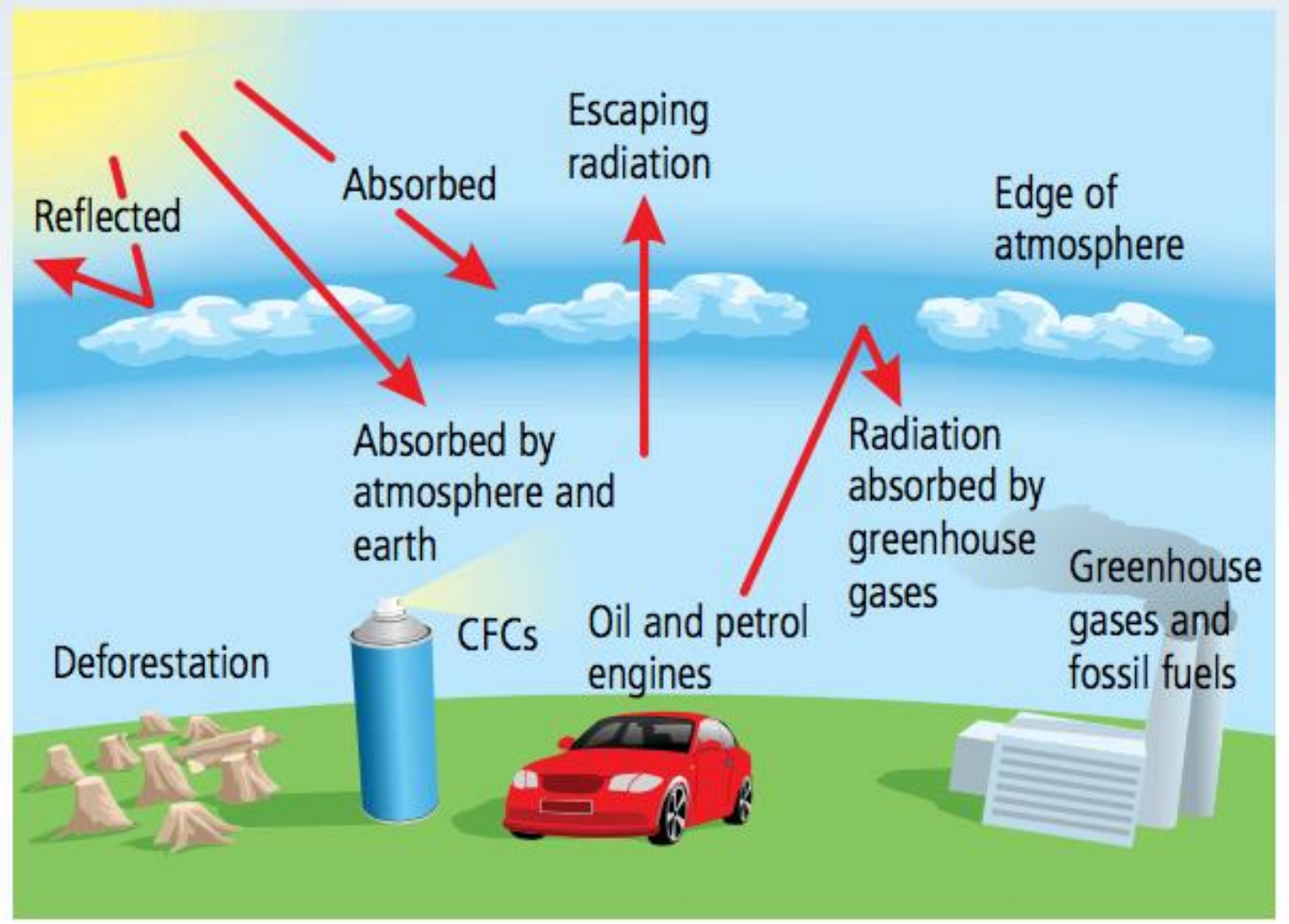
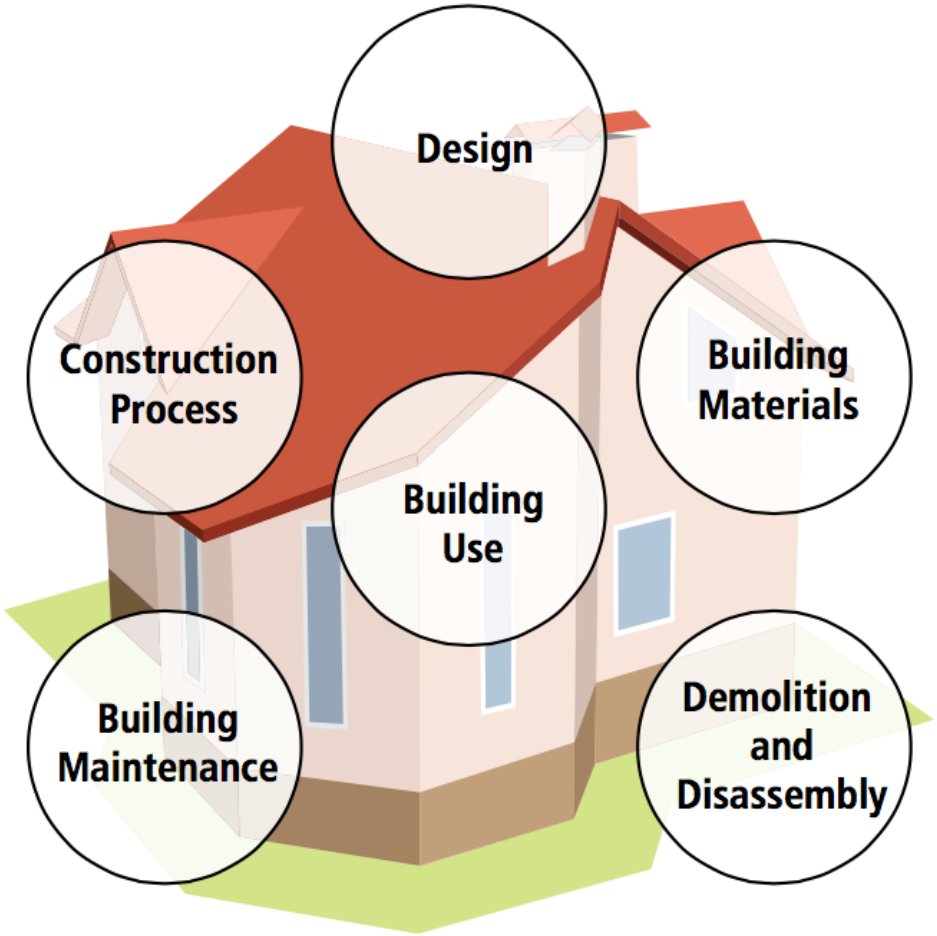
SECTION D

CHAPTER 24
ENVIRONMENTAL SUSTAINABILITY AND PASSIVE DESIGN

Causes of the greenhouse effect



A sustainable build – points to consider



Materials

Sustainable materials are products that are a waste product of other sectors, are renewable or have a low carbon footprint. Timber used in sustainable buildings must be sourced from sustainable forests, which helps to reduce deforestation and illegal logging. An example of a sustainable material in Ireland is thatch roofing.

Renewable materials – a sub-category of sustainable materials – are materials that can be produced indefinitely. This means they can be replenished: for example, if a tree is cut down another can be planted to take its place. Other examples are plants and biomass.

Renewable material – straw bale

Straw bales – advantages/disadvantages

- The advantages of straw bale construction are that it is relatively cheap and the material is renewable. Straw is also a relatively good insulator.
- There are many disadvantages of this system, however: the two most important are that straw is susceptible to rot in damp conditions, and it is extremely bulky.

Recyclable material – Zinc roofing

Zinc roofing – advantages/disadvantages

Advantages of using zinc in roofing include:

- Low toxicity
- Nearly 100 per cent recyclable – because it doesn't rust
- Fig. 24.5 A zinc roof.
- Water run-off does not pick up chemicals that could taint soil and/or groundwater
- Low manufacturing cost due to recyclability.

