Economic Case for Vacuum Insulation in Mainstream New Build Construction Applications.

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Limitations of Conventional Technology

- Many systems will struggle to achieve forthcoming building standards
- Wall and roof thicknesses require to be considerably increased
- Eccentricities on fixings are becoming a major concern
- Significant technical difficulties associated with the production of deep composite panels
- Opportunities to further optimise foam and insulation performance appear limited
- Concern over the environmental credentials of many insulation materials
- Poor acoustic performance

Perceived Benefits of Vacuum Insulation

- The evacuated zone produces particularly high ‘R’ values
- The physical thickness of panels is considerably less than conventional built-up and composite systems
- Low self weight and eccentricities
- Good environmental credentials in terms of materials usage
- Possible improvements in acoustic performance

Potential Applications

- Mainstream industrial cladding systems where in terms of cost and performance systems must be competitive with conventional technology
- Commercial building cladding where ‘thin wall technology’ can increase the net to gross area of the building and consequently deliver higher rental yields.
- Niche ‘architectural’ applications where the performance and appearance of the panels is advantageous, such as used in conjunction with structural glazing systems.

Potential Applications: Industrial Cladding

- High cost is likely to restrict early market growth
- Medium term growth may occur as a result of production efficiencies and establishment of the technology in parallel markets.

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Potential Applications: Architectural

- Opportunities for VIP units encapsulated in either metal or glass.
- Thin crisp lines of VIP panels coherent with architectural vocabulary.
- Market tolerant of cost premiums

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Potential Applications: Commercial Buildings

- Thin wall technology offers significant rental benefits
- VIP panels can be used in conjunction with both modern infill wall systems and strongback systems
- Market tolerant of cost premiums
- Potentially the initial market for the technology

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Economic Case: Commercial Buildings

Composite Panel Based Walls:

Total thickness typically 297-327mm, U Value typically 0.3-0.35 W/m^2/K

UK Rental Values:

£/m^2/pa.	Bristol	Birmingham	London
New High Specification	240	300	850
New Medium Specification	150	250	500
Mainstream Corporate Entry Level	90	120	325

Economic Case: Commercial Buildings

Assume 8 storey building with 32 x 14m floor plates:

Total floor area is 3584m^2, Total perimeter is 736m^2

Floor area given over to conventional 300mm wide external walls is 221m^2

Floor area required for VIP based external walls (assuming 30mm panel, 100mm wind post/lining zone) is: 96m^2

Assuming rental income of £500/m2/pa, and design life of 60 years, net present value of saving PV(C) given by PV(C)=C [1-(1+d) $^{-m}$]/d where C is the additional rental, d is the discount rate (assumed to be 3%) and m the period.

PV(C)=£1,730,000

Or using a simpler 7 year return rule the value of the additional rental is £437,000

