

I. What Is Your KAEM (Knowledge About Energy Management)

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-In Relation to Housing Construction

BLACKSBURG, VIRGINIA

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## I. What is your KAEM (Knowledge About Energy Management)

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## Instructions:

Listed below are 21 problem situations concerning energy management in relation to Housing Construction. After reading the problem situation, check the alternative you consider to be correct.

When you have finished answering all of the problem situations check your answers on page

1. Orientation of Housing Unit
  - 1a. With proper orientation, radiant heat from the sun may be used for heat regulation in housing.
  - 1b. For best utilization of sun rays for supplementary heat in winter and control of amount of heat from the sun entering in summer, the best orientation for house on the lot is
    - a. East-west
    - b. North-south
    - c. No difference
2. Shape of House
  - 2a. The shape of the housing unit of any specified floor area can make a difference in heat loss or gain.
  - 2b. Shape of house permitting the least heat loss or gain is
    - a. Rectangular
    - b. Square
    - c. Octagonal
3. Awnings and Overhangs
  - 3a. Awnings and overhangs may be used to protect the house from undesirable summer sun and to expose the wall and glass area to desirable winter sun.
  - 3b. Awnings and overhangs may reduce solar heat gain in summer by as much as
    - a. 20%
    - b. 50%
    - c. 80%
4. Awnings and Overhangs-Orientation
  - 4a. Awnings and overhangs are more effective with some orientations than with others.
  - 4b. Most desirable side of house for overhangs (to take maximum advantage of winter sun and protect housing unit from sun's rays in summer) is on the
    - a. North
    - b. South
    - c. East
5. Solar Radiation through Glassed Areas
  - 5a. One of the most critical sources of heat gain in summer is afternoon solar radiation through glassed areas.
  - 5b. This may be reduced by
    - a. Orienting the house so there is minimum west exposure for glassed areas
    - b. Extending overhang
    - c. Installing double glass windows
6. Reflected Solar Energy through Glassed Areas
  - 6a. Reflected solar energy through glassed areas can add considerably to the heat gain of a house.
  - 6b. A common source of this reflected heat is
    - a. Trees and Shrubs
    - b. Concrete or asphalt pavement
    - c. Parked vehicles

7. Draperies and Blinds

7a. Windows normally comprise 15 to 30% of exterior wall area. One method of reducing heat gain in summer through windows--especially those exposed to the sun--is by use of blinds and draperies.

- 7b. Blinds or draperies can reduce heat gain by as much as
- a. 10%
  - b. 30%
  - c. 50%

8. Color of Roof

8a. The color of room surfaces may be chosen which will help in reflection of summer heat.

- 8b. Do light or dark roofs reflect more heat?
- a. Light roofs
  - b. Dark roofs
  - c. It makes no difference

9. Exterior Paint Color

9a. Color of paints for exterior of houses can be selected to aid in regulation of heat absorption.

- 9b. Which colors reflect more solar radiation--and thus would aid in regulation of heat absorption?
- a. Light
  - b. Medium
  - c. Dark

10. Ceiling Insulation

10a. Proper insulation is important in reducing energy consumption. The top floor ceiling requires ample insulation to reduce the heat flow downward from the sun-heated attic in summer and heat loss to the attic in winter.

- 10b. Thickness of insulation for ceilings should be
- a. R11
  - b. R13
  - c. R19

11. Wall Insulation

11a. Well insulated walls reduce heat flow from inside to outside in winter and outside to inside in summer.

- 11b. Installed rating of insulation in walls should be
- a. R11
  - b. R13
  - c. R19

12. Storm windows and insulating glass

12a. Needless loss of heat through windows of the house can also be prevented through the insulation of storm windows or insulating glass.

