BUILDING DESCRIPTION

The Front Quad of All Souls College was originally constructed in the 15th Century. It has since been extended, particularly at roof level. It is the oldest part of the college, based upon the traditional Oxford configuration of rooms grouped around staircases. The buildings are Grade I listed, reflecting their exceptional heritage value.

In 2009, a detailed condition survey of fabric and services to identify principal issues effecting energy consumption was undertaken. Fellows' study and bedroom accommodation on the ground, first and second floors, served from staircases I to VII inclusive, plus the Chapel, Old Library, Basement Seminar Rooms, Bursar and Manciple's office, Porters Accommodation, Hovenden Room and Fellows rooms to the second floor above the Warden's Accommodation, all served by the Tower plant room, were reviewed.

Occupants have historically, not been motivated to save energy (they do not directly pay for it). This is perhaps due to its relative cheapness and a lack of understanding of the impact of continued burning of fossil fuels on the global climate.

Air pressure testing was undertaken to understand air leakage routes. This detected an unusual stack effect, with heated air escaping vertically via fixed wall panelling, through the building and out to the atmosphere at roof level. Significant air leakage into vented basements, through joints in solid stone walls was also made apparent.

Areas where improvements in insulation could be incorporated without affecting historic fabric were identified. The need to re-slate roofs due to poor condition created opportunity for a warm roof by applying thin multi-foil insulation material above rafters. External doors were installed to open staircases, creating unheated buffer zones. Selected window improvements including replacement of poorly performing C20th attic windows, draft stripping, and where not affecting historic appearance, secondary glazing.

Changes to cased radiators to improve convection have assisted in creating more stable conditions, reducing reliance on electric fires to provide back-up heat.

Low energy luminaires with movement sensor controls have replaced inefficient light fittings.

Old boiler plant and controls have been replaced with modern, high efficiency ones.

Occupants are pleased with improved internal comfort, especially the elimination of temperature fluctuations and draughts in the attic accommodation. However, it was necessary to re-balance the heating system after upgrade as the effectiveness of improvements led to overheating in some areas. To reinforce the need for occupant engagement, the placement of a simple guide to reducing energy consumption in each Fellows room was suggested.

The absence of sub-metering both before and after completion of upgrades has made it difficult to assess the actual energy savings arising therefrom.

Dynamic thermal modelling was used to predict changes in energy consumption (up to a 50% reduction compared with the pre-existing situation), following improvements. This demonstrates the potential to reduce energy consumption by up to 50% in a medieval building, given an integrated approach.

HERITAGE VALUE

The college stands on the corner of High Street and Catte Street, with important and significant frontages to both. The Front Quad largely survives from original foundation in 1438. The North Quad of c1716-33 by *Nicholas Hawksmoor.* The high Street frontage includes a traditional entrance tower. Catte Street combines medieval buildings with a screen to the North Quad, forming the west side of the significant open space between St. Mary's Church and the Radcliffe Camera.

Aesthetic Value: '*Value deriving from the ways in which people draw sensory and intellectual stimulation from a place'*

Building	Setting
Original late medieval buildings allied to a scintillating and contextual scheme by a leading architect of his day, at a prominent corner location on the High Street, next to a public/tourist viewpoint.	In Oxford's Central (University and City) Conservation Area which represents an unrivalled assembly of heritage assets: including University and College buildings, civic buildings and churches in a street pattern and continuous development dating back in essence to the founding of the city c900, as one of 32 burhs by Alfred the Great (871-899).

Communal Value: *'Value deriving from meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory'*

