The City Archive of Cologne

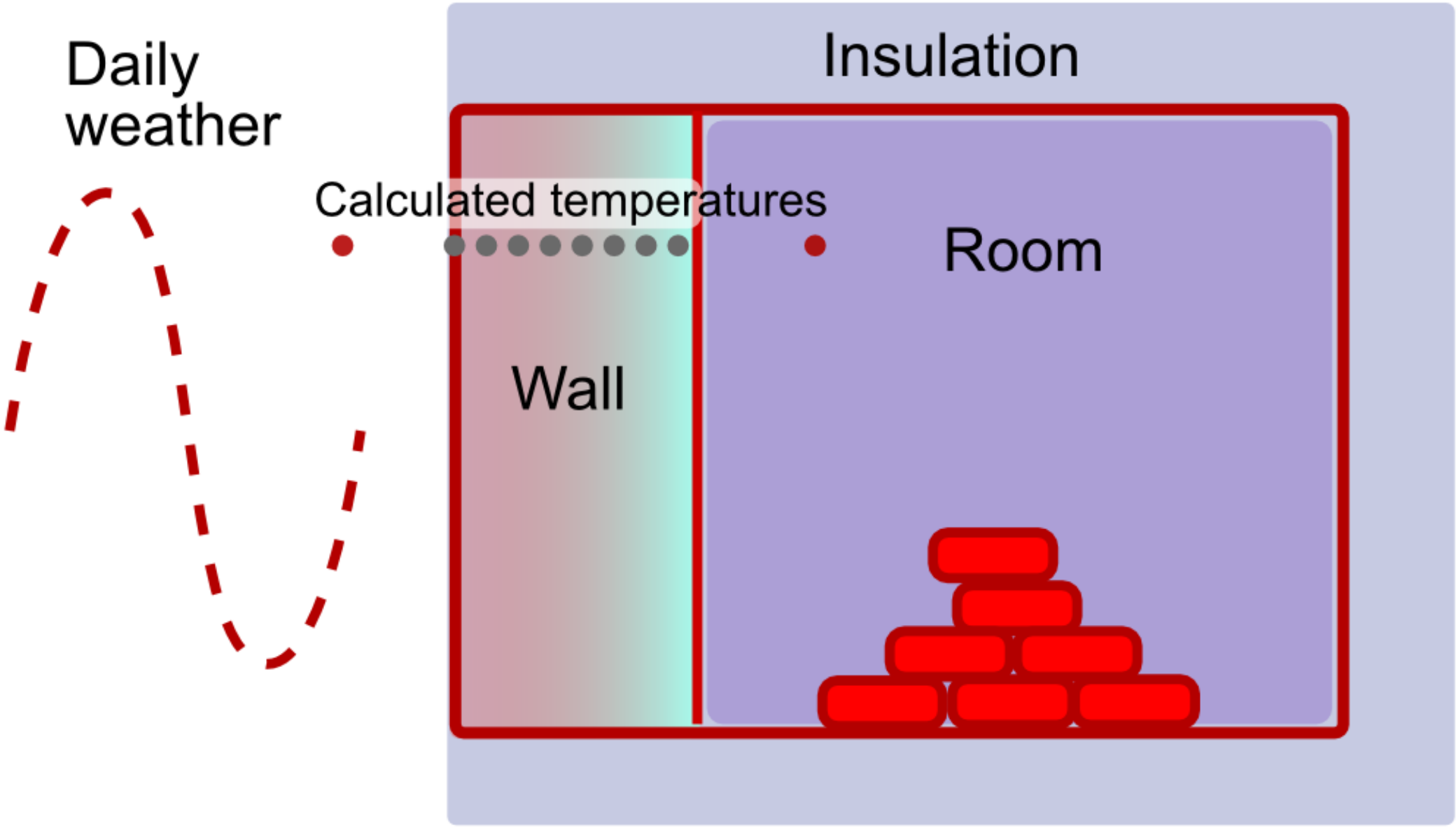
A retro-risk analysis based on a thermal analysis

The building had massive brick walls filling a concrete frame. An air gap separated the wall from the facade tiles.
Small windows minimised solar gain while permitting natural ventilation. This building became a model for building archives without air conditioning.

