIPATION**

1. New custom homes, spec homes, pre-built factory homes, and multiple-dwelling buildings up to four units are all eligible to participate in the Triple E program.
2. The builder/owner agrees to participate in the following inspections/reviews:
  - a plan review prior to construction
  - up to two on-site inspections during construction
  - a final home performance inspection that includes a building air-tightness (blower door) test and infrared thermal scan.

Triple E rebates/incentives are tied to the completion of each of the inspections. (See Appendix 2 for a complete listing of rebates.) The builder/owner is required to notify the Triple E representative at least one week in advance of each inspection.

4. The home can be heated either with electric type heating (i.e., Dual Fuel, firm, storage heat or heat pump) or a high efficient gas furnace or boiler. (Gas heated homes must meet the Tier II prescriptive standards—see Appendix 1).
5. Builders may complete up to three Triple E homes in a calendar year, subject to the discretion of the Minnesota Power rep and the availability of funds. If a builder fails to meet air tightness performance standards on two consecutive Triple E homes, he/she must wait 12 months before completing additional homes. Minnesota Power reserves the right to reject a builder application based on continued failure of the building air tightness tests.

## **ENERGY STAR HOMES PROGRAM—EPA/DOE**

In an effort to lessen the harmful side-effects of producing and using energy, the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) are working together to help consumers make energy-efficient purchasing decisions.

ENERGY STAR Homes Program is a national, voluntary program that develops partnerships with the home building and related industries to construct new homes.

Minnesota Power has partnered with the EPA ENERGY STAR Program and all Triple E homes constructed and verified to meet the Tier II performance and prescriptive guidelines receive the “EPA ENERGY STAR Home” certification. Participating builders have access to ENERGY STAR Homes marketing materials and use of the ENERGY STAR logo for promotional purposes.

## **TRIPLE E PRESCRIPTIVE AND PERFORMANCE STANDARDS**

The Triple E program provides flexibility from a design perspective. Minimum prescriptive and performance standards have been established to ensure consistency in Triple E home performance. (See Appendix 1 for specific details).

To encourage continuous improvement in building practices, the Triple E program offers an optional Tier II/ENERGY STAR level of standards. Homes that meet the Tier II/ENERGY STAR **prescriptive and performance standards**, can qualify for higher rebate incentives and achieve the highest level of efficiency in the Triple E program.

## **PRESCRIPTIVE STANDARDS (R-values listed for insulation only)**

( $\geq$  means equal to or greater than       $\leq$  means equal to or less than)

- 1. Foundation/Basement Wall and Slab on Grade Foundation Wall:** Minimum R-10 to footings. Insulation must extend to top of foundation wall and be securely attached. Required protection of exterior foam from sunlight and physical abuse and the installation of drainage materials along exterior walls to keep water away from the foundation.  
**Tier II/ENERGY STAR:** Minimum R-19 on entire foundation wall.
- 2. Slab on Grade:** Floating slab-R-10 under entire slab and R-10 on slab edge.
- 3. Basement slab or concrete floor:** Minimum R-10 under entire slab. Continuous vapor barrier/retarder under entire slab for moisture and radon control.  
**Tier II/ENERGY STAR:** same as above
- 4. Floors over exterior space:** R-24 plus R-5 continuous (rigid foam). Continuous air barrier required.  
**Tier II/ENERGY STAR:** R-30 plus R-5 continuous (rigid foam). Continuous air barrier required.

**Floors over unconditioned space:** (i.e., crawl space and tuck under garage). R-24 and continuous air barrier required.  
**Tier II/ENERGY STAR:** R-30 and continuous air barrier required.
- 5. Exterior Walls (insulation only):** minimum R-21 cavity.  
**Tier II/ENERGY STAR:** R-24 cavity or R-20 continuous.
- 6. Exterior wind barrier (house wrap):** Continuous or sealed wrap applied on the exterior of the structure, extending from bottom of rim joist to top plate. Also, the barrier should extend to the top of the attic insulation and cover cantilevered floors and bay windows. All seams must be taped with a high quality builder tape. The house wrap shall have a perm rating of greater than 1.0. (See Appendix 5 for perm ratings of common building materials.)

7. **Ceiling/Attic (insulation only):** minimum R-44 (insulation only)—(must meet winter design performance criteria as specified by Minnesota State Energy Code) with energy truss or raised heel.

