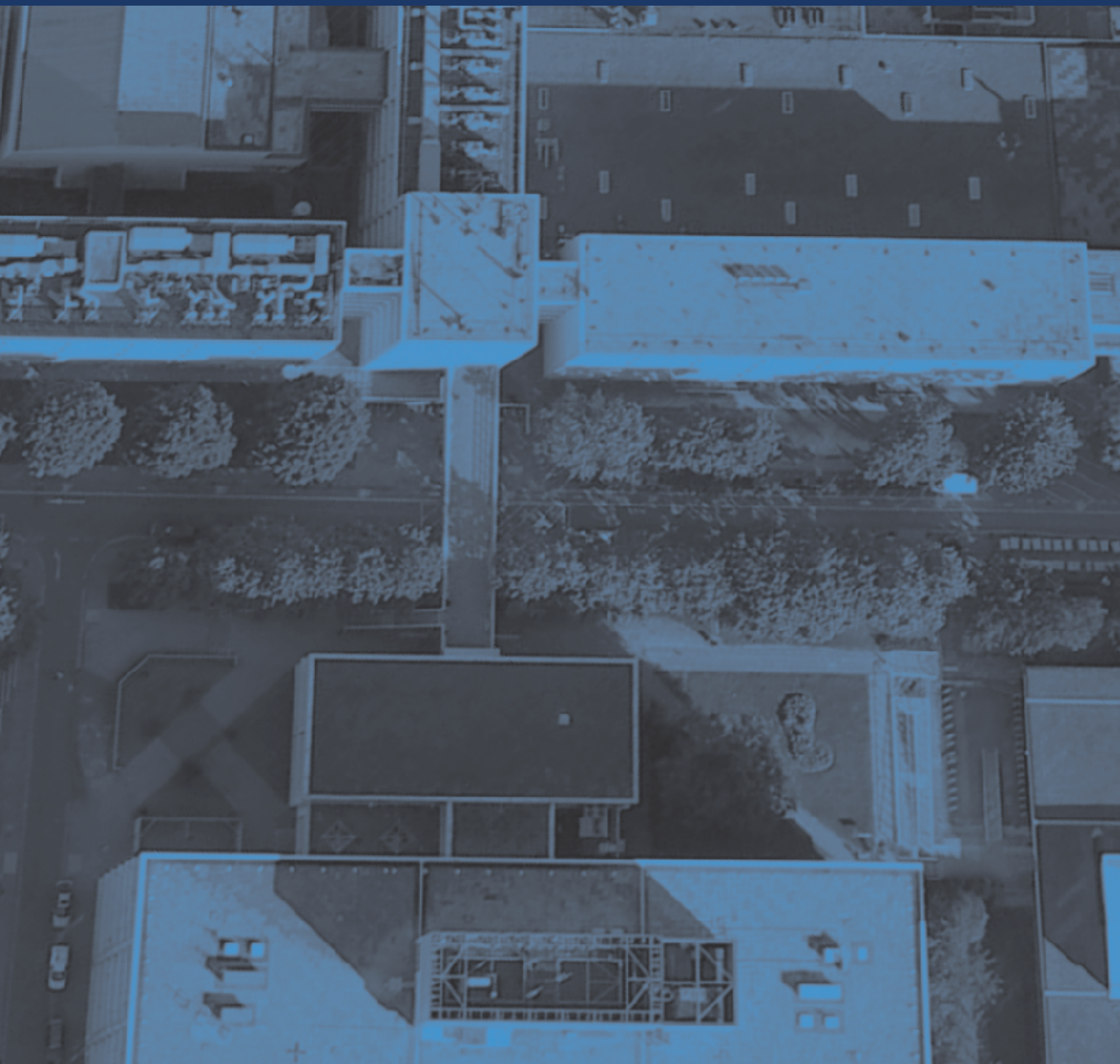
d+b facades
OVERCLADDING SPECIALISTS

waterman

THE UNIVERSITY OF WARWICK

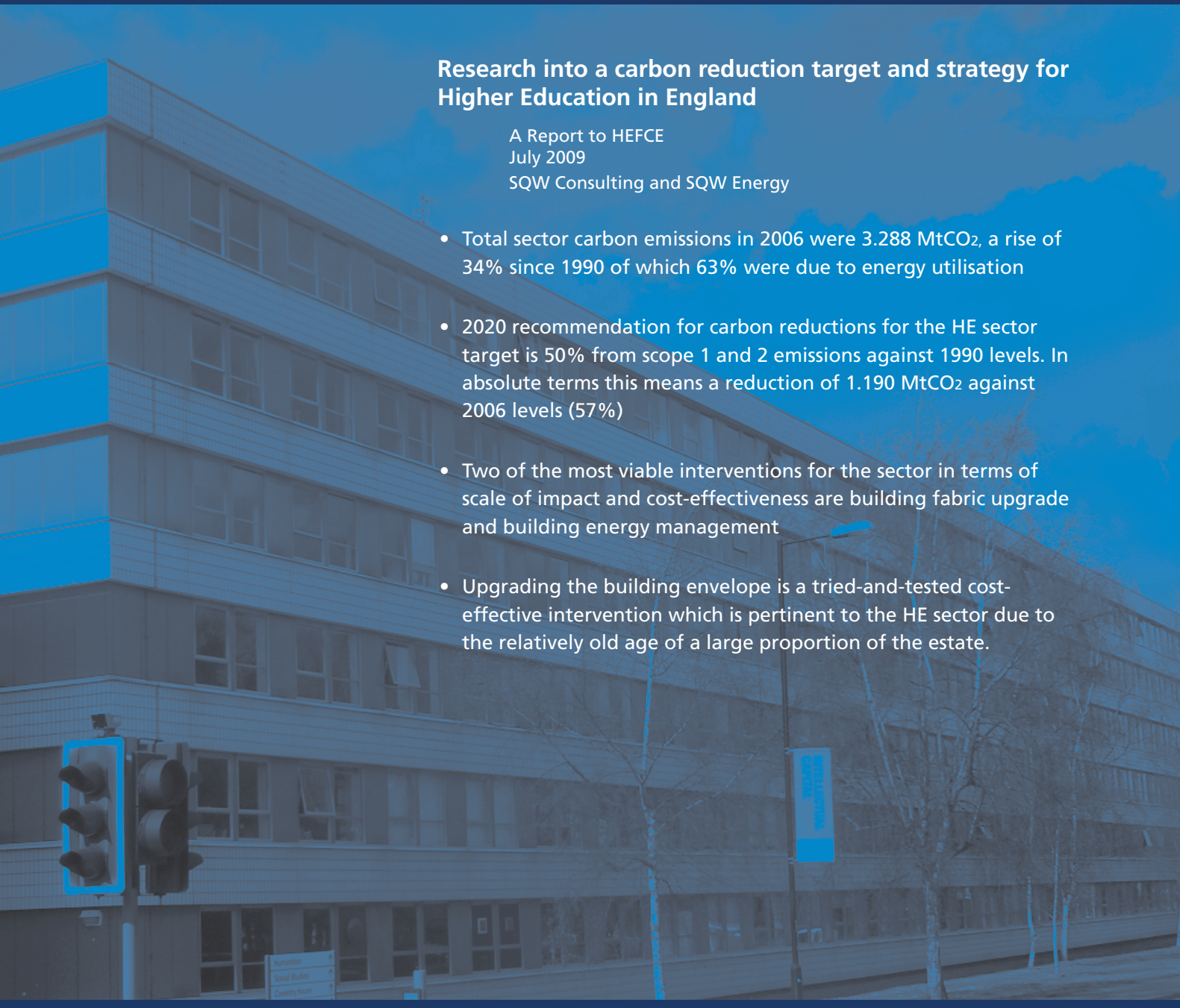
SYNOPSIS OF ENERGY SAVINGS PRODUCED BY EXTERNAL REFURBISHMENT



CARBON REDUCTION TARGET AND STRATEGY FOR HIGHER EDUCATION IN ENGLAND

"Each University and College will need institutional targets that can be measured … the need to act is universal and we can all ensure that our buildings are better insulated and our energy use better controlled"

Sir Alan Langlands
Chief Executive, HEFCE



Research into a carbon reduction target and strategy for Higher Education in England

A Report to HEFCE
July 2009
SQW Consulting and SQW Energy

- Total sector carbon emissions in 2006 were 3.288 $MtCO_2$, a rise of 34% since 1990 of which 63% were due to energy utilisation
- 2020 recommendation for carbon reductions for the HE sector target is 50% from scope 1 and 2 emissions against 1990 levels. In absolute terms this means a reduction of 1.190 $MtCO_2$ against 2006 levels (57%)
- Two of the most viable interventions for the sector in terms of scale of impact and cost-effectiveness are building fabric upgrade and building energy management
- Upgrading the building envelope is a tried-and-tested cost-effective intervention which is pertinent to the HE sector due to the relatively old age of a large proportion of the estate.

