

# **The Future Cities Laboratory Singapore - Zürich**

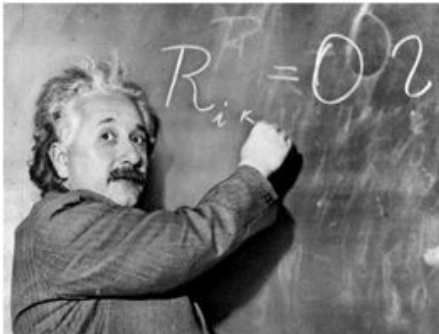
ETH – Novatlantis, August 27, 2013

Prof Gerhard Schmitt, ETH Zürich  
Director, Singapore-ETH Centre  
Senior Vice President, ETH Global

Dr Remo Burkhard  
Managing Director, Singapore-ETH Centre

# ETH Zürich

Swiss Federal Institute of Technology



Location: Where Einstein started his career  
 Ranking: #1 in Continental Europe  
 Performance: 21 Nobel Prizes  
 Science-to-industry: 2 Spin-Offs per month  
 Globalization: #1 in International Outlook:  
 China, Korea, Japan, ASEAN  
 Research contacts: >6'000 globally



Memorandum of Understanding and bilateral Agreements



				open
Country	Name	Description / URL		Total
Europe				27
Africa				1
North America				26
South America				7
Asia				41
Oceania				4
<b>TOTAL</b>				<b>106</b>

(SEC) SINGAPORE-ETH  
 CENTRE 新加坡-ETH  
 研究中心

(FCL) FUTURE  
 CITIES  
 LABORATORY 未来  
 城市  
 实验室

## Future Cities Laboratory - Motivation

- In the next 25 years, 2 Billion more people need living and working spaces in existing and new cities
- The Future Cities Laboratory in Singapore and Switzerland proposes technologies and processes for sustainable future cities
- Calculating the demand and capacities from bottom-up, the **potential** of contributions for Swiss and Singaporean industry is large

# ETH Future Cities Laboratory

- Establishment in Singapore of the first ETH research Institute outside Switzerland, starting with two people in September 2010 and growing to 200 active members in August 2013
- Attracting 13 ETH faculty as Principle Investigators, 3 Assistant Professors, more than 20 postdocs, 46 Ph.D. students and 87 master students, massively exceeding key performance indicators set for the first three years
- Producing 139 academic articles and journal publications, 142 international conference publications, 153 interim publications, 26 design studio workshops, 4 invention disclosures, 8 software disclosures, 2 Patent filings, 15 awards and honours, 1.284 million Singapore dollars in additional external industry funding, organising 8 international conferences, 154 public relations activities, 76 working meetings with highest level people.