**Tier II/ENERGY STAR:** R-50 blown

**Cathedral Ceiling  $\leq$  50% ceiling area:** R-40

**Tier II/ENERGY STAR:** same as above R-40

**Cathedral Ceiling 100% of ceiling area:** R-44

**Tier II/ENERGY STAR:** R-50

- a. Warm air bypasses (i.e., soil stacks, electrical penetrations, chimney and vent chaseways, etc.) should be sealed to maintain the integrity of the vapor barrier/retarder and to minimize heat loss and condensation in cold attic.
  - b. A solid wind wash barrier shall be provided at the exterior edge of attic insulation to prevent air intrusion into the attic insulation.
8. **Rim Joist:** minimum R-15 cavity or R-10 continuous. Continuous interior/warm side vapor/air barrier sealed in place on all rim joist areas
- Tier II/ENERGY STAR:** R-20 cavity or continuous. Continuous vapor/air barrier sealed in place on all rim joist areas

9. **Windows:** Minimum standards  $\leq$  U .35 (overall unit value)

**Tier II/ENERGY STAR:**  $\leq$  U .33 (overall unit value) and Solar Heat Gain Co-efficient (SHGC)  $\geq$  .30 or Option 2:  $\leq$  U .28 and SHGC  $\geq$  .24

Maximum allowable window area: 18% (total window area to conditioned floor area ratio)

## 10. **Moisture Control**

A continuous vapor barrier of less than 1.0 perm rating shall be installed on the winter warm side of exterior walls, ceilings and floors over unconditioned space. All bypasses caused by electrical and plumbing installations must be sealed to maintain the integrity of the vapor barrier. Also, a 6 mil polyethylene or other approved vapor barrier material must be installed

under the entire surface area of the slab. Appendix 5 lists the perm rating of common building materials.

## 11. Air Quality Control/Ventilation

The provision of adequate ventilation in residential buildings can only be assured with a central, whole house, pressure balanced, mechanical ventilation system. There is a need to assume a minimum continuous ventilation rate to control the level of indoor air and pollutants generated by occupants or by sources with no fixed or identifiable location. This is accomplished by insuring a minimum level of makeup air. There is also a need to remove some contaminants that are generated at fixed locations, such as kitchens and bathrooms.

The minimum rate for whole house ventilation, considering mechanical ventilation capacity and natural air leakage, is .35 ACH. Spot ventilation (kitchen and bathrooms) provided on an intermittent basis must be capable of 100 cfm in the kitchen and 50 cfm in the bathrooms.

### 11.1 Required Ventilation Options:

Heat Recovery Ventilator (HRV) or Energy Recovery Ventilator (ERV), also known as air-to-air heat exchangers or whole house mechanical ventilation systems. System balancing is required and an optional incentive is available for the presence of a balancing verification label on the unit.

**Tier II/ENERGY STAR:** Minimum active recovery efficiency  $\geq$  76%. (see Appendix 4 listing minimum requirements for ventilation systems.)

## **12. Space Heating and Domestic Hot Water**

### **12.1 Space Heating**

Electric space heating on the firm, dual fuel or storage/off peak rate (i.e., baseboard, slab heat, boiler, furnace, storage units, ground source heat pump, etc.). Ground source heat pumps must have a minimum 3.3 COP on closed loop systems and 3.6 COP on open loop systems.

Gas space heating: minimum 92% AFUE for furnaces with ECM motors and 85% AFUE for hot water boilers. ENERGY STAR programmable thermostat required on all gas forced air furnaces.

Ductwork located in unconditioned spaces require thorough sealing of all seams and joints and insulated to a minimum of R-8.

### **12.2 Fossil Fuel Appliances**

Combustion appliances (i.e., fireplaces, stoves, water heaters) must have an independent source of makeup air directly connected to the combustion chamber (sealed combustion).

### **12.3 Domestic Hot Water**

The builder/owner is required to install a high efficiency hot water heater and meet all state requirements for water conservation related to toilets, showerheads and faucet aerators. Also recommended to install pipe wrap insulation on the hot and cold pipes leading to and from the water heater.

**Tier II/ENERGY STAR:** (See Appendix 1 for water heater efficiency requirements)

## **13. ENERGY STAR Lighting and Appliances**

The home must have a minimum of five (5) ENERGY STAR light fixtures and the refrigerator, dishwasher, and clothes washer must be ENERGY STAR rated.

**14. Building Orientation (optional)**

Forty percent of glass area must be within 30 degrees south facing for optimum solar gain. This is an optional standard that qualifies for an additional \$200 rebate. (Patio and slider doors are considered as window area)

**15. Drain Water Heat Recovery Device (optional)**

A drain water heat recovery device captures heat from the drain water and uses it to preheat incoming cold water. GFX unit or equivalent qualifies for an additional \$100 rebate. This is an optional standard.