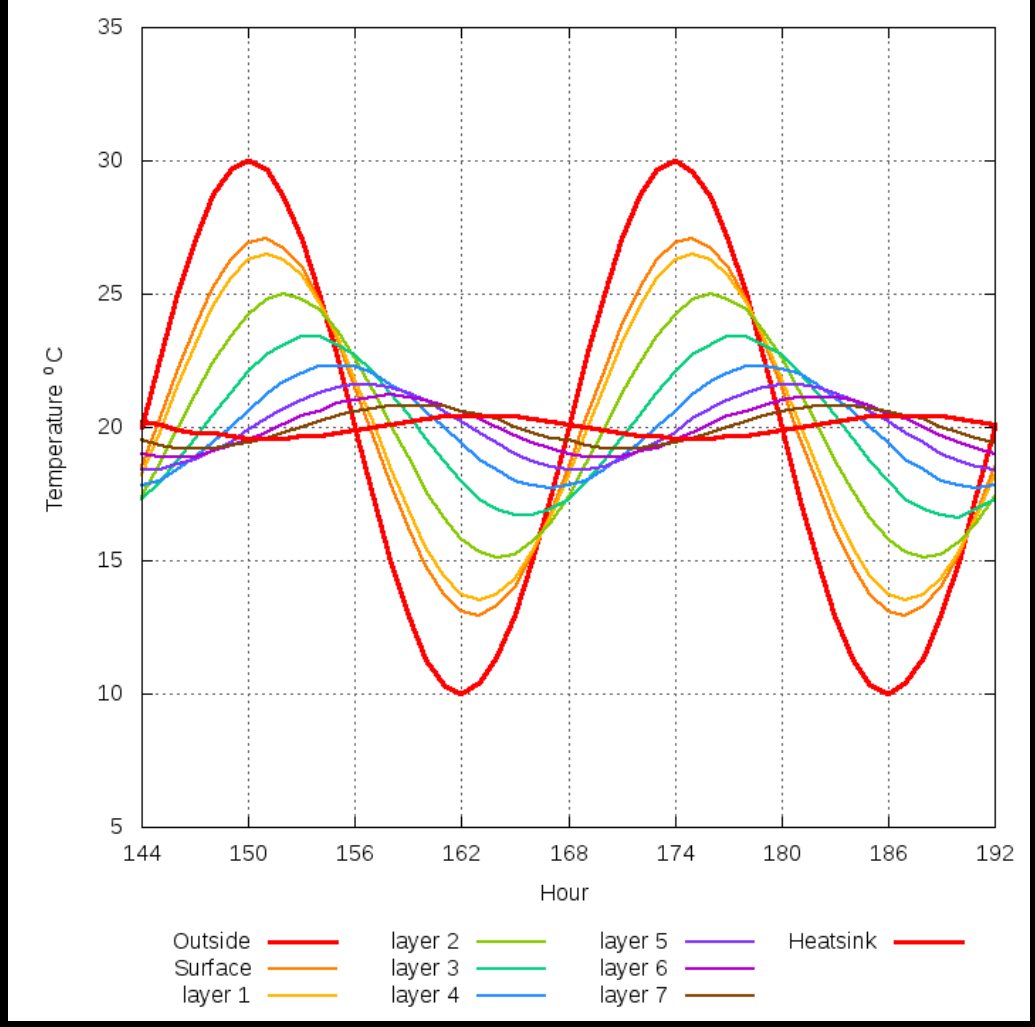
1971 – 2009

An unpredicted collapse of the metro under the road in front of the building reduced the life of the archive to much less than the predicted life span of the stored documents, which were crumpled under many tons of brick.