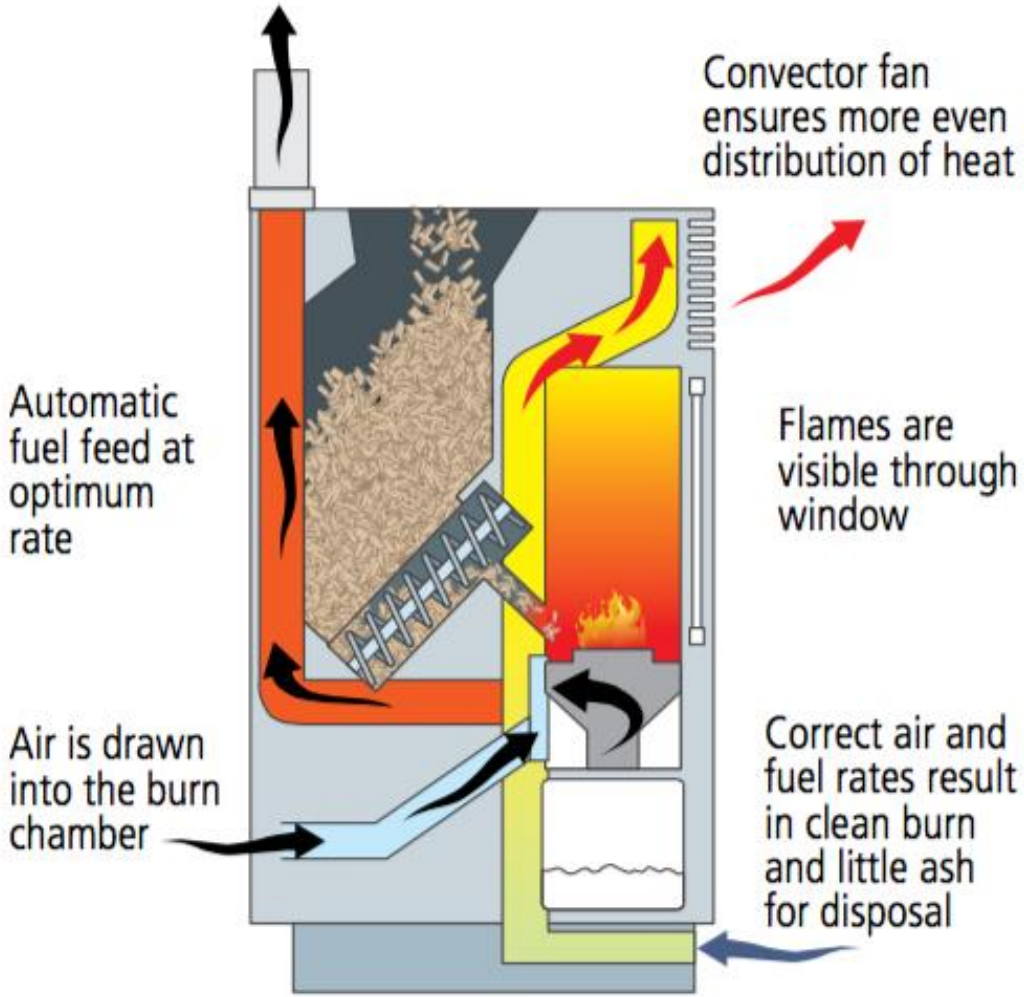
The major **disadvantage** of using zinc roofing is that it is extremely expensive - twice the price of tiles or slates.

Sources of Renewable Energy

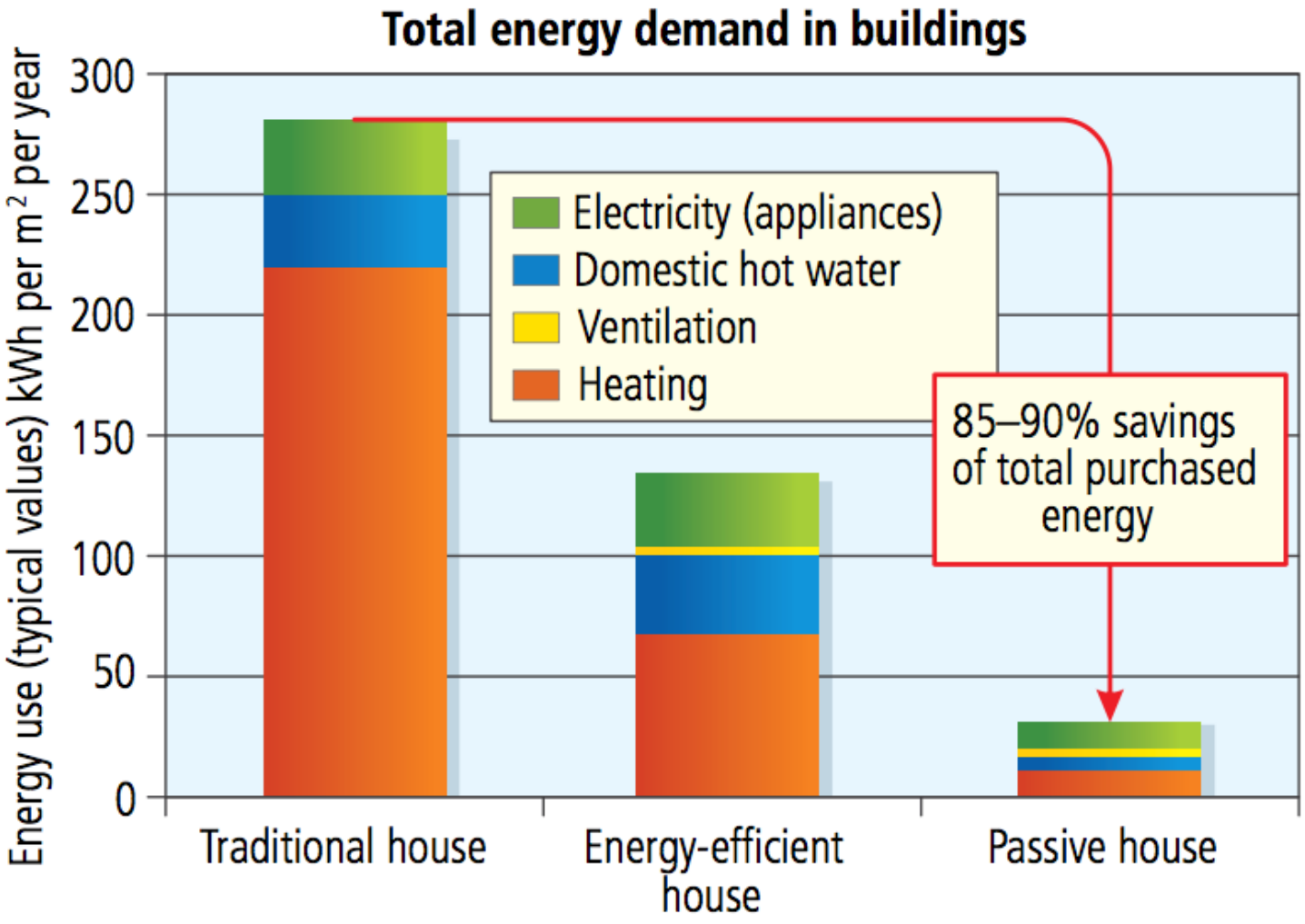
Renewable energy sources include:

- The sun (solar energy)
- Heat below the surface of the earth (geothermal energy)
- Wind
- Water
- Biomass (wood, waste, energy crops).

