10 questions concerning sustainable building renovation

In countries all over Europe the need for building renovation is receiving increased attention. One reason for this is an ageing building stock. Another reason is the need for more environmentally sustainable buildings with reductions in energy consumption and greenhouse gas emissions to limit the harmful climate impact. There is at the same time a need to upgrade many buildings to improve the quality of life – social sustainability, for instance improve indoor climate; and to increase productivity in the building process to ensure affordable housing – economic sustainability. Low productivity and frequent conflicts in the construction sector have led to an increasing interest in new forms of collaboration between the different stakeholders involved in construction projects. Development of strategic partnerships concerning a portfolio of renovation projects are seen as a promising way to achieve more sustainable building renovation for some large building clients and for companies with a high maturity in collaborative practice. There is a large number of tools for design decision support and systems for sustainability certification of buildings, but there are not many tools and systems dedicated to building renovation. Measuring the different dimensions of sustainability is a challenge. Regulations play a central role in opening the markets for sustainable building renovation through incentive schemes, building codes, etc. Although traditional approaches to energy renovation emphasize more efficient heating and lighting systems and better insulation, there is a tendency to address the challenge more holistically by emphasizing social targets.
Scopus rating (2003): SJR 0.898 SNIP 0.963
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.216 SNIP 1.436
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.809 SNIP 1.065
Scopus rating (2000): SJR 0.585 SNIP 1.086
Scopus rating (1999): SJR 0.54 SNIP 1.137
Original language: English
Keywords: Building, Measurements, Partnerships, Renovation, Sustainability, Targets
DOI:
10.1016/j.buildenv.2018.06.051
Source: FindIt
Source-ID: 2436448989
Research output: Research - peer-review › Journal article – Annual report year: 2018

Learning from Digitalised Industries: Designing Value Propositions for Disruption
Digitalisation changes the way business is made. In some industries, digital disruption has been caused by companies like AirBnB and Netflix, whereas in other industries the opportunities stemming from digitalisation have still not been fully utilised. In this article, we explore how companies from less digital industries may create digital business opportunities by learning from successful digital companies in other industries. A 3-hour workshop set-up is developed and the findings from two workshops with 17 participants from the construction industry are described. It is shown how an analysis of the customer profiles of well-known companies facilitate cross-industrial learning and aid the creation of new ideas for digital value propositions. Although substantial further work is necessary before the full potential of the ideas may be harvested, we believe the described workshop method represents a tangible first step in creating digital business model innovation.

General information
State: Published
Organisations: Department of Management Engineering, Engineering Systems, Copenhagen Center for Health Technology, NIRAS A/S
Contributors: Ernstsen, S. K., Koch-Ørvad, N., Berg, J. B., Brinck, S., Thuesen, C., Maier, A.
Number of pages: 9
Publication date: 2018
Peer-reviewed: Yes
Electronic versions:
ISPIM_full_paper_v7.pdf
Source: PublicationPreSubmission
Source-ID: 151962708
Research output: Research - peer-review › Paper – Annual report year: 2018

Prerequisites for Successful Strategic Partnerships for Sustainable Building Renovation
The purpose of this paper is to identify the prerequisites for establishing successful strategic partnerships in relation to renovating buildings sustainably. Establishing strategic partnerships is in the paper seen as a potential way to make building renovation more sustainable in Denmark particularly in terms of reducing energy consumption and use of resources and increase productivity. However, until now we have only had a limited number of such partnerships implemented and the few examples that do exist, mostly concern the construction of new buildings. The paper is based on an investigation and analysis of strategic partnerships models as well as typical processes used in building renovation. Experiences from development of new strategic partnerships have particularly been found in the UK and Sweden. Based on two workshops with practitioners representing the whole value chain in the construction industry and analyses of two exemplary cases the paper suggests prerequisites for establishing successful strategic partnerships for sustainable building renovation. The results show that strategic partnerships are collaborations set up between two or more organizations that remain independent with the purpose of obtaining a goal of mutual and high priority based on a binding commitment and a long term perspective by a consecutive number of projects. An essential prerequisite for most of the identified challenges in building renovation processes is stable project partners. Framework agreements is a way to legally establish collaboration with more stable project partners, but it is also in itself an important prerequisite to target challenges related to tender, competition and an extreme focus on lowest price.