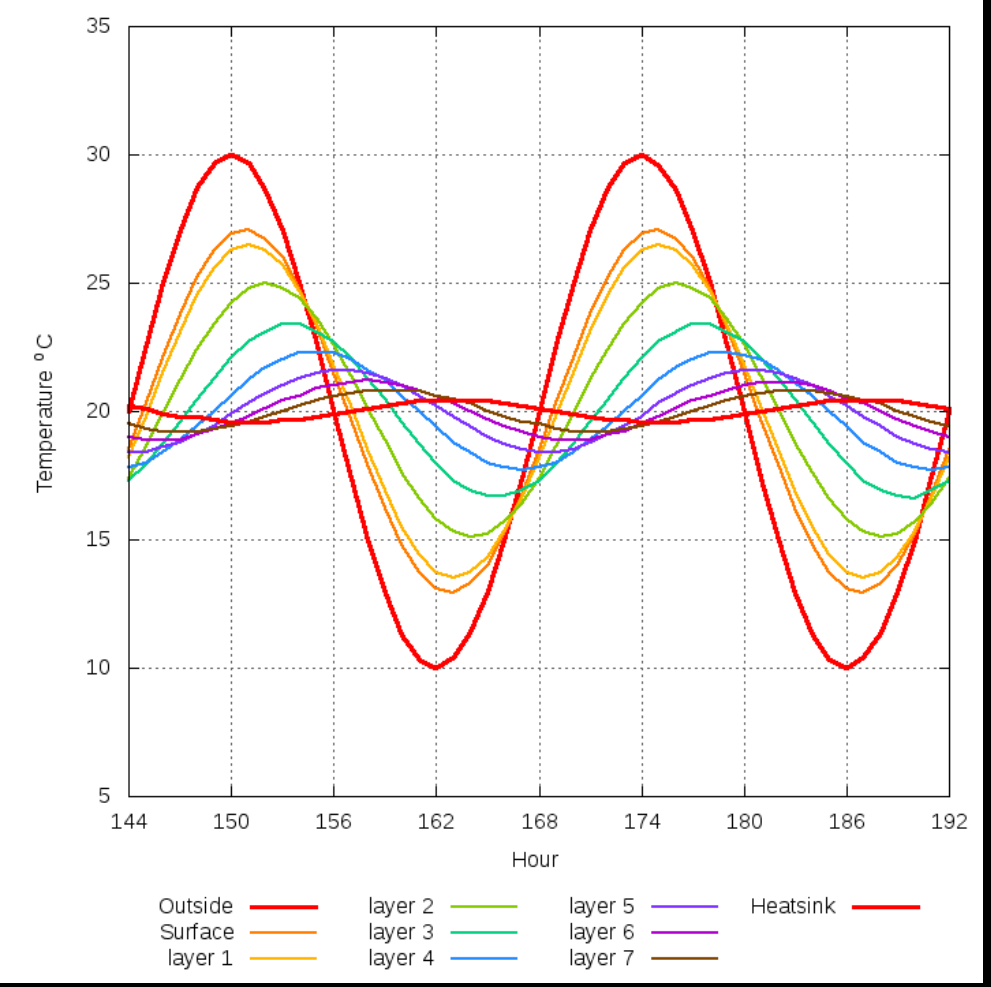
Is it necessary to have a heavy building with high thermal capacity to ensure an even temperature?

