

Thermal modelling for inter-seasonal energy earth bank storage using solar heat applied to buildings

Concept

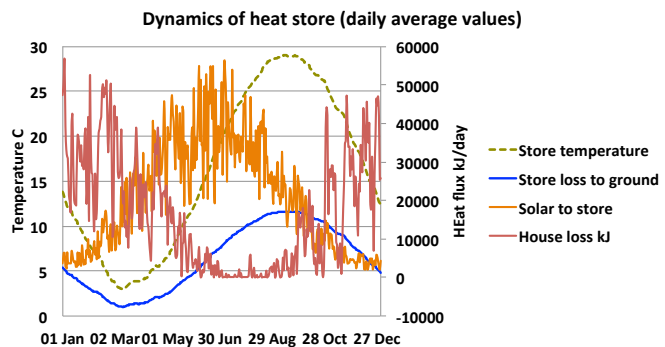
- Use rooftop PV-thermal panels to collect heat, pump into ground loop and store in earth under building. Extract for heating with heat pump.
- PVT panels more efficient than PV for electricity due to lower temperatures.
- Possible 'zero carbon' building solution.
- Store created using augured holes, no need for expensive drilling rig
- Higher store temperatures than borehole

Model

Hourly model of solar heat flux to store:

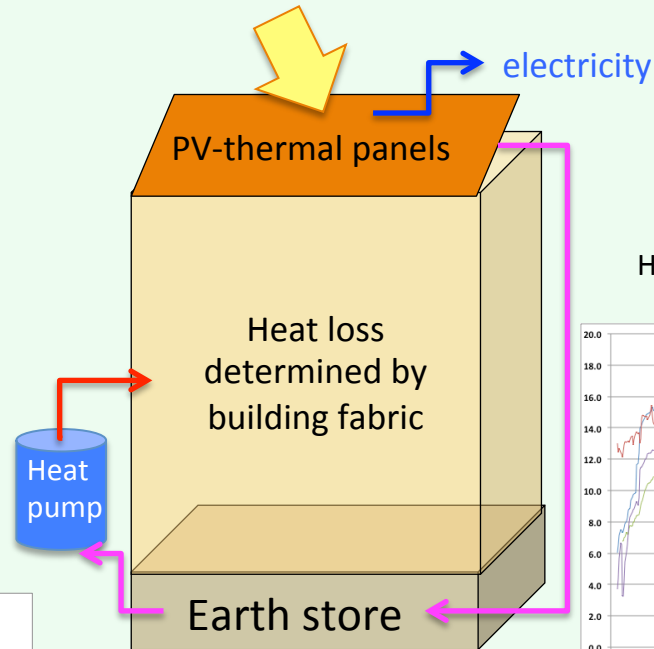
- Heat loss from store by conduction to ground
- Steady-state building heat loss to outside
- Hourly weather data for Birmingham
- Assumes uniform store temperature
- Highly insulated: building and store $U=0.12$

Store temp. max late summer, min late winter



Research question

Sizing of panels, storage, insulation of store to meet demand, dynamics

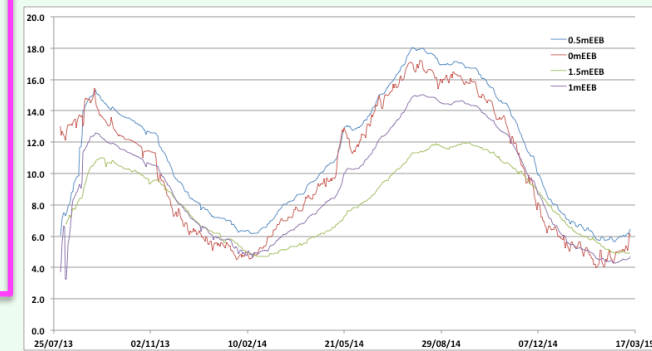


Insulation on sides but not underneath

Application, 1.5m depth



House installation, Leicester (Caplin Homes) <https://youtu.be/d9nQEwwrJGQ>



Measured performance, Leicester

Conclusions

- Complex dynamic behaviour over year and within ground. Store insulation important. Increasing depth also increases heat loss. Larger buildings have better roof/store/heat loss ratio for this approach.
- Next step: test facility at De Montfort University, and data from houses using system