EXECUTIVE SUMMARY

The University of Warwick is presently evaluating development options for a range of buildings within its estate and a critical consideration is carbon reduction consistent with meeting obligations to HEFCE's Carbon Reduction Commitment.

d+b facades has previously provided the University of Warwick with budget costings (£6.95m) to overclad a suite of five buildings along the campus' Library Road. Using actual energy consumption figures for these buildings provided by the University, Waterman Group, the international engineering and environment consultancy, has calculated the energy savings that an insulated rainscreen and replacement high performance windows would deliver. The financial benefit to the University of Warwick following external refurbishment is calculated to exceed £158,000 per annum in energy savings.

Waterman Group has recently undertaken a Carbon Reduction Calculation based upon these data. The absolute carbon reduction benefit of refurbishing the five buildings using d+b facades' system is calculated to be 1297 tonnes of carbon per annum.

63% of a University's entire carbon footprint is derived from energy utilisation and the most influential contributing factor is the quality of building envelopes. Consequently a 5-fold improvement in thermal performance of existing buildings as a result of overcladding is highly effective in achieving a headline carbon reduction figure.

d+b facades' system re-uses a building's embodied energy with predominantly recycled materials which are themselves 95% recyclable. Importantly, it also extends the building's life by circa 60 years, delivering the same building performance benefits as a new-build but saving the huge amounts of carbon otherwise associated with replacing buildings.

The case for overcladding is compelling and fully satisfies the environmental, financial and social sustainability issues that need to by addressed by the University of Warwick. d+b facades' high quality, economically-attractive overcladding would make a major contribution to the University of Warwick's carbon reduction targets and can be installed with minimal disruption to building users without the need to decant.

THE UNIVERSITY OF WARWICK: SYNOPSIS OF ENERGY SAVINGS PRODUCED BY EXTERNAL REFURBISHMENT

Energy use is directly correlated to thermal insulation performance of a given building, thus improving existing buildings through provision of high quality overcladding will deliver substantial economic benefits. These may be accurately quantified by calculating the energy usage of the existing structure and that of the same structure post-refurbishment using U-Values.

1. The Existing Buildings

These calculations are based on the combined areas of the following buildings: Main Library, Chemistry, Engineering, Central Block and Humanities.

The existing buildings are assumed to be of the following construction:

- Windows: 4,753 m^2 (3,087 m^2 - 4mm single glazed; 1,666 m^2 – 4 mm single glazed with secondary glazing).
- Spandrels: 6,310 m^2 – 75mm thick solid concrete panels with mosaic tiling externally, 10mm asbestos cement backing board, 24mm air cavity & 10mm chipboard internal finish.
- Infill panels: 3,924 m^2 steel facing panel with 10mm asbestos cement backing board, 24mm air cavity, & 10mm chipboard internal finish.
- Roof: 5,642m^2 – (assumed) 250mm concrete slab with 75mm screed, 25mm cork insulation & 20mm asphalt finish.

The rate of heat loss of the existing building is calculated from the U-values of the component elements and the overall rate of heat loss using their elemental areas:

Element	Area (m^2)	U-value (W/m^2K)	Heat loss (W/K)	Average U-value (W/m^2K)
Windows (1)	3,087	5.00	15,435	
Windows (2)	1,666	3.50	5,831	
Spandrels	6,310	1.90	11,989	
Infill panels	3,924	2.29	8,986	
Roof	5,642	0.79	4,457	
Ground Floor	5,642	0.12	677	
Totals	**26,271**		**47,375**	**1.80**

2. Buildings Post-Refurbishment

d+b facades' overcladding proposal to the University of Warwick includes the following improvements:

- Windows: High performance timber/aluminium composite units, double glazed.
- Walls: As existing, but with the addition of 150mm insulation, 50mm air cavity, and 3mm aluminium rainscreen.
- Infill panels: As proposals for walls
- Roof: As existing, but with the addition of 100mm PUR insulation.

The heat loss calculation provided by Waterman Group is based upon the following table:

Element	Area (m^2)	U-value (W/m^2K)	Heat loss (W/K)	Average U-value (W/m^2K)
Windows	4,753	1.00	4,753	
Walls	10,234	0.28	2,866	
Roof	5,642	0.20	1,128	
Ground Floor	5,642	0.12	677	
Totals	**26,271**		**9,423**	**0.36**

Actual energy consumption data supplied by the University of Warwick for the five buildings under consideration show the present annual energy consumption to be 8,519,890 kWh. The University pays for gas at 2.328p/kWh, therefore the annual cost of energy for these buildings is £198,343.

Based upon U-values, following refurbishment d+b facades' solution will deliver an estimated annual energy saving for the University of £158,892 per annum.