General information
State: Published
Organisations: Department of Management Engineering, Management Science, Implementation and Performance Management, Engineering Systems
Contributors: Jensen, P. A., Johansen, J. B., Thuesen, C.
Pages: 230-241
Experimental investigations on cylindrical latent heat storage units with sodium acetate trihydrate composites utilizing supercooling

Latent heat storage units utilizing stable supercooling of sodium acetate trihydrate (SAT) composites were tested in a laboratory. The stainless steel units were 1.5 m high cylinders with internal heat exchangers of tubes with fins. One unit was tested with 116 kg SAT with 6% extra water. Another unit was tested with 116.3 kg SAT with 0.5% Xanthan rubber as a thickening agent and 4.4% graphite powder. The heat exchange capacity rate during charge was significantly lower for the unit with SAT and Xanthan rubber compared to the unit with SAT and extra water. This was due to less convection in the thickened phase change material after melting. The heat content in the fully charged state and the heat released after solidification of the supercooled SAT mixtures at ambient temperature was higher for the unit with the thickened SAT mixture. The heat discharged after solidification of the supercooled SAT with extra water decreased over repeating charge and discharge cycles while the heat discharged from the SAT with Xanthan rubber remained stable. In both units, the solidification started spontaneously in the majority of the test cycles. This was due to the design of the unit or the method for handling the expansion and contraction of the SAT during charge and discharge.
Experimental investigations on heat content of supercooled sodium acetate trihydrate by a simple heat loss method

Sodium acetate trihydrate is a phase change material that can be used for long term heat storage in solar heating systems because of its relatively high heat of fusion, a melting temperature of 58 °C and its ability to supercool stable. In practical applications sodium acetate trihydrate tend to suffer from phase separation which is the phenomenon where anhydrous salt settles to the bottom over time. This happens especially in supercooled state. The heat released from the crystallization of supercooled sodium acetate trihydrate with phase separation will be lower than the heat released from sodium acetate trihydrate without phase separation. Possible ways of avoiding or reducing the problem of phase separation were investigated. A wide variety of composites of sodium acetate trihydrate with additives including extra water, thickening agents, solid and liquid polymers have been experimentally investigated by a simple heat loss method.
The aim was to find compositions of maximum heat released from the crystallization of supercooled sodium acetate trihydrate samples at ambient temperature. It was found that samples of sodium acetate trihydrate with 0.5–2% (wt.%) Carboxy-Methyl Cellulose, 0.3–0.5% (wt.%) Xanthan Gum or 1–2% (wt.%) of some solid or liquid polymers as additives had significantly higher heat contents compared to samples of sodium acetate trihydrate suffering from phase separation.

General information
State: Published
Organisations: Department of Civil Engineering, Section for Building Energy, Management Science
Contributors: Kong, W., Dannemand, M., Johansen, J. B., Fan, J., Dragsted, J., Englmaier, G., Furbo, S.
Pages: 249-257
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Solar Energy
Volume: 139
ISSN (Print): 0038-092x
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.89 SJR 1.615 SNIP 1.791
Web of Science (2017): Impact factor 4.374
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.52 SJR 1.504 SNIP 1.746
Web of Science (2016): Impact factor 4.018
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.61 SJR 1.912 SNIP 2.085
Web of Science (2015): Impact factor 3.685
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.77 SJR 1.962 SNIP 2.671
Web of Science (2014): Impact factor 3.469
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.44 SJR 1.99 SNIP 2.85
Web of Science (2013): Impact factor 3.541
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.65 SJR 1.605 SNIP 2.517
Web of Science (2012): Impact factor 2.952
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.19 SJR 1.283 SNIP 2.178
Web of Science (2011): Impact factor 2.475
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.369 SNIP 2.16
Web of Science (2010): Impact factor 2.172
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.265 SNIP 2.158
Experimental investigations on prototype heat storage units utilizing stable supercooling of sodium acetate trihydrate mixtures

