



An Innovative Pathway for PhD research in  
Thermal Energy Storage

June 2016

Welcome to the third INPATH-TES Newsletter which includes the latest on INPATH-TES progress and development, profiles of recently graduated PhDs, news updates of conferences and seminars on TES, and a summary of participants of the project. For further information and updates please check our website [www.inpathtes.eu](http://www.inpathtes.eu).

#### **INPATH-TES Update**

The second general meeting of the INPATH-TES project took place in Be'er Sheva, Israel from February 14<sup>th</sup> to 15<sup>th</sup>, 2016 at the Ben-Gurion University of the Negev. The board meeting was followed by the Stakeholders Advisory Board meeting where the implementation of the programme in all participating universities was discussed.



*INPATH-TES Consortium at Ben-Gurion University of the Negev, Be'er Sheva, Israel during the 2nd General Board Meeting, February 15<sup>th</sup> 2016*

#### **16<sup>th</sup> edition of the National Congress CIRIAF 2016**

The 16<sup>th</sup> edition of the National Congress CIRIAF 2016 was organized in Assisi (Perugia), Italy from 7 to 9 April 2016. It has become a key date for Italian researchers and stakeholders interested in the wide topic of environmental sustainability and energy efficiency. The president of the organizing committee, Prof. Franco Cotana, guided the 3-day event planning and the social happenings, including a technical visit to the Assisi basilica and a tour of the fresco restoration. The conference was opened by a dedicated session focused on Thermal energy storage systems, organized under the framework of the INPATH-TES conference by Prof. Luisa F. Cabeza, Prof. Franco Cotana and Dr. Anna Laura Pisello. The special session was attended by more than 50 participants and 13 original papers on TES were presented by scientists who had travelled from all parts of Italy. The INPATH-TES banner was exposed in the main conference room and in the coffee break room of the Palazzo Bernabei in Assisi, an historical palace owned by University of Perugia, located in Assisi historical district.



(L-R) Marilena de Simone, Luisa F. Cabeza and Anna Laura Pisello (members of INPATH-TES) at the Basilica of Saint Francis of Assisi.

#### **INPATH-TES Survey on needs and future demands in TES technologies**

An online based questionnaire was developed by INPATH-TES and completed by stakeholder groups with regard to expectations, needs and future demands of the industry involved in TES technologies. The questionnaire proposed 14 courses which corresponded to the main 3 aspects of the PhD programme (Thermal energy storage, Research management, Dissemination and communication and Thermal energy storage specialisation), the content of which was evaluated along with the curriculum relevance. The proposed courses will include a variety of teaching methods. Many industrial responses reported the most attractive topics as being research methods, thermal energy technologies, the role of thermal energy storages in an energy system, the development of new thermal materials, experimental testing and the design, modelling and optimization of thermal energy storage systems. Over 85% of the survey participants were satisfied by the proposed content and 2/3<sup>rd</sup> would host a student in their company. So if you would like to get further information on the survey, PhD programme, content, possibilities of hosting a student or contribute to a certain topic please feel free to contact: [lcabeza@diei.udl.cat](mailto:lcabeza@diei.udl.cat).





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### **Annex 30 – Thermal Energy Storage for Energy Management and CO<sub>2</sub> Mitigation**

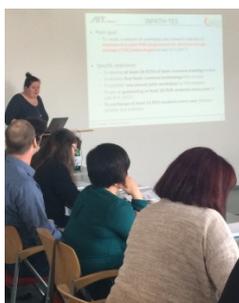
As introduced in the previous newsletter, the main objective of Annex 30 is the identification and enabling of the potential of thermal energy storage as a cross-sectoral technology. A joint conference was recently held in Frankfurt, Germany on May 3, 2016 entitled *Thermal Energy Storage – Perspectives and Applications in an Industrial Environment*. This event brought together interests from both research and industry in order to discuss process requirements, Key Performance Indicators and economic aspects of TES systems. The annex work will continue with the development of a methodology for process analysis for TES integration focusing on four sectors: industry, power plants, non-residential buildings and transportation. An upcoming workshop is scheduled in Tokyo on October 17-19, 2016. For more information, please contact the annex manager Duncan Gibb at [duncan.gibb@dlr.de](mailto:duncan.gibb@dlr.de) or visit the website at [www.eces-a30.org](http://www.eces-a30.org).



### **Annex 29/SHC Task 42 -**

#### **Thermophysical characterization and viscosity characterization of PCM**

The 4<sup>th</sup> DSC workshop on characterisation of PCM in the frame of the IEA ECES Annex 29 and SHC Task 42 was held in AIT, Vienna, Austria on 4<sup>th</sup> and 5<sup>th</sup> April, 2016. Following the development of a procedure to characterise PCM via DSC, the workshop involved the discussion of the results and consequences of a series of experimental investigations which were carried out using the newly developed characterisation method. Procedure optimisation, calculation of uncertainties and the generation of a shared database for PCM were also considered. A presentation on INPATH-TES was also given by Dr. Gundula Weber which discussed the projects aims, objectives and current progress.