**TRIPLE E PERFORMANCE STANDARDS**

**1. Air Tightness Performance Standard**

**Minimum air** leakage not to exceed .25 cfm/ft<sup>2</sup> at 50 pascals.

**Tier II/ENERGY STAR:** not to exceed .20 cfm/ft<sup>2</sup> at 50 pascals.

**Tier III:** not to exceed .15 cfm/ft<sup>2</sup> at 50 pascals (eligible for additional rebate incentive)

Blower door analysis (depressurization technique) is completed during the final inspection. Ductwork leakage in unconditioned space cannot exceed 12% leakage at 25 pascals.

## EVALUATION OF TRIPLE E HOMES

1. **Plan Review/ Blueprint Evaluation:** The builder/owner shall complete a plan review prior to construction. A \$100 incentive is available for the completion of the review.
2. **First On-site—General Building Envelope Inspection:** The home shall be inspected after the shell is complete to pre-view insulation, air sealing, ventilation design, ductwork layout, etc. A \$100 incentive is available for the completion of this inspection.
3. **Second On-site—Pre-sheetrock Inspection:** The home shall be inspected to assess installation of insulation, vapor barrier, air sealing and ventilation details, etc. prior to the installation of the drywall. This will determine compliance with Triple E prescriptive standards. A \$100 incentive is available for the completion of this inspection.
4. **Final Inspection:** The builder/owner must be present for the walk-through final inspection. An air infiltration analysis (blower door) and infrared thermal scan will be completed to determine the overall air-tightness or infiltration rate of the home, and to check insulation levels and quality of installation. The results of the blower door analysis will help the builder/owner identify any areas of air leakage requiring remedial action.

The builder and his/her subcontractors must insure the ventilation system meets minimum air change standards and that there is sufficient makeup air in the home to prevent negative pressure. Appendix 3—Triple E Inspection Report details the evaluation process.

## **BUILDER AND HOMEOWNER REBATE INCENTIVES**

State-licensed builders or owner-builders can qualify for specific incentives based on meeting or exceeding Triple E minimum or Tier II prescriptive and performance standards. Additional rebate incentives are available for installing a ground source heat pump, ENERGY STAR rated appliances and lighting fixtures, high efficient gas furnace with ECM motor, and a drain water heat recovery device.

During the final inspection, a Minnesota Power representative signs the Triple E Inspection Report (Appendix 3) and indicates rebates achieved. The builder and owner receive a Triple E home certificate of completion summarizing all the energy saving details. Tier II homes also receive an ENERGY STAR certificate.

## APPENDICES

- Appendix 1: Triple E and ENERGY STAR Program Standards
- Appendix 2: Triple E and ENERGY STAR Rebate Incentives
- Appendix 3: Triple E Project Report
- Appendix 4: Minimum Requirements for Ventilation
- Appendix 5: Perm Ratings for Common Building Materials
- Appendix 6: Definition of Terms
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## Triple E and ENERGY STAR Program Standards