# SEC Vision

FCL  
Future Cities Laboratory

Phase I: 2010 - 2015

Phase II: 2015+

FRS  
Future Resilient Systems

Phase I: 2014 - 2018

Phase II: 2018+

FFS  
Future Food Security

Phase I: 2015 - 2020

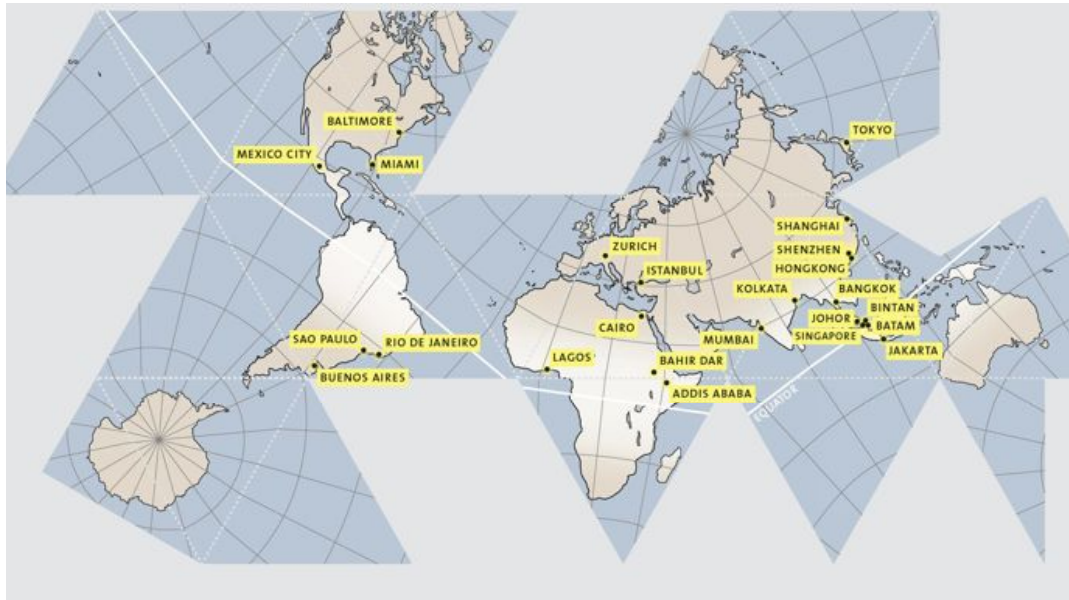


# FUTURE CITIES LABORATORY

## RESEARCH QUESTIONS

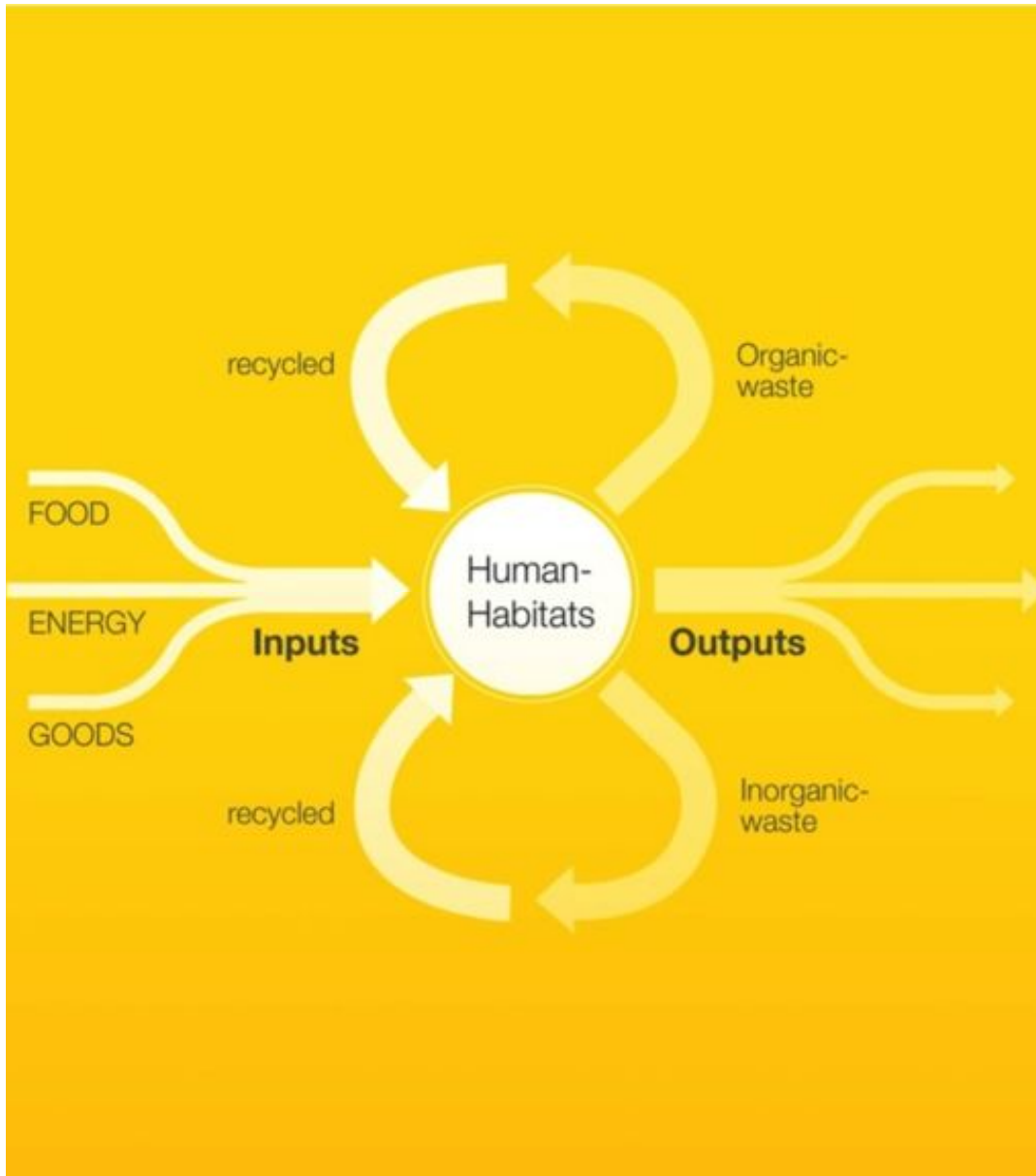
Which methods can increase the sustainable performance of cities?

