The Executive Committee of the International Conference on Sustainable Energy Technologies have regretfully decided to postpone SET2020 for a year. This decision was taken following the coronavirus pandemic and restrictions on international travel for many countries. The new date for SET2021 will be 17-19 August 2021 in Istanbul, Turkey and will take place at the CVK Park Bosphorus Hotel in the heart of Istanbul.

All abstracts / papers that have already been submitted will be carried over to 2021 and new ones are still being accepted. Applications for the WSSET Innovation Awards and Terry Payne Conference Travel Award will also be carried over to SET2021. New deadlines for entries to both awards and conference will be confirmed later in 2020 giving authors plenty of time to consider their work and write their papers.

Istanbul is one of the most popular cities in the world to visit and is spread over an area of 8500 square km: 150 km long & 100 km wide. Because of its location between Asia and Europe, the city historically had great geopolitical importance. Around 12 million tourists visit Istanbul each year to see the historical and natural sites of the city including mosques, churches and museums. For more information about this prestigious conference, visit set2020.org and submit your abstracts on EasyChair: set2020.org/submissions/.

From all of us at WSSET, we hope that you are keeping well and staying safe and we hope to see many of you next year in Istanbul at SET2021.
Investigation of a medium temperature concentrating solar water heater for building applications

Mohamed Yasin Albar, Devrim Aydin

Department of Mechanical Engineering, Eastern Mediterranean University, G. Magosa, TRNC Mersin 10, Turkey

In the last decade, solar water heaters (SWHs) have been utilized widely for cutting the operating costs of auxiliary heating units. Solar water heating is important as it allows on-site heat production, thereby enhancing the sustainability in the built environment. For this reason, research on solar water heating technologies is ongoing, and many different types of passive/active systems have been developed. Table 1 presents some of the previous studies on solar collector systems.

Table 1: Summary of some previous studies on different solar collectors

<table>
<thead>
<tr>
<th>Ref No</th>
<th>Author</th>
<th>Year</th>
<th>n(%)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nikolčič et al.</td>
<td>2015</td>
<td>53-66</td>
<td>Double exposure FPC</td>
</tr>
<tr>
<td>2</td>
<td>Zhu et al.</td>
<td>2017</td>
<td>69</td>
<td>FPC with micro-heat pipe arrays.</td>
</tr>
<tr>
<td>3</td>
<td>Bellos et al.</td>
<td>2018</td>
<td>54.2</td>
<td>Integrated system with FPC</td>
</tr>
<tr>
<td>4</td>
<td>Allouhi et al.</td>
<td>2019</td>
<td>33</td>
<td>Forced-circulation FPC integrated with heat pipe</td>
</tr>
<tr>
<td>5</td>
<td>Xu et al.</td>
<td>2019</td>
<td>43-55</td>
<td>Evacuated tube under the mid-temperature operation in China’s weather conditions.</td>
</tr>
<tr>
<td>6</td>
<td>Teles et al.</td>
<td>2019</td>
<td>61.5</td>
<td>Tracking type evacuated tube collector.</td>
</tr>
</tbody>
</table>

Of all collector types, flat plate collectors (FPCs) are the most utilized collector type in buildings. Reasonable cost, practicality and good thermal efficiency are some considerable advantages of the FPCs making them preferable for sustainable water heating. On the other hand, despite their advantages, they also have drawbacks. The efficiency of FPC dramatically drops during winter time when the hot water is mostly needed. This is mainly due to the fact that solar radiation hits the FPC absorber plate at a low angle.

A possible method to enhance the performance of SWHS is to use concentrating-type solar collectors where parabolic trough collectors (PTCs) could be a viable option. The absorber area of the PTC is much smaller when compared to the gross and aperture areas, which enables water heating through the concentration of solar radiation. In conventional designs of concentrating collectors, tracking systems are required. This condition results in high capital costs and geometric complexity, which is limiting the usage of PTC systems in the building environment. As a result, such technology is mostly utilized for high temperature applications such as in solar-driven power plants.

