

INSULATION AND WINDOWS

PREFERRED CONTRACTOR PROGRAM PARTICIPATION GUIDEBOOK
MAY 2016



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INTRODUCTION

1.1 Program Sponsor

Consumers Energy is one of the nation's largest combination utilities, providing electric and natural gas service to more than 6.5 million of Michigan's 10 million residents in all 68 counties of Michigan's lower peninsula.

As part of its Energy Optimization program filing, Consumers Energy has developed a strong portfolio of energy management programs for the residential, commercial and industrial sectors. These programs align with the goals of the 2008 Clean, Renewable and Efficient Energy Act to help Michigan residents and businesses save energy and money.

1.2 Insulation and Windows Program

The objective of the Insulation and Windows (INWIN) Program is to increase the demand for energy efficiency improvements in insulation and windows that result in long-term electric and natural gas energy savings for Consumers Energy's residential customers.

The target market for this program includes residential natural gas, electric or combination customers in single and multifamily dwellings with up to four units who install insulation and replacement windows and/or doors.

Consumers Energy's INWIN Program offers incentives for energy efficiency improvements that save electricity, natural gas or both. Incentives are available for improvements such as increased insulation that will save electricity (i.e., reduce cooling loads) and natural gas (i.e., reduce heating loads). Participants must be Consumers Energy residential customers who have either electric heat or central air conditioning for electric customers, or central gas furnaces or gas boilers for natural gas customers.

Most of the energy savings from the INWIN Program are expected to come from the following improvements:

- Insulation
- Window and patio door replacements

Key elements of the program implementation strategy include:

- Contractor recruitment and training
- Customer recruitment and feedback

1.3 Program Implementer

ICF International works on behalf of Consumers Energy to implement the INWIN Program. ICF provides:

- Program design
- Contractor participation recruiting, training and account management
- Evaluation of project paperwork and periodic onsite verification of improvements
- Marketing outreach and review of marketing materials developed by participating contractors
- Point of contact for all program activities

ICF PROGRAM CONTACT

Acct Manager/ Territory	Address	Direct	Mobile	Fax	Email Address
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SUMMARY OF PROGRAM PARTICIPATION REQUIREMENTS FOR CONTRACTORS

These requirements represent minimum standards for participation in the Consumers Energy Insulation and Windows Preferred Contractor Program.

2.1 Customer Participation Requirements

For the purposes of this program, a “customer” is defined as the person with financial responsibility for paying the natural gas or electric bill for the meter at the home where the energy efficiency improvements are to be installed. Any customer served by Consumers Energy in a single-family attached or detached home is eligible to participate in the program. Renters must certify that they have homeowner consent. Customers may receive incentives for multiple homes (i.e., locations with unique Consumers Energy account numbers). Consumers Energy customers will be identified by the account number printed on their natural gas or electric bills.

2.2 Contractor Participation Requirements

1. Sign Contractor Participation Agreement.
2. Submit required documentation per Participation Agreement (e.g., copies of appropriate licensing—builders or alterations)
3. Warrant all work performed (i.e., all materials, equipment, parts and workmanship) under the INWIN Program for one year. Provide customers with a written notice of warranty, if not already part of company documents.
4. Receive program administrative training.
5. Begin offering the INWIN Program.
6. Meet requirements of the INWIN Program.
 - Follow Consumers Energy Insulation and Windows Preferred Contractor guidelines, policies and technical standards; Michigan state laws and licensing requirements; local building codes; and permit and inspection requirements. Failure to comply may result in probation, suspension or expulsion from the program.
7. Submit a minimum of 10 INWIN Rebate Applications per contractor within a 12-month period to maintain enrollment in the program. Contractors who submit fewer than 10 INWIN Rebate Applications in a 12-month period may be subject to removal from the preferred contractor network program.
8. Ensure that newly enrolled contractors notify their assigned ICF account manager in advance with scheduled dates/times for the first five INWIN jobs performed. These first five INWIN jobs are subject to field inspection. This requirement is established to allow for account manager/contractor mentoring and to ensure that the newly enrolled contractor is correctly following the program guidelines and administrative policies.
9. Agree to provide an exceptional customer experience by submitting the rebate application with all required supporting documentation and resolving all requests for additional information or clarification on behalf of the homeowner.
10. Agree to quality assurance/quality control review for the first five jobs as indicated in item #8 and a random sampling of jobs thereafter as needed.
11. Agree to be evaluated through the Contractor Scorecard System, which will keep contractors aware of their performance in the Preferred Contractor Program and note any opportunities for mentoring from their assigned ICF account manager.