	Tier I	Tier II and ENERGY STAR	
<b>Minimum Insulation Requirements (Prescriptive &amp; Performance Standards)</b>			
Attic	R-44	R-50	
Cathedral Ceiling ≤ 50% ceiling area	R-40	R-40	
Cathedral Ceiling 100% of ceiling area	R-44	R-50	
Exterior Walls <sup>3</sup>	R-21 cavity	R-24 cavity or R-20 continuous	
Rim Joist Continuous	R-15 cavity or R-10 continuous	R-20 cavity or continuous	
Foundation/Basement Wall	R-10	R-19	
Slab Perimeter	R-10	R-10	
Under Slab	R-10	R-10	
Floor Over Exterior Space	R-24 cavity plus R-5 continuous	R-30 cavity plus R-5 continuous	
Floor Over Unconditioned Space	R-24	R-30	
Total Conditioned Floor Area	no limitations	1000-4000ft <sup>2</sup>	
Air Tightness	≤ .25 cfm/ft <sup>2</sup> @ 50 pascals	≤ .20 cfm/ft <sup>2</sup> @ 50 pascals	
<b>Window Requirements</b>			
Window U-value	≤ .35	≤ .33 or ≤ .28	
Window SHGC	no requirements	≥ .30 or ≥ .24	
Window Distribution	no requirements	≤ 62.5%	
Max Window Area <sup>1,2</sup>	no requirements	max 18%	
<b>Minimum Equipment Requirements (HVAC)</b>			
Gas Furnace Heating (forced air)	not allowed on tier 1 homes	≥ 92% AFUE with ECM motor	
Gas Boiler Heating (hot water)	not allowed on tier 1 homes	≥ 85 % AFUE	
Electric Heating	any	any	
Electric Cooling (SEER) <sup>4</sup>	≥ 14	≥ 14	
Air-to-Air Heat Exchanger	≥ 76% HRV or ERV	≥ 76% HRV or ERV	
Thermostats for Forced Air <sup>5</sup>	ENERGY STAR Programmable	ENERGY STAR Programmable	
<b>Water Heater Requirements</b>		<b>Electric</b>	<b>Gas</b>
40 Gallon	no requirements	0.93	0.62
50 Gallon	no requirements	0.92	0.59
60 Gallon	no requirements	0.91	0.57
80 Gallon	no requirements	0.89	0.53
Gas Instantaneous (tankless)	no requirements	n/a	any
<b>Additional Requirements</b>			
Compliance with Thermal Bypass Checklist <sup>6</sup>	yes	yes	
Duct Location	any location acceptable	conditioned space only	
Duct Insulation	R-8	R-8	
ENERGY STAR Lighting	5 fixtures required	5 fixtures required	
ENERGY STAR Dishwasher	required	required	
ENERGY STAR Clotheswasher	required	required	
ENERGY STAR Refrigerator	required	required	
<b>See Footnotes for specific details</b>			

## Triple E Tier I Program Standards Checklist (intended for builders and customers)

		Tier I	Proposed Home
<b>Minimum Insulation Requirements (Prescriptive &amp; Performance Standards)</b>			
<input type="checkbox"/>	Attic	R-44	
<input type="checkbox"/>	Cathedral Ceiling $\leq$ 50% ceiling area	R-40	
<input type="checkbox"/>	Cathedral Ceiling 100% of ceiling area	R-44	
<input type="checkbox"/>	Exterior Walls <sup>3</sup>	R-21 cavity	
<input type="checkbox"/>	Rim Joist Continuous	R-15 cavity or R-10 continuous	
<input type="checkbox"/>	Foundation/Basement Wall	R-10	
<input type="checkbox"/>	Slab Perimeter	R-10	
<input type="checkbox"/>	Under Slab	R-10	
<input type="checkbox"/>	Floor Over Exterior Space	R-24 cavity plus R-5 continuous	
<input type="checkbox"/>	Floor Over Unconditioned Space	R-24	
<input type="checkbox"/>	Total Conditioned Floor Area	no limitations	
<input type="checkbox"/>	Air Tightness	$\leq$ .25 cfm/ft <sup>2</sup> @ 50 pascals	
<b>Window Requirements</b>			
<input type="checkbox"/>	Window U-value	$\leq$ .35	
<input type="checkbox"/>	Window SHGC	no requirements	
<input type="checkbox"/>	Window Distribution	no requirements	
<input type="checkbox"/>	Max Window Area <sup>1,2</sup>	no requirements	
<b>Minimum Equipment Requirements (HVAC)</b>			
<input type="checkbox"/>	Gas Furnace Heating (forced air)	not allowed on tier 1 homes	
<input type="checkbox"/>	Gas Boiler Heating (hot water)	not allowed on tier 1 homes	
<input type="checkbox"/>	Electric Heating	any	
<input type="checkbox"/>	Electric Cooling (SEER) <sup>4</sup>	$\geq$ 14	
<input type="checkbox"/>	Air-to-Air Heat Exchanger	$\geq$ 76% HRV or ERV	
<input type="checkbox"/>	Thermostats for Forced Air <sup>5</sup>	ENERGY STAR Programmable	
<b>Water Heater Requirements</b>			
<input type="checkbox"/>	40 Gallon	no requirements	
<input type="checkbox"/>	50 Gallon	no requirements	
<input type="checkbox"/>	60 Gallon	no requirements	
<input type="checkbox"/>	80 Gallon	no requirements	
<input type="checkbox"/>	Gas Instantaneous (tankless)	no requirements	
<b>Additional Requirements</b>			
<input type="checkbox"/>	Compliance with Thermal Bypass Checklist <sup>6</sup>	yes	
<input type="checkbox"/>	Duct Location	any location acceptable	
<input type="checkbox"/>	Duct Insulation	R-8	
<input type="checkbox"/>	ENERGY STAR Lighting	5 fixtures required	
<input type="checkbox"/>	ENERGY STAR Dishwasher	required	
<input type="checkbox"/>	ENERGY STAR Clothes Washer	required	
<input type="checkbox"/>	ENERGY STAR Refrigerator	required	
<b>See Footnotes for specific details</b>			

