# THE DIMINISHING BENEFIT OF EXTRA HOME INSULATION

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In most Australian homes, insulation is essential to assist heating and air conditioning systems to maintain comfortable temperatures.

Insulation reduces winter heat loss, reduces summer heat load, and improves comfort by reducing temperature variations.

However, additional insulation has diminishing advantage. The table below shows a ballpark result of modelling a Melbourne home with R2.5m².K/W total roof path insulation rating and a $1000pa heating energy bill.

| **Example: MELBOURNE HOME** | No roof insulation | | | Typical Example | | | | |
|---|---|---|---|---|---|---|---|---|
| **Roof total R-value, m².K/W** | **R0.3** | **R1.0** | **R2.0** | **R2.5** | **R3.0** | **R3.5** | **R4.0** | **R5.0** |
| **Home heating cost per year:** | **$3,933** | **$1,600** | **$1,100** | **$1,000** | **$933** | **$886** | **$850** | **$800** |
| Portion due to ceiling losses: | $3,333 | $1,000 | $500 | $400 | $333 | $286 | $250 | $200 |

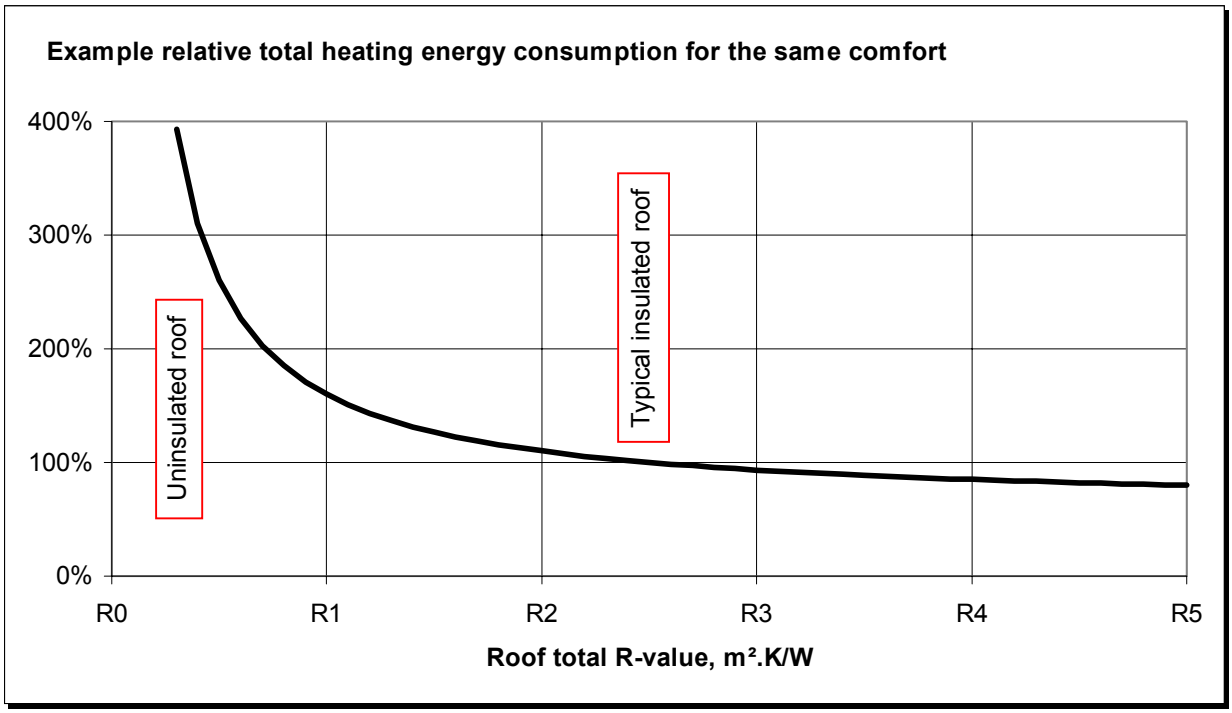
*Assumptions:* Floor, wall & window losses: $300pa; Infiltration losses: $300pa (estimate for home having carpetted slab floor and insulated walls)

It is evident that if there was no ceiling insulation at all, the heating bill would have to climb by nearly $3000pa to achieve similar comfort.

Also:

- If the ceiling insulation was poorly installed making an average roof total R-value of R2 instead of R2.5, there would be a penalty of $100pa.
- If the roof total was R3, there would be an extra $67pa saved over an R2.5.roof.
- If the roof total was R3.5, there would be an extra $48pa saved over an R3 roof.

