Low Exergy
Workshop, Module and Group Overview

Forrest Meggers

MONDAY — INTRODUCTIONS

Welcomes

Singapore ETH Collaboration (SEC)
- Prof Dr. Gerhard Schmitt

Future Cities Lab (FCL)
- Prof Dr. Franz Oswald

Low Exergy Module Group

"Why are we here"
- Prof Dr. Hansjürg Leibundgut

"What are we doing here"
- Forrest Meggers

"What do we hope to accomplish here"
- Prof Dr. Arno Schlueter

Discussion of Expectations

Forrest Meggers – Low Exergy Module
Low Exergy Workshop Intro – 24.01.2011

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

TUESDAY — THEORY

4 Architecture Drive, SDE3 #02-26A
09:00 Introduction of exergy
(Prof Dr Hansjürg Leibundgut)
09:20 Exery Theory and Background
(Forrest Meggers)
10:00 Zero Emission Architecture
(Prof Dr Arno Schlueter)
10:40 Break/Disscussion
11:00 Singapore Building Practices
(Prof Dr Chandra Sehkar)
11:40 Round Table Discussion
"How can exergy theory be applied in Singapore?"
12:00 Lunch Break

4 Architecture Drive, SDE1 #04-24
13:00 Design Studio
Preliminary Design Options
16:00 end

WEDNESDAY — SYSTEMS

4 Architecture Drive, SDE3 #02-26A
09:00 Introduction of systems
(Prof Dr Hansjürg Leibundgut)
09:20 Low Exergy Building Systems
(Forrest Meggers)
10:00 Design Integration of Sustainable Building Technologies
(Prof Dr Arno Schlueter)
10:40 Break/Disscussion
11:00 Efficient Solar Assisted Building Air-conditioning Systems
(Prof Dr Wenjian Cai)
11:40 Round Table Discussion
"How can we adapt and bring new systems to Singapore?"
12:00 Lunch Break

4 Architecture Drive, SDE1 #04-24
13:00 Design Studio
Refine designs and integrate systems
16:00 end

THURSDAY — CASE STUDIES

4 Architecture Drive, SDE3 #02-26A
09:00 Studio progess and intro to case studies
(Prof Dr Arno Schlueter and Forrest Meggers)
09:20 B35 and HPZ presentation
(Prof Dr Hasnjürg Leibundgut)
10:40 Break/Disscussion
11:00 ZERO Energy Building at Singapore BCA
(Prof Dr Benny Raphael)
11:40 Round Table Discussion
"What lessons can we learn from these case studies?"
12:00 Lunch Break

4 Architecture Drive, SDE1 #04-24
13:00 Design Studio
Interim design presentations by groups
16:00 end

FRIDAY — EXTENSIONS

4 Architecture Drive, ~~SDE3 #02-26A~~ SDE1 #04-24
09:00 Summary of the Week
(Prof Dr Hansjürg Leibundgut and Prof Dr Arno Schlueter)
09:20 Future Plans in Singapore
(Forrest Meggers)
10:00 Break
10:20 Final Roundtable
"What fruitful collaborations can be established"
12:00 Lunch

4 Architecture Drive, SDE1 #04-24
13:00 Design Studio
Design and Presentation Finalization
16:00 end

MONDAY 31.JAN — DESIGN STUDIO FINAL PRESENTATIONS

13:00 Presentations SDE3 #02-26A

14:00 Discussion

15:00 Apero

Low Exergy Module Overview

- Module Coordinator and 4 PhD students working in Singapore
  - Starting September 2011
- Module Leader, Prof. Leibundgut and Prof Schlueter serve as advisors from ETH
- Collaborators Prof. Tham Kwok Wai (NUS) and Prof. Cai Wenjian (NTU) also potential advisors
- Innovative mix of applied and theoretical research will spur further collaborations

