Summary Version

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Lifetime Energy, CO_2 and Financial Balances for Insulation Materials

A White Paper

Kingspan® Insulation Solutions

1 This 'White Paper' illustrates the net energy, environmental and financial benefits of phenolic insulation, rigid urethane insulation and extruded polystyrene insulation (XPS) relative to rock mineral fibre, glass mineral fibre and expanded polystyrene (EPS), by establishing profiles of all the above insulants in varying applications.

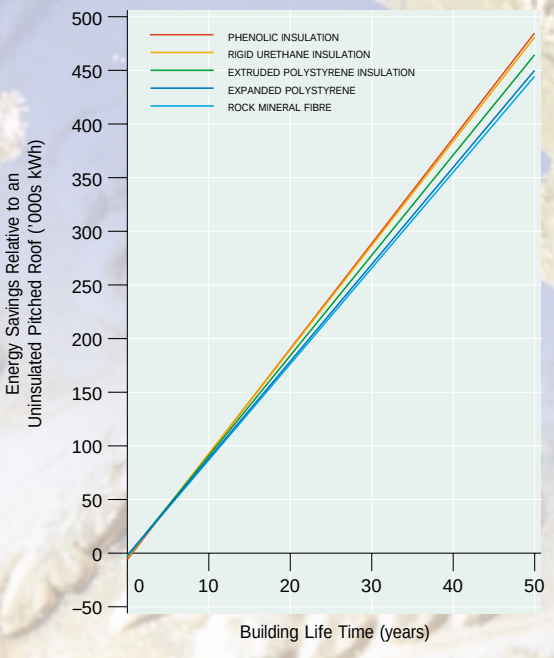
2 The methodology used in this paper is based on the Total Equivalent Warming Impact (TEWI) principal, which provides a means by which the value of insulation (net environmental benefit) can be measured in terms of carbon dioxide (CO_2) equivalents for specified building elements. It does so by comparing the energy consumed over the lifetime of an insulated building element with that consumed by the same element if uninsulated. In the process, it also provides a means by which various insulation materials can be compared in terms of energy, CO_2 equivalent emissions and money saved.

3 The 'Elemental Method' of compliance with Approved Document L of the Building Regulations (England & Wales) requires certain U-values to be met for each element of a building. For each application, the thickness required of the worst performing insulant, to achieve the required U-value for that element, has been determined. The same thickness of all generic insulants was then used for comparison on the premise that design changes would not be required in converting from one generic insulant to the other. The change would simply yield a better U-value than required by the Regulations.

4 The evidence contained in this 'White Paper' clearly demonstrates that the differing embodied energies, carbon dioxide equivalent emissions and capital costs of differing insulation products are insignificant when compared with the savings made by any of the considered insulants in use.

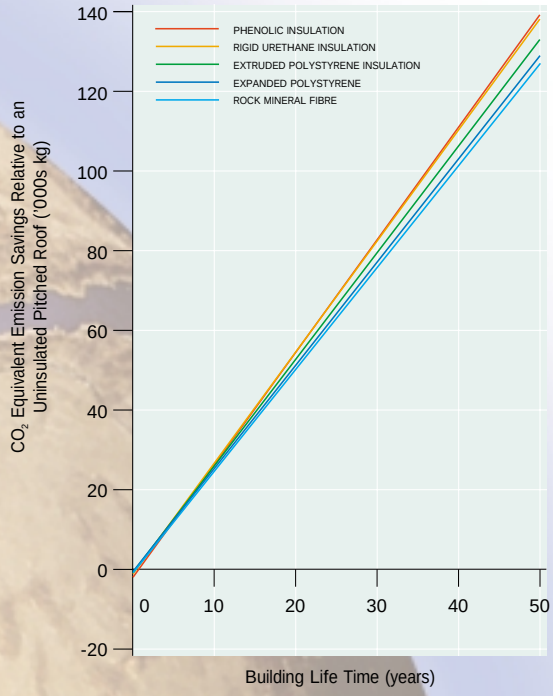
5 For instance, the results of the analysis for a pitched roof with over rafter insulation are shown below. The construction is assumed to be a pitched roof with tiles or slates on battens, breather membrane then counter battens, insulation then rafters lined with plasterboard. The insulant thickness is 77mm.