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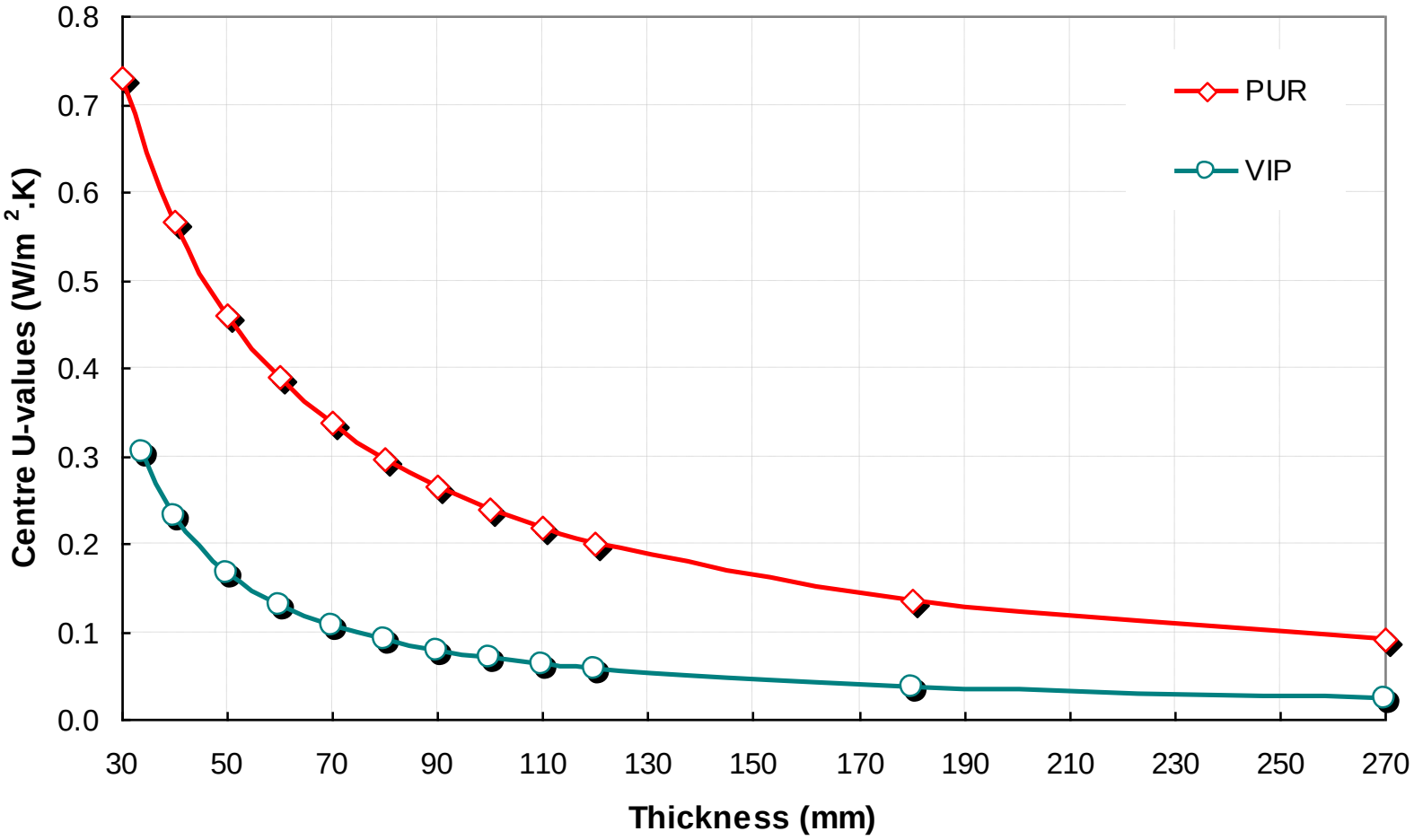
Cost Justification 1: Centre Panel ‘U’ Values