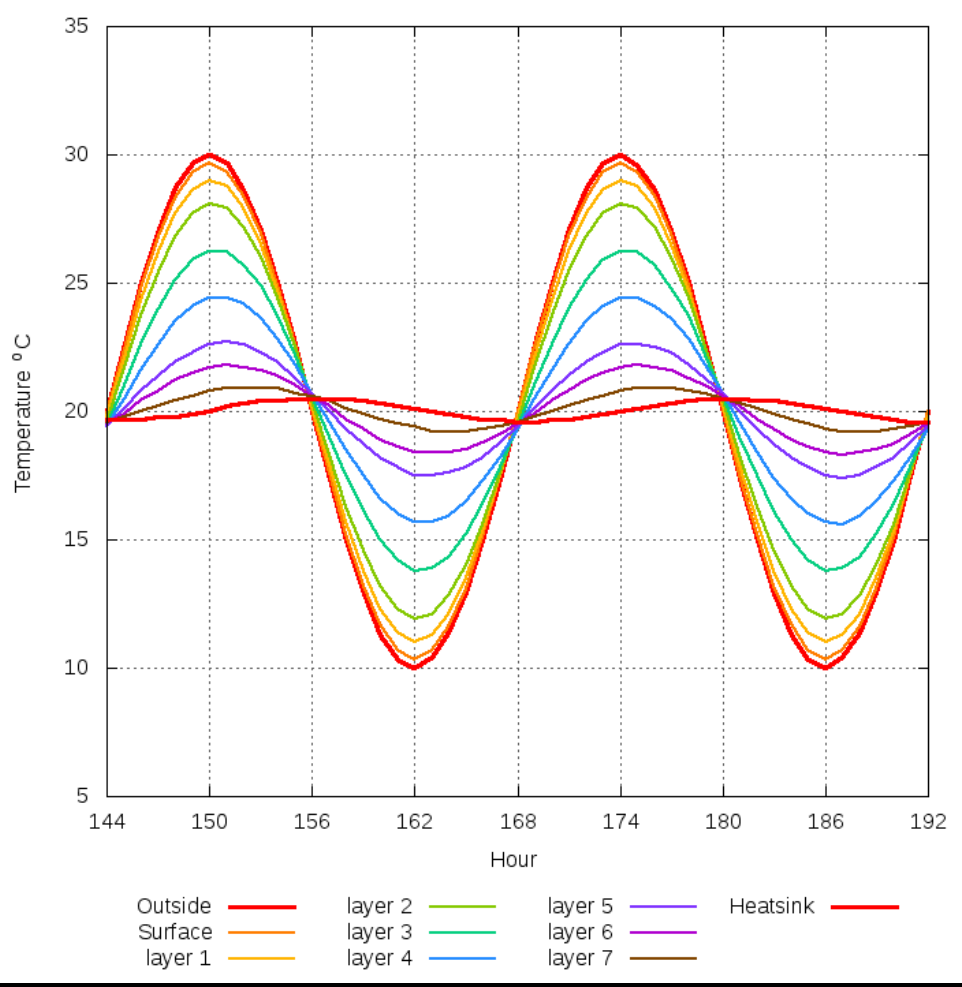


An archive has no internal heat source. The temperature is defined by heat moving through the wall



Temperature distribution through a 240 mm brick wall. Heat from the daily outdoor cycle is stored within the wall.
The middle red curve shows the temperature of the room.

