GLOBAL SECURE
GLOBAL 'Sustainable Energy through China-Uk Research Engagement'
(Funded by EPSRC 2012-2013)

GLOBAL SECURE Newsletter
April - July 2012 Edition

THE FIRST EDITION OF THE 'GLOBAL SECURE' NEWSLETTER

Welcome… We are now 4 months into the GLOBAL SECURE project and this newsletter aims to inform people about the exciting ongoing research work.

GLOBAL SECURE is a collaborative project funded by EPSRC to address research challenges associated with achieving sustainable and clean energy. It has an international engagement focus and will involve academics from Newcastle University and academic institutions in China. The Sir Joseph Swan Centre for Energy Research (SWAN) at Newcastle University will be working closely with a number of leading researchers and centres of excellence in China.

There are 12 themes within the GLOBAL SECURE project involving 6 schools within Newcastle University and currently 13 Chinese institutions.

THEME 3: 'LOW GRADE HEAT DRIVEN COGENERATION OF POWER & COOLING'

Theme 3 is looking at the recovery of low grade heat or solar energy for the efficient cogeneration of electrical power and cooling. This involves improving the modified design of an adsorption system and rotary & linear expanders/generators to enable integration and demonstration of the new cycles.

Shanghai Jiao Tong University (SHJT) have manufactured an adsorption unit for experimental studies. Dr Huashan Bao and PhD student Constantinos Charalambous from Newcastle University recently visited SHJT to collaborate with Dr Zisheng Lu to learn the tuning and operation of the adsorption unit and to carry out tests.

PROFESSOR TONY ROSKILLY OPENING A JOINT LABORATORY BETWEEN NEWCASTLE UNIVERSITY & BEIJING INSTITUTE OF TECHNOLOGY IN CHINA

(THEME 3: CONTINUED)

The image below illustrates a new design adsorption chiller that uses a refrigerant (ammonia) to produce power at the same time as cooling. The design is slightly different from the basic adsorption chiller in that a rotary machine can be attached for power production. The system is enhanced by a mass recovery process from the refrigerant desorption from one adsorbent bed to the evaporator. The cycle can be run either in cooling mode or in cogeneration mode. Manual regulating and automatic pneumatic valves are used in both fluid circuits in order to control the direction of the fluids. Temperature and pressure sensors are installed around the ammonia and water circuits to collect data while others are connected to control heating and cooling processes according to the set-up temperatures. Pneumatic valves are connected to drive the hot and cold water stream in the correct direction according to the program and also to control the ammonia mass recovery process.

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PROJECT THEMES

THEME 2: 'CO_2 CAPTURE AND H_2 PRODUCTION'

A novel inorganic catalyst had been discovered by Dr L.Siller and G.Bhaduri of Newcastle University which helps in the reversible hydration of CO_2 at room temperature and atmospheric pressure, prior to the Global Secure project. Theme 2 will build on the initial work to explore and characterise the mechanisms involved in the absorption process so that greater improvements can be made in the future. Further developments working with the Graduate University of Chinese Academy of Science (GU-CAS) will determine the rates of reactions for future reactor design, process development and explore various routes for catalyst recovery.

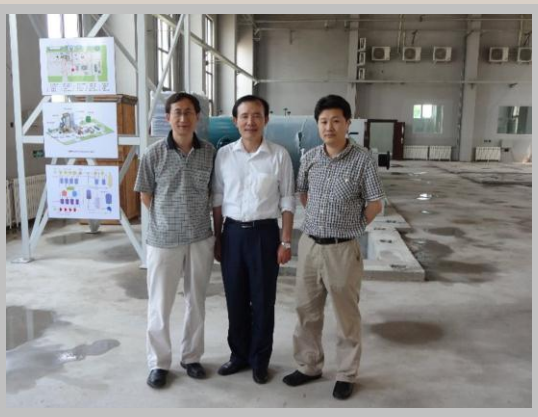
Gaurav Bhaduri has spent one month working in the laboratory of Professor Wenfeng Shangguan at Shanghai Jiao Tong University. He has measured the kinetic reaction rate for the reversible hydration of Carbon Dioxide as a function of temperature (20-60°C) and is planning to do this for different concentrations of CO_2. The following article 'Nickel nanoparticles catalyse reversible hydration of Carbon Dioxide' is currently being prepared with the aim of submission in August 2012.