## Triple E Tier II and ENERGY STAR Program Standards Checklist (intended for builders and customers)

Tier II and ENERGY STAR

Proposed Home

Minimum Insulation Requirements (Prescriptive & Performance Standards)			
<input type="checkbox"/>	Attic	R-50	
<input type="checkbox"/>	Cathedral Ceiling $\leq$ 50% ceiling area	R-40	
<input type="checkbox"/>	Cathedral Ceiling 100% of ceiling area	R-50	
<input type="checkbox"/>	Exterior Walls <sup>3</sup>	R-24 cavity or R-20 continuous	
<input type="checkbox"/>	Rim Joist Continuous	R-20 cavity or continuous	
<input type="checkbox"/>	Foundation/Basement Wall	R-19	
<input type="checkbox"/>	Slab Perimeter	R-10	
<input type="checkbox"/>	Under Slab	R-10	
<input type="checkbox"/>	Floor Over Exterior Space	R-30 cavity plus R-5 continuous	
<input type="checkbox"/>	Floor Over Unconditioned Space	R-30	
<input type="checkbox"/>	Total Conditioned Floor Area	1000-4000ft <sup>2</sup>	
<input type="checkbox"/>	Air Tightness	$\leq$ .20 cfm/ft <sup>2</sup> @ 50 pascals	
Window Requirements			
<input type="checkbox"/>	Window U-value	$\leq$ .33 or $\leq$ .28	
<input type="checkbox"/>	Window SHGC	$\geq$ .30 or $\geq$ .24	
<input type="checkbox"/>	Window Distribution	$\leq$ 62.5%	
<input type="checkbox"/>	Max Window Area <sup>1,2</sup>	max 18%	
Minimum Equipment Requirements (HVAC)			
<input type="checkbox"/>	Gas Furnace Heating (forced air)	$\geq$ 92% AFUE with ECM motor	
<input type="checkbox"/>	Gas Boiler Heating (hot water)	$\geq$ 85% AFUE	
<input type="checkbox"/>	Electric Heating	any	
<input type="checkbox"/>	Electric Cooling (SEER) <sup>4</sup>	$\geq$ 14	
<input type="checkbox"/>	Air-to-Air Heat Exchanger	$\geq$ 76 % HRV or ERV	
<input type="checkbox"/>	Thermostats for Forced Air <sup>5</sup>	ENERGY STAR Programmable	
Water Heater Requirements			
		Electric	Gas
<input type="checkbox"/>	40 Gallon	0.93	0.62
<input type="checkbox"/>	50 Gallon	0.92	0.59
<input type="checkbox"/>	60 Gallon	0.91	0.57
<input type="checkbox"/>	80 Gallon	0.89	0.53
<input type="checkbox"/>	Gas Instantaneous (tankless)	n/a	any
Additional Requirements			
<input type="checkbox"/>	Compliance with Thermal Bypass Checklist <sup>6</sup>	yes	
<input type="checkbox"/>	Duct Location	conditioned space only	
<input type="checkbox"/>	Duct Insulation	R-8	
<input type="checkbox"/>	ENERGY STAR Lighting	5 fixtures required	
<input type="checkbox"/>	ENERGY STAR Dishwasher	required	
<input type="checkbox"/>	ENERGY STAR Clothes Washer	required	
<input type="checkbox"/>	ENERGY STAR Refrigerator	required	
See Footnotes for specific details			



## ENERGY STAR Qualified Homes Equivalent Program Footnotes For Use in the State of Minnesota

1. All decorative glass and skylight window area counts toward the total window area to above-grade conditioned floor area (WFA) ratio. For homes with conditioned basements, the following equation must be used to determine the allowable window area: Allowable Window Area =  $18\% \times \text{Total Conditioned Floor Area} \times \text{FA}$ , where  $\text{FA} = (\text{Above-grade thermal boundary gross wall area}) / (\text{Above-grade thermal boundary gross wall area} + 0.5 \times \text{below-grade thermal boundary gross wall area})$ . For example, for a one-story home with a conditioned basement, 1000 sq. ft. of conditioned space per floor, 8' floor to ceiling height, and 6' below grade basement depth, the following window area would be allowed:  