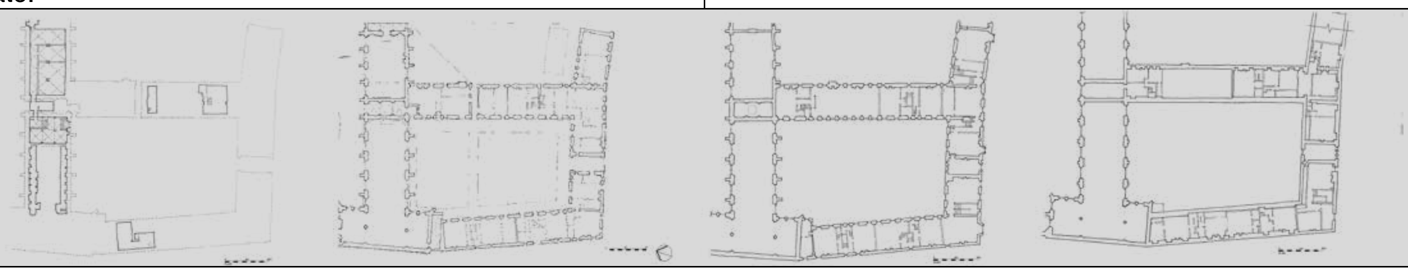
Important historic buildings in prominent location of a famous university city, on the premier 'British tourist trail' and a prominent part of the university for alumni and particularly those of the college itself.	The High Street is a significant location in a famous university city on the premier 'British tourist trail' and as 'The High', a quintessential element of the university town for all alumni.

Evidential Value: *'Value deriving from the potential of a place to yield evidence about past human activity'*

Survival of historic buildings from different periods holds important evidence of past college practices, requirements and expectations.	Continuous adaptation of historic buildings fronting the High Street preserves the evidence of activity in the City Centre.

Historical Value: *'Value derived from the ways in which past people, events and aspects of life can be connected through a place to the present'*

Survival of historic buildings from different periods offers potential evidence of past college members and the co-founders, Archbishop Chichele and King Henry VI.	Continuous adaptation of historic buildings fronting the High Street preserves the evidence of activity and former life in the City Centre.



OXFORD HEET CASE STUDY 1: ALL SOULS COLLEGE FRONT QUAD

Element	Assessment	Maintenance Issues	Retrofit Options	Heritage Impact		Planning Permission/LBC required	Advice Required	Recommendations/Comments
FABRIC								
Pitched Roofs	Comprised of stone slate coverings on timber boarded sarking. Most of the roof was uninsulated prior to upgrade works. Where applied, insulation was limited and poorly fitted, resulting in significant heat loss. The considerable amount of plant and equipment in loft spaces compromised access to fit insulation. The risk of condensation and subsequent damage to fabric was a major consideration in the selection of insulation material. Slates were found to be near the end of their service life and re-covering was undertaken as part of the upgrade works.	Check integrity of flashings, keep gutters and downpipes free from debris, as blocked pipes can lead to dampness in walls and thermal discomfort via evaporative cooling of fabric.	Apply insulation above roof ties within loft spaces	Low	☺		Architect, Conservation specialist	Applying additional insulation at ceiling level is a quick and cost effective measure with low heritage impact, however in this instance, the considerable amount of plant and equipment in loft spaces compromised access to fit insulation.
			Strip roofs and insulate voids from above prior to re-slating (cold roof)	Low	☺		Architect, Conservation specialist	Traditional thick insulants were not a viable option, as the roof profile could not be raised. Continuity of ventilation paths are essential to eliminate condensation risk.
			Strip roofs and insulate voids from above prior to re-slating (warm roof)	Low	☺		Architect, Conservation specialist	Traditional thick insulants were not a viable option, as the roof profile could not be raised. A thin multi-foil insulant was applied.
			Remove ceiling linings and insulate from below.	Medium	😐	Listed Building Consent	Architect, Conservation specialist	Some of the second floor accommodation with limited sloping ceilings might have been accessible to insulate from within the loft, however to effectively avoid gaps in the insulation, most would have to be stripped off. This is an acceptable solution where there are few visible historic features and loss of headroom is not an issue.
			Retain existing ceiling finishes, dryline and insulate from below.	Medium	😐	Listed Building Consent	Architect, Conservation specialist	This is also an acceptable solution where there are few visible historic features and loss of headroom is not an issue.
Dormers and eaves boxings	Lead on timber boards to dormers was found to be in generally in good condition. All uninsulated prior to upgrades.	Check integrity of covering periodically, particularly joints and abutments. Ensure rainwater outlets are free of debris. Insulate internal downpipes as condensation on pipe walls can cause dampness in adjoining building fabric.	Apply insulation between studs and joists.	Low	☺	Listed Building Consent	Architect, Conservation specialist	Tightly fitted rigid insulation was applied between dormer roof joists and studs to cheeks and eaves boxings.
Walls	Traditional construction in solid stone		Insulate walls	High - External insulation would hide historic stone/brick detailing	☹	Listed building consent, planning permission	Architect, Conservation specialist	Applying wall insulation offers a high potential energy saving, but would be extremely damaging to internal and external decorative features given the building's significance. There is also an increased condensation risk. Not recommended in this instance.
				High - Internal insulation would reduce floor space and hide internal historic detailing	☹			
	Timber stud walls with plaster linings adjoining unheated, external staircases	Check linings to ensure that these are properly sealed to avoid heat loss by air infiltration	Apply insulation between studs	Low	☹	Listed Building Consent	Architect, Conservation specialist	Removal of either side of plaster would result in loss of historic fabric. In this instance, new doors were fitted to the external staircases at entrance level.

