

Anonymous Attendee

What are the heat exchanger requirements for these systems?

Nicholas Jankowski

Once we know and can predict how a material super-cools, what do we do with that information to reduce the energy penalty you showed other than picking different materials? Has there been any general progress in nucleation control?

Andrew Rohskopf

What is the molecular design space for discovering new PCMs for TES?

Is the goal basically to find new functional groups, dopants, nanostructures, etc. that maximize latent heat of fusion?

Rick Clemenzi

Low "value" but "HUGE" volume across the economy!!

Arpit Dwivedi

Cost of heat exchanger for bringing heat in and out is a major part of phase change energy storage system. What are your thoughts on the economics of the system, say even after we have tunable high heat capacity material?

Renkun Chen

Ravi, great talk. You mentioned the control of the sensible heat flow or temperature. What is your thought about the control of the latent heat or moistures? Are there similar concepts such as tunable or switchable control for moisture?

Som Shrestha

Materials with tunable thermal conductivity feasible for building envelope application are not available currently. So, how about diverting the unwanted heat and coolness from the building envelope and store it in a thermal storage system and use the heat or coolness when and where needed? This will allow using the low-grade thermal energy as thermal energy without converting it to electrical energy, which is the concern raised in the previous question.

Anonymous Attendee

One of the first of these MIT seminars included a presentation about thermal insulation and storage at scale saying (para phrasing) 'you can't get cheaper than dirt, so use it'. Have DOE/others looked at ground source storage (as opposed to just direct heat pumping) as a cost-effective thermal storage option on supply or demand side?

Anonymous Attendee

Hi Ravi, thanks for the great presentation. How can we handle the volume change of the phase change materials before and after phase change once they have been enveloped?

Andrew Rohskopf

Are there any molecular features that are known to work best for PCMs?

Xiaobing Liu

Regarding the economics of thermal storage, I think the potential long lifespan of the TES should be considered. The long life and frequent operations of the TES could make it economically competitive.

Stefan Henninger

What is your proposal to overcome typical heat transfer issues, e.g. if solidification starts, you typically build an isolation on your heat exchanger? So how to get heat quickly in and out?

Rohini Bala Chandran

From an economics standpoint for thermal energy storage systems: the ice-based storage has been used for a very long time (even for district level heating and cooling) and quite economic; depending upon the geographic location, we also get snow/ice for free in cold-weather places. Which of the discussed technologies has the potential to outcompete with ice-based storage and what are the drawbacks of this technology?

Ethan Novek

If you had some liquid with a specific heat capacity at 1.8X greater than water (7.56 J/gdegC) and lower viscosity than glycol antifreeze, and the liquid is also non-toxic, non-flammable, non-volatile, and costs less than \$2000 per metric ton, how would you accelerate its deployment?

Arpit Dwivedi

Why do we tune melting temperatures rather than using different materials since bringing ions in and out for tunability will reduce the round-trip efficiency?

Carlos Daniel Diaz Mari

Can you comment on what you see as advantages and disadvantages of PCM in the demand site over district heating/geothermal pumps where heat is stored sensibly underground/in a network?

Adam Wilson

Can these concepts be combined with passive radiative heating and cooling by dynamically tuning optical properties of buildings?