Biomass – wood pellet burning stove



Energy consumption – passive house



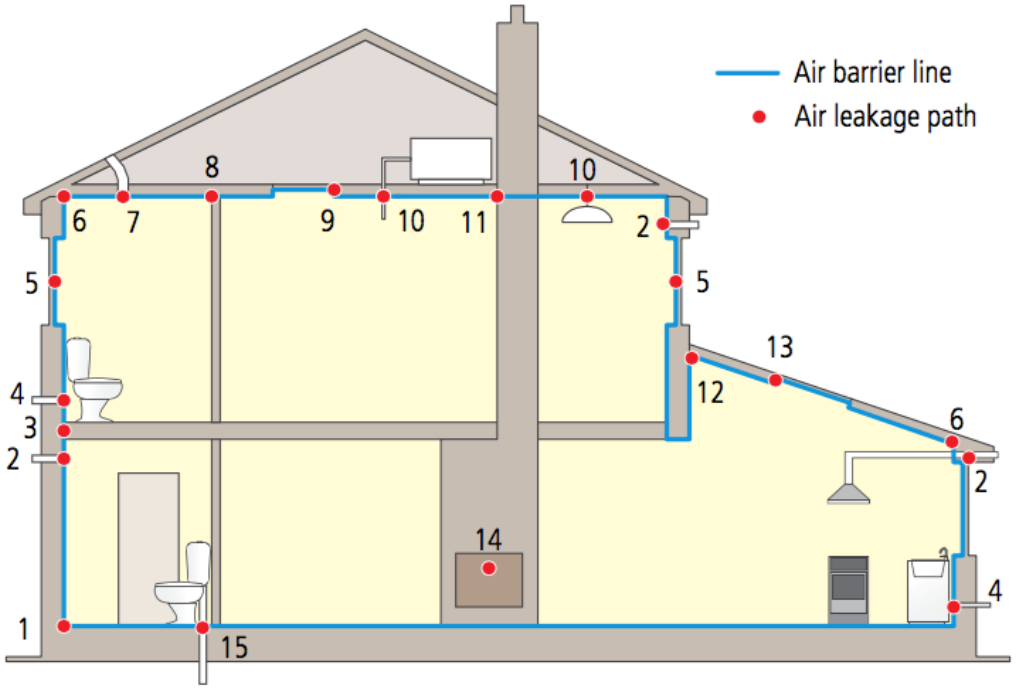
Passive house - criteria

- Annual heat requirement = 1.5 litres of heating oil per metre squared per year
- Airtightness
- Super-insulated to an average U-value of less than 0.15kWh/m2/yr
- No thermal bridges
- Compact building form
- Passive use of solar energy (through orientation)
- Glazing and window frames to a U-value of less than 0.8kWh/m2/yr (triple glazed)
- A1-rated household appliances.

U-values in traditional & passive buildings

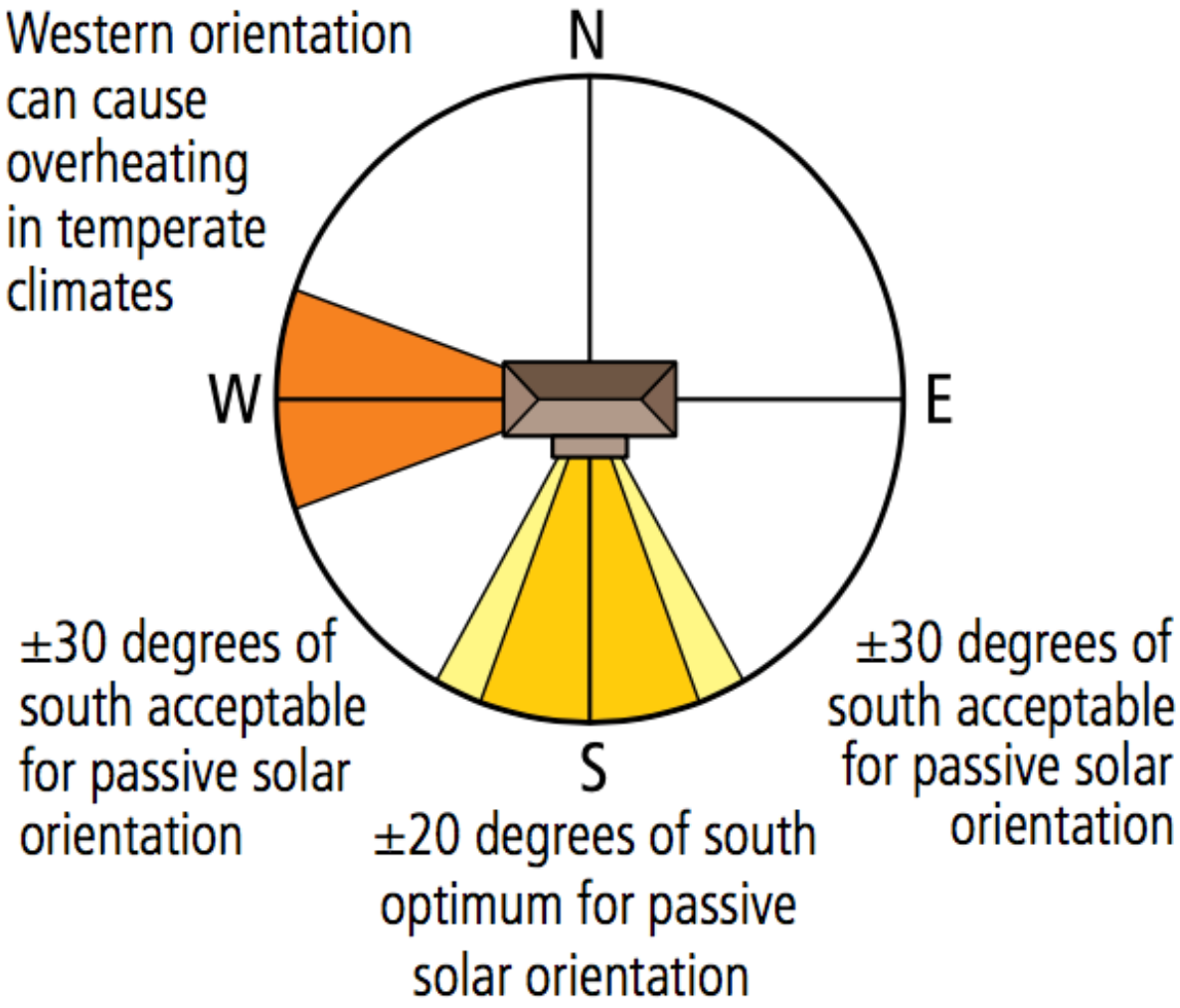
Building element	Traditional requirement	Passive requirement
Roof	0.16	0.15
Walls	0.21	0.175
Windows	1.6	0.8
Doors	1.6	0.8
Floors	0.21	0.15