Calculations based on PU k = 0.025W/m.K. VIP k = 0.006W/m.K

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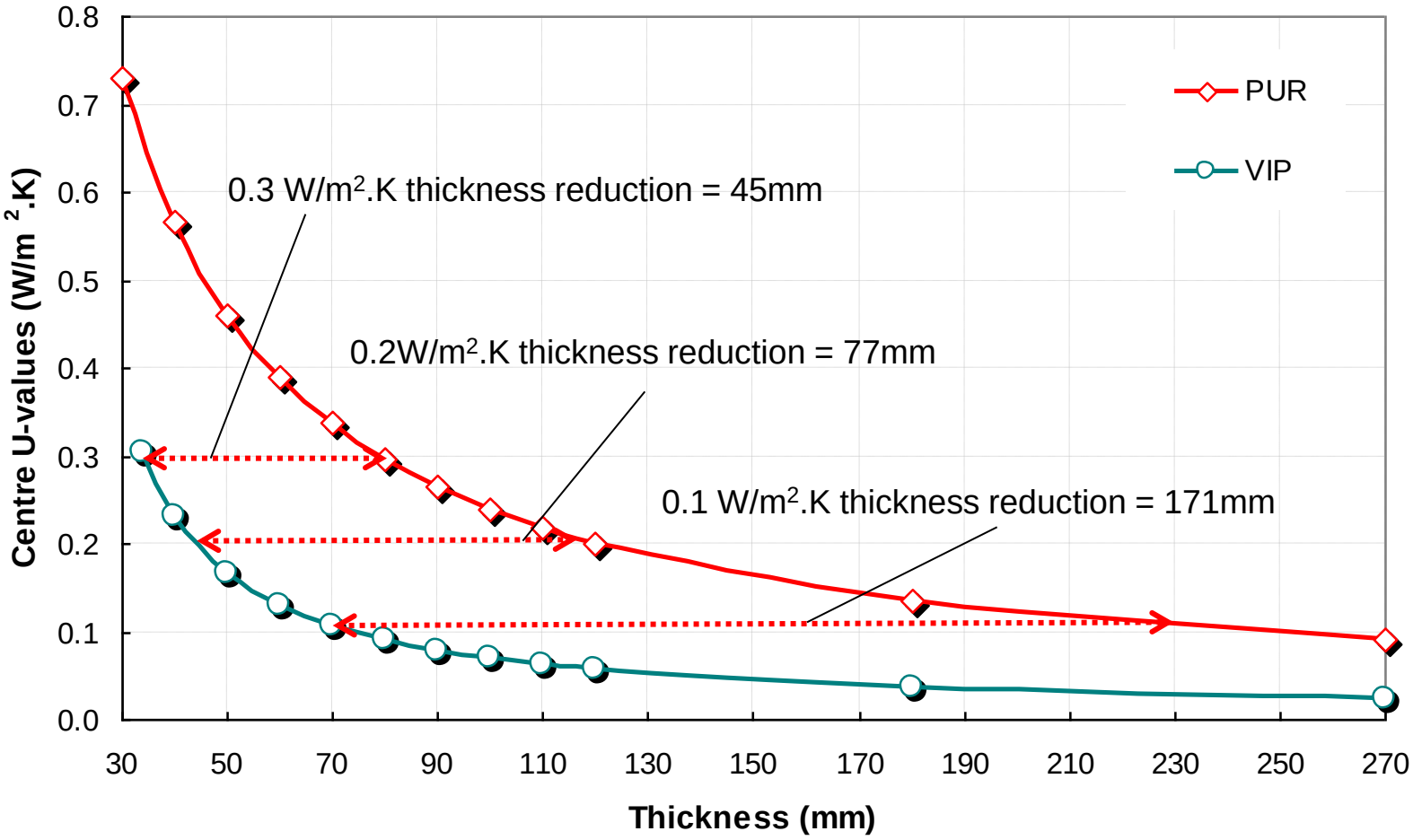
Cost Justification 2: Centre Panel ‘U’ Values