OXFORD HEET CASE STUDY 1: ALL SOULS COLLEGE FRONT QUAD								
Element	Assessment	Maintenance Issues	Retrofit Options	Heritage Impact		Planning Permission/LBC required	Advice Required	Recommendations/Comments
Ground Floor	Suspended timber floor over unheated/ partially heated basement with solid floor with no evidence of floor insulation.		Apply draught sealing to floorboard joints or impervious floor covering	Low	☺	Listed Building Consent	Architect, Conservation specialist	Take care to ensure that basement ventilation is not compromised. Additional ventilation was introduced in this instance to ensure that airflow remained sufficient. Foam seals applied to open joints between floorboards proved troublesome in practice as movement in the timber floor causes the foam to lift slightly and come free over time.

OXFORD HEET CASE STUDY 1: ALL SOULS COLLEGE FRONT QUAD								
Element	Assessment	Maintenance Issues	Retrofit Options	Heritage Impact		Planning Permission/LBC required	Advice Required	Recommendations/Comments
Windows	Timber framed vertical sliding sash, timber framed side-hung casements or metal framed side-hung casements. Air test revealed that windows were susceptible to air leakage, with the more recent c20th metal framed casements being the most leaky. These metal framed windows are also prevalent on the attic floor	Regular maintenance to prevent corrosion of steel frames and decay of timber ones. Clean regularly, particularly in a city centre location like this as dirty windows reduce benefits of daylighting	Draught stripping	Low	☺	None	Architect, Conservation specialist	Steel framed windows require particularly sensitive approach. Appropriate proprietary systems have been applied successfully, for example in the St Aldates room of the Town Hall. In this instance replacement double-glazing incorporating draught-stripping was considered appropriate for steel framed windows (see below), with draught stripping to frames of timber windows wherever possible.
			Secondary glazing	Medium	☺	Listed Building Consent	Architect, Conservation Specialist	Consider ease of operation and impact on internal features. In this instance this was not considered appropriate for most of the timber framed windows. Draught stripping was incorporated into frames wherever possible.
			Heavyweight/ thermally lined curtains	Low	☺	None	None	Relatively quick and easy solution. Carefully consider impact on feature windows and sensitive internal features. Applied successfully to clerestory windows in the Main Hall.
			Replacement double glazing				Architect, Conservation Specialist	The poorly performing metal framed attic windows were replaced with identically sized thin section double glazed units incorporating draught stripping.
External Doors	Open external staircases provided direct access to rooms off staircase landings. This effectively meant, that each study room door was external. The doors also serve as fire doors and have smoke seals, hence are effectively draught stripped already.	Check seals for integrity and ensure that loose strips are repaired/replaced promptly.	Draught stripping	Low	☺	None	Architect, Conservation Specialist	Draught stripping is a relatively simple and cost effective measure. On the new entrance doors, which are subject to heavier traffic, seals could be vulnerable to damage. The detail in such areas would need careful consideration.
			Draught lobby	Medium	😐	Listed Building Consent		New external doors were fitted to each access staircase, effectively creating draught lobbies. Acceptable in this instance as a historical precedent was established and appropriately styled doors could be obtained.