How can we develop a new curriculum of urban science?



# Understanding the City

- Cultural Context
- Urban Metabolism
- Stocks and Flows



# Urban Metabolism

Understand the city as a dynamic and complex system

Read and model this system in terms of Stocks and Flows

Recognise Urban Stocks as basic elements of the urban metabolism and as locally available resources



# Examples for Urban Stocks and Flows

- People and Health
- Water and Capital
- Energy and Materials
- Space and Density
- Transportation and Information

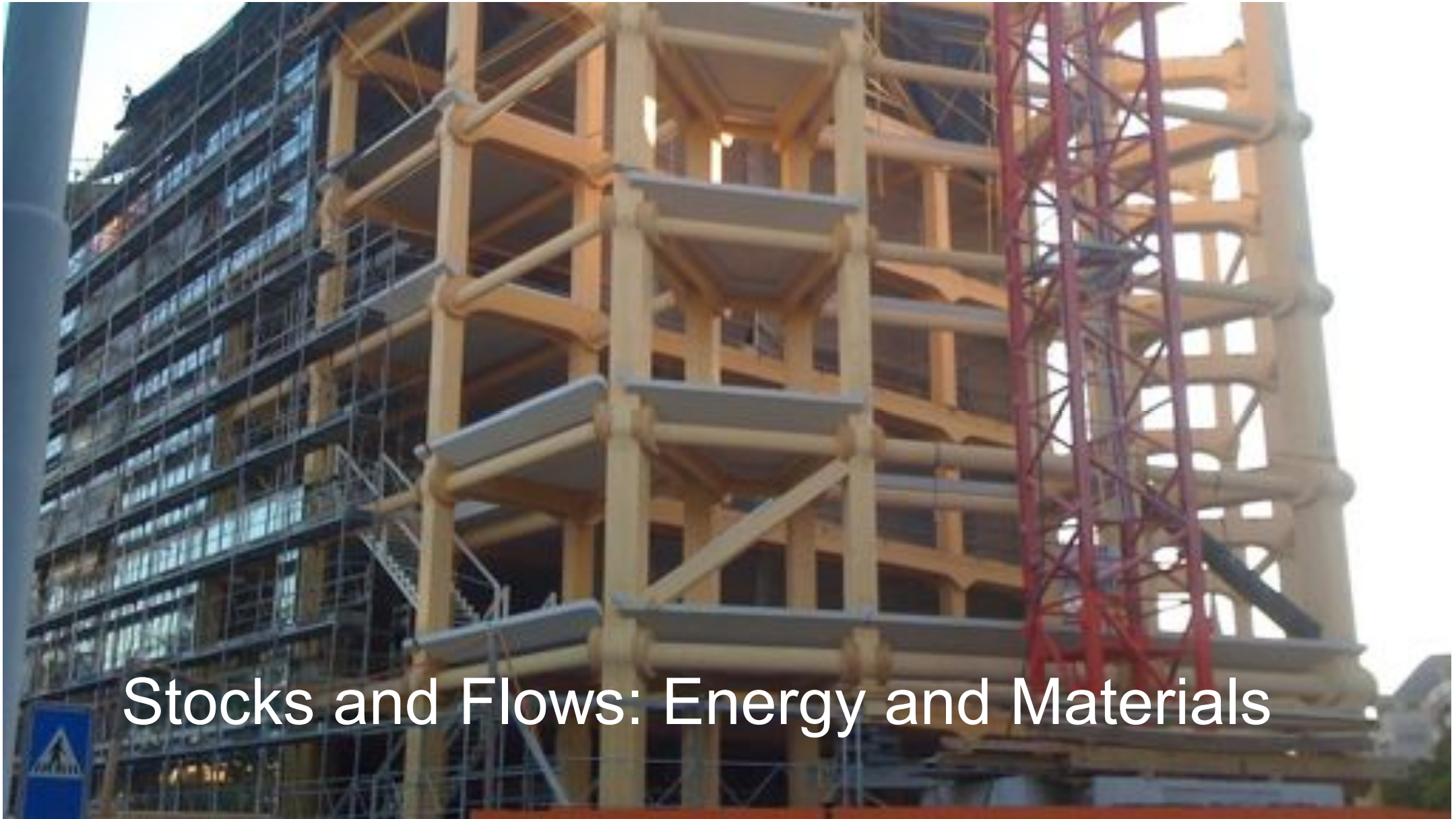
# Stocks and Flows: People and Health



# Stocks and Flows: Water and Capital





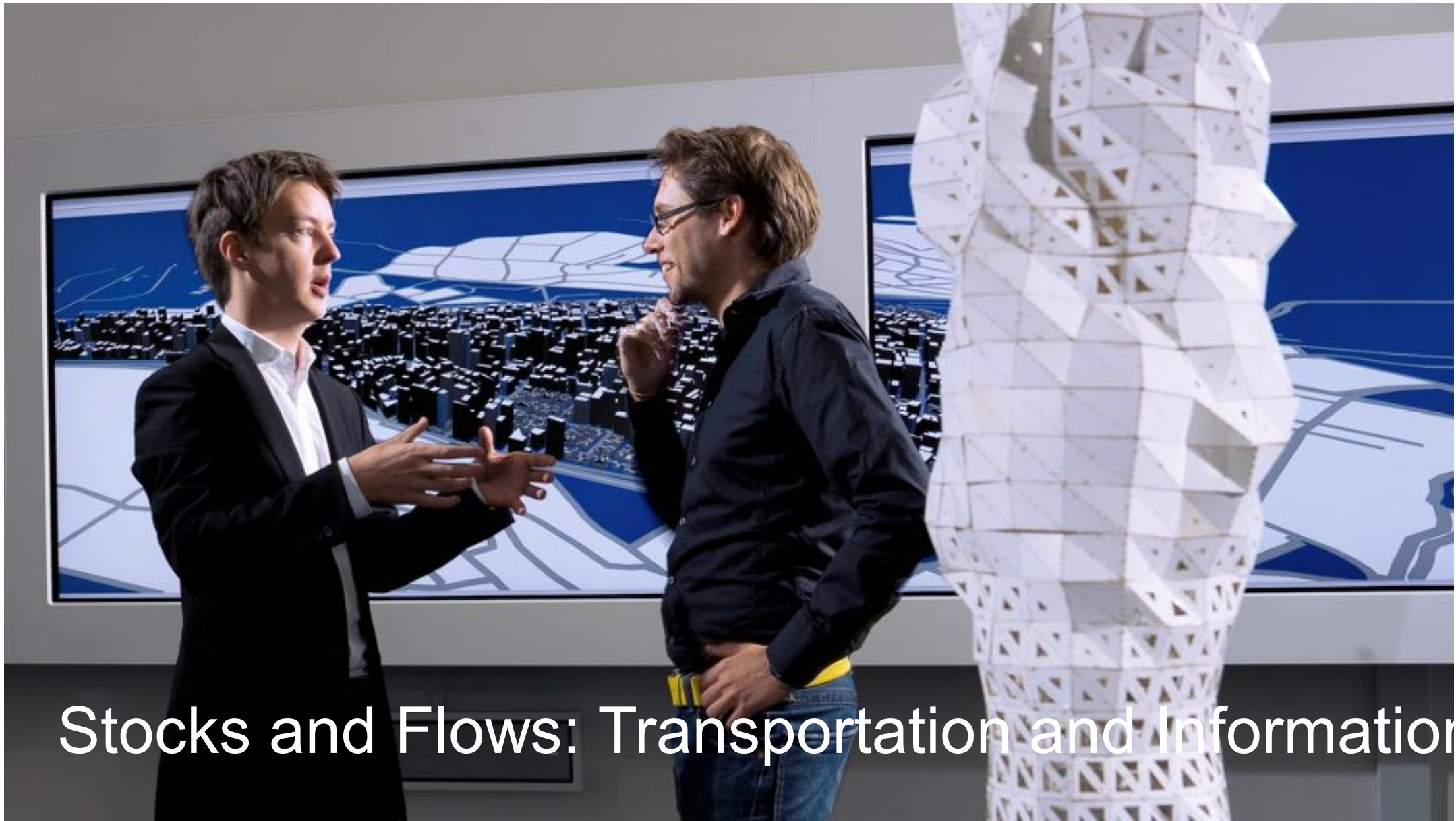