It is understood that the University's existing gas prices are fixed for the next two years but thereafter market adjustments will take place. Consequently d+b facades' solution will actually deliver greater future annual energy savings in direct proportion to future increases in gas prices.

3. Capital Payback

The budget price of the proposed cladding, replacement windows and roofing works is £6,948,522. Using the calculated annual energy saving of £158,892 (Section 2.), the capital payback period attributable solely to the energy savings derived from external refurbishment may be determined. Energy costs will not remain static – over the past decade energy costs have risen by an average of 12%, and this trend is expected to continue. The following table of cumulative savings incorporates this assumption but applies it after the University's existing fixed gas price arrangement ends in two years time.

Year	Existing Energy Cost £0.03/kWh	Energy Cost Post Overcladding @ £0.03/kWh	Annual Saving	Cumulative Saving
1	£198,343.13	£39,450.90	£158,892.23	£158,892.23
2	£198,343.13	£39,450.90	£158,892.23	£317,784.46
3	£222,144.31	£44,185.01	£177,959.30	£495,743.76
4	£248,801.62	£49,487.21	£199,314.41	£695,058.17
5	£278,657.82	£55,425.67	£223,232.14	£918,290.31
6	£312,096.75	£62,076.75	£250,020.00	£1,168,310.31
7	£349,548.37	£69,525.97	£280,022.40	£1,448,332.71
8	£391,494.17	£77,869.08	£313,625.09	£1,761,957.80
9	£438,473.47	£87,213.37	£351,260.10	£2,113,217.90
10	£491,090.29	£97,678.98	£393,411.31	£2,506,629.21
11	£550,021.12	£109,400.45	£440,620.67	£2,947,249.88
12	£616,023.65	£122,528.51	£493,495.15	£3,440,745.03
13	£689,946.49	£137,231.93	£552,714.57	£3,993,459.59
14	£772,740.07	£153,699.76	£619,040.31	£4,612,499.91
15	£865,468.88	£172,143.73	£693,325.15	£5,305,825.06
16	£969,325.15	£192,800.98	£776,524.17	£6,082,349.23
17	£1,085,644.16	£215,937.10	£869,707.07	£6,952,056.30
18	£1,215,921.46	£241,849.55	£974,071.92	£7,926,128.21
19	£1,361,832.04	£270,871.49	£1,090,960.55	£9,017,088.76
20	£1,525,251.89	£303,376.07	£1,221,875.81	£10,238,964.58

This table shows that payback of the total project cost from energy savings alone is just under 17 years.

Carbon Reduction Calculation:

Estimation of carbon reduction resulting directly from the proposed overcladding of all five buildings under consideration has been made using a conversion factor supplied by Waterman Group of 0.19 for gas.

It is calculated that refurbishment of the existing buildings' external envelopes using d+b facades' system will achieve annual reductions in carbon of 1,296 tonnes per annum for the University of Warwick.

At the same time, refurbishment will extend the buildings' lives by 50-60 years thereby preserving embodied energy and carbon and saving the huge amounts of carbon otherwise associated with demolition and replacement.

SUSTAINABLE DEVELOPMENT - THE BENEFITS OF OVERCLADDING

Economic Sustainability

- Reduced heating costs of up to 80% per annum achieving direct payback via energy savings alone in approximately 17 years
- Extension of service life of the building by 50-60 years
- Increased net asset value which can be leveraged to enhance borrowing capability
- Increased future revenue through improved accommodation rentals and making the establishment more commercially appealing to potential corporate partners
- Substantially reduced ongoing maintenance costs.

Environmental Sustainability

- Fully utilising and recycling the embodied energy in the existing structure
- Substantially reduced carbon emissions and maintenance of embedded carbon - key elements of a carbon management strategy and plan
- Avoids the increased environmental impact of demolition and replacement or new build
- Utilisation of predominantly recycled materials in the overcladding system which are 95% reusable at the end of the building's useful life
- Greatly reduces future energy consumption.

Social Sustainability

- Overcladding with a new envelope transforms the external and internal appearance creating an aesthetically attractive building fit for the 21st Century
- Meets the expectations of students and staff, aiding in attracting and retaining them and enhancing their educational experience
- Improves the academic institution's appeal, improving its brand and provides a coherent campus with a stronger visual identity
- Achievable without decanting occupants and maintaining full building use throughout installation with minimal disruption
- Flexibility to accommodate future functional change of building use.

Overcladding dramatically transforms the internal environment as seen at Liverpool John Moores University pictured right.

Before

After

d+b facades

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