Low Exergy Module Group

- Prof. Dr. Hansjürg Leibundgut (MechEng) and Forrest Meggers (MechEng & EnvEng)
  - Chair of Building Systems
- Prof. Dr. Arno Schlueter (Arch)
  - Chair of Architecture and Sustainable Building Technology
- Marcel Bruelisauer (Civil Eng)
- 3 PhD TBD – Min 1 von NTU/NUS

Group History

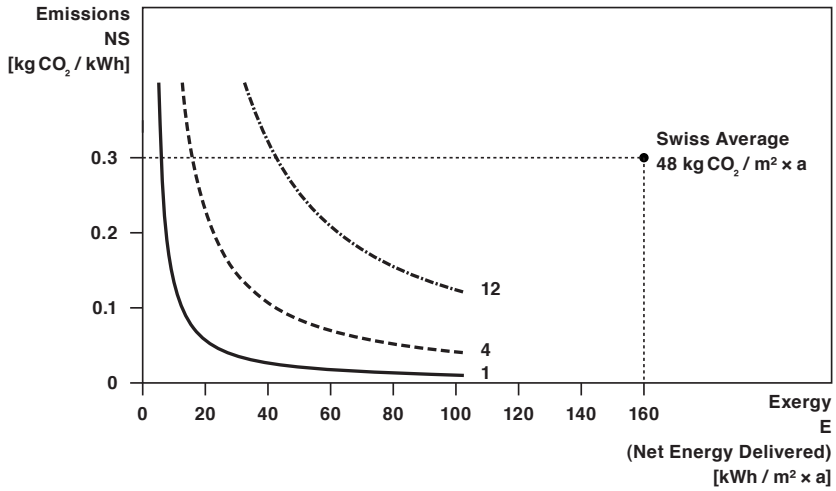
Low Exergy Lab

Low Exergy Renovation

Low Exergy Building

Low Exergy Singapore

Our core motivation



New paradigms for operation and materials

- Change the way building systems are designed
- Broader perspective in analysis
  - Exergy analysis
  - Grey energy/emissions
  - Zero Energy → Zero Emissions
- Apply new techniques to the building sector

  … and its technology, i.e. Low Exergy

Apply active LowEx concepts in Singapore

- Switzerland
  - Focus has remained on heating systems
  - Balance between seasons
- Singapore
  - Hot and humid climate
  - High temperature cooling systems
    - Humidity is a major obstacle
    - Redefining comfort models
  - Heat pump = AC/Chiller

Collaboration

- Work with labs at NUS and NTU, and with Singapore agencies
- Large potential for module overlap
  - High Performance Systems
  - Simulation of System
  - Advanced Control and Operation
    - Sensors and Smart buildings
  - Planning and Integrated building systems
  - Evaluating impacts on larger scales

Industry Collaboration

- Siemens
- 3S Solar
- Autodesk
- BS2
- Mivune
- Digitalstrom

International Collaborations

- International Energy Agency (IEA) Energy Conservation in Buildings and Community Systems (ECBCS)
  - Annex 49: Low Exergy Systems for High Performance Buildings and Communities www.annex49.com
- Holcim Foundation for Sustainable Construction

Deliverables

- Evaluation of Singapore energy overflows and material flows for low exergy design
- Low exergy technology adapted for hot and humid climates
- Novel research and development of new systems and technology
- Four PhD projects (Plus my work)
- Courses and Workshops (Design Research Studio)
- Low Exergy Demonstration Container Laboratory
- Minimum one further implementation project

Workshop Deliverables

- Provide the background of our work
  - Exergy theory and its use with buildings
  - Description of low exergy technologies
  - Presentation of cases studies demonstrating the use of these systems
- Incorporate the Singapore Perspective
  - Clarify the challenges and opportunities here
  - Discover the successes already made and the remaining needs
- Design Research Studio with students
  - More from Prof Schlueter

Summary

Creating a framework to expand the application of **new methods** to achieve **high performance buildings** into a wider variety of climates to **reduce CO_2** emissions.

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