



Using wax in walls to save energy

TakeAIM Winner 2015:
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With the threat of climate change, and many families struggling to pay energy bills, we must reduce energy consumption in our buildings. Heating and cooling buildings uses a lot of energy. Can we instead store heat during the day, to be used at night, smoothing out temperature changes, and reducing the demand for heating and cooling?

Thick, heavyweight walls can store a lot of heat. However, modern, lightweight buildings, with lots of glass and steel, need a new way to store heat. One such way is to add materials like wax to walls. Wax stores and releases heat as it melts and solidifies.

We use a mathematical model to describe how, with walls containing wax, temperatures change in response to scenarios like periods of hot weather. Using our model, we find the ideal wall thickness and amount of wax - enough to substantially smooth out temperature changes, but not so much that some wax stays solid. Our ideal wall could be mass-manufactured, as plasterboard containing wax, to be used both in new buildings, and in retrofitting existing ones.

Construction companies are increasingly under pressure to construct energy-efficient buildings, and our walls containing wax could help them to achieve this. Smoothing out temperature variations is beneficial to us all, keeping us comfortable, and is especially beneficial to the elderly, who are particularly sensitive to temperature extremes. Reducing the need for extra heating and cooling reduces our energy consumption, therefore reducing our contribution to climate change and our energy bills too.

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The use of mathematics has profound consequences in all walks of life, but the opportunities that it opens up often go unrecognised or underexploited. The Smith Institute, enabled by the generous sponsorship of our leading corporate partners, ran the fifth annual TakeAIM competition in 2015 to make visible the crucial role that mathematics will increasingly play in all aspects of our lives. The competition was open to all undergraduate and postgraduate students working in the mathematical sciences. The authors of the two best entries each received £1,000 of Apple vouchers as their prize, with £100 of Amazon vouchers being awarded to four runners-up.