Stocks and Flows: Energy and Materials



# Stocks and Flows: Space and Density



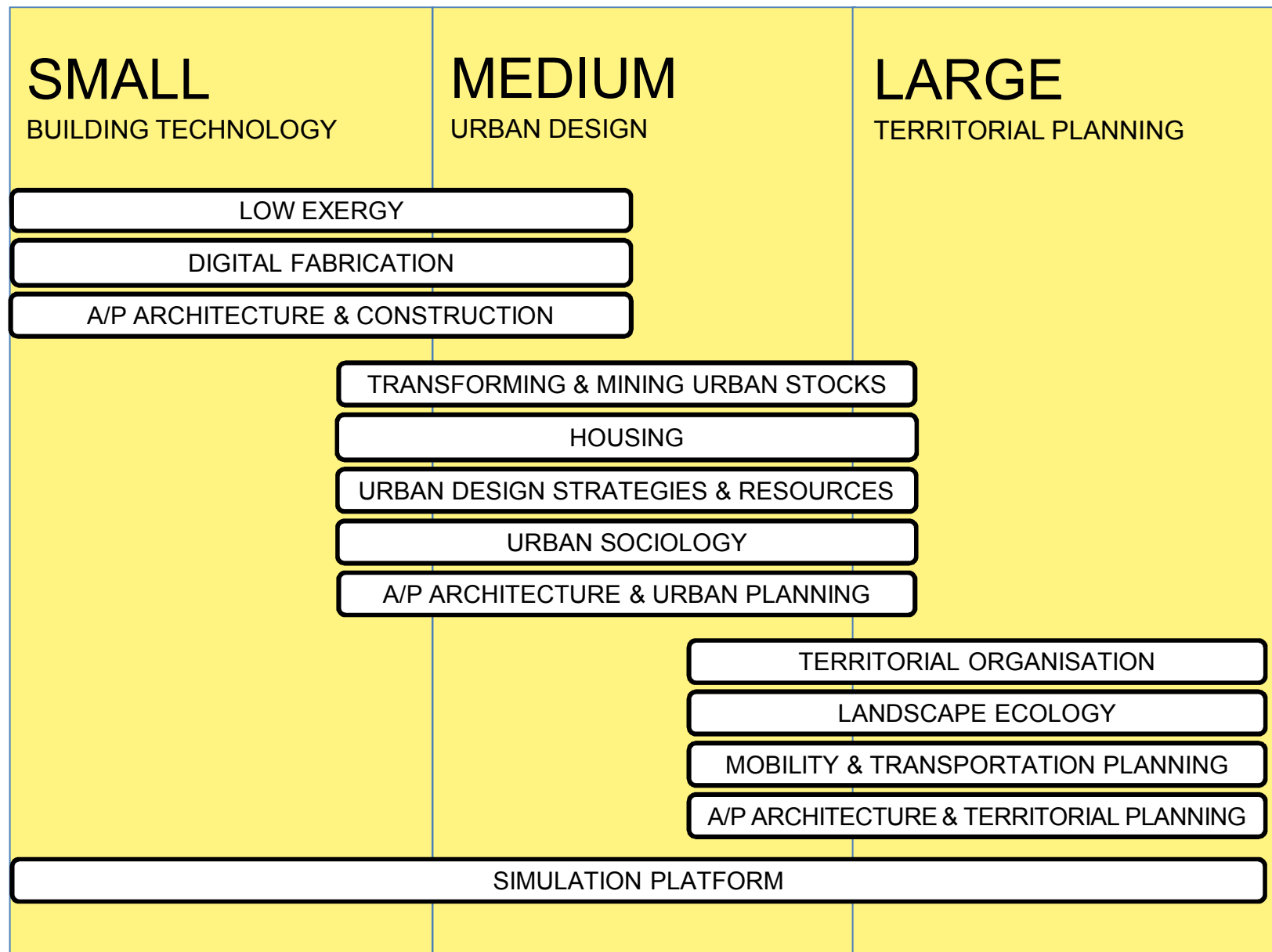


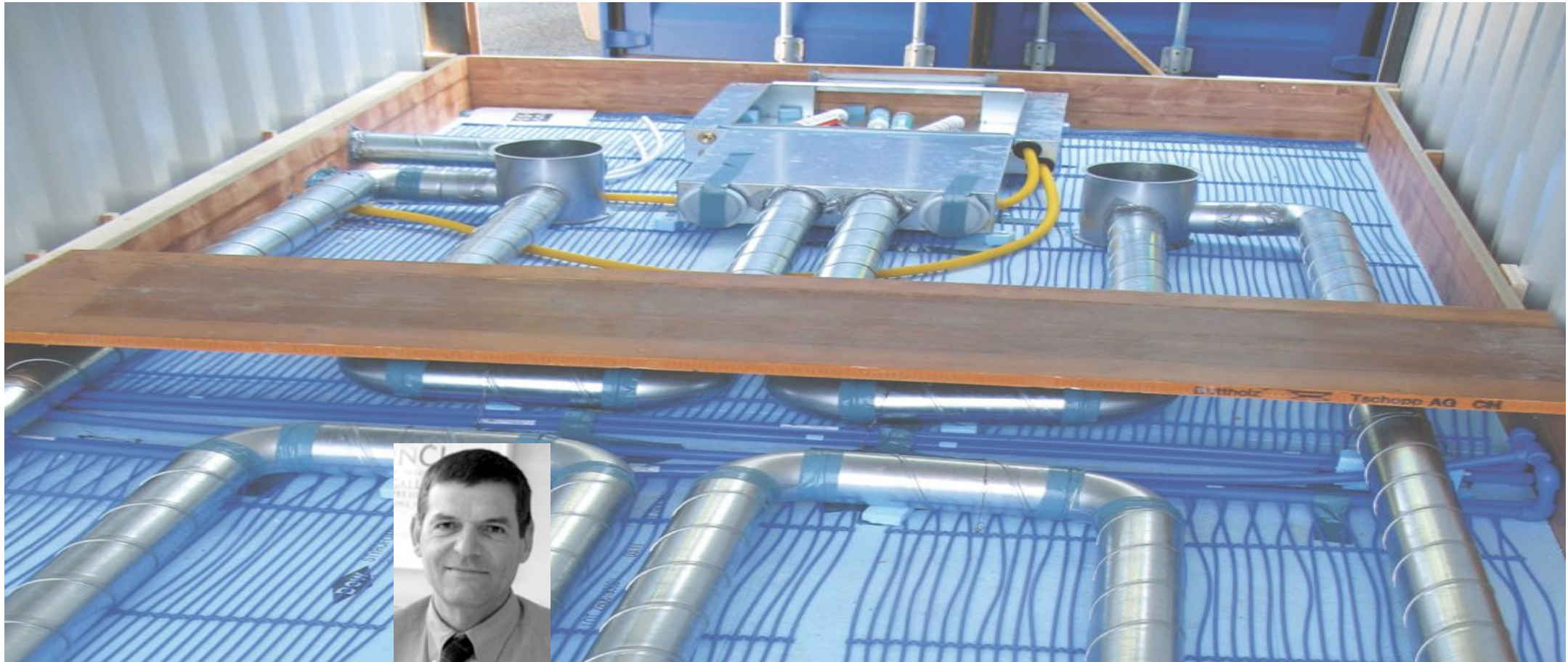
Stocks and Flows: Transportation and Information



