

NEWSLETTER

Issue 1
June 2019

Launch of E2S2 Website

We are pleased to announce the launch of E2S2 website. The goal with this new website is to publicize E2S2 Programme. Visitors will find useful information about our programme such as Phase II theme and projects, Phase I achievements, our location and people, career. E2S2 staff and students are encouraged to visit the website regularly for any upcoming events and activities.

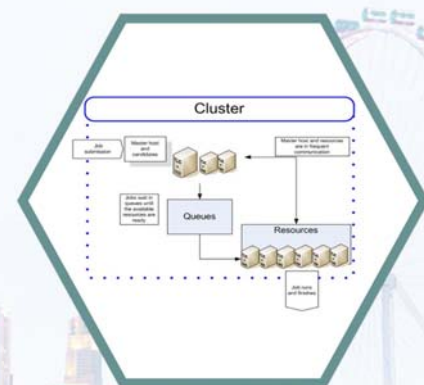
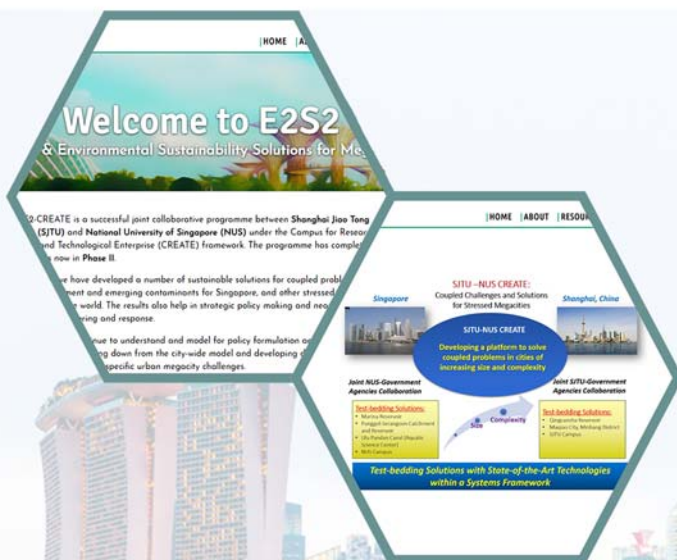
The new website is available at the URL <http://e2s2-create.org/>. If you have any feedback about the experience with the website, feel free to send email to the admin team.

E2S2 Server Network

240-core server has been set up and it is ready to use. The server is made up of 9 computer nodes and managed by one head node. To reap the performance of the server, PBSPro scheduler has been installed to auto selection of hosts based on the current server load requirements as well as resource requirement of the applications.

The server runs on CentOS Linux operating center, installed with various GNU compiler GCC, GCC-C++ & GCC-GFortran as well as other software such as MATLAB, Delf3D, Python & R to meet your research needs.

More details on how to access the server, please refer to the server training slides in the administration office.



Lab Safety

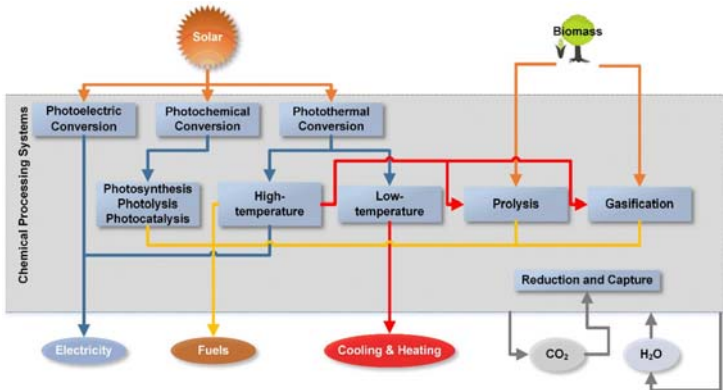
The 4th NUS Safety, Health and Environment (SHE) Conference is now open for registration for NUS staff and students.

The conference will be held at the **Shaw Foundation Alumni House (National University of Singapore)** on 4th July 2019.

The theme for this year's conference is '**Inspiring Safety and Health Transformation through Innovation and Integration**' and will feature a plenary session, a panel discussion with experts, and symposiums. In addition to the talks, there will be vendor exhibits showcasing the latest safety innovations and products. [Click here](#) for registration.

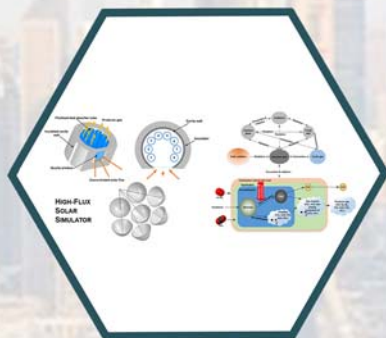


The people behind E2S2 and their contributions.