Laboratory tests of two heat storage units based on the principle of stable supercooling of sodium acetate trihydrate (SAT) mixtures were carried out. One unit was filled with 199.5 kg of SAT with 9% extra water to avoid phase separation of the incongruently melting salt hydrate. The other unit was filled with 220 kg SAT mixture thickened with 1% carboxymethyl cellulose. The heat exchange capacity rate during the charging of the unit with the extra water was significantly higher than for the unit with the thickening agent due to the different levels of convection. The SAT mixtures in the units were stable and supercooled at indoor ambient temperatures for up to two months, after which the units were discharged. The energy discharged after solidification of the supercooled SAT and water mixture was 194 kJ/kg in the first test cycle, dropping to 179 kJ/kg after 20 test cycles. The energy discharged from the unit with SAT and the thickening agent after solidification was stable at 205 kJ/kg over 6 test cycles.
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 8.44 SJR 3.162 SNIP 2.765
Web of Science (2017): Impact factor 7.9
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.011 SNIP 2.61
Web of Science (2016): Impact factor 7.182
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.4 SJR 2.835 SNIP 2.593
Web of Science (2015): Impact factor 5.746
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.93 SJR 3.158 SNIP 3.218
Web of Science (2014): Impact factor 5.613
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 6.59 SJR 3.06 SNIP 3.346
Web of Science (2013): Impact factor 5.261
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 5.69 SJR 2.778 SNIP 3.076
Web of Science (2012): Impact factor 4.781
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 5.5 SJR 2.416 SNIP 2.827
Web of Science (2011): Impact factor 5.106
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.531 SNIP 2.259
Web of Science (2010): Impact factor 3.915
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.992 SNIP 1.85
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.95 SNIP 1.206
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.168 SNIP 1.704
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.95 SNIP 1.277
Scopus rating (2005): SJR 1.02 SNIP 0.988
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.67 SNIP 0.844
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.713 SNIP 0.775
Scopus rating (2002): SJR 0.589 SNIP 0.779
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.368 SNIP 0.567
Scopus rating (2000): SJR 0.154 SNIP 0.498
Laboratory Testing of Solar Combi System with Compact Long Term PCM Heat Storage

To enable the transition from fossil fuels as a primary heat source for domestic hot water preparation and space heating, solar thermal energy has great potential. The heat from the sun has the disadvantage that it is not always available when there is a demand. To solve this mismatch a thermal seasonal storage can be used to store excess heat from the summer to the winter when the demand is higher than the supply. Installing a long term thermal storage in a one family house it needs to be compact and sensible heat storages are not suitable. A latent heat storage with a phase change material (PCM) can provide a more compact way of storing heat. Sodium acetate trihydrate (SAT) is a good candidate material as it has a relatively high heat of fusion and in addition it has the ability to supercool to room temperature without solidifying.

In this paper results from the test of a solar combi system with a latent heat storage with SAT is presented. The SAT heat storage modules were heated to 80 °C by the solar collectors 53 times in the test period from June to November 2015 and this enabled the modules to supercool. Supercooling was achieved for 39 days for a SAT module after which 11 kWh of heat were discharged.

Laboratory Test of a Cylindrical Heat Storage Module with Water and Sodium Acetate Trihydrate

Cylindrical heat storage modules with internal heat exchangers have been tested in a laboratory. The modules were filled with water and sodium acetate trihydrate with additives. The testing focused on the heat content of the storage material and the heat exchange capacity rate during charge of the module. For the tests with the phase change materials, the focus was furthermore on the stability of supercooling and cycling stability. Testing the module with sodium acetate trihydrate and 6.4% extra water showed that phase separation increased and the heat released after solidification of supercooled phase change material was reduced over 17 test cycles. The heat released after solidification of the supercooled sodium acetate trihydrate with thickening agent and graphite was stable over the test cycles. Stable supercooling was obtained in 7 out of 17 test cycles with the module with sodium acetate trihydrate with extra water and in 6 out of 35 test cycles for the module with thickening agent.
Solidification behavior and thermal conductivity of bulk sodium acetate trihydrate composites with thickening agents and graphite