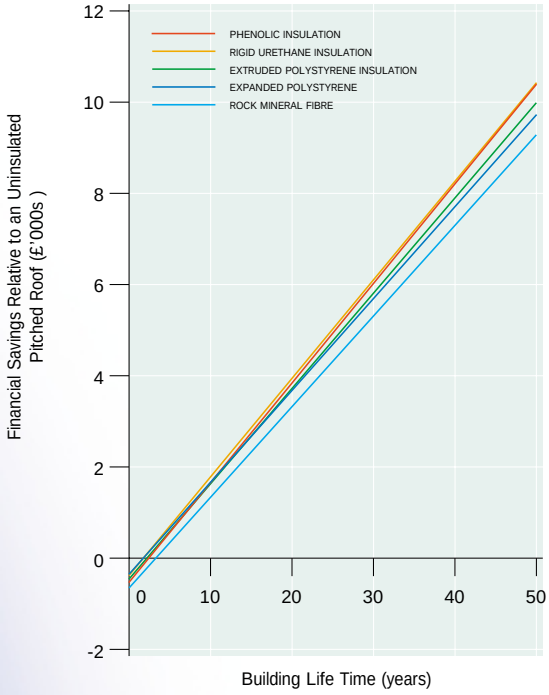
6 Over the fifty year lifespan of a pitched roof various insulants have net energy benefits ranging from 446-485 thousand kWh with phenolic insulation showing the greatest benefit and rock mineral fibre the worst. These net energy benefits are significantly greater than the embodied energies of the products which range from 2.2-6.1 thousand kWh. All insulants give net energy benefits within one year.



7 Similarly, over the fifty year lifespan of a pitched roof various insulants have net environmental benefits ranging from 127-139 tonnes of CO_2 equivalent emissions with phenolic insulation showing the greatest benefit and rock mineral fibre the worst. These net environmental benefits are significantly greater than the CO_2 equivalents of the embodied energies of the products which range from 0.6-1.7 tonnes of CO_2 equivalent emissions. All insulants give net environmental benefits within one year.

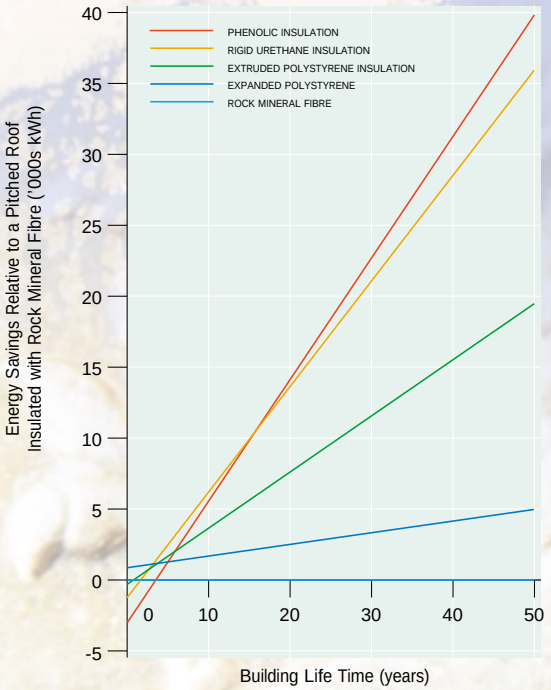
8 Again, over the fifty year lifespan of a pitched roof various insulants have net financial benefits ranging from £9,321-£10,394 with phenolic insulation showing the greatest benefit and rock mineral fibre the worst. These net financial benefits are significantly greater than the capital costs of the products which range from £356-653. All insulants give net financial benefits within three years with the exception of rock mineral fibre which gives a net financial benefit within four years.



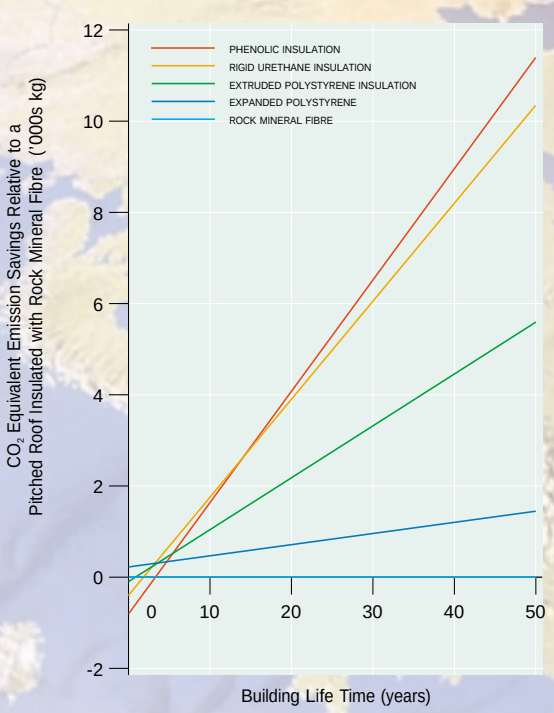


9 At the same time, the use of a more efficient and effective material such as phenolic insulation, rigid urethane insulation or extruded polystyrene insulation can do more towards significantly reducing the energy used in heating a building, by reducing the burning of fossil fuels, than less efficient and effective insulation materials. The same is true for consequent financial costs and the resulting output of greenhouse gases.