$$18\% \times 2000 \text{ sq. ft.} \times [(8 \text{ ft.} + 2 \text{ ft.}) \times \text{house perimeter}] / [(8 \text{ ft.} + 2 \text{ ft.} + 0.5 \times 6 \text{ ft.}) \times \text{house perimeter}] = 277 \text{ sq. ft.}$$
2. Up to 0.75% WFA may be used for decorative glass that does not meet ENERGY STAR requirements. For example, a home with total above-grade conditioned floor area of 2,000 sq. ft. may have up to 15 sq. ft. (0.75% of 2,000) of decorative glass.
3. Walls constructed of Insulated Concrete Forms (ICF) or Structurally Insulated Panels (SIP) with a nominal insulation level of at least R-20 may be used in place of the required R-24 wood-frame walls.
4. Central cooling equipment should have a SEER rating of 14 or greater and must be properly installed by a contractor who has been trained through the Minnesota Power HVAC rebate program. Visit [www.mnpower.com/hvacspecials](http://www.mnpower.com/hvacspecials) for more information, or contractors can call 1-800-969-9322, ext. 167 to participate.
5. In homes with heat pumps that have programmable thermostats, the thermostat must have "Adaptive Recovery" technology to prevent the excessive use of electric back-up heating.
6. The Thermal Bypass Inspection Checklist must be completed for homes to earn the ENERGY STAR label. The Checklist requires visual inspection of framing areas where air barriers are commonly missed and inspection of insulation to ensure proper alignment with air barriers, thus serving as an extra check that the air and thermal barriers are continuous and complete.
7. Envelope leakage must be determined by a RESNET-certified rater using a RESNET-approved testing protocol.
8. To determine domestic hot water (DHW) EF requirements for additional tank sizes, use the following equations:  
 Gas DHW  $\text{EF} \geq 0.69 - (0.002 \times \text{Tank Gallon Capacity})$ ; Electric DHW  $\text{EF} \geq 0.97 - (0.001 \times \text{Tank Gallon Capacity})$ . In addition, any gas or electric instantaneous water heater may be used in place of a storage water heater.

### Triple E & ENERGY STAR Rebate Incentives

(The prescriptive and performance incentives are available for electric heat homes only on account of Minnesota Power's ability to claim electric energy savings as a result of energy improvements. Minnesota Power's Conservation Improvement Programs (CIP) rebate incentives are relative to the amount of electric energy savings. The associated value of the plan review, site inspections, and final home analysis is estimated to be between \$600 and \$900.)

#### Prescriptive Standards

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	Rebate Incentive Amount \$	
	<u>Electric Heat</u>	<u>Gas Heat</u>
<b>Tier I Minimum Standards</b>	\$0	N/A
<b>Tier II &amp; ENERGY STAR Standards</b>	\$800	N/A
<b>Plan Review Complete</b>	\$100	N/A
<b>First On-Site Inspection</b>	\$100	N/A
<b>Second On-Site Inspection</b>	\$100	N/A

#### Performance Standards

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	Rebate Incentive Amount \$	
	<u>Electric Heat</u>	<u>Gas Heat</u>
<b>Air Tightness Standard</b>		
$\leq .25$ cfm/ft <sup>2</sup> @ 50 pascals	\$0	N/A
$\leq .20$ cfm/ft <sup>2</sup> @ 50 pascals	\$500	N/A
$\leq .15$ cfm/ft <sup>2</sup> @ 50 pascals	\$800	N/A

## OPTIONAL INCENTIVES

## FOR ELECTRIC HEATED HOMES ONLY

1. **Building Orientation**      **\$200** rebate for south facing glass area. Must have a minimum of 40 percent of glass area within 30 degrees south facing for optimum solar gain. Glass doors included in total area. This is an optional incentive.
2. **Drain Water Heat Recovery**      **\$400** rebate on installation of a Drain Water Heat Recovery device installed by a participating installer.
3. **Ground Source Heat Pump**      **\$200** per ton on closed loop systems ( $\geq 3.3$  COP)  
**\$100** per ton on open loop systems ( $\geq 3.6$  COP)
4. **Window Upgrade**      **\$300** rebate on windows with a total unit U-value of .28 or less

## FOR ELECTRIC OR GAS HEATED HOMES

5. **Verification Label on Air-to-Air Heat Exchanger**      **\$50** rebate for verification of air-to-air heat exchanger balancing
6. **Solar Electric (PV)**      **\$2,000/KW** on a grid tie solar electric system up to a maximum \$4,000. Additional rebates of \$2,000/KW available through the MN Department of Commerce to a maximum of \$8,000.
7. **ENERGY STAR Appliances**      up to **\$100** on ENERGY STAR appliance package. (refrigerator, clothes washer and dishwasher)
8. **ENERGY STAR Lighting**      **\$15** rebate on each ENERGY STAR qualified lamp or fixture.
9. **High Efficiency Gas ECM Furnace** (electronically commutated motor)      **\$200** rebate for installing a high efficiency gas furnace ( $\geq 92\%$ ) with ECM motor
10. **Central Air Conditioning**      **\$50** rebate for the proper installation and testing of a central air conditioning system. SEER rating must be  $\geq 14$ .