Common areas for air leakages

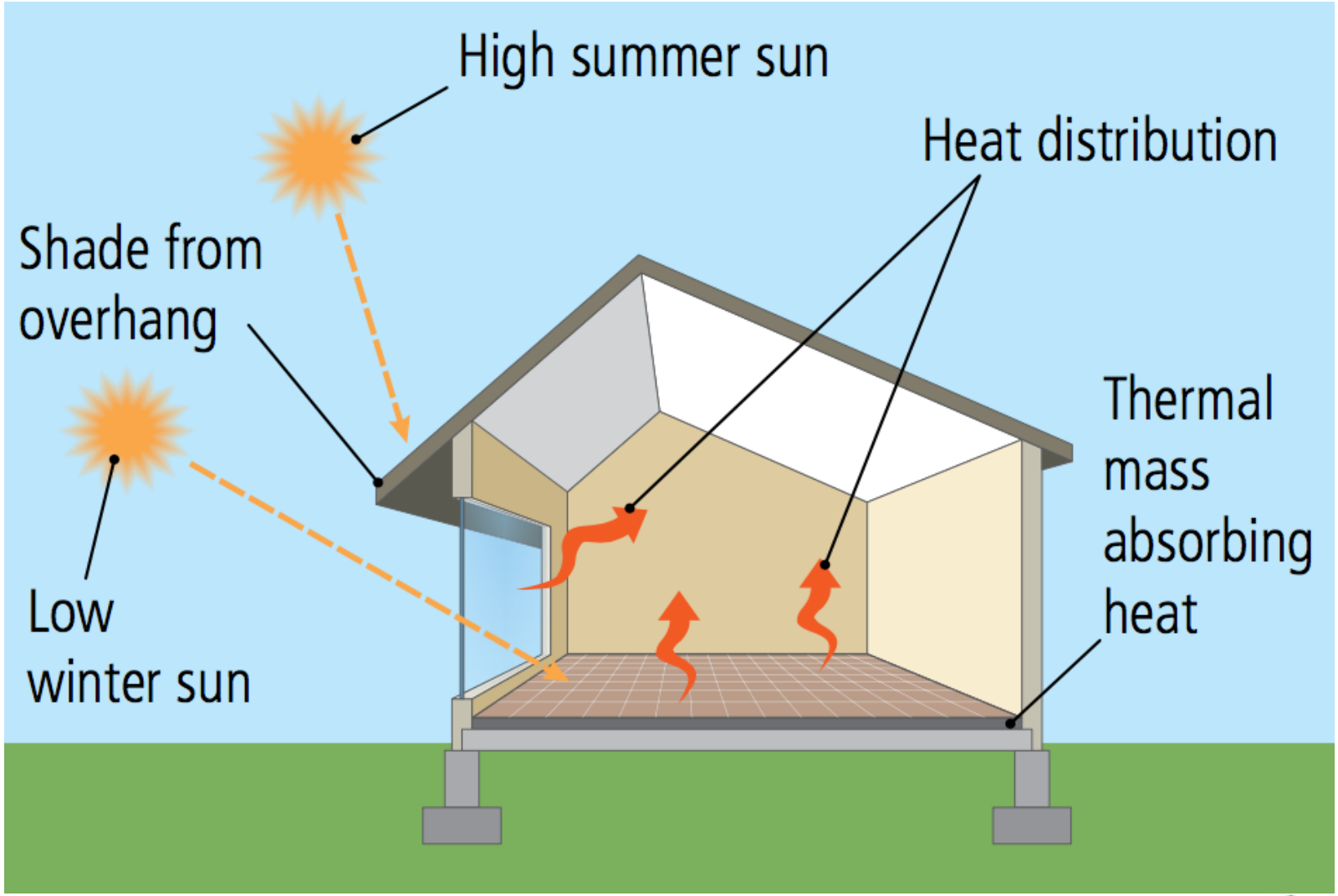


1. Wall/floor junction
2. Mechanical extract vent or wall vent
3. Wall/intermediate floor junction
4. Service penetrations through walls, e.g. WC, sink, bath or shower, waste pipes (particularly those obscured by vanity units or kitchen units, etc.)
5. Windows and doors
6. Wall/roof junction (eaves)
7. Ceiling penetrations, e.g. mechanical extract vent, soil stack, passive vent stack, etc.
8. Partition junction with external wall or ceiling
9. Attic trap door
10. Ceiling penetrations, e.g. water pipes from attic storage tank, light fittings (particularly recessed fittings)
11. Chimney/ceiling junction
12. Wall/lean-to roof abutment
13. Rooflights
14. Open fireplace
15. Floor penetrations, e.g. waste pipes from WCs, sinks, dishwashers, etc.