Dr. Gundula Weber, AIT,  
presenting INPATH-TES project

### **Profiles of INPATH-TES Partners**

#### **Solar Energy Applications Group (SEAG), Trinity College Dublin, Ireland**

The Solar Energy Applications Group is based in Trinity College Dublin, Ireland and the team is lead by Associate Prof. Sarah McCormack. The main objective of the group is to address the need to generate clean energy and improve current methods of energy generation and storage to provide sufficient green energy for an increasing global population. The group specialises in the development and enhancement of a wide range of renewable and green technologies including luminescent devices, thermal energy storage, solar collectors and many more. SEAG is involved in different European and national projects (Plasmonic Enhancement and Directionality of Emission for Advanced Luminescent Solar Devices, Innovation Pathways to Thermal Energy Storage and Drivers of Sustainable-Behaviour). The Solar Energy Applications Laboratory consists of three test facility areas; the synthesis, the electrical and the optical laboratory which support the development and enhancement of a wide range of solar technologies. For more information please go to <https://www.tcd.ie/civileng/research/energy/SEAG/index.php>.



### **INPATH-TES Conference for policy makers and stakeholders**

INPATH-TES will host a Conference for Policy Makers and Stakeholders in Brussels during Sustainable Energy Week on 15<sup>th</sup> June 2016. The purpose of the event is to engage with policy makers and stakeholders, and specifically with component manufacturers, material manufacturers, design consultants, construction companies, and trade associations who are the likely employers of the successful PhD graduates. We would like to present the educational proposals that we are developing and to discuss how we meet the various needs of industry in the area of thermal energy storage. If you are interested in attending, please register at <http://eusew.eu/energy-days/conference-policy-makers-and-stakeholders-within-h2020-inpath-tes-project>.





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### *Profiles of PhD Graduates*

Dr. Harald Pointner was awarded his PhD from University of Stuttgart in April 2016. His research was entitled 'Development and Demonstration of a Novel Latent Heat Storage Concept with Separation of Power and Capacity'. The PCM flux concept provides a constant power output through separation of the heat exchanger and storage material by a fluid layer. Due to this separation, the storage material can be moved continuously towards the heat exchanger and crystallized material can be steadily transported away. If the forward velocity is chosen within a certain range, a locally-fixed quasistationary phase change interface is established, even though the storage material is still moving. This results in a constant thermal output which can be controlled by varying the velocity as well as a separation of power and capacity. (Supervisor: Prof. Andre Thess)



Dr. Maria Browne was awarded a PhD from Trinity College Dublin in April 2016. Her research entitled 'Experimental and Numerical Investigation of a Photovoltaic/ Thermal/ Phase Change Material System' combined a PV module with a thermal collector; in which heat was removed from a heat exchanger embedded in PCM through a thermosyphon flow. System performance was compared against a) the same system without PCM, b) the same system without heat exchanger or PCM, and c) the PV module alone on an experimental and numerical basis. Further experiments were conducted on the corrosive nature of PCM for use in thermal energy storage applications. (Supervisor: Dr. Sarah McCormack)



Dr. Damien Gondre was awarded his PhD in April 2016 from University of Lyon, France. The title of his thesis was 'Numerical modelling and analysis of heat and mass transfers in an adsorption heat storage tank'. The project concentrated on the renewable energy share in building heating which requires efficient heat storage solutions. In this PhD thesis, heat and mass transfers in an open adsorption heat storage tank were investigated through a numerical modelling and analysis. The influence of material properties, operating conditions and tank geometry on storage performances has been addressed. (Supervisors: Dr. Frédéric Kuznik and Dr. Kévy Johannes)



Dr. Claire Ferchaud was awarded her PhD in April 2016 from Eindhoven University of Technology, The Netherlands. The title of her thesis was 'Experimental study of salt hydrates for thermochemical seasonal heat storage'. The main purpose of the research was to characterize the thermal performance and structural properties of different salt hydrate materials under cycling and specific conditions of seasonal heat storage for domestic application. The results of the research highlighted an energy storage density for some salt hydrates that was four times higher than for sensible heat storage in water, with the advantage of minimum heat losses over long storage periods. However, material development is still required to overcome material stability issues like structural breaking of such salt hydrates over cycles, which is degrading the performance in a packed bed design. (Supervisors: Prof. Herbert Zondag, Prof. Anton van Steenhoven, Dr. Camilo Rindt)



# InPath TES



Universitat  
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UNIVERSITAT DE  
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Putting built environment USERS first, for a smarter, sustainable future

User feedback program



Trinity College Dublin  
Coláiste na Tríonóid, Baile Átha Cliath  
The University of Dublin



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DI PERUGIA



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DELLA CALABRIA



INSTITUT NATIONAL  
DES SCIENCES  
APPLIQUÉES  
LYON



Ben-Gurion University  
of the Negev



RIGA TECHNICAL UNIVERSITY



AUSTRIAN INSTITUTE  
OF TECHNOLOGY



TU/e Technische Universiteit  
Eindhoven  
University of Technology



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