Sodium acetate trihydrate is a promising phase change material for long term storage of solar thermal energy if supercooling is actively utilized. Well performing thermal energy storages need to be able to charge and discharge energy at a high rate. The relatively low thermal conductivity of the phase change material limits the heat exchange capacity rate to and from the storage. Another factor that limits the heat transfer is the contraction and expansion of the salt hydrate during the phase change. This density change causes formation of cavities inside the solid storage material. Investigations of the solidification behavior, the formation of cavities and thermal conductivity of composites based on sodium acetate trihydrate crystalizing with or without supercooling are presented in this paper. The thermal conductivity was measured with an ISOMET hot disc surface measurement probe. Samples that crystalized without supercooling tended to form solid crystals near the heat transfer surface and cavities away from the heat transfer surface. The measured thermal conductivity was up to 0.7 W/m K in solid sodium acetate trihydrate. Samples that crystallized from supercooled state formed fewer large cavities but had a lower thermal conductivity. A composite with sodium acetate trihydrate, thickening agent and 5% graphite flakes had a thermal conductivity of up to 1.1 W/m K.
Testing of PCM Heat Storage Modules with Solar Collectors as Heat Source

A latent heat storage based on the phase change material Sodium Acetate Trihydrate (SAT) has been tested as part of a demonstration system. The full heat storage consisted of 4 individual modules each containing about 200 kg of sodium acetate trihydrate with different additives. The aim was to actively utilize the ability of the material to supercool to obtain long storage periods. The modules were charged with solar heat supplied by 22.4 m² evacuated tubular collectors. The investigation showed that it was possible to fully charge one module within a period of 270 minutes with clear skies. In long periods with high level of irradiance several modules were charged in parallel due to the limited heat exchange capacity of the integrated heat exchanger of the modules. After the modules were heated to more than 80 °C they were set to passively cool down. Modules reached 30 °C in a period of parallel cool down without the sodium acetate trihydrate solidified in 3 of the 4 modules. Further tests showed that stable supercooling at ambient temperature is possible.
Laboratory test of a prototype heat storage module based on stable supercooling of sodium acetate trihydrate

Laboratory test of a long term heat storage module utilizing the principle of stable supercooling of 199.5 kg of sodium acetate water mixture has been carried out. Avoiding phase separation of the incongruently melting salt hydrate by using the extra water principle increased the heat storage capacity. An external expansion vessel minimized the pressure built up in the module while heating and reduced the risk of instable supercooling. The module was stable supercooled at indoor ambient temperature for up to two months after which it was discharged. The energy discharged after activating the supercooled sodium acetate water mixture was 194 kJ/kg of sodium acetate water mixture in the first test cycles dropping to 179 kJ/kg in the later test cycles. Instability of the supercooling occurred when the charging periods were short and in the last test cycles where the tube connecting the module to the expansion vessel had been blocked by the salt hydrate.

General information
State: Published
Organisations: Department of Civil Engineering, Section for Building Physics and Services
Contributors: Dannemand, M., Kong, W., Fan, J., Johansen, J. B., Furbo, S.
Pages: 172-181
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Energy Procedia
Volume: 70
ISSN (Print): 1876-6102
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.44 SJR 0.495 SNIP 0.799
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.16 SJR 0.464 SNIP 0.598
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.92 SJR 0.359 SNIP 0.562
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.09 SJR 0.429 SNIP 0.807
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.02 SJR 0.42 SNIP 0.778
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 1.08 SJR 0.411 SNIP 0.55
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 2.42 SJR 0.877 SNIP 1.45
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.416 SNIP 0.91
Web of Science (2009): Indexed yes
Original language: English
Keywords: Seasonal heat storage, Sodium acetate trihydrate, Supercooling, Prototype testing, Thermal energy storage
Electronic versions:
SHC2014_paper_dannemand_final_v2.pdf
Laboratory_test_of_a_prototype.pdf

Bibliographical note
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Source: PublicationPreSubmission
Source-ID: 102116302
Research output: Research - peer-review › Conference article – Annual report year: 2015
Long term thermal energy storage with stable supercooled sodium acetate trihydrate

