Something in Store? Principles of Danish Low-Energy Storage Buildings

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Summary

Contrary to the other talks focusing mainly on public access to storage facilities my talk was dedicated to a presentation of the so-called low-energy museum storage facility. In order to qualify as such the structure of a purposely build storage facility requires an extremely well-insulated superstructure or "building envelope". It must have a high thermal inertia that keeps temperature variations to a minimum, using the ground beneath the floor for heat storage.

A building fulfilling these requirements removes the need for active heating; it is possible to rely entirely on a low air exchange rate and to dispense with forced ventilation. When necessary, in response to challenging climate conditions, provision is made for activating mechanical dehumidification, which can be driven by solar energy. The relative humidity can be kept at 40 % or 50 % while the temperature in a temperate climate would fluctuate seasonally between 9° centigrade in winter and 15° centigrade during summer.

The presentation discussed pertinent questions like how purposely built low-energy storage facilities may challenge access to museum staff as well as external researchers and visitors. Especially the question of the so called glass transition temperature, or Tg for short, of modern objects or paintings made by polymers (plastics, acrylics etc). Each polymer has a different Tg and when the polymer is cooled below this temperature, it becomes hard and brittle, like glass and prone to cracking if it is knocked etc. A crucial factor is the speed of impact. Short sudden shocks would be far more likely to cause cracking at sub-Tg temps, but as long as good standards for moving works of art occur, then there should not be a danger.

The lecture presented examples of constructions of low-energy storage buildings and demonstrated their effectiveness. For more detailed information I refer to M. Ryhl-Svendsen, L.AA. Jensen, B. Bøhm, P.K. Larsen (2012), 'Low-energy Museum Storage Buildings: Climate, Energy Consumption and Air Quality. UMTS Research Project 2007-2011: Final Data Report'. The report is available as a PDF via this link: www.conservationphysics.org/storage/low-energy_museum_storage_buildings.pdf

The select bibliography (as a PDF) will offer a variety of information pertaining to the establishment of low-energy storage facilities in Denmark and related issues. The most recent study, 'Performance of Danish low-energy museum storage buildings', will be presented at the *ICOM Committee for Conservation Triennial Conference*, September 4-8, 2017, in Copenhagen.

Selected bibliography:

Ankersmit, B. *Managing Indoor Climate Risks in Museums*, Springer: Switzerland, 2016.

Bøhm, Benny; Ryhl-Svendsen, Morten. 'Analysis of the thermal conditions in an unheated museum store in a temperate climate. On the thermal interaction of earth and store.', In *Energy and Buildings*, no. 43 (2011), pp. 3337-3342.

Mecklenberg, M.F. *Determining the Acceptable Ranges of Relative Humidity and Temperature in Museums and Galleries*, Smithsonian Museum Conservation Institute, 2007.

Ræder Knudsen, L. & Rosenvinge Lundbye. 'Performance of Danish low-energy museum storage buildings', *ICOM-CC 18th Triennial Conference, Copenhagen 4-8 September 2017* (forthcoming)

Ryhl-Svendsen, Morten; Aasbjerg Jensen, Lars; Klenz Larsen, Poul; Bøhm, Benny; Padfield, Tim. 'Ultra-low-energy museum storage.' In Bridegland, Janet (ed.) *Preprints: ICOM-CC 16th Triennial Conference, Lisbon 19-23 September 2011*. Producao Grafica, Lda., Lissabon, 2011.

Ryhl-Svendsen, Morten; Klenz Larsen, Poul; Aasbjerg Jensen, Lars; Morawska, Lidia (ed). 'Ultra-low energy buildings for storage in museums and archives.' Paper presented at *Healthy Buildings 2012*, Brisbane, Australia, 2012.

Ryhl-Svendsen, Morten; Aasbjerg Jensen, Lars; Klenz Larsen, Poul; Bøhm, Benny; Padfield, Tim. 'A museum building controlled by solar energy.' In Ashley-Smith, Jonathan, Burmester, Andreas, Eibl, Melanie (eds.). *Climate for Collections: Standards and Uncertainties*. London: Archetype, 2013, p. 141.