"There have already been a number of successful collaborating visits to China"

THEME 3: DR HUASHAN BAO & MR CONSTANTINOS CHARALAMBOUS VISIT SHANGHAI JIAO TONG UNIVERSITY

THEME 1: 'TRIGENERATION WITH INTEGRATED ENERGY STORAGE & BIOFUEL USE'

Theme 1 is investigating methods of high efficiency generation of electrical power, heating and cooling (trigeneration) with the integration of electrical and thermal storage. Dr Yaodong Wang has recently visited SHJT and IET (Institute of Engineering Thermophysics) to investigate the use of biofuels



THEME 1: DR YAODONG WANG FROM NEWCASTLE UNIVERSITY VISITING IET (PROF CHUNQING TAN & PROF HAISHENG CHEN)

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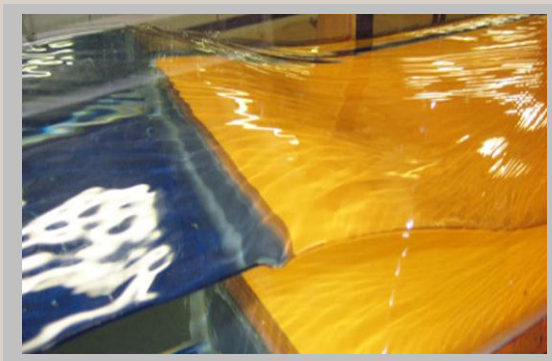

THEME 12: WATER RESOURCE SYSTEMS RESEARCH LABORATORY AT NEWCASTLE UNIVERSITY

Chinese Universities & Institutions

- SHJT (Shanghai Jiao Tong University)
- IET (Institute of Engineering Thermophysics)
- GU-CAS (Graduate University of Chinese Academy of Science)
- BIT (Beijing Institute of Technology)
- East China Normal University
- University of Hong Kong
- Peking University
- Wuhan University
- Guangxi University
- Dalian Maritime University
- Tsinghua University
- Dalian University of Technology

(THEME 1: CONTINUED)

and the optimisation of CHP (Combined Heat and Power) systems for a wide range of applications.

Further visits to China are planned in October 2012 to investigate additional biofuels.

ADDITIONAL GLOBAL SECURE THEMES

A further 2 new GLOBAL SECURE themes have been added to the original project.

The first theme ‘Optimal management of Water Resources and Flood risk for Hydropower Generation’ involves Civil Engineering & Geosciences at Newcastle University, Dalian University of Technology and the China Institute of Water resources & Hydropower Research (IWHR). This work will compare the current practice in water resources and flood risk management in China and the UK. It will develop an integrated toolkit for optimal management of water resources and flood risk assessment for hydropower generation.

The second theme ‘Energy Reduction through Promoting Sustainable Living’ involves Computing Science at Newcastle University and Tsinghua University. Promoting more sustainable lifestyles in modern societies is a key to energy reduction in times of diminishing resources. The work will use computational behaviour analysis techniques for monitoring changes in lifestyles with respect to overly increased energy consumption. It will investigate the effectiveness of innovative human computer interaction techniques for promoting more sustainable living. Behaviour monitoring will be based on machine learning techniques for human activity assessment using opportunistic sensing and intervention techniques based on the user-centred design paradigm. For the latter eceologically valid user studies will be conducted and interventions will be designed with future users integrated into the design and evaluation process.

GLOBAL SECURE is Funded by EPSRC for 12 months: April 2012-2013

Theme 4: Visit by Dr Guohong Tian to Dalian Maritime University (Absorption Chiller)

Project Themes Update:

Theme 4: 'Integration of renewable energy systems and power optimisation for ships'

- Initial contact with Dalian Maritime University & Shanghai research institute CISC 701 concerning a research work plan.

Theme 6: 'Thermal Energy Management in Processing Industries'

- Initial contacts have been made for a number of possible case studies involving a brewery, paper, pharmaceutical and steel plants.

For more information check out the Global Secure Website at: http://research.ncl.ac.uk/globalsecure/

Theme 7: 'Energy Reduction in Waste Treatment'

- Laboratory work has begun and early data suggests that the hybrid technology has considerable potential.

Theme 8: 'Energy Reduction in Road Transport'

- Initial research is underway and progressing well. Visits are planned in October to China by Newcastle University staff.
- A conference on 'Transport, Energy and Environment' is planned in Beijing during the visit.
- Confirmed visits by Wuhan and Peking University to Newcastle in October 2012.

Theme 9: 'Advanced hydrodynamics, simulation and operation for improved marine transport efficiency'

- MAST (Marine Science and Technology) at Newcastle University have been working on the numerical simulation to provide the test matrices for the experimental study in SHJT.

Theme 10: 'Sustainable Retrofitting'

- Initial meetings have taken place with visits between Newcastle and China planned in October 2012.
- A paper related to the project is planned to be presented in September 2012.