SET2020: Istanbul, Turkey - Call for Papers

SET2020 will be held in Istanbul, Turkey, from 18th to 20th August, 2020. Hosted by the University of Nottingham, the World Society of Sustainable Energy Technologies and Sunum Engineering and Education, SET2020 will take place at the CVK Park Bosphorus Hotel in the heart of Istanbul.

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 a 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/.

With the ‘Early-Bird’ rate you can save €80 if you register and pay before 15th June 2020, so get your abstracts in now and arrange your funding in plenty of time. To register, visit http://set2020.org/registration-and-fees/. WSSET members benefit from a 20% discount.

<table>
<thead>
<tr>
<th>Deadline Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday 6th April 2020</td>
<td>One page abstract submission</td>
</tr>
<tr>
<td>Monday 15th June 2020</td>
<td>Full manuscript submission; Deadline for 'Early Bird' registration</td>
</tr>
<tr>
<td>Monday 13th July 2020</td>
<td>Submission of revised accepted papers</td>
</tr>
<tr>
<td>Monday 3rd August 2020</td>
<td>Registration &amp; payment deadline for paper presentation and conference attendance</td>
</tr>
<tr>
<td>Monday 10th August 2020</td>
<td>Registration and payment deadline for attendance only – without paper/poster presentation</td>
</tr>
</tbody>
</table>

Because of its location between Asia and Europe, the city historically had a 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/.

With the ‘Early-Bird’ rate you can save €80 if you register and pay before 15th June 2020, so get your abstracts in now and arrange your funding in plenty of time. To register, visit http://set2020.org/registration-and-fees/. WSSET members benefit from a 20% discount.
A new heat exchanger for passive ventilation in cool climates

Daniel Marshall Cross\(^1\), Ben Hughes\(^1\), Dominic O’Connor\(^2\)

\(^1\)Department of Mechanical and Aerospace Engineering, University of Strathclyde, Glasgow G1 1XJ, United Kingdom
\(^2\)Free Running Buildings, Advanced Manufacturing Park, Catcliffe, Rotherham, S60 SWG, United Kingdom

The UK Government has set ambitious targets for reductions in carbon dioxide emissions, with the aim of complete decarbonisation by 2050. In the UK space heat and air-conditioning of buildings accounts for 23% of total energy demand and 20% of CO2 emissions. Therefore, improvements in building efficiency, heating and ventilation are key to achieving emissions targets. Thus far, the efficiency of non-residential buildings has shown little improvement.

To maintain a healthy indoor air quality (IAQ) in buildings ventilation is provided by removing stale air whilst providing a supply of fresh air. Poor IAQ has been shown to affect thermal comfort, health and productivity. With increased attempts to improve the thermal efficiency of buildings, new buildings are highly insulated and airtight. However, without sufficient ventilation this is detrimental for IAQ.

In non-residential buildings mechanical HVAC systems are commonly used to provide heating and ventilation, however such systems are energy intensive. Passive ventilation systems are able to supply ventilation air to a building with little energy demand. However, passive systems do not have a means of regulating the temperature of the incoming air. Where passive systems are currently installed building users may experience poor thermal comfort caused by draughts. In these circumstances the user may then shut the passive ventilation, reducing IAQ, or make use of heating, increasing the energy demand.

At the University of Strathclyde, in collaboration with Free Running Buildings, a team has been developing a new heat recovery technology for integration in passive ventilation systems. The aim is to design a new heat exchanger to increase the temperature of the incoming air by 3-5°C so that passive ventilation can provide a healthy air supply while also maintaining thermal comfort. The heat exchanger will increase the temperature of the incoming air by recovering heat from the air leaving the building.

The heat exchanger concept is based on a heat pipe, but instead of being filled with saturated liquid-vapour a solid internal structure will be used to achieve the desired heat transfer. While within a standard heat pipe heat transfer is achieved by exploiting the evaporation-condensation process, the research team are investigating the use of different solid structures within a heat pipe to achieve the heat transfer, as shown in figure 1. Through investigating variations in material structure and choice within the heat exchanger, the design will be tailored to the specific requirements of passive ventilation in cool climates.

Computational fluid dynamics is used to investigate different internal structure designs and material choices and once determined, the structures are prototyped using 3D printing technologies. The internal structures are then tested in a wind tunnel facility located at Free Running Buildings, shown in Figure 2. The wind tunnel provides a heated air stream and a chiller provides a cold sink, so that the performance of the heat exchanger can be assessed.