In this study, performance of a novel medium temperature non-tracking PTC was experimentally investigated. The impact of solar radiation and water flow rates on the system performance were evaluated based on the testing results. The investigated system was made up of a low temperature PTC, a water storage tank and a circulation pump (Figure 1). Experiments were performed in the first and third weeks of April in Famagusta, corresponding to the early spring season when solar radiation is limited due to rain and the cloudy sky.

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**Figure 1:** (a) View of the investigated medium temperature PTC, (b) schematic front view of the FPC, (c) schematic view of the solar water heating system

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Mini grids as pathways to reliable, affordable electricity in development setting

Abubakr S. Bahaj

Energy and Climate Change Division, Sustainable Energy Research Group, (www.energ.soton.ac.uk)
School of Engineering, University of Southampton, Boldrewood Innovation Campus, Building 178, Southampton, SO16 7QF, UK

The UN Sustainable Development Goals (SDGs) has one of its goals, SDG7, stating that by 2030 we must “ensure universal access to affordable, reliable, sustainable and modern energy services for all”. SDG7 addresses energy needs including electricity, which is crucial for achieving almost all of the SDGs, from eradicating poverty through advancements in health, education, water supply and industrialisation, to combating climate change. Today, there are around 840 million people living without access to electricity and hundreds of millions more with only very limited or unreliable electricity access [1]. Around 600 million of these people live in sub-Saharan Africa (SSA), with ~85% living in rural areas. Access to reliable electricity transforms lives, provides opportunities for income generation, greater economic diversity / increases in productivity / creation of small businesses, lifting many of these people away from subsistence living.

The Energy for Development (e4D) programme instigated by the author has the primary aim of providing exemplar pathway projects for electricity access in remote villages in SSA [2]. The concept, developed in early 2008, has at its core renewable energy power generation, distributed through a confined electrical distribution network mapped onto the village-trading centre footprint. The power plant, distribution network and consumer connectivity constitute the mini grid. The electrified centre (~100 connections) provides a nucleus for commercial activities to grow, whilst providing a power supply to health centres, schools, places of worship, households and electrical charging for appliances within the village centre and beyond. The e4D programme and projects target improvement of living standards of the poor in communities in rural Africa, and provide pathways for growth and development. It has implemented six rural electrification projects as learning entities to support energy access (Figure 1).

![Figure 1: Six container based PV-driven mini grids deployed under the Energy for Development (e4D) programme in Kenya, Uganda and Cameroon. Further details can be seen at www.energyfordevelopment.net](www.wsset.org)
turn provide security of the modules, shading for the community and in some cases rainwater harvesting. The first project was installed in Kenya in 2012 and the others installed around 2015 in Cameroon, Kenya and Uganda (Figure 1). Funding for the first project (Kitonyoni) was through a grant whilst the others were in collaboration with the Kenyan and Ugandan Governments. These projects are continuously monitored by the e4D team in Southampton.

It is important to recognise that such systems, which are installed in very remote areas, will require management and technical support infrastructure. To this end, all the projects are run through locally created cooperatives with structures developed by the e4D team, conforming to the relevant country’s legal requirements. The cooperatives manage the projects including the collection of money from power consumers, maintaining the project and addressing its expansion needs. Technical as well as management training are provided by the e4D team during the initial surveys undertaken and the inception phases of the projects [3].

The electrical tariff in the Kenyan project was based on the average monthly cost of kerosene consumption in the community households gained through surveys conducted before project inception. In the Kenyan case, the tariff was agreed by the community, which is approximately 2 to 3 times that of the national tariff. Figure 2 shows an example of the recent consumption profile of the first mini grid project in Kitonyoni in Kenya. In Uganda, the tariff was agreed by the Rural Electrification Agency (REA) and was set slightly higher than that of the national tariff. Such tariff setting provides an insight into development where it is clear from the evidence gained by the e4D work that cheaper tariffs are important for growth especially in low and variable income communities in SSA [4]. Further details on tariff impacts can be found in Bahaj & James, 2019.