Calculations based on PU k = 0.025W/m.K. VIP k = 0.006W/m.K

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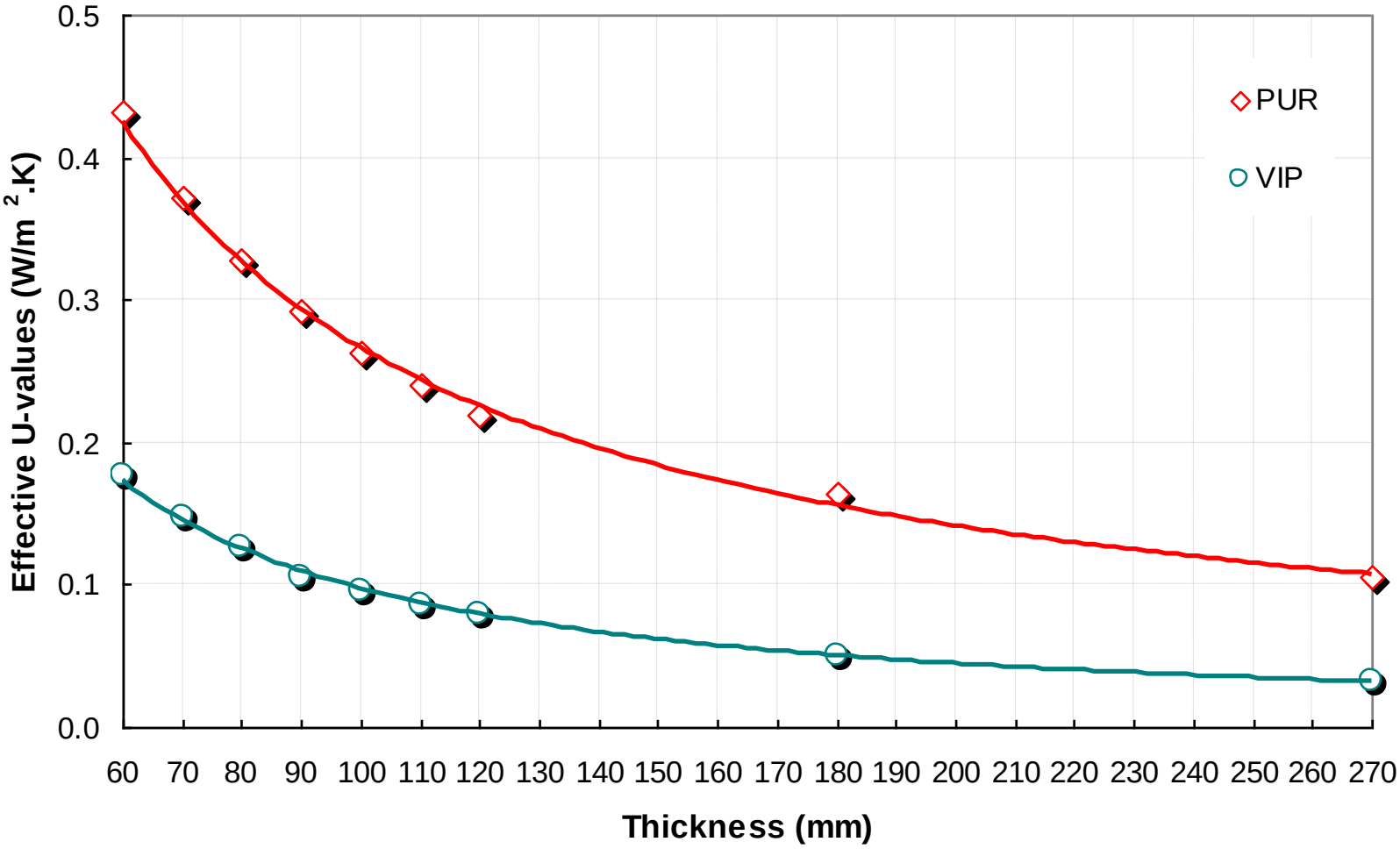
Cost Justification 3: Overall Panel ‘U’ Values



Calculations based on 2000x1200 panel size, PU k = 0.025W/m.K, VIP k = 0.006W/m.K