Utilizing stable supercooling of sodium acetate trihydrate makes it possible to store thermal energy partly loss free. This principle makes seasonal heat storage in compact systems possible. To keep high and stable energy content and cycling stability phase separation of the storage material must be avoided. This can be done by the use of the thickening agents carboxymethyl cellulose or xanthan rubber. Stable supercooling requires that the sodium acetate trihydrate is heated to a temperature somewhat higher than the melting temperature of 58 °C before it cools down. As the phase change material melts it expands and will cause a pressure built up in a closed chamber which might compromise stability of the supercooling. This can be avoided by having an air volume above the phase change material connected to an external pressure less expansion tank. Supercooled sodium acetate trihydrate at 20 °C stores up to 230 kJ/kg. TRNSYS simulations of a solar combi system including a storage with four heat storage modules of each 200 kg of sodium acetate trihydrate utilizing stable supercooling achieved a solar fraction of 80% for a low energy house in Danish climatic conditions.

General information
State: Published
Organisations: Department of Civil Engineering, Steensen Varming
Contributors: Dannemand, M., Schultz, J. M., Johansen, J. B., Furbo, S.
Number of pages: 8
Pages: 671-678
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Applied Thermal Engineering
Volume: 91
ISSN (Print): 1359-4311
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.14 SJR 1.505 SNIP 1.837
Web of Science (2017): Impact factor 3.771
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.78 SJR 1.438 SNIP 1.851
Web of Science (2016): Impact factor 3.444
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.32 SJR 1.683 SNIP 1.884
Web of Science (2015): Impact factor 3.043
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.16 SJR 1.539 SNIP 2.187
Web of Science (2014): Impact factor 2.739
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.31 SJR 1.466 SNIP 2.469
Web of Science (2013): Impact factor 2.624
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.7 SJR 1.492 SNIP 2.422
Web of Science (2012): Impact factor 2.127
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.83 SJR 1.338 SNIP 2.186
Thermal conductivity enhancement of sodium acetate trihydrate by adding graphite powder and the effect on stability of supercooling

Sodium acetate trihydrate and graphite powder mixtures have been evaluated to investigate the influence of the graphite powder on the stability of supercooling. A sodium acetate and water mixture mixed with graphite powder was successfully supercooled at ambient indoor temperatures for five months. The graphite powder was stabilized using carboxymethyl cellulose and successfully tested in heating and supercooling cycles with no loss of performance. Thermal conductivity enhancing properties of graphite powder was shown in samples.

Since the experiments were conducted in small scale, at 200 g per sample, large scale experiments are required to validate graphite as a thermo conductivity enhancing agent, suitable for use in seasonal heat storage applications utilizing SAT.
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.44 SJR 0.495 SNIP 0.799
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.16 SJR 0.464 SNIP 0.598
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.92 SJR 0.359 SNIP 0.562
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.09 SJR 0.429 SNIP 0.807
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.02 SJR 0.42 SNIP 0.778
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 1.08 SJR 0.411 SNIP 0.55
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 2.42 SJR 0.877 SNIP 1.45
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.416 SNIP 0.91
Web of Science (2009): Indexed yes
Original language: English
Keywords: Thermal conductivity, Seasonal heat storage, Phase change material, PCM, Sodium acetate trihydrate, SAT, Graphite, Carbon, Supercooling, Xanthan gum, X-gum, Carboxymethyl cellulose, CMC
Electronic versions:
elsevier_40.pdf
DOIs:
10.1016/j.egypro.2015.02.121

Bibliographical note
This is an open access article under the CC BY-NC-ND license
Source: PublicationPreSubmission
Source-ID: 102018444
Research output: Research - peer-review › Conference article – Annual report year: 2015

Projects:

**Strategic Partnerships in the municipality of Copenhagen.**
Evaluation of strategic partnerships in the municipality of Copenhagen. Funded by Realdania.
Thuesen, C., PI, Department of Management Engineering, Engineering Systems
Berg, J. B., Col, Engineering Systems, Department of Management Engineering
Project ID: 81591
01/01/2017 → 31/12/2021
Nature of activity type: Research
Collaborators: Aalborg University, KTH - Royal Institute of Technology, Byggeriets Evaluering Center
Project: Research

**Radical improvements in sustainable building renovation based on new forms of collaboration and business models**
Berg, J. B., PhD Student, Department of Management Engineering
Thuesen, C., Main Supervisor, Department of Management Engineering
Jensen, P. A., Supervisor, Department of Management Engineering
Forskningsrådsfinansiering
01/08/2016 → 25/12/2019
Award relations: Radical improvements in sustainable building renovation based on new forms of collaboration and business models
Project: PhD
Development of PVT module for multiapartment buildings

Development of PVT module, which both can produce heat and electricity from solar radiation.

