

# CEBEC

Advanced Curriculum on Energy  
Efficient Buildings in Extreme  
Continental and Sunny Climate in  
Mongolia

GMIT Report on 31 AUG 2020

Prof. Dr. Daniel Karthe



## Topic 1

# Heating and Energy Consumption of Buildings on the Mongolian Plateau

## DOMESTIC SOLAR SPACE HEATING IN MONGOLIA: DESIGN AND DEMONSTRATION

Joanna Dawes<sup>\*</sup>, Galbaatar<sup>\*\*</sup>, Nigel Lucas<sup>\*\*\*</sup>

<sup>\*</sup> Centre for Environmental Technology, Imperial College of Science, Technology and Medicine, London, UK

<sup>\*\*</sup> Mongolian Academy of Sciences and ABE Co. Ltd., Ulaanbaatar, Mongolia

<sup>\*\*\*</sup> ERM, London  
e-mail: j.dawes@ic.ac.uk

CHANG, C.; ZHU, N. & SHANG, J. (2017): *The study of occupant behavior analysis of Inner Mongolia in regard to heating energy consumption*. Procedia Engineering 205:915-922. DOI:10.1016/j.proeng.2017.10.122.

CHANG, C.; ZHU, N.; YANG, K. & YANG, F. (2018): *Data and analytics for heating energy consumption of residential buildings: The case of a severe cold climate region of China*. Energy and Buildings 172:104-115. DOI:10.1016/j.enbuild.2018.04.037.

DAMIRAN, N. & FRANK, A. (2018): *Asbestos Consumption in Mongolia: 1996–2014*. International Journal of Environmental Research and Public Health 15(1):136. DOI:10.3390/ijerph15010136

DAWES, J.; GALBAATAR & LUCAS, N. (1998): *Domestic solar space heating in Mongolia: design and demonstration*. In: GAVASCI, R. & ZANDARYAA, S. (Eds.): *Environmental Engineering and Renewable Energy*, pp. 109-118. Amsterdam, The Netherlands: Elsevier. DOI:10.1016/B978-0-08-043006-5.50020-3.

ERDENEDAVAA, P.; ADIYABAT, A.; AKISAWA, A. & OTGONJANCHIV, E. (2018): *Performance analysis of solar thermal system for heating of a detached house in harsh cold region of Mongolia*. Renewable Energy 117:217-226. DOI:10.1016/j.renene.2017.10.042.

LU, S.; ZHENG, S. & KONG, X. (2016): *The performance and analysis of office building energy consumption in the west of Inner Mongolia Autonomous Region, China*. Energy and Buildings 127:499-511. DOI:10.1016/j.enbuild.2016.06.008.

PILLARISETTI, A.; MA, R.; BUYAN, M.; NANZAD, B.; ARGO, Y.; YANG, X. & SMITH, K.R. (2019): *Advanced household heat pumps for air pollution control: A pilot field study in Ulaanbaatar, the coldest capital city in the world*. Environmental Research 176:108381. DOI:10.1016/j.envres.2019.03.019.

SAMBUU, O. & OBARA, T. (2012): *Conceptual design for a small modular district heating reactor for Mongolia*. Annals of Nuclear Energy 47:210-215. DOI:10.1016/j.anucene.2012.04.013.

SHANG, C.; WU, T.; HUANG, G. & WU, J. (2019): *Weak sustainability is not sustainable: Socioeconomic and environmental assessment of Inner Mongolia for the past three decades*. Resources, Conservation and Recycling 141:243-252. DOI:10.1016/j.resconrec.2018.10.032.

ZHANG, Y.; XIA, J.; FANG, H.; ZUO, H. & JIANG, Y. (2019): *Roadmap towards clean heating in 2035: Case study of inner Mongolia, China*. Energy 189:116152. DOI:10.1016/j.energy.2019.116152.

## Topic 2

# Buildings and Energy-Efficient Heating / Insulation (under harsh climate)

Energy and Buildings 85 (2014) 672–680

Contents lists available at ScienceDirect

Energy and Buildings

journal homepage: [www.elsevier.com/locate/enbuild](http://www.elsevier.com/locate/enbuild)



## Building application and thermal performance of vacuum insulation panels (VIPs) in Canadian subarctic climate

P. Mukhopadhyaya<sup>a,\*</sup>, D. MacLean<sup>b</sup>, J. Korn<sup>c</sup>, D. van Reenen<sup>a</sup>, S. Molleti<sup>a</sup>

<sup>a</sup>National Research Council Canada, Ottawa, Ontario, Canada

<sup>b</sup>Energy Solutions Centre, Whitehorse, Yukon, Canada

<sup>c</sup>Yukon Housing Corporation, Whitehorse, Yukon, Canada



BERARDI, U. (2017): *The impact of temperature dependency of the building insulation thermal conductivity in the Canadian climate*. Energy Procedia 132:237-242. DOI:10.1016/j.egypro.2017.09.684.