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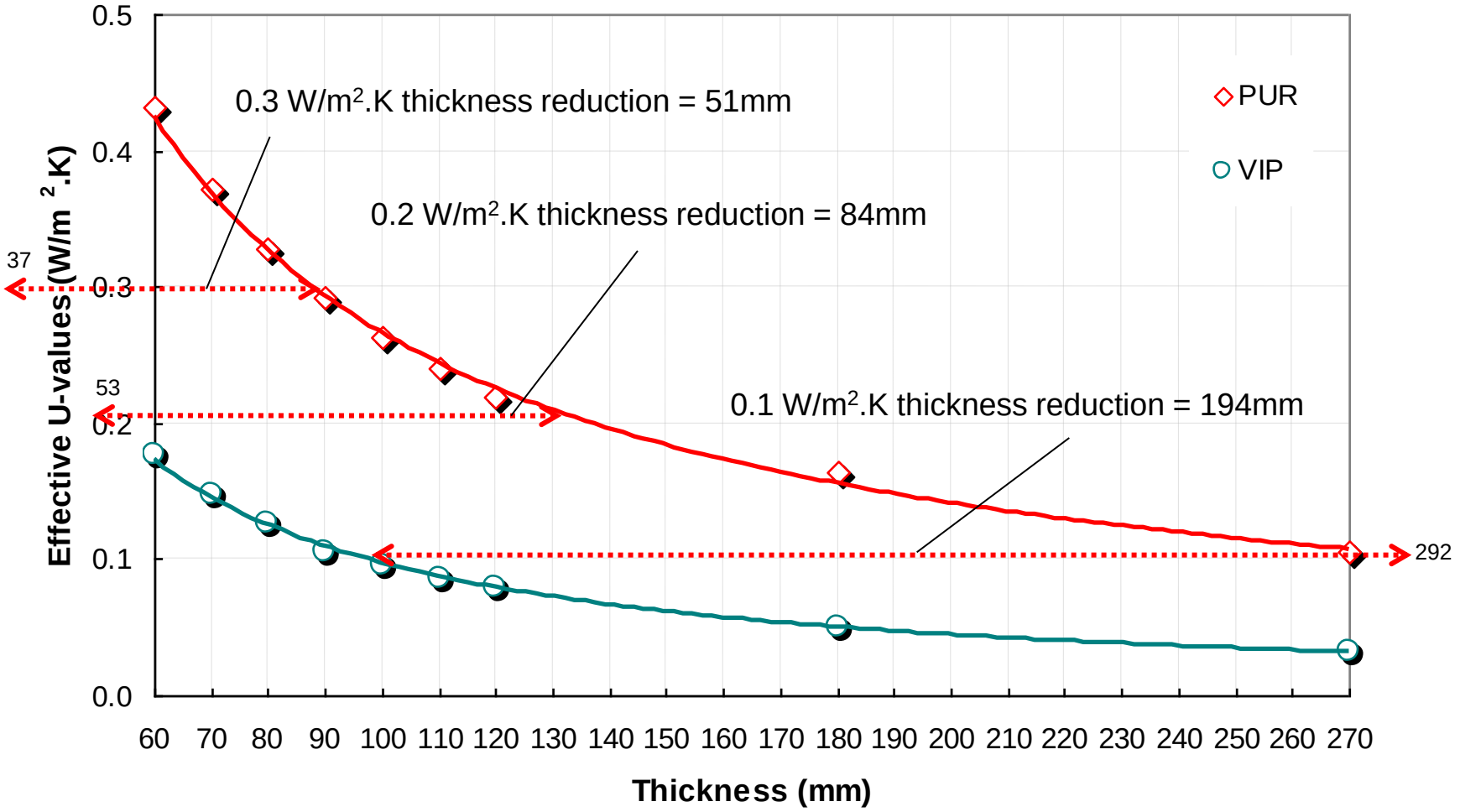
Cost Justification 4: Overall Panel ‘U’ Values



Calculations based on 2000x1200 panel size, PU k = 0.025W/m.K, VIP k = 0.006W/m.K

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Cost Justification 5: Trend Comparison 1

Centre Panel

U value	*Centre Panel Thickness PU (mm)*	*Centre Panel Thickness VIP (mm)*	*% Thickness Reduction*
0.1	245	74	70
0.2	121	44	64
0.3	79	34	57

Overall Panel

U value	*Overall Panel Thickness PU (mm)*	*Overall Panel Thickness VIP (mm)*	*% Thickness Reduction*
0.1	292	74	75
0.2	137	44	68
0.3	88	34	61