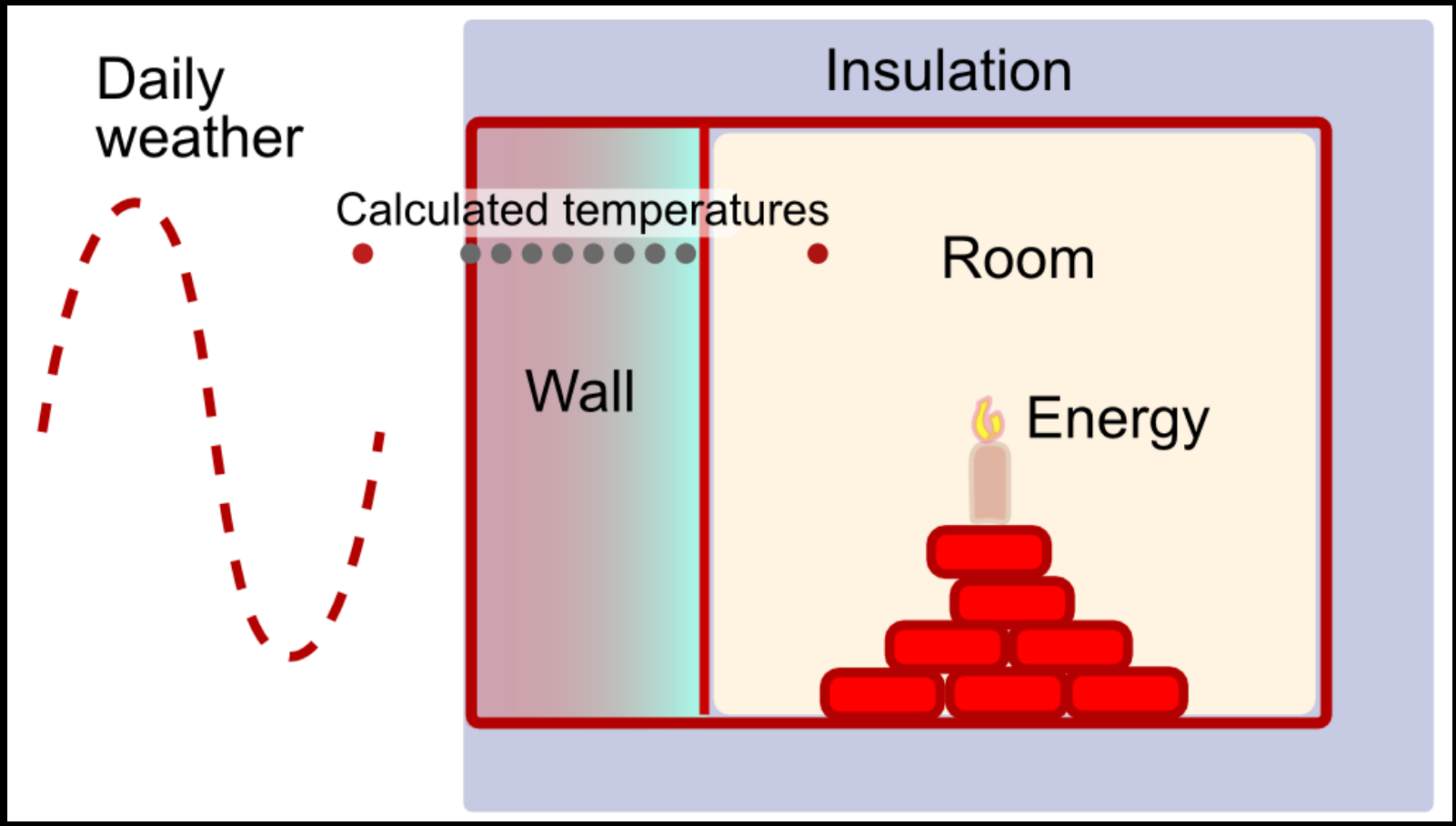




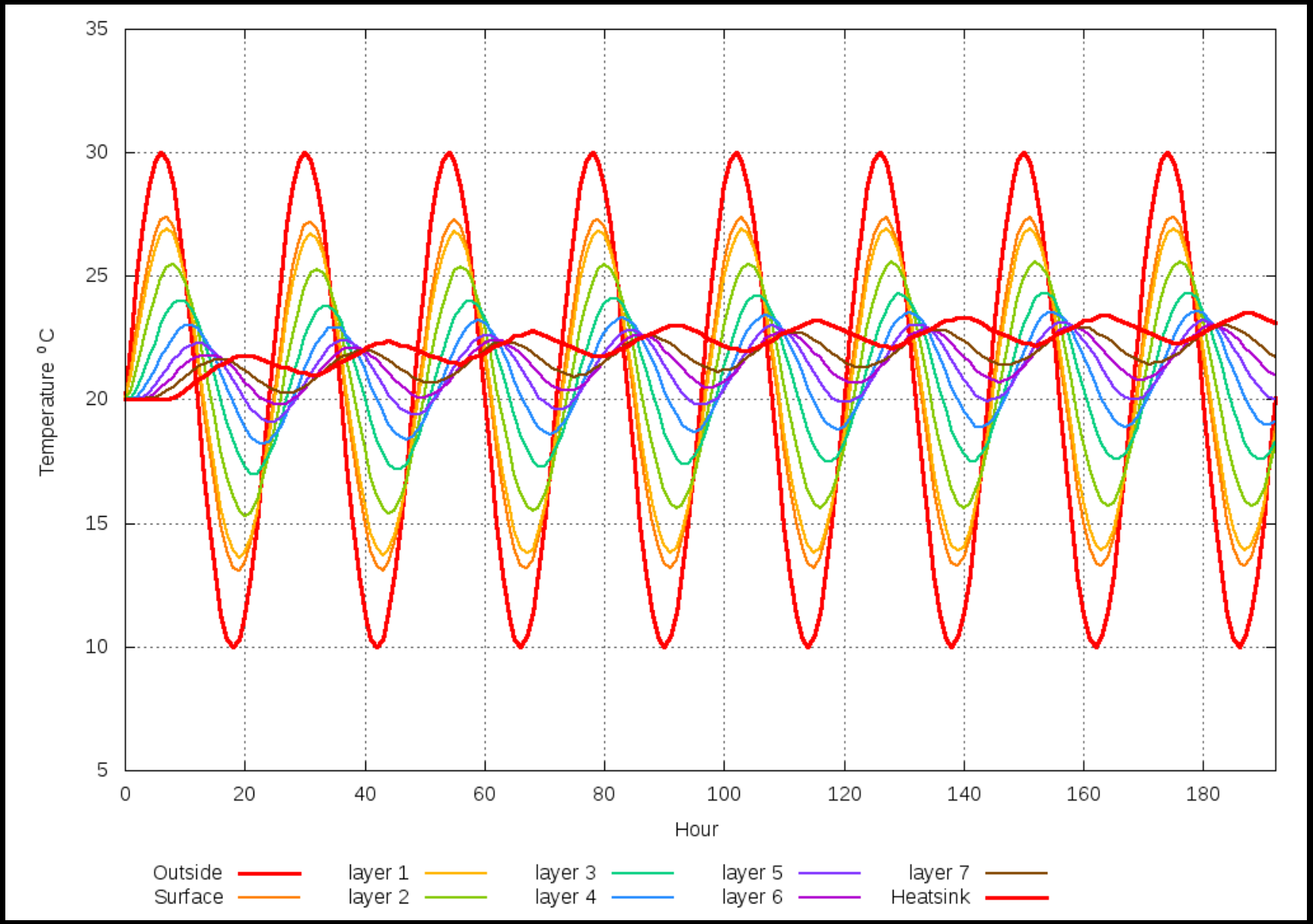
Compare the 240 mm brick wall (left) with a 100 mm insulating foam wall (right).