- 12b. Amount of heat that is needlessly lost through the windows of your house as well as difference in room air and window surface temperature can be reduced by storm windows (or double glass) by as much as
- a. 20%
  - b. 50%
  - c. 80%

13. Insulation-Concrete Slab Floors

- 13a. Houses built with concrete slab floors are sources of cold air intake. Houses built on concrete slab have considerable heat loss through the floor near the outside walls.
- 13b. To aid in eliminating cold floors near the outside walls use
- Perimeter insulation and carpet
  - Perimeter insulation only
  - Carpet only

14. Crawl Spaces Insulation

- 14a. Another source of considerable heat loss in housing is unheated crawl spaces.
- 14b. Which of the following would not be helpful in preventing heat loss to crawl spaces?
- Insulating perimeter walls of crawl spaces
  - Sloping ground away from housing unit
  - Installing curtain wall or skirting around mobile home

15. Caulking and Weather Stripping

- 15a. A cold draft coming from a window or door that faces against the direction of a winter wind is an indication of warm air leakage or cold air infiltration.
- 15b. A remedy for this is
- Repainting the house a warm color
  - Installing a large furnace
  - Caulking and weatherstripping

16. Broken Window Panes

- 16a. Loose fitting, cracked, or broken window panes cause an excessive loss of conditioned air in both winter or summer. Generally, this is more critical in winter than in summer.
- 16b. To reduce this loss:
- Cover broken pane with plastic and tape until warm weather
  - Replace broken or cracked pane and loose putty at once, especially in winter
  - Keep shades and curtains closed

17. Air Duct Systems

- 17a. Air duct systems are used for cool air flow in summer and warm air flow in winter.
- 17b. Efficient use of air ducts includes several practices. Which of the following does not contribute toward efficiency of air duct systems?
- Insulating of air ducts
  - Sealing air leaks
  - Using closet space as part of duct system
  - Cleaning or changing air filters

18. Vents

- 18a. When the roof is heated by the sun, your attic will be as much as 40° hotter than the temperature of outside air. This adds to heat gain in the living spaces in summer.
- 18b. One effective and economically justified means of reducing downward heat flow is through the use of
- Portable electric fan
  - Louvred vents or soffet vents
  - Radiant heating

19. Entry Halls and Vestibules

19a. One source of cold air entering living spaces in winter and escaping cooled living spaces in summer is through open doors.

19b. Houses are build with and without entry halls or vestibules.

Entry halls or vestibules

- a. Are helpful in conserving energy
- b. Are not helpful in conserving energy
- c. Make no difference

20. Closed Garage Doors

20a. Heat moves through a wall much faster if air is in motion and there is a considerable temperature difference.

20b. In winter keep doors of attached garages closed as much as possible to save energy by

- a. Reducing heat loss through adjoining wall
- b. Conserving heat from automobile engine
- c. Preventing snow drifts

21. Size of air conditioning systems

21a. Oversized air conditioning systems with improper insulation use excessive electrical energy in operation

21b. Eliminate this energy waste by

- a. installing storm windows and doors
- b. setting the thermostat lower
- c. having the system designed by a competent person

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## Answers

## 1. Orientation of Housing Unit

1c. A. is correct. An east-west orientation (direction of ridge) provides for best utilization of sun rays for supplementary heat in winter and controlling the amount of heat from the sun entering in summer.

## 2. Shape of House

2c. B. is correct. Of the above listed shapes, the square has less exterior wall exposure through which heat is lost or gained. The only other shape which is more economical in terms of heat loss or gain is round.

## 3. Awnings and Overhangs

3c. C. is correct. Shading devices such as awnings, overhangs, side fins, louvered sun screens and trees may reduce solar heat gain by as much as 90% if properly designed. A word of caution: Awnings and overhangs should be designed so as not to trap hot air in the window area.

## 4. Awnings and Overhangs-Orientation

4c. B. is correct. Wide roof overhang on the south wall of the house protects from the undesirable summer sun and exposes the wall and glassed area to desirable winter-sun.

## 5. Solar Radiation Through Glassed Areas

5c. A. is correct. Unshaded glassed areas facing west are critical sources of heat gain.