Furbo, S., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Berg, J. B., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Perers, B., Project Participant, Department of Civil Engineering, Section for Building Physics and Services

Project ID: 26395
01/01/2014 → 31/12/2014

Keywords: PVT module, Efficiency, Measurements

Collaborators: MAP Architects, STO Danmark A/S, RACELL SAPHIRE Technologies ApS

Development of seasonal compact heat storage

Cooperation with H.M. Heizkörper GmbH & Co. KG on development of PCM heat storage. Cooperation with H.M. Heizkörper GmbH & Co. KG.

Furbo, S., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Dannemand, M., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Kong, W., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Fan, J., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Berg, J. B., Project Participant, Department of Civil Engineering, Section for Building Physics and Services

External Project ID: 26403
03/07/2014 → 30/09/2015

Keywords: PCM heat storage, Sodium acetate

Collaborators: H.M. Heizkörper GmbH & Co. KG

COMTES: Combined development of compact thermal energy storage technologies

The aim of the project is to develop a seasonal heat storage consisting of heat storage modules with a salt water mixture of sodium acetate and water. The heat storage concept is based on the advantage of stable supercooling. By using this concept the heat storage module will have no heat loss for a long period making seasonal heat storage possible. If a sodium acetate water mixture, which has a melting point of 58°C, has been fully melted during the sunny summer, it can cool down in its liquid phase to the surrounding temperature and still preserve the latent heat related to the heat of fusion. The heat storage module can be left in this state with no heat loss until a heat demand occurs in the house in the winter, in which case solidification is activated, the heat of fusion is released, and the heat storage temperature increases almost immediately to the melting point. The developed heat storage will be a part of a demonstration solar heating system which is intended to cover the total yearly heat demand and hot water consumption of a low energy one family house.

Furbo, S., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Fan, J., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Dragsted, J., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Chen, Z., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Dannemand, M., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Nielsen, E. N. N., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Perers, B., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Berg, J. B., Project Participant, Department of Civil Engineering, Section for Building Physics and Services

seventh framework programme: DKK4,428,000.00
01/04/2012 → 31/03/2016

Keywords: Development, Demonstration, Seasonal heat storage, PCM, Supercooling

Collaborators: Technische Universität Graz, Velux, Nilan A/S

Award relations: Combined development of compact thermal energy storage technologies

Project: Research

Activities:

Forskningens døgn 2017 - Hvordan bygger og renoverer vi grønt?
Period: 28 Apr 2017
Jakob Brinke Berg (Speaker)
Department of Management Engineering
Management Science
Implementation and Performance Management
Degree of recognition: Regional
Links:
**International Conference on Solar Heating and Cooling for Buildings and Industry**
*Period: 13 Oct 2014 → 15 Oct 2014*

Jakob Brinke Berg (Participant)

Department of Civil Engineering
Section for Building Physics and Services

**Description**
Præsentation af forskningsresultater i form af poster præsentation.

Links:

**Related event**

3rd International Conference on Solar Heating and Cooling for Buildings and Industry
13/10/2014 → 15/10/2014
Beijing, China

Activity: Attending an event › Participating in or organising a conference

**Press clippings:**

**Et kar med salt er fremtidens oliefyr**
Jakob Brinke Berg
05/01/2015

**Subject**
Solvarme, Faseskifte varmelagring
Department of Civil Engineering, Section for Building Physics and Services

**Media contribution (1)**

**Et kar med salt er fremtidens oliefyr**
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Jakob Brinke Berg
29/10/2014
Department of Civil Engineering, Section for Building Physics and Services

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