THE DAILY EBB AND FLOW OF HEAT IS THE SAME AT THE INTERIOR SURFACE

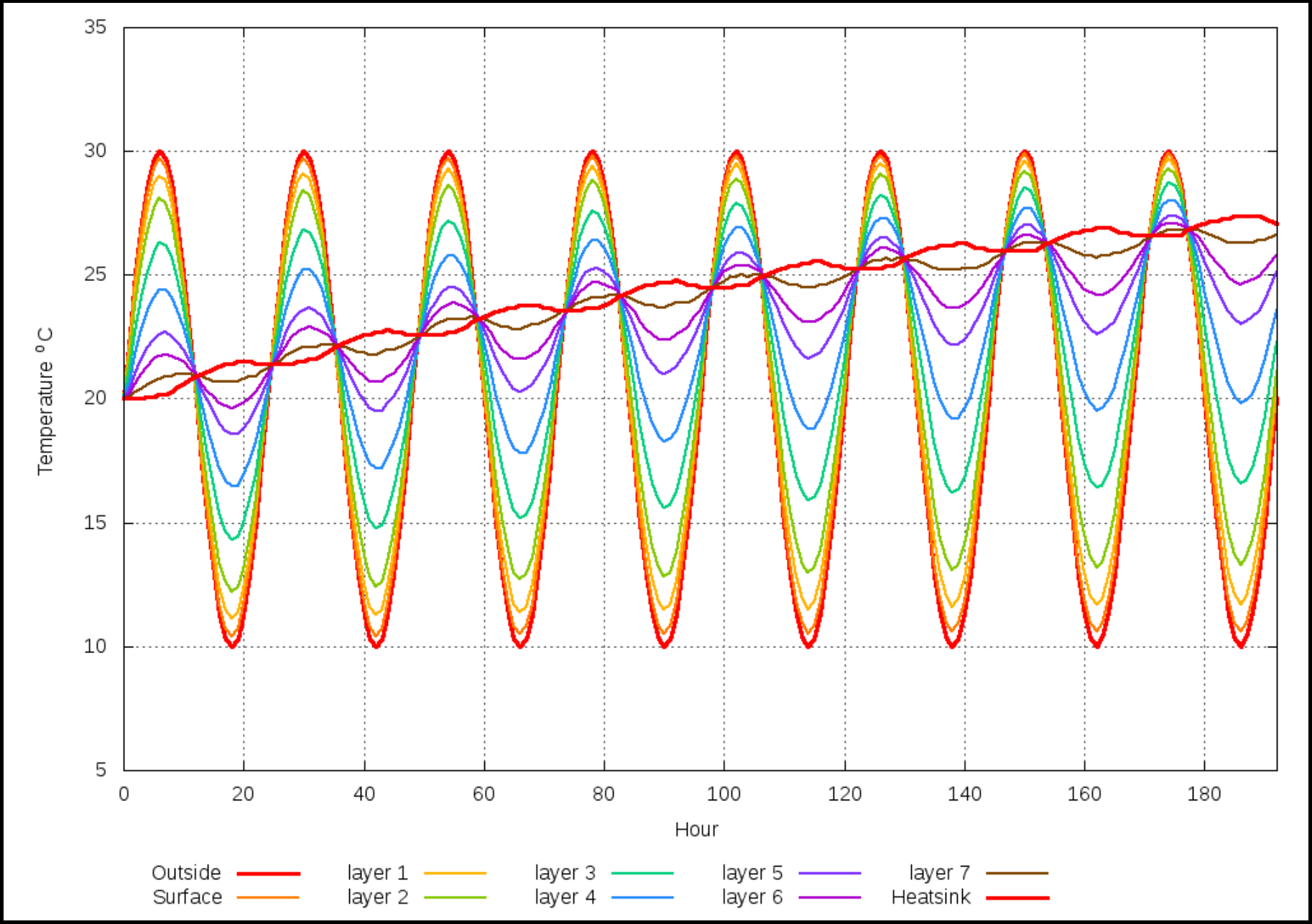
COMPARISON WITH A HEATED BUILDING



A museum exhibition generates internal heat. In the following graphs the heat flow is $10 W/m^2$ of wall for a twelve hour period every day.



The temperature within the brick museum rises towards a steady state with about four degree temperature rise.



But the insulating wall shows an eight degree temperature rise.

So why do we build archives (at Ipswich UK above) from massive brick?

and museums (Danish National Gallery, right) from hi–tech glass and insulated walls?

LET'S TRY AGAIN:

A standard insulated agricultural store serves as a starting model for an archive of lightweight construction.

But for museums, a suitable model is the City Museum of Berlin

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Workshop in low energy museum building
October 2010 in Copenhagen

www.conservationphysics.org/cpw/Storage