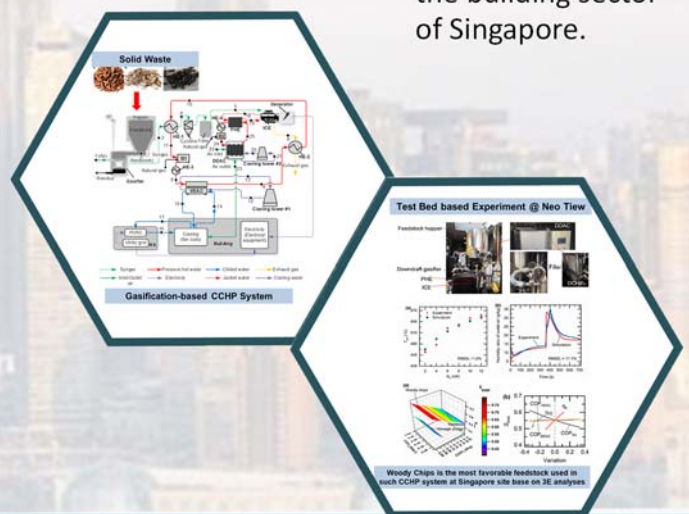


Dr. Li Xian has served as a research fellow in E2S2-CREATE program for over 3 years. He is focusing on a solar-and-biomass/solid waste bi-source nexus to provide a promising and

In E2S2-CREATE program, Dr. Li has comprehensively and theoretically studied a solar/ autothermal hybrid gasifier with an indirectly irradiative reactor driven by concentrated solar radiation and organic solid waste, which is able to enhance the overall energy efficiency by 15% in Singapore' climate. Most recently, Dr. Li is working on the design, fabricate and calibration of a 30 kWe high-flux solar simulator (i.e. artificial sunlight simulator) with ellipsoid-reflector-based 7-xenon lamps. E2S2-CREATE program will launch **Singapore's first high-flux solar simulator** that is able to supply 9 kWth high flux to the focal plane, associated with a peak concentration of >5000 suns (1 sun = 1 kW/m²) and an average concentration of 2900 suns at the target region with a diameter of 6 cm. This high-flux solar simulator will be used to provide sufficient solar radiation for the syngas production by using a high-temperature solar reactor/gasifier. The experimental study of solar fuel synthesis from local solid waste (e.g. sewage sludge, plastic waste, and municipal solid waste) will be performed in near future.



He has designed, optimized and demonstrated a highly efficient gasification-based CCHP system integrated with a novel desiccant dehumidification air-conditioning that can harvest waste heat of the engine and convert the waste heat to cooling required by end users e.g. net-zero energy buildings or vertical farming. The overall waste-to-energy efficiency of ~50% was achieved in the field test at the local farm site, and the biochar (i.e. the main by-product from gasification) was reutilized for land reclamation for the zero-waste-nation goal and circular economy. Furthermore, he has evaluated the energetic, economic and environmental impacts of such a system further integrated with an efficient variable-effect absorption chiller. The whole efficiency of 81% can be obtained from waste wood chips. Dr. Li's research outcomes regarding the gasification-based CCHP system is able to provide a guideline for the design, optimization, and deployment of such a decentralized system in the building sector of Singapore.





The people behind E2S2 and their contributions.

The major outcomes and achievements related to E2S2-CREATE programme are summarized below:

Refereed Journal Papers

- **Li X**, Lin M, Dai YJ*, Wang CH. Comparison-based optical assessment of hyperboloid and ellipsoid reflectors in a beam-down solar tower system with linear Fresnel heliostats. *Journal of Solar Energy Engineering*. 2017;139(6):061003.
- **Li X**, Shen Y, Kan X, Hardiman TK, Dai Y, Wang CH*. Thermodynamic assessment of a solar/autothermal hybrid gasification CCHP system with an indirectly radiative reactor. *Energy*. 2018;142:201–14.
- **Li X**, Kan X, Sun X, Zhao Y, Ge T, Dai Y, Wang CH*. Performance analysis of a biomass gasification-based CCHP system integrated with variable-effect LiBr-H₂O absorption cooling and desiccant dehumidification. *Energy*. 2019; 176:961–79.
- Zhou L¹, **Li X**¹, Zhao Y, Dai Y*. Performance assessment of a single/double hybrid effect absorption cooling system driven by linear Fresnel solar collectors with latent thermal storage. *Solar Energy*. 2017;151:82–94. (Co-first author)
- Maneerung T¹, **Li X**¹, Li C, Dai Y, Wang CH*. Integrated downdraft gasification with power generation system and gasification bottom ash reutilization for clean waste-to-energy and resource recovery system. *Journal of Cleaner Production*. 2018;188:69–79. (Co-first author)
- Shen Y, **Li X**, Cui X, Yao Z, Wang CH. CO₂ gasification of woody biomass: Experiment study from a lab-scale reactor to a small-scale autothermal gasifier. *Energy*, 2018;170:497–506.
- Wang CH, Tong YW, Loh KC, Wang RZ, **Li X**, Advanced technologies on sustainable energy and environment: SET2016 virtual special issue, *Energy*, 2017, 137:350–2. (Guest Editor)