OXFORD HEET CASE STUDY 1: ALL SOULS COLLEGE FRONT QUAD

Element	Assessment	Maintenance Issues	Retrofit Options	Heritage Impact		Planning Permission/LBC required	Advice Required	Recommendations/Comments
SERVICES								
Boilers	Low-temperature hot water (LTHW) system is served by 300kW Hamworthy Wessex 6 Module boiler installation located in the Tower plant room. The existing boiler was installed in 1987 and was considered to have an efficiency of 70-75% at best. A flue dilution fan had been installed in 1991 to overcome pressure difference issues that were causing boiler failures	Although the boilers are old, continued service is possible with a good maintenance regime, although it is likely that there will be an increased maintenance requirement as well as an increased risk of failure and issues of reliability.	Replace with new, higher efficiency boilers	Low	☺	None	HVAC Engineer	Aging boiler plant upgraded to high efficiency gas boiler plant.
Heating Controls	Heating was historically programmed to switch off at night and come back on in the morning, resulting in very cold rooms on winter mornings.		Run boiler continuously for 24hrs with slightly lower temperature overnight.	Low	☺	None	HVAC Engineer	Running the boiler continuously has resulted in more stable, even temperatures.
	Radiators are concealed within architectural casings, with limited free area, thus limiting convection and contributing to very cold rooms on winter mornings.	Difficult to access radiators for maintenance	Remove casings entirely	Medium	☹	LBC	Architect, Conservation Specialist	Unacceptable impact on internal features and historic fabric.
	In response to the above, occupants were using local electric heaters, which in turn boosted room temperatures to a point were thermostatic radiator valves would be triggered to switch off the central heating radiator.		Re-design casings to increase free area and improve convection.	Medium	😐		Architect, Conservation Specialist HVAC Engineer	Carefully consider modifications were made to improve free circulation area of casings.
Distribution Pipework	Pipe runs appear to be well lagged, but older pipework and radiators were re-used as part of 1991 remedial works. Extent of cleaning flushing carried out at that time was unclear.	Build-up of sludge and lime scale within pipework can cause corrosion of pipework and other components, whilst reducing efficiency over time.	Periodic power flushing of the system	Low	☺	None	HVAC Engineer	This should be carried out as part of the regular maintenance cycle.
	Single circuit LTHW distribution pipework system was operating at a higher duty for longer than would otherwise be required, with old single speed drive pumps	Older pumps have a higher energy consumption	Replace with modern inverter driven pumps	Low	☺	None	HVAC Engineer	
	Single circuit LTHW distribution pipework serves fan convectors and radiators	Fan convectors are better served by a constant temperature circuit and radiators by a variable temperature circuit	Provide separate circuits to serve different types of heating	Medium	😐	Listed Building Consent only if likely to affect historic features.	Architect, Conservation Specialist HVAC Engineer	May involve re-routing of pipework or introduction of new runs. Carefully consider routes to avoid historically sensitive features.
Heat Emitters	Old cast iron column radiators were re-used as part of 1991 remedial works	Build-up of sludge and lime scale in radiators can cause corrosion whilst reducing efficiency over time.	Periodic power flushing of the system.	Low	☺	None	HVAC Engineer	This should be carried out as part of the regular maintenance cycle.
			Replace all old radiators with more efficient, modern ones	Medium	😐	Listed Building Consent only if likely to affect historic features.	Architect, Conservation Specialist HVAC Engineer	This work will need to be carefully carried out to avoid damaging casings and adjoining fabric. It would also present an opportunity to apply reflector panels behind radiators on heat loss walls (see below).
	Radiators do not appear to incorporate reflector panels	Installation access difficult as radiators are generally located within casings	Apply radiator reflector panels to all radiators on heat loss walls	Medium	😐	Listed Building Consent only if likely to affect historic features.	HVAC Engineer Conservation Specialist	Some mounting adhesives can damage historic features; care must be taken to select an appropriate product.