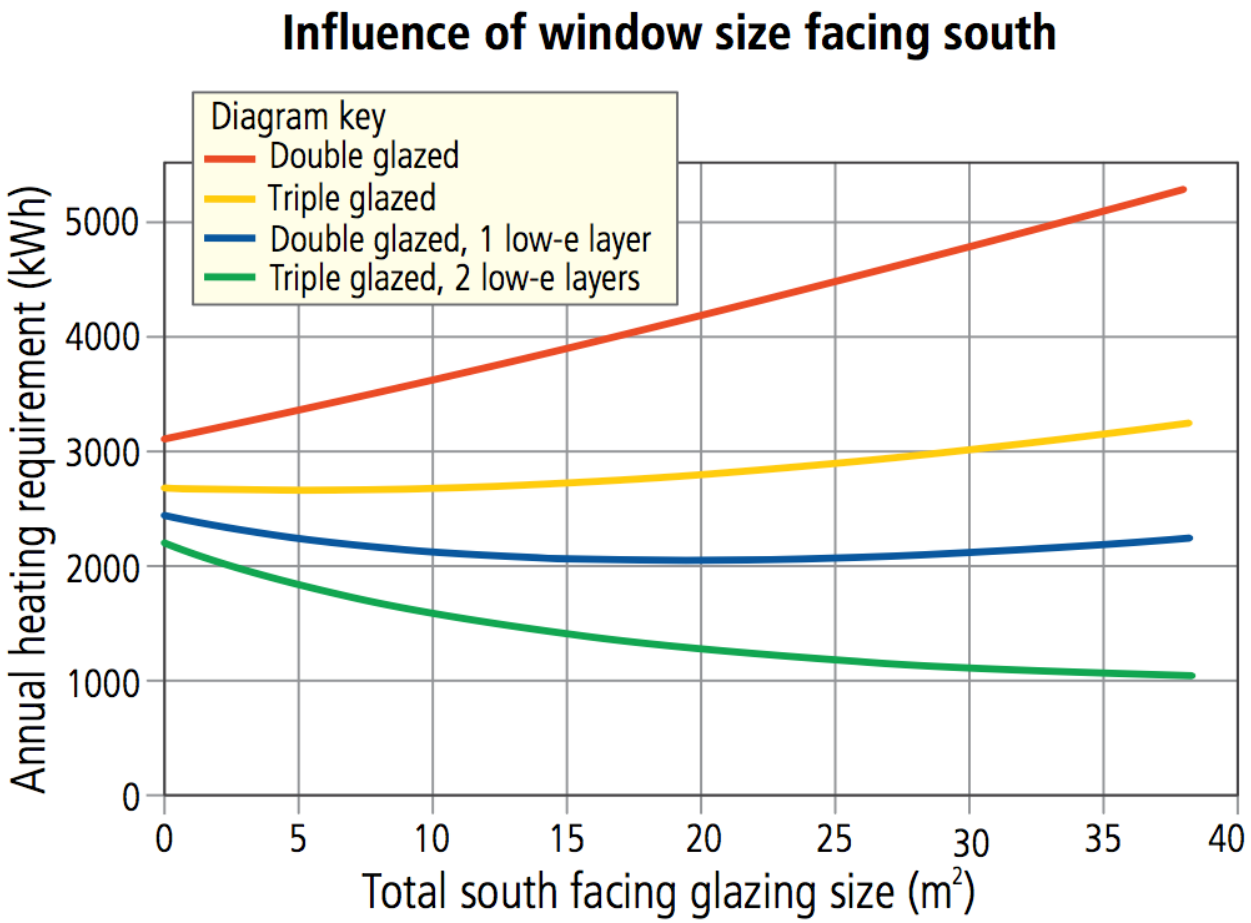
Passive build - orientation



Correct orientation

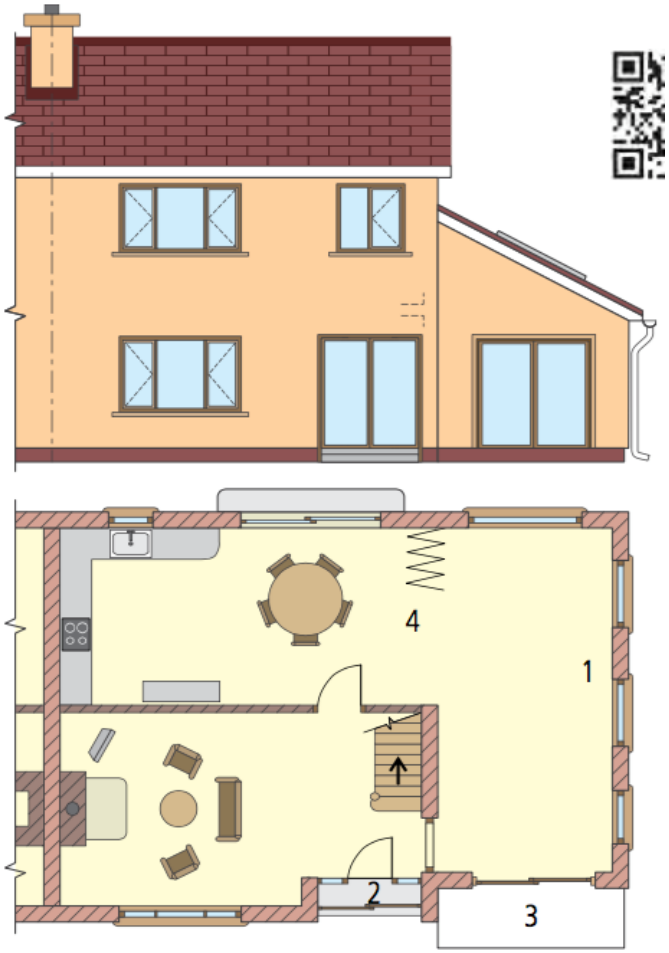


Influence of window size facing south



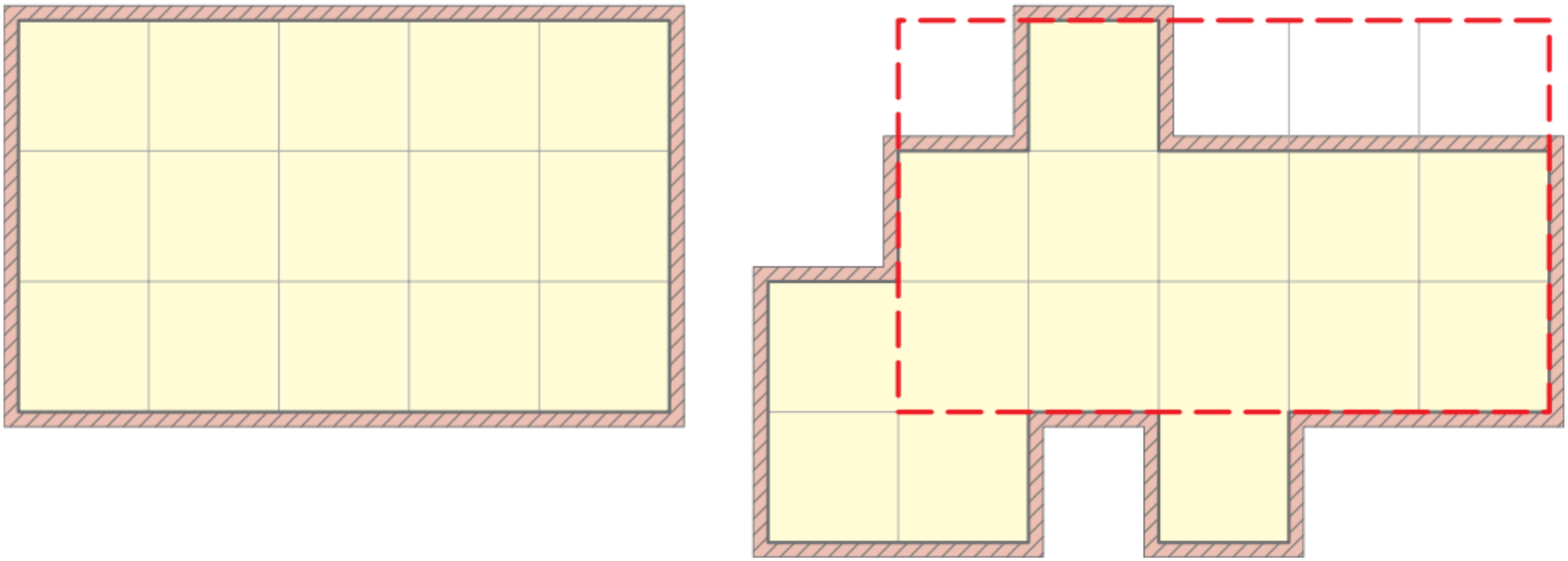
Renovation with more passive design

1. More glazing on south face to maximise solar heating
2. Glass sliding door added to the front
3. Garage door replaced with glass sliding door
4. Open plan layout developed to maximise warmth from the south



Compact building form

Footprint of two houses with identical volumes (assuming equal heights) – the house on the right has a greater surface area and hence a higher compactness ratio.



Passive foundations

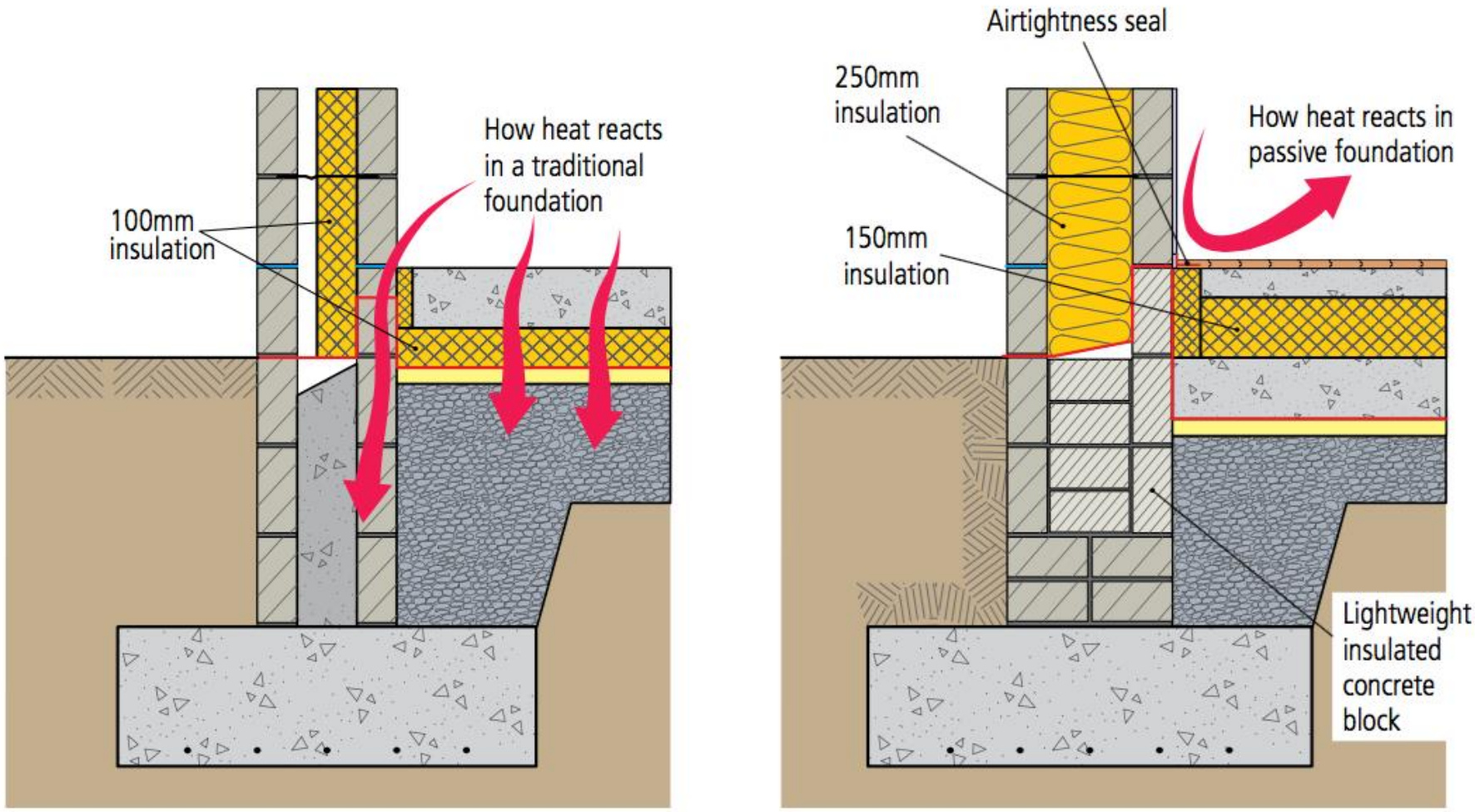


Fig. 24.20 A normal foundation (left) and a passive foundation (right).

