CHAPTER 2

ENERGY SMART DESIGN

The contents of this chapter outline the general principles of energy smart design and identify the most critical factors affecting energy use in Victoria.

Design for energy efficiency

The design of an energy efficient home begins with the decisions made in the early stages of the design process. For best results the floor plan and the dwelling/site relationship need to be organised at the same time. The orientation of the building to gain northern winter sun will affect the zoning and relationship of internal spaces, the placement of windows, the location and the layout of major outdoor features, and the planting for sun-shading and wind-screening.

Getting the first steps right means that overall energy efficiency will be easier to achieve. The northerly sun can be harnessed to warm the most frequently occupied areas of a home in the winter and can be easily controlled in summer with the appropriate shading.

Principles of energy smart design

There are many factors that contribute to energy smart design. Some must be dealt with in the design process if they are to be incorporated (e.g. orientation of living areas), while others may be added after construction if necessary (e.g. draught-stripping to doors and windows). Getting the ‘hard to fix later’ factors included at the outset is crucial to maximising energy benefits and lifecycle savings.

While some components of energy smart design have the potential for greater energy savings than others, overall energy savings depend on their combination and interaction.

The key principles of energy smart design include:

- daytime living areas with large north-facing windows to receive unobstructed winter sun;
- internal planning to create zones which reduce the amount of energy required for heating and cooling;
- windows which are appropriately orientated and sized with protection from winter heat loss and summer heat gain;
- adequate thermal mass (heavy building materials) to stabilise indoor temperatures;
- adequate insulation in walls, ceilings and floors;
- good draught proofing;
- cross ventilation for summer cooling;
- an efficient heating system that can set different temperatures for different zones;
- an efficient hot water system and fittings;
- efficient lighting and appliances; and
- landscape design that assists in modifying the microclimate for more comfortable conditions.

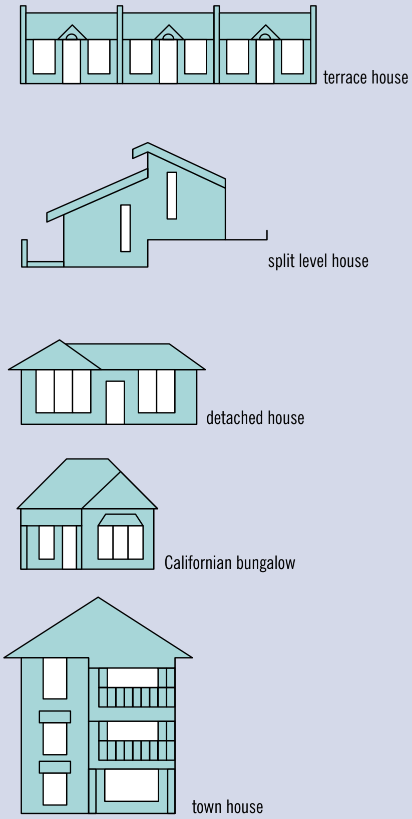


Figure 2.1: Any type or style of home can be energy efficient

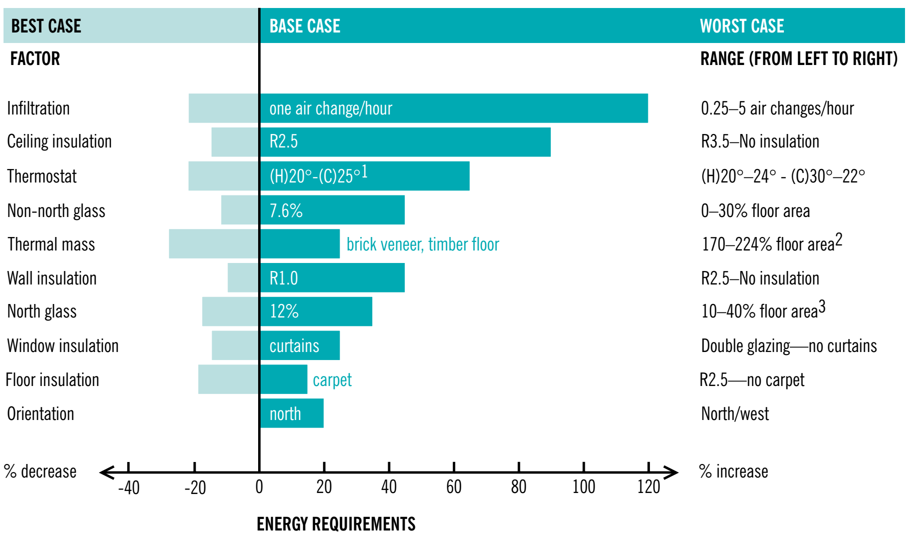
DESIGN STYLE

Any style of home can be designed to be energy efficient and any existing home can improve its energy efficiency. Federation, Victorian, Colonial, Georgian, Neoclassical and contemporary alike can all be energy efficient (see figure 2.1).

Medium and higher density housing can offer even more energy savings. In general, buildings with shared walls and/or more than one storey (such as two-storey homes, semi-detached homes, terraces and apartments) use less energy for heating and cooling than typical single-storey detached homes.

Priority design factors in Victoria

In the development of the *First Rate* House Energy Rating software (refer to Chapter 11), computer simulations of energy requirements were carried out for a typical brick veneer project home with timber floor, insulated to the minimum Victorian standard. The effects of varying design factors were measured and the critical factors identified (see figure 2.2).



Explanatory notes
1 (H) refers to temperature in °C of thermostat setting during the heating season. (C) refers to temperature in °C of thermostat setting during the cooling season.
2 Thermal mass ranges from 170% of floor area with concrete slab and insulated brick walls, to 224% of floor area with slab and uninsulated brick walls. The base case has timber floor and brick veneer walls.
3 North glass ranges from 10% in buildings with a slab floor to 40% in buildings with a timber floor.
4 Window insulation ranges from double glazing with Low-E glass to single glazing without curtains (or with curtains left open). The base case has single glazing with curtains.

Figure 2.2: Relative impact on energy requirements of critical factors (Victoria)

Figure 2.2 shows the relative impacts of design factors on energy requirements. The base case is shown as the central vertical axis for each critical factor, and the range of these factors is described to the right of this line. A bar to the left indicates a decrease in energy requirements while a bar to the right indicates an increase in energy requirements. It should be noted that relative impacts would vary if the base case home was not insulated, or insulated to a lesser standard than required for new construction in Victoria.

The greatest change to energy requirements was experienced with the following factors:

- extent of air leakage;
- ceiling insulation;
- adjustment to heater thermostat;
- area of non north-facing windows;
- amount of thermal mass;
- wall insulation;
- area of north-facing windows;
- floor insulation; and
- building orientation.

Factors such as air leakage, ceiling insulation and thermostat adjustment can usually be modified after construction. However, it becomes more costly or impractical at a later stage to modify such factors as building orientation, area and location of windows, thermal mass, and wall/floor insulation.