BISWAS, K.; PATEL, T.; SHRESTHA, S.; SMITH, D. & DESJARLAIS, A. (2019): *Whole building retrofit using vacuum insulation panels and energy performance analysis*. Energy and Buildings 203:109430. DOI:10.1016/j.enbuild.2019.109430.

MINGOTTI, N.; CHENVIDYAKARN, T. & WOODS, A.W. (2013): *Combined impacts of climate and wall insulation on the energy benefit of an extra layer of glazing in the facade*. Energy and Buildings 58:237-249. DOI:10.1016/j.enbuild.2012.11.033.

MUKHOPADHYAYA, P.; MACLEAN, D.; KORN, J.; VAN REENEN, D. & MOLLETI, S. (2014): *Building application and thermal performance of vacuum insulation panels (VIPs) in Canadian subarctic climate*. Energy and Buildings 85:672-680. DOI:10.1016/j.enbuild.2014.08.038.

OZEL, M. (2013): *Thermal, economical and environmental analysis of insulated building walls in a cold climate*. Energy Conversion and Management 76:674-684. DOI:10.1016/j.enconman.2013.08.013.

SALMERÓN, J.M.; ÁLVAREZ, S.; MOLINA, J.L.; RUIZ, A.; SÁNCHEZ, F.J. (2013): *Tightening the energy consumptions of buildings depending on their typology and on Climate Severity Indexes*. Energy and Buildings 58:372-377. DOI:10.1016/j.enbuild.2012.09.039.

TETTEY, U.Y.A.; DODOO, A. & GUSTAVSSON, L. (2014): *Primary Energy Implications of different Wall Insulation Materials for Buildings in a Cold Climate*. Energy Procedia 61:1204-1207. DOI:10.1016/j.egypro.2014.11.1056.

ZHAO, Y.; DUNN, A. & SHI, D. (2019): *Effective reduction of building heat loss without insulation materials via the photothermal effect of a chlorophyll thin film coated "Green Window"*. MRS Communications 9(2):675-681. DOI:10.1557/mrc.2019.52



## Original Plan

### Bachelor Level

NEW: Renewable energy and small scale energy production for buildings

NEW: Solar energy

UPDATE: Energy Systems

### Master level:

NEW: Energy audit, Energy regulations and Energy management

NEW: Energy Economics and Market Development



## New Developments

2 new relevant study programs introduced in 2020/21

B.Sc. Energy and Electrical Engineering

M.Sc. Resources and Technology

## Changes to be discussed

### Prof Ariunbolor

Renewable energy and small scale energy production for buildings  
→ change to: Renewable small scale energy production for buildings

Energy audit, Energy regulations, and Energy management  
→ Name is too long and complex

## **NEW: Matlab Programming and Dynamic Simulation**

### Prof. Altangerel:

Energy audit, Energy regulations, and Energy management  
→ Change to "**Engineering Models**" or "**Engineering Computation and Modeling in Matlab**"



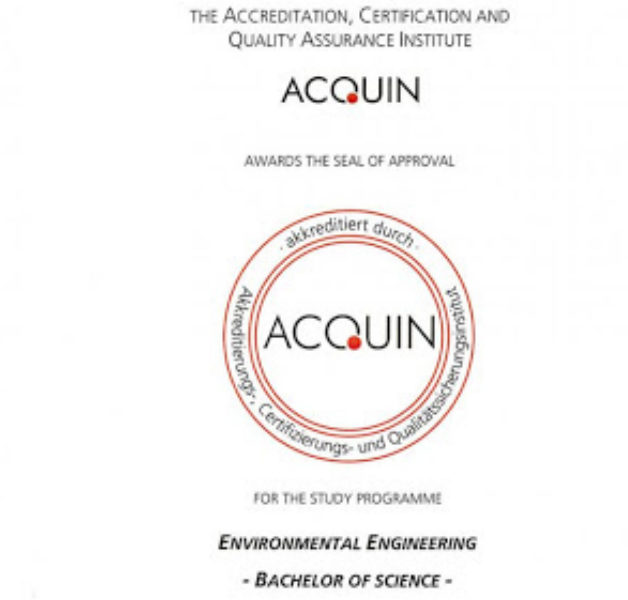
## 4 B.Sc. study programs are accredited by ACQUIN

until 30 September 2024

No re-accreditation is needed if small number of modules is introduced/modified

- Including Environmental, Mechanical, Raw Materials and Process, and Industrial Engineering

**2 new programs shall be accredited:**  
B.Sc. Electrical and Energy Engineering  
M.Sc. Resources and Technology



AT THE GERMAN MONGOLIAN INSTITUTE FOR RESOURCES AND TECHNOLOGY (GMIT)

THE ACCREDITATION IS VALID UNTIL 30 SEPTEMBER 2024.

BAYREUTH, 26 MARCH 2019

*S. Kegg*  
PROF. DR. SEBASTIAN KEGG  
CHAIRMAN OF THE BOARD

# CEBEC

Advanced Curriculum on Energy  
Efficient Buildings in Extreme  
Continental and Sunny Climate in  
Mongolia

GMIT Report on 31 AUG 2020

Prof. Dr. Daniel Karthe