## 6. Reflected Solar Energy Through Glassed Areas

6c. B. is correct. Heat rays are reflected directly from light colored paved areas or from the heated mass of dark surfaces.

## 7. Draperies and Blinds

7c. C. is correct. Blinds or draperies can reduce heat gain through windows by as much as 50%. Their effectiveness depends on how well they reflect solar radiation back through the window. They should be light in color and opaque. And they should be drawn when sunlight enters your rooms--particularly in rooms not being used at moment.

## 8. Color of Roof

8c. A. is right. Light roofs reflect more heat than dark roofs. With good insulation in the attic, this factor is less important.

## 9. Exterior Paint Color

9c. A. is right. Light colors reflect more solar radiation than dark colors. The whiter and smoother a surface is the less solar radiation energy it absorbs. A dark colored surface can get as much as 60 degrees hotter than the air temperature. That same surface, if painted white, would heat up to only about 20 degrees above the air temperature.

## 10. Ceiling Insulation

10c. C. is correct. The cost of installing ceiling insulation with a rating of R19 will be paid back in a few years, by savings in cooling costs during summer and heating costs during winter.

## 11. Wall Insulation

11c. A. is right. Installed rating of insulation in walls should have a resistance value of R11. Well insulated exterior walls--besides saving you money--contribute much to your thermal comfort and make room space near exterior walls more habitable in both summer and winter.

## 12. Storm Windows and Insulating Glass

12c. B. is right. Storm windows will cut in half the heat that is needlessly lost through windows of your house in winter. In addition, they will cut in half the difference between room air and window surface temperature which produces a cold feeling when you are near a window in the winter and causes cold drafts across the floor.

## 13. Insulation-Concrete Slab Floors

13c. A. is correct. Perimeter insulation and carpet both aid in cutting down cold at floor level on concrete slab floors. New housing units built with concrete slab floors should have perimeter insulation under and on the edges of the slab. This should be an insulation which is rigid, and resists temperature change and moisture. Polystyrene and Fiberglass boards are the type generally used. Carpets installed on the floor with a good matting serve as further barrier to heat loss.

## 14. Crawl Spaces Insulation

14c. B. is correct. Sloping ground away from housing unit is useful in preventing moisture content.

To prevent heat loss to housing units through crawl spaces it is sometimes desirable to insulate perimeter walls of crawl spaces especially if the housing unit is two feet or more above the ground. It is especially important to install a curtain wall or skirting around a mobile home, both for insulation and appearance.

## 15. Caulking and Weather Stripping

15c. C. is right. Installing weatherstripping at movable joints and caulking the frames of all windows and doors can be done at low cost.

## 16. Broken Window Panes

16c. B. is correct. Delaying the replacement not only costs in energy loss but also causes progressive damage to the window sash.

## 17. Air Duct Systems

17c. C. is right. Closet spaces and other building spaces should not be used as part of air duct systems because of the possibility of excessive air leakage. In contrast insulated air ducts, elimination of air leaks, and clean air filters all contribute toward efficiency of air duct systems.

## 18. Vents

18c. B. is correct. Properly designed vents located in gables or soffits can be an effective and economically justified means of reducing downward heat flow. Allow at least 1 sq. foot of ventilation area for each 300 sq. ft. of attic space.

## 19. Entry Halls and Vestibules

19c. A. is correct. Vestibules or small entrance halls cut down on the amount of cold air entering heated living areas in winter and escaping air from cooled living spaces in summer. This is especially important at doors which are used constantly. Since one does not remain in entry halls long, they can be maintained at lower temperatures.

## 20. Closed Garage Doors

20c. A. is right. A dead air film does provide insulation and heat will flow faster if the temperature difference between the heated inside air and cooler outside air is greater.

## 21. Size of Air Conditioning Systems

21c. C. is correct. Established design practices for preventing heat gain and sizing systems should be followed precisely.