Heat loss from a building

INTRODUCTION

Heat is lost from a building through:

1

Fabric Heat Loss from the external building envelope (Q_F)
e.g. external walls, windows, roof, etc.

The rate of heat loss through an external building element is given by:

$$Q_F = U A (T_1 - T_2) \text{ (W)}$$

Where T_1 and T_2 are the inside and outside air temperatures (K)
This is often abbreviated to ΔT

A (m^2) is the area of the external surface

U (W/m^2K) is the thermal transmittance of the external element.
Tables of U values are available for most building elements
in the Building Regulations Part L.

Exposed Element	**U-value** (W/m^2K)
Walls	0.35
Floor	0.25
Roof	0.25
Glazing	2.2
Doors	0.8

The fabric heat loss is determined separately for each exposed element
and added together to give a total fabric heat loss.

2

Ventilation Heat Loss by exfiltration of indoor air through cracks
and openings in the external building fabric (Q_V)
e.g. around window frames, door, etc.

The rate of heat loss by exfiltration is given by:

$$Q_V = \frac{1}{3} N V \Delta T \text{ (W)}$$

Where:

N = Number of fresh air changes per hour of the building (ac/h)

V = Volume of the inside space of the building (m^3)

The total building heat loss is then:

$$Q = Q_F + Q_V \text{ (W)}$$

Heat loss from a building

Virtualmaths
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CALCULATION

A flat roofed dwelling measures 8.5m x 12.5m in plan and is 3.2m high.
The total external wall area includes 25% area of glazing and has front / back doors with a total area of 4m^2

The thermal transmittence (U-values) of the various elements of the building comply with current building regulations and are as follows:

Element	**U-value** (W/m^{2}K)
Walls	0.35
Floor	0.25
Roof	0.25
Glazing	2.2
Doors	0.8

The air infiltration or ventilation rate of the building is 0.5 air changes per hour.
The winter internal and external air temperatures are 21^{o}C and -4^{o}C respectively.

Calculate the total heat loss for the dwelling in winter conditions.

Fabric Heat Loss $Q_F = UA\,\Delta T$ (W)

Element	U (W/m^{2}K)	A (m^2)	ΔT (K)	Heat Loss (W)
Walls				
Floor				
Roof				
Glazing				
Doors				
			TOTAL	(W)

U	=	Thermal transmittance of building element (W/m^{2}K)
A	=	Surface area of building element (m^2)
ΔT	=	Temperature difference inside to outside (K)
N	=	Number of fresh air changes per hour
V	=	Volume of the inside space (m^3)
K	=	Degrees Kelvin
W	=	Watts

Ventilation Heat Loss $Q_V = \frac{1}{3}\,N\,V\,\Delta T$ (W) = (W)

Total Dwelling Heat Loss $Q = Q_F + Q_V$ = (W)

How might the heat loss from the dwelling be reduced to move toward a zero carbon emissions building?

Consider the major sources of heat loss from the dwelling.

Where might it be possible to reduce these values?

How might this be achieved?