2.3 Marketing Policies and Procedures

1. Participating contractors may promote the program by distributing pre-approved program materials provided by Consumers Energy.
2. Contractors may put a link on their company websites to the Consumers Energy website: ConsumersEnergy.com. The use of the Consumers Energy logo on their company website must be pre-approved.
3. Contractors may NOT co-brand their company promotional materials or efforts with Consumers Energy without the consent of Consumers Energy. This includes co-branding on:
 - Brochures
 - Print ads
 - Radio/television ads
 - Website/online ads
4. Participating contractors may not present themselves as Consumers Energy employees, nor communicate in any way that they work on behalf of Consumers Energy. The following is sample approved language to present your association with Consumers Energy to customers:

[Company Name] is participating in Consumers Energy's Insulation and Windows Program. Through this program, we are able to install energy efficiency improvements at reduced cost to Consumers Energy customers.
5. Media Relations:
 - Consumers Energy is responsible for media relations.
 - The definition of "media relations" is: Any earned media gained through relationships or news releases or by speaking with a reporter, whether for broadcast, print or online media.
 - Consumers Energy prohibits any co-branding with participating contractors. This includes promoting your participation in Consumers Energy programs in a news release.
 - Consumers Energy handles all media interviews about its programs. Participating contractors may assist with interviews in cooperation with Consumers Energy. No one is to speak to the media on Consumers Energy's behalf without its knowledge.
6. Company Marketing:
 - Promoting your company and services to the public and media is appropriate.
 - Co-branding with Consumers Energy is not appropriate without Consumers Energy's consent. Do not promote any participation with Consumers Energy programs in any type of advertising or news release without prior consent by Consumers Energy.
7. Media Relations and the Program:
 - Consumers Energy is interested in promoting projects on behalf of INWIN. Participating contractors are in a unique position to identify media-worthy projects and work with Consumers Energy to promote them to the media.
 - Together, Consumers Energy and INWIN contractors can achieve a high level of visibility for the program, Consumers Energy and contractors.

8. Online:

- Contractors may link to Consumers Energy's website and indicate that they are participating in Consumers Energy's INWIN Program.
- Contractors should use the language provided in item #4 of Marketing Policies and Procedures, on the previous page, to explain how they are affiliated with Consumers Energy's program.

9. Mass Mailings:

- It is not acceptable for contractors to send out mass mailings that have their company's logo and Consumers Energy's logo.

10. Print, Radio, Television and Internet Ads:

- Contractors may not mention Consumers Energy programs and Consumers Energy's name specifically in print, radio, television or Internet ads.
- Contractors are permitted to talk about "locally available incentives" or "incentives available from your natural gas or electric utility."
- Contractors may also state that they are a participating contractor in INWIN.
- Ads must be pre-approved.

11. Project Economics Under Consumers Energy's Program:

- Participating contractors may market the economics of the program, but they cannot do so in a co-branded marketing piece (e.g., brochure, print ad, online).

12. Recommendation:

- Bring your account manager exactly what you want to mail, email, print, broadcast or distribute for review.

WORKER HEALTH AND SAFETY

3.1 Technician Safety

The contractor performing the work is responsible for initiating and maintaining programs that comply with applicable Occupational Safety and Health Act regulations (29 CFR 1910 & 1926) and any other applicable federal or state laws enacted to protect worker safety.

All technicians performing diagnostic tests, inspections or installations must have access to all necessary personal safety equipment required by the Occupational Safety and Health Administration. Required safety equipment includes:

- Fitted respirators with canister filters
- Dust masks
- Gloves
- Protective clothing
- Safety glasses
- Hard hats

All hand tools, power tools, ladders and diagnostic equipment must be handled and used in a safe manner and be kept in good working condition. Equipment and diagnostic tools must be maintained and calibrated according to manufacturer specifications.