Lastly, as the world is experiencing a pandemic, which is creating enormous pressure on societies and their economies, mapping this to developing countries will be heart breaking since many people lack the resources to cope with the challenges presented by COVID-19. In particular, the measures needed to stem the spread of the coronavirus, namely social distancing and staying home, are based on the assumption that these people will have access to reliable and affordable electricity not only to stay connected to each other and their families, but also to have access to essential services such as electrified health centres. COVID-19 (on top of the needed development) will intensify the urgency for solutions as recently emphasised by Bill Gates [5]. In my view, such solutions should be based on mini grids to provide universal access to electricity. Governments, funding agencies - EU, World Bank, development banks and aid providers - should have heeded advice to speed up electricity access infrastructure in SSA and elsewhere. Their current funding processes are long and ridden with bureaucracy, which will definitely exacerbate the impact of the pandemic on an already stressed population.

Establishing speedy mini grid projects for electricity access will undoubtedly alleviate current and future pressures as mini grids offer the cheapest solution (when compared to extending the national grid) for productive use, health and educational oriented electrical services in off-grid, isolated and rural communities in Africa.

Acknowledgments: This work is part of the activities of the Energy and Climate Change Division and the Sustainable Energy Research Group at the University of Southampton (www.energy.soton.ac.uk). The work was also supported by the EPSRC under grant EP/G06394X/1, “Replication of Rural Decentralised off-grid Electricity Generation through Technology and Business Innovation”, the International Centre for Infrastructure Futures (ICIF) (EP/K012347/1), British Council UK Newton Fund (NF) Institutional Links (Grant No. 261850721) and Fortis Unum: Clustering Mini-Grid Networks to Widen Energy Access and Enhance Utility Network Resilience (EP/R030391/1). The author would like to thank the entire e4D research team who have helped to make these mini grid systems happen.

References:
2. http://www.energy.soton.ac.uk/category/research/energy-for-development/
Solar assisted heat pump with PCM heat battery for DHW applications

Yanan Zhang, Cagri Kutlu, Saffa Riffat

Department of Architecture and Built Environment, Faculty of Engineering, University of Nottingham, University Park, NG7 2RD, Nottingham, UK

Phase change materials (PCMs) are substances that release or absorb thermal energy during the phase transformation. In particular, salt hydrates are promising options for energy storage because of their high latent heat. Many of these compounds are prone to supercooling, which means a beneficial ability for long-term energy storage with minimum heat losses (Sakurai et al., 2018). Among this type of inorganic PCM, the supercooled are outstanding thanks to its ability to release thermal energy at any time desired. Solar thermal storage collects solar energy and accumulates energy for later use. The storage of thermal energy is like a thermal battery for supplying hot water/heating in buildings. This project aims to provide a smart solution to increase energy efficiency in the built environment by developing a novel thermal energy storage battery for water heating using a supercooled PCM solution called SolarHeatStore for domestic application. SolarHeatStore uses a standard solar collector system, plus a PCM energy storage tank (see Figure 1) to provide users with hot water on demand. During off-peak hours, the PCM is charged through the solar-assisted heat pump system and the thermal energy is stored in the PCM storage tank.

The results of the PCM tank charging and discharging performance are given in Figure 3. For the charging period, hot water came from the buffer tank and passed through the PCM tank, losing heat and leaving at a lower temperature. The amount of temperature reduction depended on the heat transfer rate. In given conditions, temperature reduction was observed to average 0.5°C because the flow rate was high (14.2 L/min). For the discharging process of the PCM tank, the cold water tap was turned on for different periods to simulate real hot water usage. According to initial results, the hot water temperature can be 52°C at the beginning and reduced as time passed.

Acknowledgements: The authors would like to thank Innovate UK for funding the project. And also thank our partners PCMP Ltd, Geo Green Power Ltd, Midea and SCUT for supporting this project.