Refereed Conference Papers

- **Li X***, Dai, Y, Wang CH. Waste-to-energy systems towards energetic and environmental sustainability. International Young Scholar's Symposium of Fuzhou University Green Petrochemical Engineering Innovation Center. Fuzhou, China, 31 Dec 2018. (**Invited Speaker**)
- **Li X**, Kan X, Sun X, Zhao Y, Ge T, Dai Y, Wang CH*. Performance analysis of a biomass gasification based CCHP system with variable-effect LiBr-H₂O absorption cooling and desiccant dehumidification. ICAE2018. Hong Kong, China, 22–25 August 2018.
- **Li X***, Shen Y, Kan X, Dai Y, Wang CH. Potential Evaluation of a Solar/autothermal Hybrid Gasification based Tri-generation System in Singapore. 2018 AIChE Singapore Local Section Annual Conference. Singapore, 18 May 2018. (**Invited Speaker**)
- **Li X***, He C, Shen Y, Dai Y, Wang CH. Syngas Production from Sewage Sludge By Solar-Driven CO₂ Gasification. 2017 AIChE Annual Meeting. Minneapolis, MN, USA, Oct. 29–Nov. 3, 2017.

Professional Awards

- Outstanding reviewer of Renewable and Sustainable Energy Reviews, *Energy*, *Solar Energy*, *Applied Energy*, and *Renewable Energy*
- 2017, Committee Member of NRF CREATE 10th Symposium
- 2017, Member of American Institute of Chemical Engineering (AIChE)
- 2016, Guest Editor of Special Issue of *Energy*
- 2016, Executive Committee Member of 15th International Conference on Sustainable Energy Technologies
- 2016, Executive Committee Member of 8th Global Chinese Chemical Engineers Symposium

Email address: erilx@nus.edu.sg



The people behind E2S2 and their contributions.

Mr. Le ZHANG as a Ph.D. student joined E2S2-CREATE Programme at NUS from the August, 2015. Since then, he has studied the enhanced anaerobic digestion of municipal organic wastes (e.g. food wastes), operation and optimization of lab-scale and pilot-scale anaerobic digesters with high-solids organic wastes, and bioinformatics analysis of microbial community structure in the anaerobic digesters.

Recently published papers are as below:

1. L. Zhang, K.-C. Loh, J. Zhang, L. Mao, Y.W. Tong, C.-H. Wang, Y. Dai. Three-stage anaerobic co-digestion of food waste and waste activated sludge: identifying bacterial and methanogenic archaeal communities and their correlations with performance parameters. *Bioresource Technology*. 2019, 285: 121333.
2. L. Zhang, K.-C. Loh. Synergistic effect of activated carbon and encapsulated trace element additive on methane production from anaerobic digestion of food wastes - Enhanced operation stability and balanced trace nutrition. *Biore-source Technology*. 2019, 278: 108–115.
3. L. Zhang, K.-C. Loh, J.W. Lim, J. Zhang. Bioinformatics analysis of metagenomics data of bio-gas-producing microbial communities in anaerobic digesters: A review. *Renewable & Sustainable Energy Reviews*, 2019, 100: 110–126.
4. L. Zhang, K.-C. Loh, J. Zhang. Food waste enhanced anaerobic digestion of biologically pre-treated yard waste: Analysis of cellulose crystallinity and microbial communities. *Waste Management*. 2018, 79: 109-119.
5. L. Zhang, J. Zhang, K.-C. Loh. Activated carbon enhanced anaerobic digestion of food waste - Laboratory-scale and Pilot-scale operation. *Waste Management*. 2018, 75: 270-279.

Email Address: zhangle@u.nus.edu