Passive concrete strip foundation

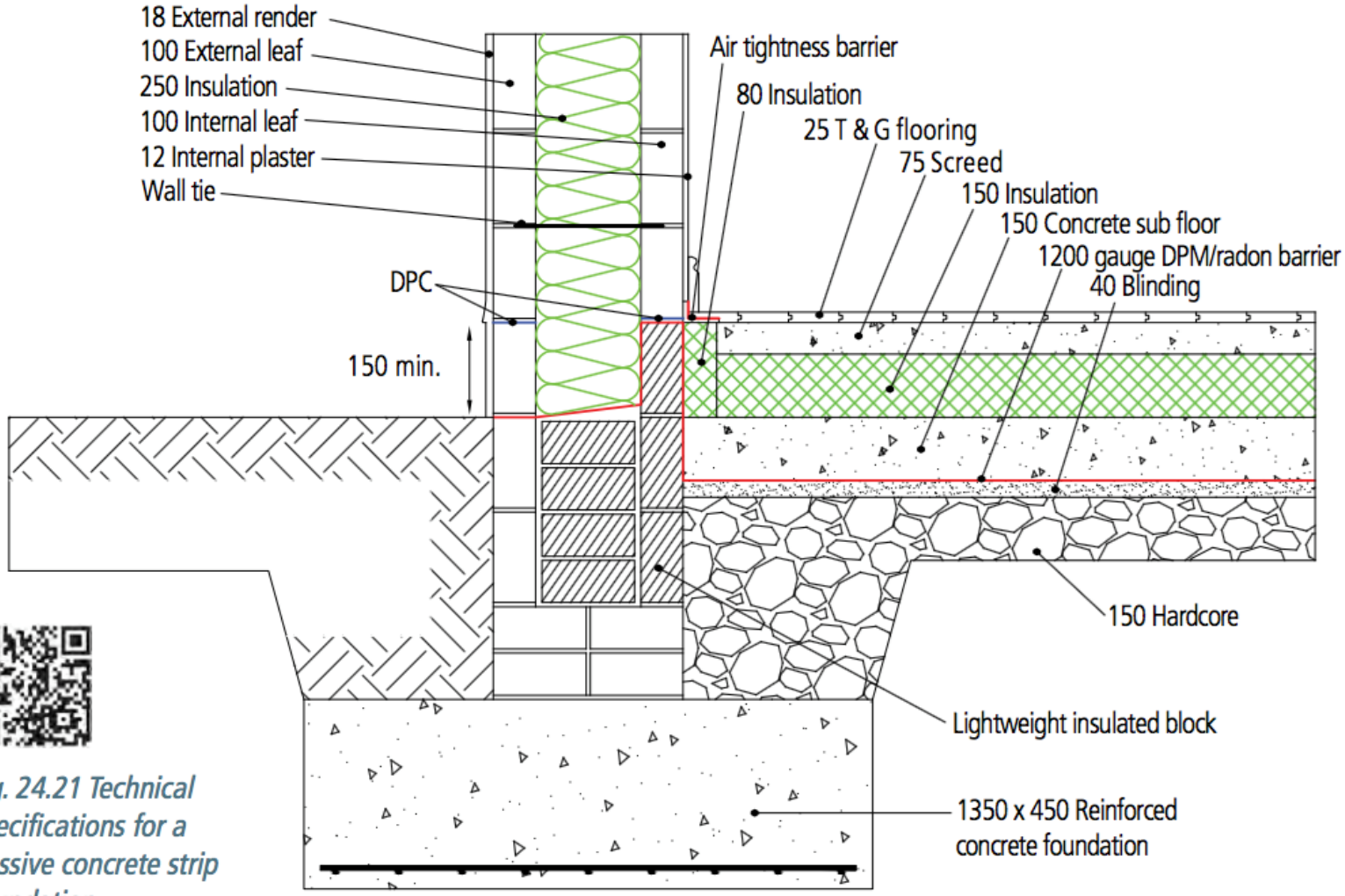


Fig. 24.21 Technical specifications for a passive concrete strip foundation.

Passive timber frame foundation

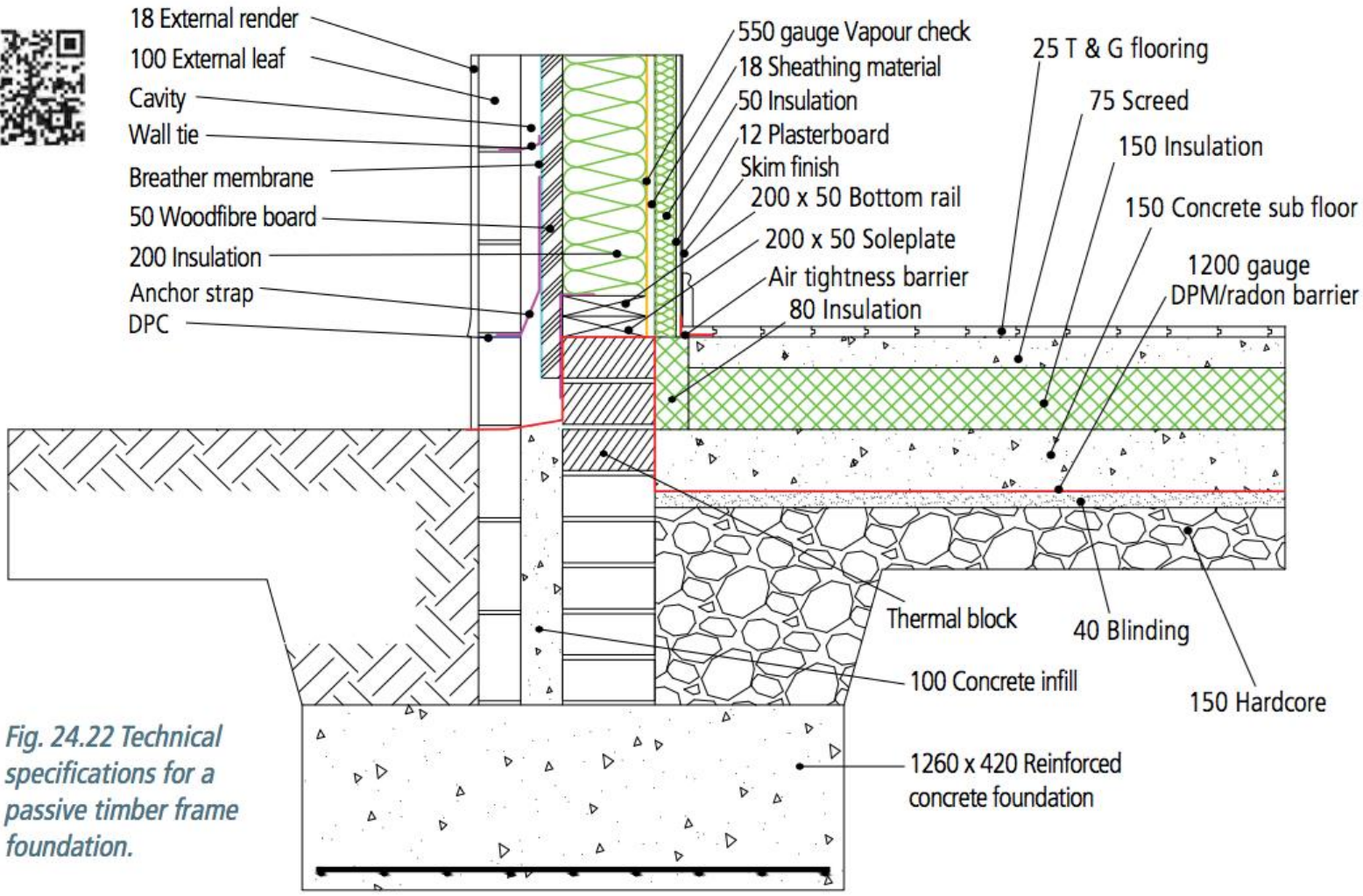


Fig. 24.22 Technical specifications for a passive timber frame foundation.

Technical specs for block wall in passive build

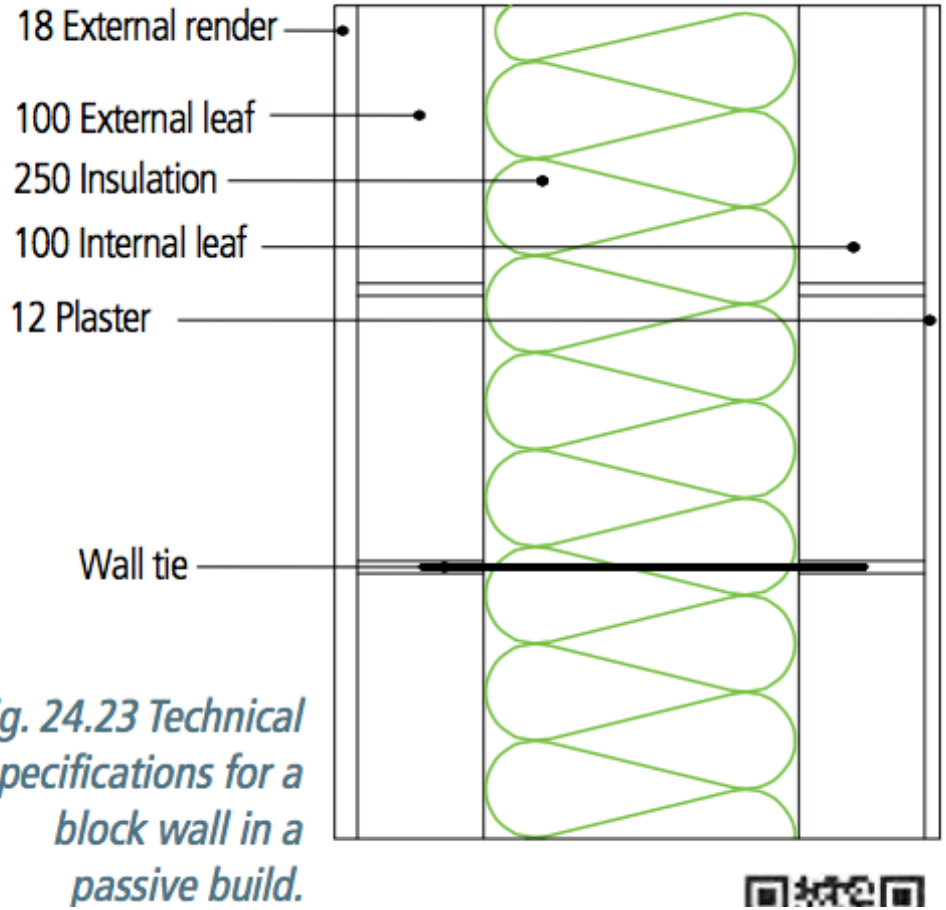


Fig. 24.23 Technical specifications for a block wall in a passive build.