Thus there is a diminishing return from additional insulation. The correct choice is that choice that gives the minimum life-cycle cost. This evaluation depends on local climate, insulation and energy costs. The following applies to the modelled Melbourne home:

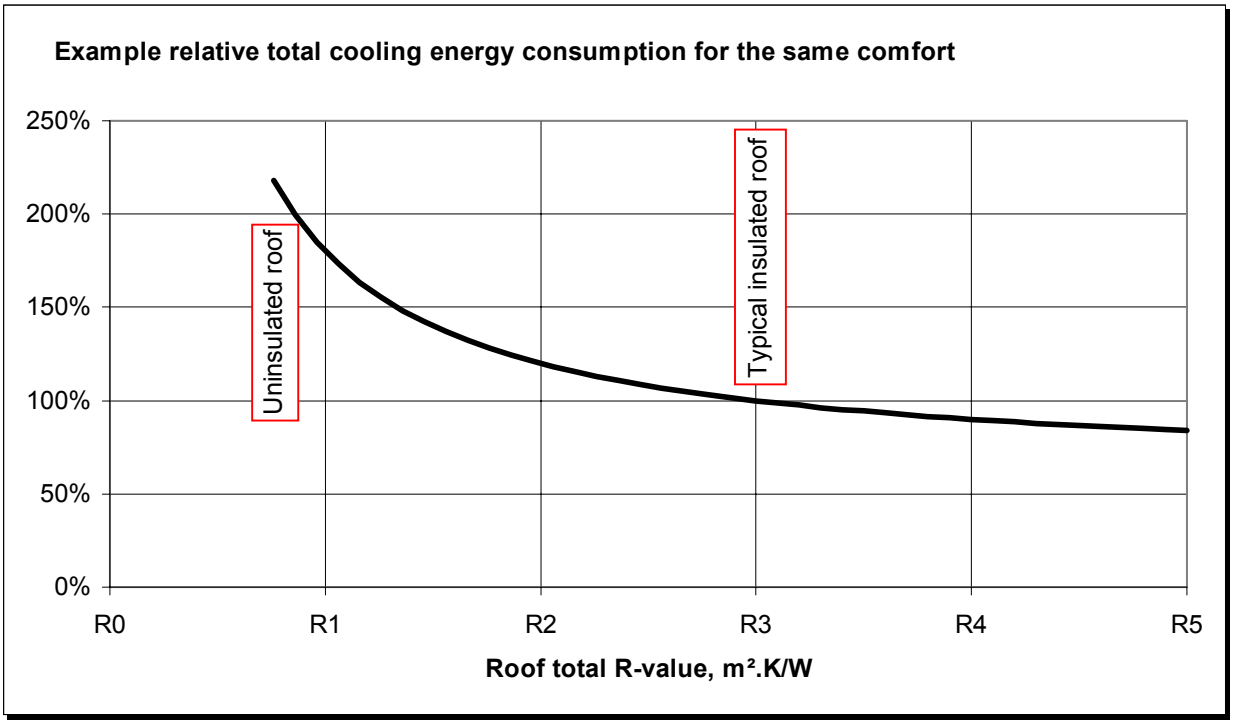


A similar analysis can be modelled for a home in Brisbane with air conditioning.

In this case, the roof insulation rating is typically higher because heat flow is downwards, hence results are slightly different:

| **Example: BRISBANE HOME** | No roof insulation | | | Typical Example | | | |
|---|---|---|---|---|---|---|---|
| **Roof total R-value, m².K/W** | **R0.8** | **R1.0** | **R2.0** | **R3.0** | **R4.0** | **R4.5** | **R5.0** |
| **Home cooling cost per year:** | **$2,179** | **$1,850** | **$1,212** | **$1,000** | **$900** | **$867** | **$840** |
| Portion due to ceiling losses: | $1,579 | $1,250 | $612 | $400 | $300 | $267 | $240 |

*Assumptions:* Wall & window losses: $300pa; Infiltration losses: $300pa
(estimate for home having carpetted slab floor and insulated walls)




Most energy uses (as well as insulation manufacture) are allied with generation of the greenhouse gas, carbon dioxide. A life-cycle analysis could be made on minimum total CO2 generation, but it is likely it would give a similar optimum “best insulation” result to the life-cycle cost analysis results above.

The lesson: **Extra R does not necessarily mean extra comfort or substantially more energy cost savings or greenhouse gas reductions**. In fact, there is a level where extra R will actually cause an increase in life-cycle energy and greenhouse gas costs.