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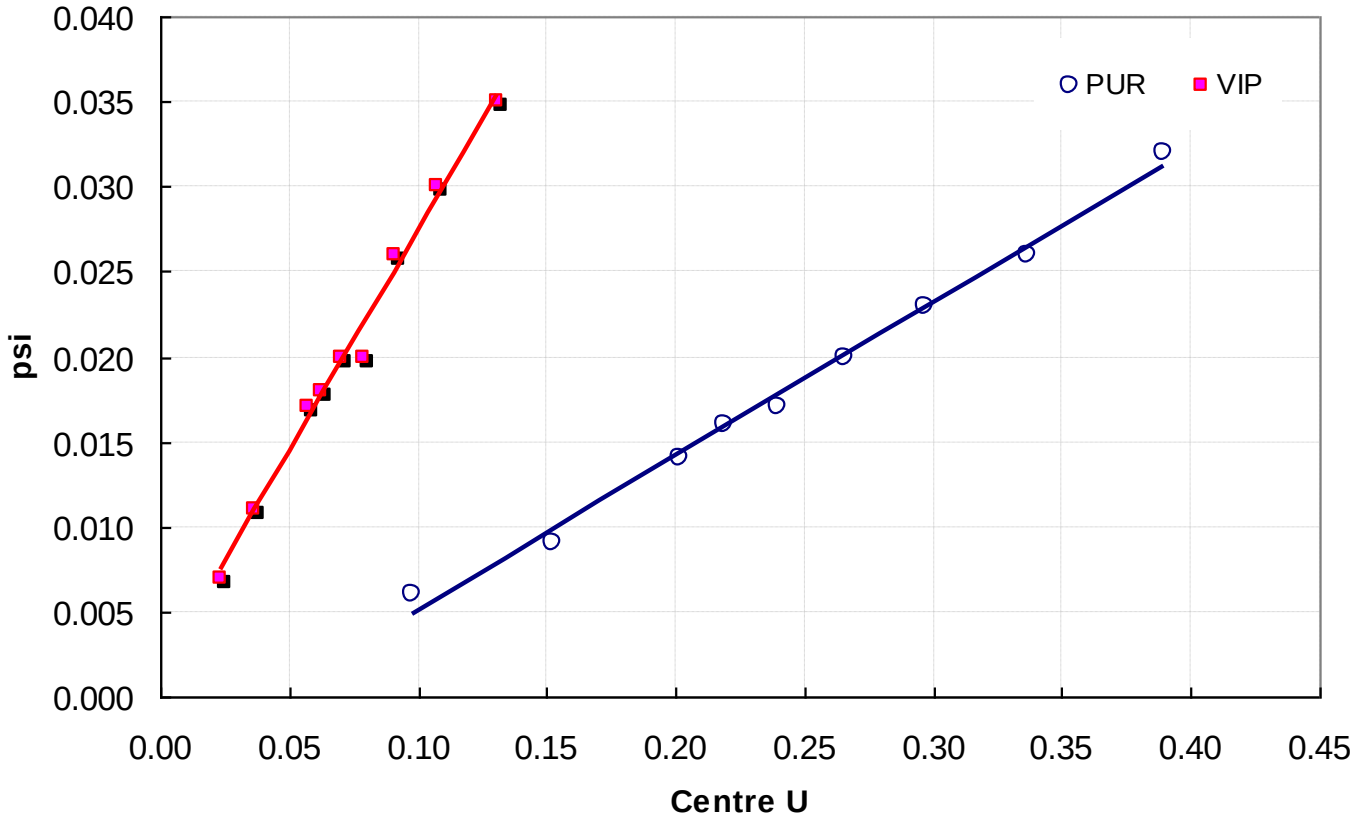
Cost Justification 5: Trend Comparison 2



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Conclusions

- Studies have shown that the extra costs associated with VIP may be offset against maximised rental income as a result of thinner walls

- There are significant engineering issues concerning how the required levels of stiffness can be achieved in large ‘curtain wall’ applications. The structural design of cladding components is challenging.

- Vacuum systems are one of the most realistic opportunities for step change in thermal performance.