Technical specs for timber frame wall in passive build

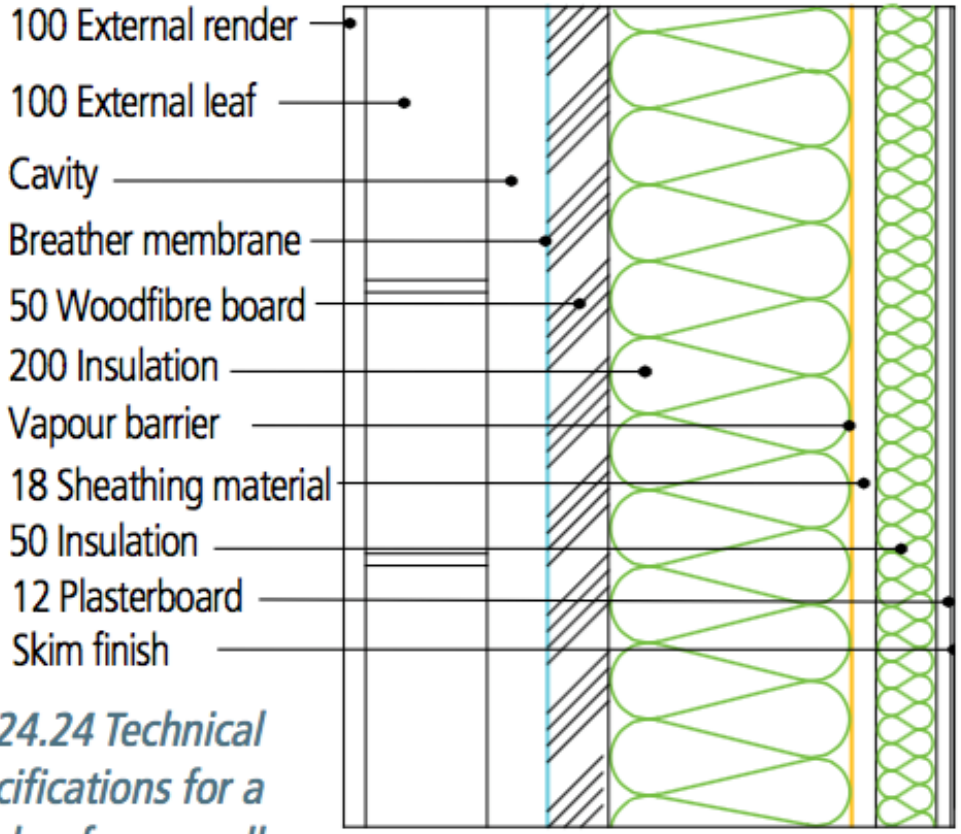
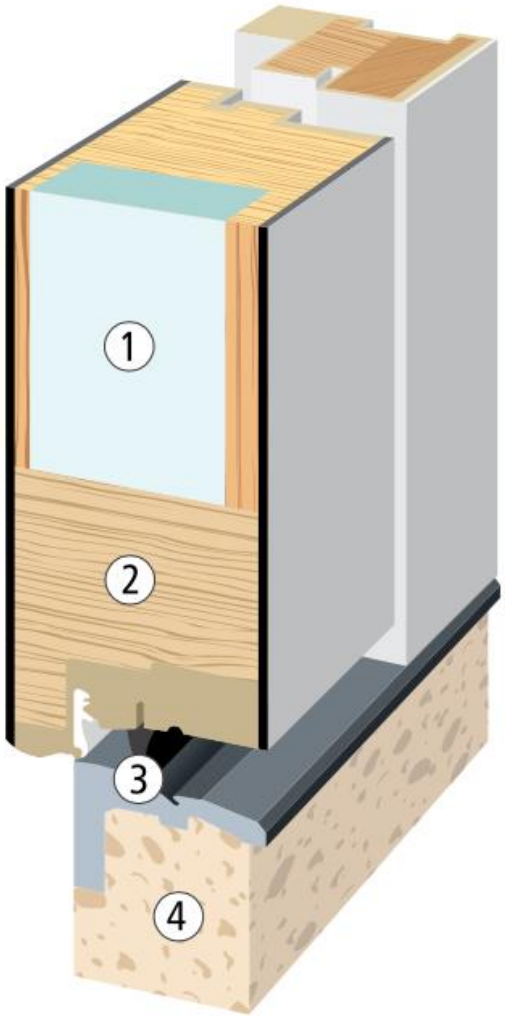


Fig. 24.24 Technical specifications for a timber frame wall in a passive build.

A passive door



① **Insulation core**
High-strength, damp-resistant, provides improved noise insulation and optimum heat insulation

② **Extra-strong door leaf**
Approx. 92mm thick, optimum heat insulation

③ **Top sealing function**
Double silicon seal. No signs of fatigue, high levels of heat insulation, a full-bodied sound, no door banging

④ **Thermal threshold substructure (optional)**
Optimum thermal separation, no underfloor cold or damp bridges, no door sagging

Fig. 24.26 A passive door.

Fig. 24.27 Technical specifications for passive windows in a block-built house.

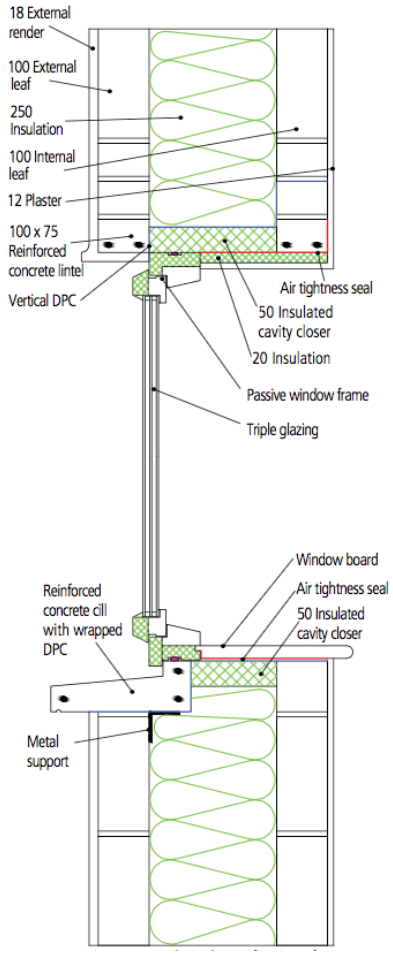


Fig. 24.28 Technical specifications for passive windows in a timber frame house.

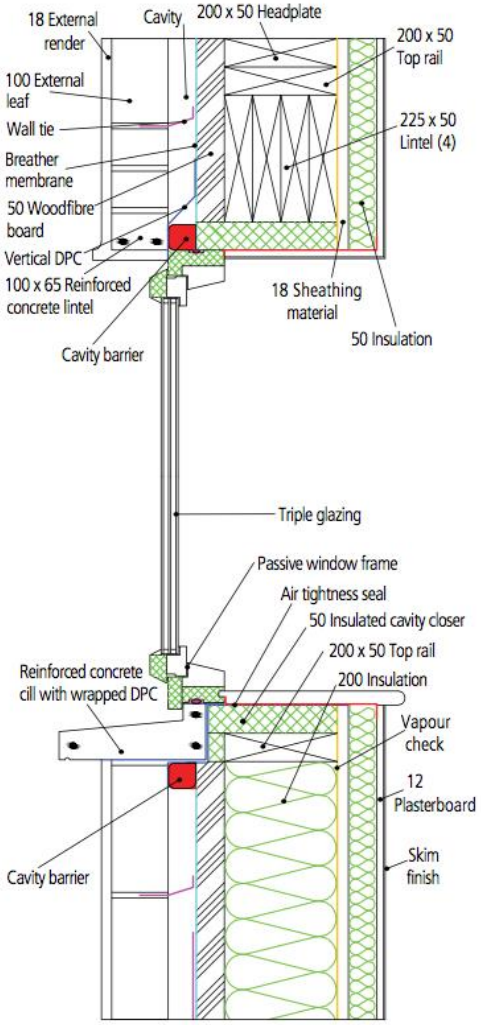


Fig. 24.29 Technical specifications for passive roofing in a block-built house.