Once an optimal internal structure is determined full scale testing will be carried out in a passive ventilation system. The development of this heat exchanger technology will increase the viability of passive ventilation for buildings in cool climates, such as the UK.

This project is support by the UK Government’s Department for Business, Energy and Industrial Strategy through the Thermal Efficiency Innovation Fund.
Comprehensive technical, economic and environmental optimization of a photovoltaic battery energy storage system in a low-energy building

Jia Liu\textsuperscript{1,2}, Xi Chen\textsuperscript{1,2}, Yutong Li\textsuperscript{3}, Hongxing Yang\textsuperscript{1}

\textsuperscript{1}Renewable Energy Research Group (RERG), Department of Building Services Engineering, The Hong Kong Polytechnic University, Kowloon, Hong Kong, China.
\textsuperscript{2}School of Science and Technology, The Open University of Hong Kong, Hong Kong, China.
\textsuperscript{3}Shenzhen Institute of Building Research Co. Ltd., Shenzhen, Guangdong, China.

The building sector accounts for nearly 30% of total final energy consumption in the world, with 31% directly served by electricity which contributes to 49% of the world electricity use (REN21. Renewables 2019 Global Status Report, 2019). It is necessary to introduce renewable sources such as solar and wind energy for power supply to buildings to reduce its overall impact on energy and environment sustainability. Since both solar and wind power depend highly on local weather conditions, which are intermittent, unstable and unmatched with the fluctuating building load, electrical energy storage such as battery may therefore be required to store surplus renewable energy during off-peak hours and supply to electric appliances in peak time to assure a reliable power supply to buildings.

A comprehensive study was conducted to optimize the technical, economic and environmental performances of a photovoltaic (PV) system with battery energy storage (BES) technology installed in a low-energy building in Shenzhen, China. The PV-BES system was developed on TRNSYS platform as shown in Figure 1, integrating the building load, PV panel, battery storage, utility grid and energy management strategy. A SketchUp model of the building was first established according to practical building dimensions and then imported into TRNSYS to define internal building properties. Both rooftop and façade PV panels were modelled according to practical building installations. The battery model was developed based on the energy balance considering the state of charge and the battery cycling aging (Jiang Y, Kang L, Liu Y. A unified model to optimize configuration of battery energy storage systems with multiple types of batteries. Energy, 2019; 176:552-560). The grid import limit explained as the ratio of the rated PV power and the grid export limit setting to restrict battery charge from the utility grid, were introduced to consider grid integration with the PV-BES system. Finally, a novel energy management strategy considering the battery cycling aging, grid relief and local time-of-use pricing was proposed to optimize the system performances.

The optimization analyses were conducted on the joint modeling and optimization platform of the TRNSYS and JETplus-IA based on the Non-dominated Sorting Genetic Algorithm with the battery cell number, grid export limit and grid import limit as optimization variables. It was concluded that compared with existing operating scenario in the building, the PV self-consumption and PV application efficiency can be increased by 15.0% and 48.6%, while the standard deviation of net grid power, battery cycling aging and CO\textsubscript{2} emission were reduced by 3.4%, 78.5% and 34.7% respectively in the final optimal solution. A balance between technical, environmental and economic performance aspects was achieved to deliver an overall optimum design and energy management solution for the low-energy building, which can guide the renewable energy and energy storage system design to achieve higher penetration of renewable applications into urban areas.

![Figure 1: Developed TRNSYS model of the PV-BES system](image-url)
Integrated eucalyptus fibre shutters for passive evaporative cooling applications in buildings

Pervin Abohorlu Dogramaci¹, Devrim Aydin², Guohui Gan³, Saffa Riffat⁴

¹Department of Interior Architecture, Faculty of Fine Arts, Design and Architecture, Cyprus International University, Haspolat-Lefkosa, Mersin 10, Turkey. ²Department of Mechanical Engineering, Eastern Mediterranean University, G. Magosa, TRNC Mersin 10, Turkey. ³Department of Architecture and Built Environment, Faculty of Engineering, University of Nottingham, University Park, NG7 2RD, Nottingham, UK

The idea of integrating energy efficient systems in to buildings is significant as current objectives aim to reduce energy consumption, particularly as buildings are responsible for 40% of CO₂ emissions and total energy consumption (Directive 2010/31/EU).