**Space and Water Heating/Cooling Systems**

Heating system type \_\_\_\_\_ fuel type \_\_\_\_\_ AFUE \_\_\_\_\_  
 Back-up heating system \_\_\_\_\_ fuel type \_\_\_\_\_ AFUE \_\_\_\_\_  
 AC SEER rating \_\_\_\_\_ ENERGY STAR Programmable Thermostat Y/N  
 Ground Source Heat Pump \_\_\_\_\_ tons (loop - open \_\_\_\_\_ closed \_\_\_\_\_) model # \_\_\_\_\_  
 Water Heater brand \_\_\_\_\_ size \_\_\_\_\_ Model # \_\_\_\_\_  
 Energy Factor \_\_\_\_\_ Fuel Type \_\_\_\_\_

**Ventilation System**

Type and brand \_\_\_\_\_ Model \_\_\_\_\_ Balanced Y/N  
 Heat Recovery Efficiency \_\_\_\_\_% Control options \_\_\_\_\_

**ENERGY STAR Lighting and Appliances**

# of fixtures \_\_\_\_\_ Appliances: refrigerator/clothes washer/dishwasher Y/N

**Building Performance Standards**

Meets or exceeds standards Y/N

House Volume \_\_\_\_\_ ft<sup>3</sup> \_\_\_\_\_ ft<sup>2</sup> Normalized ft<sup>2</sup> \_\_\_\_\_  
 Air tightness performance at 50 pascals \_\_\_\_\_ cfm total \_\_\_\_\_ cfm/ft<sup>2</sup> \_\_\_\_\_ AC/H  
 Minimum standard: .25 cfm/ft<sup>2</sup> at 50 pascals  
 TIER II/ENERGY STAR std: .20 cfm/ft<sup>2</sup> TIER III std: .15 cfm/ft<sup>2</sup>  
 Remedial Action Required Y/N (Comments) \_\_\_\_\_

**Electric Heating Rebates**

	Tier I	Tier II/ ENERGY STAR	Tier III
Prescriptive Standards met	Y/N [ ] \$0	[ ] \$800	n/a
Heating and Air tightness Performance Met	Y/N [ ] \$0	[ ] \$500	[ ] \$800

**Optional Rebates (Electric Heating only)**

Plan review complete Y/N [ ] \$100  
 First On-Site Inspection Y/N [ ] \$100  
 Second On-Site Inspection Y/N [ ] \$100  
 Building Orientation Y/N [ ] \$200  
 Drain water heat recovery device Y/N [ ] \$100  
 Ground Source Heat Pump Y/N \$200/ton Closed Loop Total \_\_\_\_\_  
 Ground Source Heat Pump Y/N \$100/ton Open Loop Total \_\_\_\_\_  
 Window Upgrade (≤U.28 & ≥ .24 SHGC) Y/N [ ] \$300  
 Verification label on HRV Y/N [ ] \$50  
 Applied for ENERGY STAR Lighting and Appliance rebates Y/N  
 Applied for ECM furnace motor rebate Y/N  
 TOTAL HOMEOWNER REBATE \$ \_\_\_\_\_ TOTAL BUILDER REBATE \$ \_\_\_\_\_

I have reviewed this document for completeness and accuracy. I approve the rebates listed above, based on Builder meeting specific Triple E standards.

\_\_\_\_\_  
 Triple E Third-Party Contractor Date: \_\_\_\_\_

## MINIMUM REQUIREMENTS FOR VENTILATION SYSTEMS

1. Ventilation system must be capable of providing .35 Air Changes Per Hour (ACH) based on the volume of the heated portion of the house. (Consistent with ASHRAE 62-81.)
2. System sizing and the continuous ventilation rate should be based on the following formula:total number of bedrooms + 1 X 15 cfm. (e.g., 4 bedroom home = 4 + 1 = 5, 5 x 15 cfm = 75 cfm continuous ventilation rate.)
2. Ventilation systems should be designed and installed to ensure that ventilation air is thoroughly mixed through the house without thermal discomfort.
3. Air-to-air heat exchangers must use minimum 6" ductwork on all supply and exhaust distribution.
4. Exhaust points must be installed in each high moisture/odor area such as bathrooms, kitchens and utility rooms.
5. Fresh air supplies should be ducted into each habitable room with the use of 6" rigid duct.
6. Ventilation systems must be installed in a heated area and cannot be installed in areas such as unheated garages, attics and crawlspaces.
7. All ductwork seams and joints should be taped with high quality tapes or mastic.