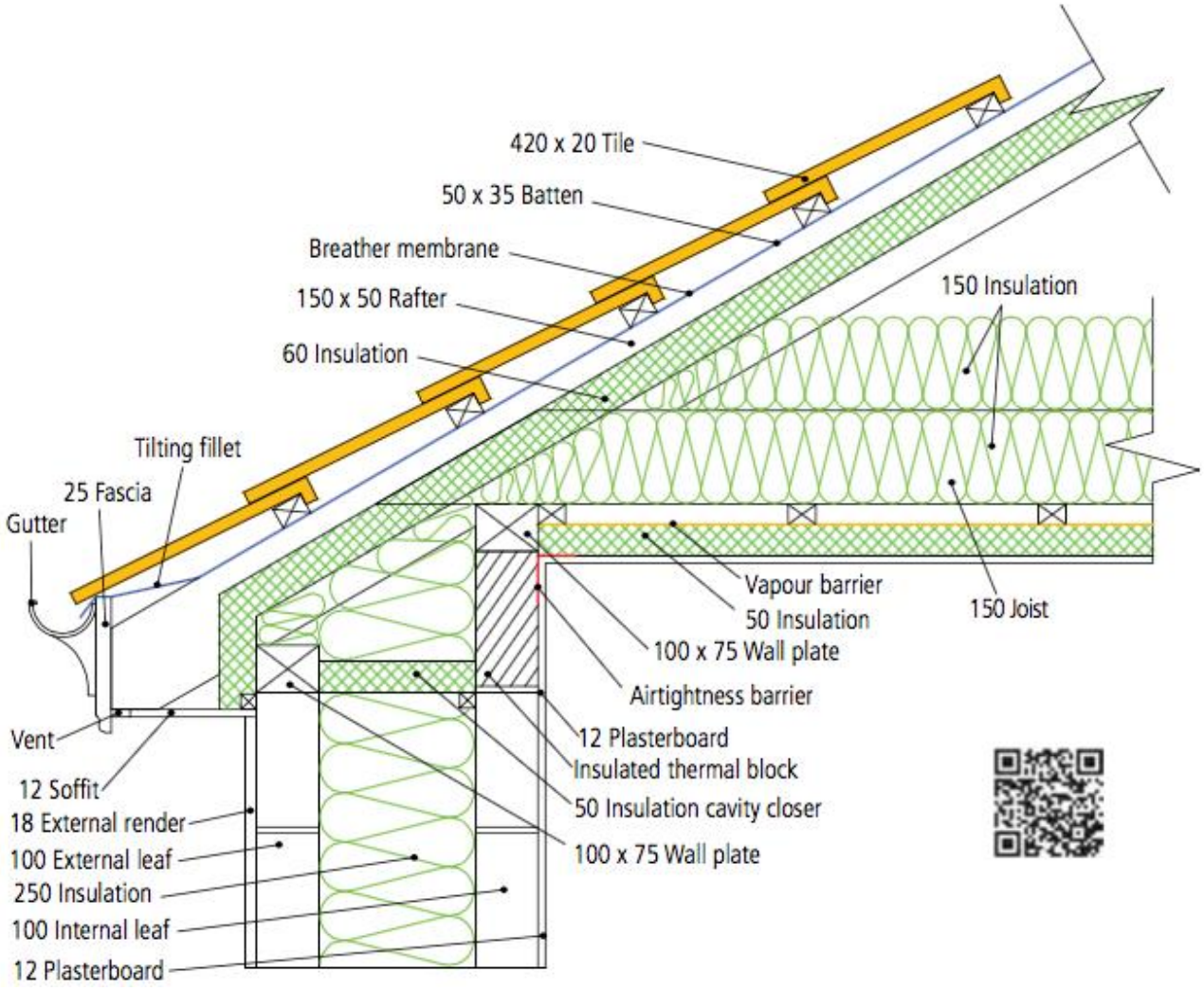
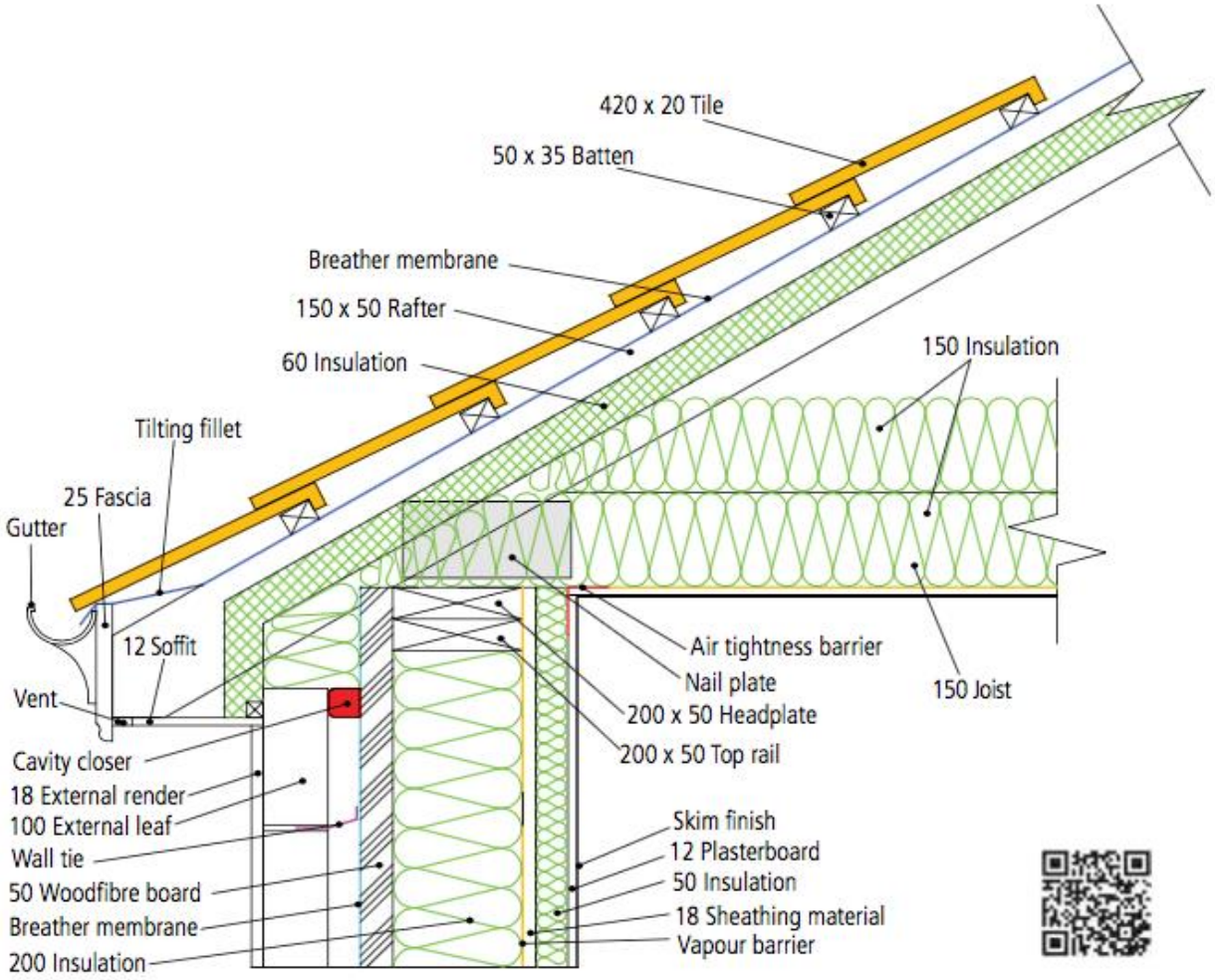


Fig. 24.30 Technical specifications for passive roofing in a timber frame house.



Passive design - advantages

There are a number of advantages in choosing passive building over traditional block or timber frame building. These include:

- Low energy consumption – 75 per cent less than traditional houses
- Consistent level of comfort – 18–21°C all year round
- Reduced environmental impact – lower CO2 emissions (because less fuel is used for heating).

Passive design - disadvantages

The disadvantages of building a passive dwelling rather than a typical block or timber frame dwelling include:

- High level of workmanship required
- Precise detailing (for airtightness, insulation, etc.), which is very time consuming
- MHRV is arguably unnecessary in the Irish climate
- Heavy maintenance – constant change of filters needed to provide clean air in MRHV system
- Lack of available expertise
- Cost.