Integrating evaporative cooling (EC) systems into the building element is important not only for providing clean energy, but also for meeting the architectural requirements of a building. Architectural design elements such as walls, wind catcher, solar chimney, shutters, etc. become multifunctional elements of the building components based on cooling approach.

The elements that form the building design play a vital role for low energy design strategies. According to Santamouris et al. (2008), the building form plays the highest role for low-energy design by 67%. It is then followed by façade design (52%). Thus, the form and façade design of the building should be considered at the design stage of the building in order to reduce the energy consumption caused by heating and cooling loads.

Windows are the most significant part of the building for facilitating air ventilation. Based on the literature, ancient people placed pottery jars filled with water or wet mats as cooling pad in front of windows to allow evaporation and thus cool the indoor air (Lechner, 2015). Theoretically speaking, evaporative cooling windows made of natural eucalyptus fibre-based shutters could be used to reduce the indoor air temperature. Consequently, the integration of EC methods into the windows of a building could considerably reduce the energy consumption through decreasing the cooling load. As seen in Figure 1, eucalyptus fibres (EF) integrated into shutters in two different configurations (horizontally and vertically folded evaporative shutters) provide not only cool air but also visual communication and daylighting. Such innovative building integration concepts with natural materials could enhance the passive use of EC, thereby enhance the sustainability in buildings. This architectural integration approach can be called ‘multifunctional sustainable shutter’ since it provides a wide range of solutions such as shading, light diffusion and aesthetic views by moveable louvres. Additionally, it is cost effective, easy to install and easy to maintain.

In order to investigate the performance of eucalyptus fibres for EC, experimental investigations were performed. For the inlet conditions of Tin = 35°C and Rhin = 20%, test materials showed a promising performance, where outlet temperature varied between 23.6°C – 29.7°C for the air velocity range of 0.1m/s → 1.2 m/s (see Figure 2). Testing results demonstrated that eucalyptus fibres were capable of providing ΔT>10°C at low air velocities (vair = 0.1 m/s).

Performed investigations indicated that eucalyptus fibres satisfied the expected characteristics from the EC materials such as: (i) high surface area for fast water evaporation; (ii) spongy nature/high porosity for high water absorption/evaporation capacity; (iii) good heat and mass transfer; (iv) low cost and (v) abundance. Therefore this environmentally-friendly organic material could be used as a shutter integrated passive EC for enhancing sustainability in residential and commercial buildings.

![Figure 1: EC system integrated shutter](image)

![Figure 2: Outlet air temperature variations for the testing of EF](image)

REFERENCES


Use of Industrial waste/process heat for thermochemical hydrogen production

Ibrahim Dincer and Haris Ishaq

Faculty of Engineering and Applied Science, University of Ontario, Institute of Technology, 2000 Simcoe Street North, Oshawa, Ontario, L1H 7K4, Canada
Email: ibrahim.dincer@uoit.ca, haris.ishaq@uoit.net

Importance and Approach

The economic development of any country significantly depends upon energy and energy demand is progressively increasing with growth in population. On the commercial scale, steel, cement, glass and petrochemical industries are the major consumers of energy and significant part of this demand is dependent on fossil fuels which causes CO₂ emissions [1]. These industries also emit flue gases having CO₂ emissions. This study focused on the industrial waste heat recovery through thermal management and employed the recovered heat to the thermochemical Cu-Cl cycle for hydrogen production. Hydrogen is a globally recognized potential fuel and provide carbon-free solutions for the energy systems. As compared with hydrogen, electricity undergoes transmission and heat losses and it cannot be stored using available fuel storage systems.

This study used a 3S approach using source, system and service for hydrogen production system [2]. Figure 1 displays the 3S approach used for the designed hydrogen production system. The sources used for the system design are the steel industrial waste heat/cement slag waste heat/glass industrial flue gas to recover the heat through thermal management. Second step is the system which employs the thermal energy recovered from the source and uses is for hydrogen production. The third step of the 3S approach which stands for service and hydrogen is the service for the designed system.

Objectives and System Description

The main objectives of this kind of heat recovery for hydrogen production are listed as follows:

- To recover the industrial waste heat through thermal management.
- To utilize the recovered heat to the thermochemical Cu-Cl cycle for H₂ production
- To explore system performance and efficiencies under different operating parameters.