BuildCOM - automated auditing and continuous commissioning of next generation building management systems

Muhuyiddine Jradi

Center for Energy Informatics, The Maersk Mc-Kinney Møller Institute, University of Southern Denmark
mjr@mmmi.sdu.dk, www.sdu.dk/energyinformatics

The recent 2018/844 EU Directive on energy efficiency and energy performance of buildings sets strict requirements that each non-residential building in the EU member states with an effective rated output for heating and ventilation of over 290 kW should be equipped with a building automation and control system by 2025. In addition, it urges the implementation of systematic commissioning of building automation systems as an effective replacement for manual inspections, highlighting the significant energy savings and cost reductions for both consumers and businesses. Confidence at the building design stage and simply claiming that the building management system (BMS) will operate properly and improve energy efficiency doesn’t ensure proper operation of the different building systems and components. Currently, there is a requirement for manual performance testing and initial commissioning before the building is handed over to the owner of a new or renovated building. These tests are currently performed manually, with no guarantee for the building owner that the tests are actually performed or that it has the required quality. The manual auditing and performance testing is very time consuming and thereby very expensive to conduct and prone to errors. As the building goes into the operation phase, major modifications could happen. This includes upgrading of building services, installing new automation and control devices, modification in the management strategy and upgrades in the software and hardware components of the BMS itself. Therefore, implementing retro-commissioning and auditing of the BMS is indispensable to ensure a proper function of different features and smooth integration of various systems. Currently, retro-commissioning of the BMS is often either insufficiently comprehensive in its execution, limited to the level of the modification occurring, or it is not conducted at all.

Figure 1: BuildCOM project logo

Figure 2: BuildCOM project overall auditing and commissioning approach

The Energiteknologiske Udviklings- og Demonstrations-program EUDP-funded project, Automated Auditing and Continuous Commissioning of Next Generation Building Management Systems (BuildCOM), is driven by industry and customer needs. It responds to the increasing demands for energy efficiency, comfort, and safety in the buildings sector. The project is led by SDU Associate Professor Muhuyiddine Jradi and brings together academic, public and industrial partners: University of Southern Denmark, Schneider Electric Danmark A/S, ReMoni, Sweco Danmark A/S, Capital Region of Denmark and Odense University Hospital. IBACSA is one of the innovative holistic tools developed under the BuildCOM project, for BACS assessment and smartness evaluation employing a qualitative-based multi-criteria approach.

A specific set of energy systems and their associated services form the basis of the proposed auditing and evaluation methodology. The targeted building domains have 60 different services in total based on guidelines and functionalities listed in the EN15232 standard. Using a points-grading system, IBACSA is able to quantify the specific impacts of the selected control functionalities on five building operation criteria: 1) Energy efficiency; 2) Maintenance and fault prediction; 3) Energy flexibility; 4) Comfort and 5) Information to occupants. With its comprehensive and user-friendly environment and interface, IBACSA serves as an instrument for systematic building initial and retro commissioning, ensuring a proper start-up for newly built and retrofitted buildings.

Figure 3: IBACSA tool interface

To read more about the project, https://www.sdu.dk/en/om_sdu/centr eforenergyinformatics/research+projects/buildcom
For more information, please contact Associate Professor Muhuyiddine Jradi, mjr@mmmi.sdu.dk

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5th WSSET Innovation Awards 2021

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The WSSET Innovation Awards recognise the achievements of private individuals and organisations in new sustainable technologies and encourage the wider application of these new developments. The WSSET Innovation Awards recognise the achievements of private individuals and organisations in new sustainable technologies and encourage the wider application of these new developments. Innovative ideas are welcome in any of the following areas:

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- Energy efficiency
- Water treatment and desalination
- Waste management and water recycling
- Power generation technologies
- Low carbon buildings and future cities
- Sustainable materials
- Agri-food technologies

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Articles should be no more than 400-500 words and one or two photographs would be very much appreciated. Submissions should be emailed to secretary@wsset.org

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