### PERM RATINGS FOR COMMON BUILDING MATERIALS

Type	Material	Permeance•
Vapor Barriers	1 mil aluminum foil	0.00
	6 mil polyethylene	0.06
Paint & Wallpaper	2 coats aluminum paint	0.5
	1 coat of Glidden "Insulaid" latex vapor barrier paint	0.6
	Vinyl wallpaper	1
	3 coats oil paint on wood	1
	2 coats oil paint on plaster	2
	3 coats latex paint on wood	10
	Ordinary wallpaper	20
Foam Insulation	1" Urethane	1.1
	1" Styrofoam	1.2
	1" Bead-board	4
	4" Urea formaldehyde	9
Fibrous Insulation	4" Blown insulation	30
Masonry	4" Brick	1
	8" Concrete block	2
Papers	Builder's foil	0.2
	15 lb. tar paper	18
	Builder's sheathing paper	40
Other	1/2" CDX plywood	0.5
	3/4" board	3
	Plaster	20
	Gypsum drywall	50
	1/2" insulating board	50

- 1 Perm = 1 grain H<sub>2</sub>O/hr./sq. ft./inch Hg

A perm is a unit that designates the degree of permeability of a material to moisture. The higher the number, the more porous the material will be; and conversely, the lower the number, the more effective a moisture barrier the material will be. To be an effective vapor barrier, a material should have a perm rating of less than 1.0.

## Definition of Terms

**Air-to-Air Heat Exchanger:** a factory-assembled unit which contains elements in which heat is transferred between two isolated air streams and a means to circulate air for ventilation. (Also known as a Heat Recovery Ventilator [HRV].)

**Conduction:** transfer of heat from a warm area to a cold area through a solid material.

**Degree-Days (DD):** the mean inside/outside daily temperature over the day with the inside assumed to be 65°F for heating (HDD) and 75°F for cooling (CDD). A degree day is the mean inside/outside daily temperature subtracted from 65° base. Degree days are totaled for monthly and annual purposes.

**Exhaust Air:** air removed from a space and not reused within a dwelling unit.

**House Wrap:** designed to reduce wind washing and air infiltration.

**Infiltration:** involves the loss of heated or conditioned air from a building and replacement of that lost air with cold or unconditioned air infiltrating the building envelope. Infiltration is the result of two factors acting on a building. The most significant is the stack effect which is driven by the temperature differential. The second important cause of infiltration is wind. Infiltration is usually calculated in terms of air changes per hours (ACH).

**Makeup Air:** outdoor air supplied to replace exhaust air (also known as combustion air to provide adequate oxygen and draft for fossil fuel appliances).

**Perm:** a unit that designates the degree of permeability of a material to moisture. The higher the number, the more porous the material will be; and conversely, the lower the number, the more effective a moisture barrier the material will be. To be an effective vapor barrier, a material should have a perm rating of less than 1.0.

**Vapor Barrier/Retarder:** installed on the winter warm side of the house. It must have a perm rating of less than 1.0.

**Ventilation:** the process of supplying and/or removing air by natural or mechanical means to and from any space. Such air may or may not be conditioned.

**Volume of a Home:** total cubic foot measurement of heated space.

Triple E  
Space Heating Costs Comparisons  
 New Construction

<u>Category</u>	<u>\$/ft<sup>2</sup>/yr</u>
<u>Highest Efficiency level</u> (Tier II Triple E, insulated slab, super high performance windows, passive solar)	\$.12 – .16
<u>Tier II Triple E Homes</u>	\$.20 – .25
<u>Tier I Triple E Homes</u>	\$.25 – .35
<u>Standard New Construction</u>	\$.40 – .50
<u>Poor New Construction</u> (poorly installed insulation, high air leakage rate, poor quality windows, high water table on heated slab, etc.)	\$.60 – 1.00

\*Square footage includes all heated areas including basements

\*Costs are based on Dual Fuel heating rates of 3.7 cents per KWH