OXFORD HEET CASE STUDY 1: ALL SOULS COLLEGE FRONT QUAD

Element	Assessment	Maintenance Issues	Retrofit Options	Heritage Impact		Planning Permission/LBC required	Advice Required	Recommendations/Comments
Heat Emitters (contd)	Widespread use of portable electric heaters to 'boost' heating on cold mornings	Very high electricity consumption, should be safety checked regularly	Discourage use of portable electric heaters	Low	☺	None	None	Though an easy win, needs to be properly managed to get users on side.
Domestic Hot Water	Due to intermittent nature of overnight residential occupation, each staircase has its own insulated electric immersion cylinder controlled by a time clock.	Requires college staff to manually set each timer to suit predicted occupancy. With multiple staircases, this requires significant effort	Provide hot water via separate circuit on central heating system building services management system controlled from the porters lodge	Medium	😐	Listed Building Consent only if likely to affect historic features.	HVAC Engineer Conservation Specialist	May involve re-routing of pipework or introduction of new runs. Carefully consider routes to avoid historically sensitive features.
Ventilation	Habitable rooms are naturally ventilated via operable windows.	Ensure locks and handles are in good working order. Where necessary, provide operating instructions to users to avoid damage to historic fabric.		Low	☺	None	None	Management plan only.
	There are a number of disused open fireplaces in the building that are generally well sealed	Ensure that chimney pots are capped and that grilles are provided to maintain ventilation and prevent dampness in chimneybreasts.	Where open chimneys are required to maintain ventilation, install inflatable chimney balloons during the heating season, and remove during the summer months.	Low	☺	None	None	Management plan only.
Lighting	Typically, ceiling mounted, four or five incandescent candle light chandelier, supplemented by standing lamps, high energy halogen uplighters and 'anglepoise' desk lamps. Although single 5amp power outlets were provided for the lamps, many of these were plugged into the higher energy 13amp sockets.	Dirty lampshades/reflectors reduce light output from lamps and uplighters, clean regularly. Incandescent bulbs typically have a service life of 750-1000 hrs as compared with 6,000-15,000 for low energy compact flourescents	Replace old style candle lights with similar low energy bulbs. Lamps should all be plugged into 5amp circuit. Install PIR controlled fittings to corridors and staircases.	Low	☺	None	Lighting Engineer	Recommended, a relatively low cost option that can be carried out quickly. Encourage use of task lighting via desk or floor lamps as opposed to general lighting.
MANAGEMENT								
Sub-Metering	There do not appear to be any sub-meters installed in the building.		Install sub-meters to facilitate monitoring of use patterns in different parts of the building	Low	☺	None	HVAC Engineer Electrical Engineer Conservation Specialist	Recommended. It is not possible to verify

OXFORD HEET CASE STUDY 1: ALL SOULS COLLEGE FRONT QUAD								
Element	Assessment	Maintenance Issues	Retrofit Options	Heritage Impact		Planning Permission/LBC required	Advice Required	Recommendations/Comments

RENEWABLE OPTIONS								
Solar Thermal Hot Water	Solar access is available via roof slopes within 30^{O} of due south. Hot water demand would need to be assessed to establish viability.			High	☹	Listed Building Consent	Conservation Specialist Renewables Consultant	This would impact historically important Oxford roofscape. Not recommended
Photovoltaics	Solar access is available via roof slopes within 30^{O} of due south.			High	☹	Listed Building Consent	Conservation Specialist Renewables Consultant	This would impact historically important Oxford roofscape. Not recommended
Wind Turbines	Wind resource assessment required.			High	☹	Listed Building Consent	Conservation Specialist Renewables Consultant	This would impact historically important Oxford roofscape. Not recommended
Biomass Boilers	These could be considered as a boiler replacement option.			Medium	😐		Conservation Specialist Renewables Consultant	Heritage impact in relation to routing of flues. Carry out cost-benefit analysis prior to main boiler replacement, note issues around additional plant space and flues.
Ground Source Heat Pump	Building size suggests the depth/ area of pipework would be substantial. Less efficient in historic buildings as these tend to have higher air change rates. Heat pumps work best on buildings with highly insulated, airtight envelopes that can be heated with relatively low temperature systems such as under floor heating. Resizing/additional heat emitters would be needed.			High	☹		Conservation Specialist Renewables Consultant	Drilling within archaeologically sensitive location would be required. Not recommended.
Air Source Heat Pump	Limited potential for location of outdoor units. Performance issues with heat pumps in historic buildings as noted above. Resizing/additional heat emitters would be necessary.			High	☹		Conservation Specialist Renewables Consultant HVAC Engineer	Not recommended in this instance due to sensitivity of adjoining outdoor spaces
Combined Heat and Power Unit	Year round hot water demand would ensure consistent heat demand to enable the CHP unit to run efficiently. It would also require coupling with back-up boilers and has implications on plant space, and require additional flues.	Shorter service interval than conventional boilers		Medium	😐		Renewables Consultant HVAC Engineer	Carry out cost-benefit analysis prior to main boiler replacement, note issues around additional plant space and flues.