Recently we have designed an energy system using industrial waste heat for thermochemical hydrogen production shown in Figure 2. Industrial waste heat is recovered through thermal management and employed to the thermochemical Cu-Cl cycle for hydrogen production. Thermochemical Cu-Cl cycle designed by clean energy research laboratory (CERL) is a heat-intensive process irrespective to the water electrolysis and significantly depends upon thermal energy. This process consists of four significant steps which only consumes water with thermal energy and electrical power and all remaining constituents are recycled throughout the system. Hydrolysis is the first step which facilitates the hydrolysis of CuCl₂ in hydrolysis reactor and generates output of Cu₄OCl₂ and HCl. The produced Cu₄OCl₂ reaches the decomposition reactor which facilitates the decomposition of Cu₄OCl₂ into O₂ and CuCl. Produced CuCl reaches the PEM electrolyser and reacts with HCl coming from hydrolysis reactor to produce hydrogen gas and aqueous CuCl₂. Water is separated from CuCl₂ using dryer and separated CuCl₂ is recycled again to the hydrolysis reactor. Thermochemical CuCl is a continuous cycle which requires the inputs of water, heat and electricity to produce oxygen and hydrogen.

Results

The effect of steam input flow rate is important to be investigated to analyse the system performance. Figure 3 displays the steam input flow rate effect on hydrogen and oxygen flow rates and heat recovery from CuCl and HCl streams. The primary Y-axis is used for hydrogen and oxygen production while secondary Y-axis is used for heat recovery. The rise in increase of hydrogen and oxygen flow rates and heat recovery from CuCl and HCl streams can be depicted from Figure 3. Figure 4 exhibits the effect of input flow rates of steam and CuCl₂ on the hydrogen output flow rate. In the 3D representation, the input steam flow rate is ranged from 1.8-54 kmol/h and CuCl₂ flow rate is ranged from 3.6-108 kmol/h. The rise is hydrogen production flow rate can be depicted from the figure.

Cont.

Figure 1: 3S approach used for the system design

Figure 2: Schematic of the designed thermochemical hydrogen production system
In summary, the result presented above reveals that integrating industrial waste heat recovery with thermochemical Cu-Cl cycle can be a promising route for producing clean hydrogen. The thermolysis step showed the maximum exergy destruction rate. This study will also help in the industrialization of the thermochemical Cu-Cl cycle. The performance indicator showed promising results of the designed configuration for clean hydrogen production.

REFERENCES
WSSET exclusive offer – IJLCT

The International Journal of Low-Carbon Technologies (IJLCT), whose Impact Factor has increased to 1.054 with indexing in the WOS and the JCR, offers a 20% discount to the APC (article processing charge) for WSSET members wishing to publish a paper in IJLCT (open access). This will cost WSSET members £915 (€1099) as opposed to the full charge of £1144 (€1373). Authors will need to state that they are WSSET members when paying.

Please visit www.ijlct.oxfordjournals.org to submit your articles.

WSSET exclusive offer - FCaE

Also in conjunction with Future Cities and Environment (FCaE), WSSET have agreed a £25 discount to the APC (article processing charge) for WSSET members wishing to publish a paper in FCaE (open access). This will cost WSSET members £475 compared to the full charge of £500. Authors will need to declare their membership details to the editorial team when it comes to payment before publication.

Please visit www.futurecitiesandenvironment.com to submit your articles.

Renewable Bioresources is an Open Access (Gold OA), peer reviewed, international online publishing journal, which aims to publish premier papers on all the related areas of advanced research carried in its field. Renewable Bioresources emphasizes the advanced applications of biotechnology to improve biological ecosystems through renewable energy derived from biological sources.

Please visit www.hoajonline.com/renewablebioresources to submit your articles.
All WSSET members are kindly invited to submit articles for publication in future WSSET newsletters. Articles can be on a range of topics surrounding the word of sustainable energy technologies. With nearly 2000 members, the WSSET newsletter provides a great opportunity to publicise new ideas, technologies or products – all free of charge!

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

Furthermore please contact secretary@wsset.org regarding any conferences, seminars or symposiums relating to topics of sustainable energy technologies that you wish to be advertised in the newsletter.

Once again, thank you for your continued support to WSSET.

www.wsset.org