A copy of the Material Safety Data Sheets for all materials used on the job and installed in the home must be kept on each crew vehicle and made available to all workers and clients upon request.

Where the presence of asbestos, lead, mold and/or other potentially hazardous material is known or suspected, all relevant state and federal (U.S. Environmental Protection Agency) guidelines must be followed to ensure technician and occupant safety.

Respirators with filter cartridges must be worn when working in areas where exposure to airborne mold, asbestos, lead, fiberglass or formaldehyde is a risk.

3.2 Dust and Lead

Contractors will adhere to the Toxic Substances Control Act amended by Title X, EPA 40 CFR Rules, and lead-safe practices in any home constructed before 1978 where pre-existing paint finish or dust might be disturbed as part of the work. Compliance is not required if an owner has documentation from a certified inspector or risk assessor that the house is free of lead-based paint or has undergone lead abatement in conformance with regulations.

3.3 Occupant Health and Safety

Where moisture problems exist, they must be mitigated through elimination or isolation of the source, or ventilation of the space around the source, before contractors proceed with other shell-related measures.

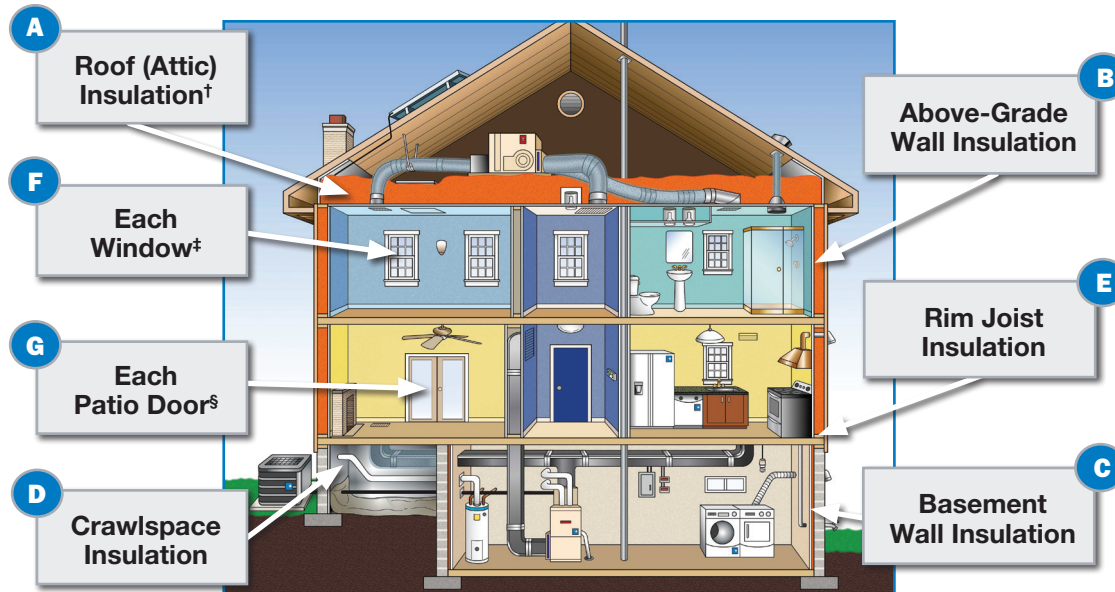
The homeowner must be notified of any health and safety hazards identified during inspections and installations in the home. These hazards include indoor air contaminant sources, moisture problems, structural problems, electrical problems and fire protection issues. Wherever problems are identified or suspected that fall outside the technician's area of expertise, the technician must inform the client of the problem and recommend an evaluation by a professional who specializes in the subject.

A dwelling using any unvented combustion appliance should not be tightened or insulated. The service provider should explain the consequences of using an unvented space heater to the customer. When the customer has agreed in writing that he/she understands and will not use the unvented space heater, insulation work may begin.

INSULATION AND WINDOWS PROGRAM

2016 CUSTOMER OVERVIEW

If you're a Consumers Energy residential natural gas or electric customer, you can get cash back for insulation and replacement windows. For a limited time, rebates on insulation and window installation from Consumers Energy will help make upgrading your home more affordable. You can either hire a contractor to do the work, or do it yourself—the choice is yours! Save now with your rebates and continue to save with lower energy bills year round.