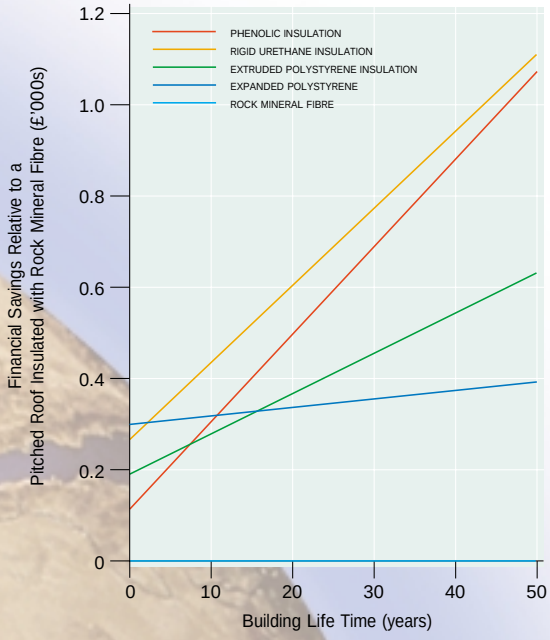
10 Phenolic insulation's net energy benefit in a pitched roof is 39 thousand kWh more than that of rock mineral fibre after a fifty year life span and the equivalent figures for rigid urethane insulation and extruded polystyrene insulation when compared with rock mineral fibre are 36 and 20 thousand kWh respectively. Phenolic insulation shows a better net energy benefit than rock mineral fibre after less than four years and similarly rigid urethane insulation and extruded polystyrene insulation show better net energy benefits than rock mineral fibre after less than three years and one year respectively.



11 Phenolic insulation's net environmental benefit in a pitched roof is 11 tonnes of CO_2 equivalent emissions more than that of rock mineral fibre after a fifty year life span and the equivalent figures for rigid urethane insulation and extruded polystyrene insulation when compared with rock mineral fibre are 10 and 6 tonnes respectively. Phenolic insulation shows a better net environmental benefit than rock mineral fibre after less than four years and similarly rigid urethane insulation and extruded polystyrene insulation better net environmental benefits than mineral fibre after less than three years and one year respectively.



12 Phenolic insulation's net financial benefit in a pitched roof is £1,073 more than that of rock mineral fibre after a fifty year life span and the equivalent figures for rigid urethane insulation and extruded polystyrene insulation when compared with rock mineral fibre are £1,102 and £633 respectively. All insulants show better net financial benefits than rock mineral fibre immediately.



13 In general, for all applications considered in this 'White Paper' phenolic insulation, rigid urethane insulation and extruded polystyrene insulation show relatively similar net energy, environmental and financial benefits due to their similar and high thermal resistances (at a given thickness).

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14 Similarly, in general, for all applications considered in this 'White Paper' rock mineral fibre, glass mineral fibre and expanded polystyrene insulation also show relatively similar net energy, environmental and financial benefits due to their similar and lower thermal resistances (at a given thickness).

15 The first group are better than the second with, in general, phenolic insulation exhibiting the best result and rigid urethane insulation a close second. Rock mineral fibre, glass mineral fibre and expanded polystyrene insulation are the worst performing insulants in all cases considered in this 'White Paper' over a building's lifetime.

16 Although, in some applications, non-fibrous insulants are characterised by higher embodied energies and capital costs than rock and glass mineral fibre, their higher insulation performance results in better energy savings and more positive net energy, environmental and financial benefits over the lifetime of a building.

Technical Advice

Kingspan Insulation Limited support all of their products with a comprehensive Technical Advisory Service for specifiers, stockists and contractors.

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We can also give general application advice and advice on design detailing and fixing etc… Site surveys are also undertaken as appropriate.

Please contact our Technical Services Department on the *TECHLINE* numbers below:

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