Consumers Energy Insulation and Windows Rebates*			
Minimum Efficiency for Measure	Consumers Energy Customer Type		
	Gas and Electric	Gas Only	Electric Heat Only
A. Roof (Attic) Insulation† (must insulate a minimum of 500 square feet of attic area)	\$125	\$125	\$50
B. Above-Grade Wall Insulation (must insulate a minimum of 500 square feet of wall area)	\$125	\$125	\$50
C. Basement Wall Insulation (must insulate a minimum of 500 square feet of wall area)	\$50	\$50	\$50
D. Crawlspace Insulation (must insulate a minimum of 200 square feet of wall area)	\$50	\$50	\$10
E. Rim Joist Insulation (must insulate all accessible rim joist areas)	\$50	\$50	\$20
F. Window‡ (U-factor must be ≤ 0.30 or window rated as ENERGY STAR® for Northern Climate Zone)	\$15 each		
G. Patio Door Replacement§ (U-factor must be ≤ 0.30 or patio door rated as ENERGY STAR)	\$40 each		

Applying for your rebates is simple:

1. Apply online at Consumersinwin.com for fast and easy processing. If you're unable to apply online, download an application at ConsumersEnergy.com/myhome.
2. Submit the rebate application within 30 days of completing your improvements to ensure availability of funding. Program funds are limited and available on a first-come, first-served basis.
3. Upload, email or mail your materials receipts and/or contractor invoices. (See the next page for proof-of-purchase requirements.)
4. Receive your rebate check in the mail in six to eight weeks. Amount cannot exceed total project cost, including installation equipment.

For more information, call **866-234-0445** or visit ConsumersEnergy.com/myhome.

* Applications must be received by December 31, 2016, to qualify for incentive amounts advertised above.

† Reflective attic barriers and siding are ineligible.

‡ Glass block windows, house wrap and skylights are ineligible. Windows are per opening and may include those rated as ENERGY STAR for Northern Climate Zone.

§ Includes sliding and swinging glass doors. Solid core doors with glass lites smaller than 75 percent of total door area, glass block doors and storm doors are ineligible. Patio doors are per opening and may include those rated as ENERGY STAR.

The Consumers Energy Insulation and Windows Program customer incentives will be offered for a limited time in all Consumers Energy service territories. Incentives are subject to availability. Before investing in energy efficiency improvements, please confirm the availability of rebate funds by contacting the program at 866-234-0445 or ConsumersEnergy.com/myhome. Customers only are eligible for the incentive associated with their service and must have an active Consumers Energy account. Rebate amount cannot exceed total project cost including installation equipment.

TERMS AND CONDITIONS

PAPER APPLICATION: Applications for customer incentives can be downloaded or completed online at ConsumersEnergy.com/myhome. This application and any required additional documentation, including the invoice and/or a copy of the original sales receipt, must be filled out completely, truthfully and accurately. Participants are advised to print and retain a copy of their confirmation code and any accompanying documentation submitted to Consumers Energy under the Insulation and Windows Program. Consumers Energy will not be responsible for lost documentation pertaining to this application request. This program covers projects completed and installed on or after January 1, 2016. Details of this program, including incentive levels, are subject to change or cancellation without prior notice. It is recommended that the application, with required proof-of-purchase documents, be submitted within 30 days of installation completion to ensure availability of funding. Funds for incentives are limited and available on a first-come, first-served basis. Incentive amounts are valid through December 31, 2016, but can change without notice. Please call 866-234-0445 or visit ConsumersEnergy.com/myhome for the most up-to-date program details.

ELIGIBILITY: This offer is valid for Consumers Energy residential natural gas and/or electric customers (active account at time of installation) applying only through the Consumers Energy Insulation and Windows Program. PARTICIPANTS MUST BE CONSUMERS ENERGY ELECTRIC CUSTOMERS WHO HAVE ELECTRIC HEAT (INCLUDES HEAT PUMPS AND ELECTRIC RESISTANCE HEATING SYSTEMS) OR NATURAL GAS CUSTOMERS WITH CENTRAL GAS FURNACES OR GAS BOILERS. Single-family dwellings, including condominiums and townhouses, must be individually owned and metered for natural gas and/or electricity. This offer is not valid for new additions, garages, enclosed porches, new construction homes, multiple rental units managed or owned by a third party, or commercial properties or otherwise approved by Consumers Energy. Only one rebate is available per customer for each qualifying measure at address where installed. Windows are per unit and include sliding and swinging glass doors. Ineligible insulation measures include reflective attic barriers, house wrap and siding. Ineligible window and door measures include storm doors, glass block windows or doors, skylights and solid core doors with glass lites smaller than 75 percent of total door area. For other programs and eligible incentives, please visit ConsumersEnergy.com/myhome.

APPROVAL, VERIFICATION AND INSPECTION: Prior to any payment of incentives, Consumers Energy reserves the right to verify all installed energy-saving measures and sales transactions. Homeowner/Contractor will verify that the installed energy-saving measures meet all applicable building codes; zoning laws; local, state and federal requirements; and other relevant requirements including any applicable permits as required by code/law. Participant's home also may be selected for a quality control post-installation inspection by the Program Implementer, ICF International. No warranty is implied by this inspection.

REQUIRED DOCUMENTATION: Homeowners may scan and upload, email or mail their application, in addition to the following supporting documentation where applicable:

☐ Proof of Purchase:

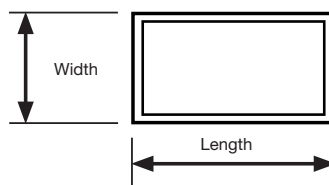
- ☐ Receipt Requirements: Must show product name, quantity, place, cost and date of purchase. Return receipts are not valid as proof of purchase.
- ☐ Invoice Requirements: Must include customer name, account service location (where work was performed), date of installation, cost and the following:
 - Windows/Doors—Product description and quantity
 - Insulation—Detailed scope of work indicating type of material installed and quantity or square footage for area installed. See the Square Ft. Calculation example above, right.

☐ **Additional Windows/Doors Requirements:** Must have a National Fenestration Rating Council (NFRC) sticker with a U-factor of 0.30 or less for windows and 0.30 or less for doors or be rated as ENERGY STAR for Northern Climate Zone **OR** must include the manufacturer product literature or specification sheet indicating that the product has a U-factor of 0.30 or less. See the sample NFRC label above, right.


See Sections III and IV of the application for specific product and installation requirements.

Square Ft. Calculation Example

Length x Width = Sq. Ft. (Area)



Sample NFRC Label

 World's Best Window Co. Millennium 2000® Vinyl-Casement Single-Hung Window Product Type: Vertical Slider	
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./h·ft²·°F)	Solar Heat Gain Coefficient
0.30	0.30
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance	Air Leakage (U.S./h·ft³)
0.51	0.2

PAYMENT: Please allow six to eight weeks for payment, which will be in the form of a check in the account holder's name. Payment processing may take longer if information is missing on the application. Rebates are calculated based on the date of insulation and/or window installation. Rebate amount cannot exceed total project cost including installation equipment. Please call 866-234-0445 if you have questions about your incentive or accompanying documentation.

TAX LIABILITY: Consumers Energy will not be responsible for any tax liability that may be imposed on the homeowner as a result of the payment of incentives. Please contact your tax adviser for more information.

SCANNED DOCUMENTS: Scanned original documents transmitted to the Program Implementer, ICF International, as an attachment to the electronic rebate application will be the same as delivery of the original signed documents. At the request of Consumers Energy, the participant must provide the original document to confirm that documents were sent with a scanned signature.

ENDORSEMENT: Consumers Energy does not endorse any particular manufacturer, product, system design, claim or contractor in promoting this program.

INFORMATION RELEASE: Participant agrees that Consumers Energy may include participant's name, Consumers Energy services used and resulting energy savings in reports or other documentation submitted to Consumers Energy and/or the Michigan Public Service Commission (MPSC). Consumers Energy will treat all other information gathered in evaluations as confidential and report it only in the aggregate.

LIMITATION OF LIABILITY: Consumers Energy's liability is limited to paying the incentive specified. IN NO EVENT WILL CONSUMERS ENERGY BE LIABLE, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, WARRANTY OR OTHERWISE, FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES CONNECTED WITH OR RESULTING FROM PARTICIPATION IN THIS PROGRAM. Consumers Energy reserves the right to not pay this incentive if the application and all required additional information are not complete and accurate.

WARRANTIES: Consumers Energy DOES NOT WARRANT THE PERFORMANCE OF MEASURES OR OF INSTALLED EQUIPMENT EXPRESSLY OR IMPLICITLY. Consumers Energy makes no warranties or representations of any kind, whether statutory, expressed or implied, including without limitations, warranties of merchantability or fitness for a particular purpose regarding any energy-efficiency measure or window provided by a manufacturer or vendor. Contact the manufacturer for details regarding measure or window performance and warranties.

PROPERTY RIGHTS: Participant represents that he/she has the right to complete and/or install the energy-saving measures on the property on which those measures are completed and/or installed and that any necessary landlord's consent has been obtained.

OWNER'S CERTIFICATION: Owner certifies that he/she has purchased and has installed the eligible improvement measures and equipment listed in this Rebate Application at the defined location. Owner agrees that all information is true and that he/she has conformed to all program requirements listed.

TERMINOLOGY AND DEFINITIONS

Air Sealing: Process of sealing bypasses in the pressure boundary to prevent air leakage. Air sealing reduces heat flow from air movement and prevents water vapor from entering the wall.

Area: Formula for area is length (linear feet) x width (linear feet) = area (square feet).

Asbestos: Heat-resistant material once used in many building products. Serious health hazard as an airborne particulate.

Attic Bypass: Air connection between the living space and attic.

Attic Ventilation: Ventilation intended to remove heat and moisture from attic to the outside.

Balloon Framing: Construction method where the walls are framed before the floor is built, and the wall cavity is often open to the attic and basement.

Band Joist: Framing ribbon between first and second floors of a structure.

Bottom Plate: Bottom horizontal wall component.

Building Envelope/Building Shell: Any part of the building that creates a boundary between indoor and outdoor space.

Cantilever: Characteristic of some houses where a floor protrudes beyond the foundation wall, exposing part of the floor area to the outside.

Capillary Action: Moisture transfer through which water is sucked into tiny spaces in and between building materials, caused by the attraction of water molecules to each other and to other substances.

Cellulose: Insulation made from recycled material and treated to be flame/insect retardant.

Condensation: Process by which moisture vapor changes to liquid form.

Conditioned Space: Areas or zones within a house that are heated or cooled for comfort.

Conduction: Transfer of heat between objects that are in contact. (Heat is transferred from molecule to molecule through solid materials.)

Consumption Analysis: Analysis of energy use. This could be an in-depth review of month-to-month use or a comparative analysis before and after work is completed.

Convection: Transfer of heat by circulation or movement of the heated parts of a liquid or gas.

Convective Loop: When air (or other medium) continuously circulates in an enclosed space as it is heated or cooled.

Cost Effectiveness: Indicator of how worthwhile an investment is.

Crawlspace: Space under a house often used to distribute mechanical/electrical systems. Usually unconditioned.

Cripple Stud: Stud over or under a header or sill.

Diffusion: Moisture transport mechanism; the way water vapor moves through materials such as sheetrock and plywood, going from high concentrations of moisture to low concentrations.

EPA: U.S. Environmental Protection Agency.

Exfiltration: Air leakage. Air leaving a building through the building envelope, caused by pressurization with reference to outside (replaced by an equal amount of air entering the building).

Fenestration: Envelope penetration used for access/egress or lighting. Examples include windows, doors and skylights.

Fiberglass: Common insulation material made from glass fibers.

Firestop: Material used to stop smoke, toxic fumes and fire from migrating from one floor to another.

First Law of Thermodynamics: Energy is neither created nor destroyed, but merely moves from place to place and changes form.

Floor Joist: Horizontal floor-framing member.

Formaldehyde: Harmful chemical vapor emitted by many building materials.

Gross Area: Total area before subtracting fenestrations.

IAQ: Indoor air quality.

Infiltration: Air leakage. The air that enters a structure through the envelope (replaced by an equal amount of air leaving the home). Caused by depressurization with respect to outside.

Insulation: Any material that slows heat transfer.

Interstitial Spaces: Building cavities (e.g., joist area, interior spaces of walls).

Jack Stud: Stud that supports either end of a header.

Jamb: Top or side piece of a door or window frame.

King Stud: Full-length stud closest to either end of a header.

Knee Wall: Short wall, usually about three to four feet high, in the attic of a home, anchored with plates between the attic floor joists and the roof joist. Sheathing can be attached to these walls to enclose an attic space. Commonly found in Cape-style homes.

Liquid Flow: Movement of bulk moisture from one place to another, driven by gravity or pressure differences.

Material Safety Data Sheet: Product information, provided by the manufacturer, detailing potential health/safety hazards and required precautions for dealing with a specific material.

Moisture Transport Mechanisms: Liquid flow, capillary action, diffusion, air movement.

Mold: Parasitic, microscopic fungi that make spores, which float in the air like pollen. Mold is a common trigger for allergies and is often found in damp areas such as basements and bathrooms.

Net Area: Square footage of a building component minus any fenestrations or areas of different R-value.

NFPA: National Fire Protection Association.

NFRC: National Fenestration Rating Council.

OSHA: Occupational Safety and Health Administration.

Platform Framing: Construction method in which the floor is framed and subfloored before the walls are set up. For two-story homes, another floor assembly is framed and subfloored on top of these walls. This greatly reduces air movement from basement to attic compared to balloon framing.

Polystyrene: Foam insulation type; available in sheet or spray.

Pressure Boundary: Refers to location of the barrier that separates indoor air from outdoor air. It should be continuous and aligned with the thermal boundary.

Rafter: Roof framing member.

Rate of Return: Percentage of savings from an energy investment accrued each year.

Respirator: Personal safety device designed to protect against airborne particulates.

Rim Joist: External frame for a floor platform of a house; also called box sill.

Rock Wool: Insulation type made from glass fiber.

R-Value: Measured resistance of a material to heat transfer.

Savings to Investment Ratio (SIR): Life-cycle savings of an energy improvement divided by the initial investment. (For every dollar invested in an energy improvement, how many dollars will be saved over the life of the improvement, in today's dollars?)

Second Law of Thermodynamics: Energy flows naturally from high concentrations to low concentrations.

Simple Payback: Number of years it takes for annual savings from an energy improvement to equal the initial investment.

Soffit: Underside of a roof overhang. A dropped soffit is a small, lowered ceiling often found above cabinets.

Solar Heat Gain Coefficient: Percentage of solar heat that is absorbed vs. reflected when it contacts a window.

Solar Light Transmittance: Percentage of light that is absorbed vs. reflected when it contacts a window.

Stack Effect: Occurs when a building is heated and the warm air inside is less dense than the colder air outside. The inside air rises up and out of any holes in the upper portions of the envelope and is replaced with outside air that enters through holes in the lower portions.

Thermal Boundary: Insulation boundary that separates conditioned from non-conditioned spaces in a building. It should be continuous and aligned with the pressure boundary.

Thermal Bypass: Material or component piece that allows more heat transfer compared to adjoining component pieces.

Top Plate: Horizontal framing member at the top of a wall.

Unconditioned Space: Area or zone in a building that is not intentionally conditioned.

Urea Formaldehyde: Common glue type used in wood products.

Urethane: Common foam insulation; available in sheet or spray.

U-Value: Measure of thermal transmittance (how fast heat moves through a material).

Vapor Barrier/Vapor Diffusion Retarder: Material with low permeability that is used to reduce moisture migration through building components.

Vapor Pressure: Natural force that drives moisture vapor to diffuse and equalize with other areas or zones with different moisture content.

Ventilation: Air turnover (intentional and unintentional) in a house.

Vermiculite: Ceramic insulation type commonly used before 1950.

Volume: Formula for volume is length (linear feet) x width (linear feet) x height (linear feet) = volume (cubic feet).

Water Vapor: Water in the form of gas. Water vapor is transported by air movement caused by pressure differences.

Windwashing: Reductions in R-value of insulation caused by air movement through insulation.