# Scales, Stocks and Flows

SPACE  
ENERGY  
MATERIALS  
PEOPLE  
CAPITAL  
WATER  
INFORMATION





# Research Modules

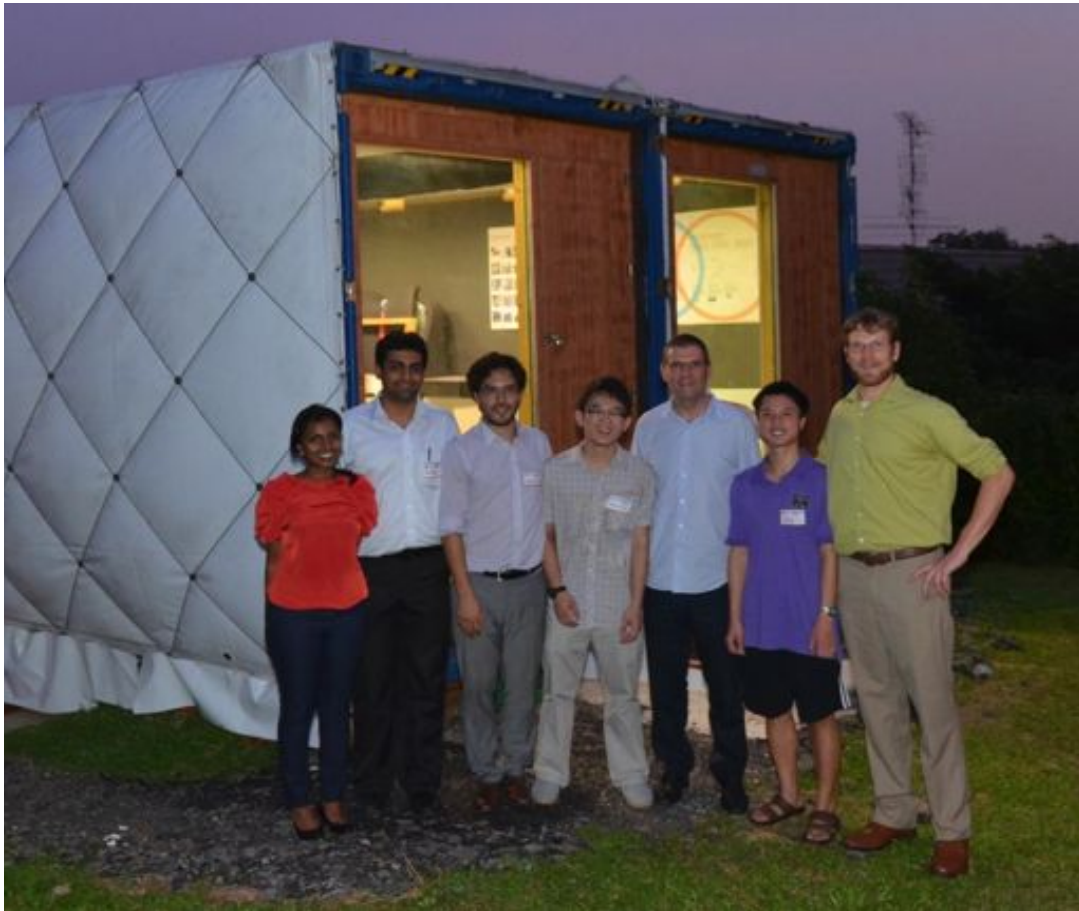
Low Exergy

Prof. Dr Hansjürg Leibundgut

Developing systems to cut the electricity used for the standard air-conditioner and to reduce CO<sub>2</sub> emissions caused by air conditioners.

Image source: Module I

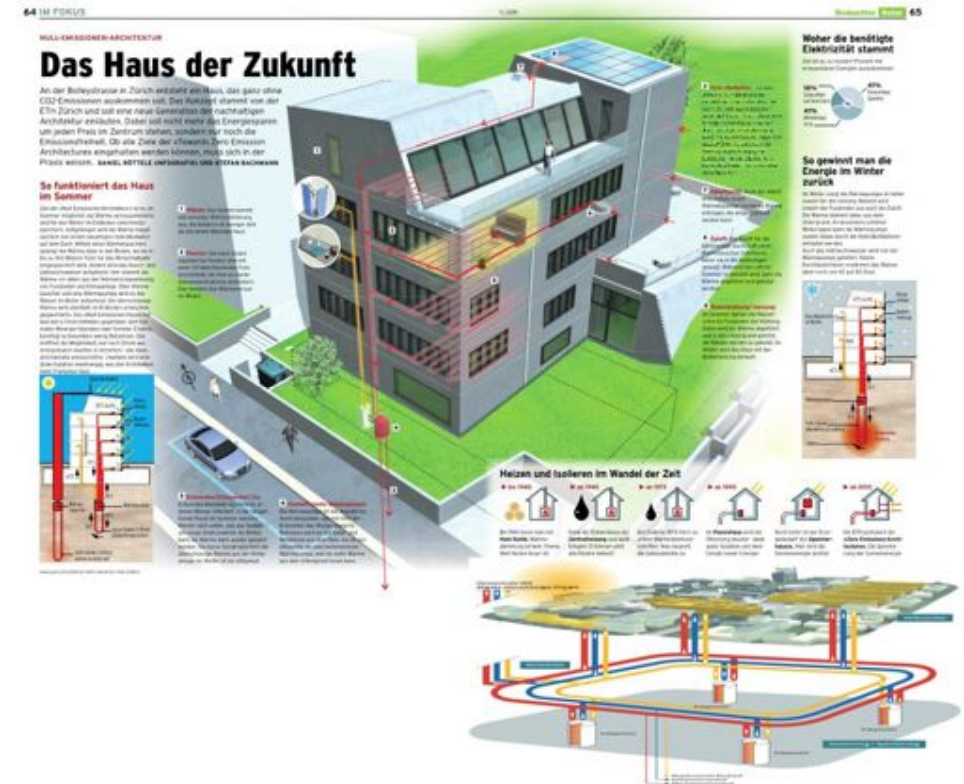
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Using the concept of exergy to develop better building systems, reducing energy consumption and eliminating CO2 emissions.

Implemented in Switzerland  
Monte Rosa, Science City, B35 etc.  
Transported to Singapore  
BubbleZERO

## Module I: Low Exergy







# Research Modules

Digital Fabrication

Prof. Fabio Gramazio  
Prof. Matthias Kohler

Using robotic technology to  
design models of high-rise  
buildings.

Image source: Bas Princen

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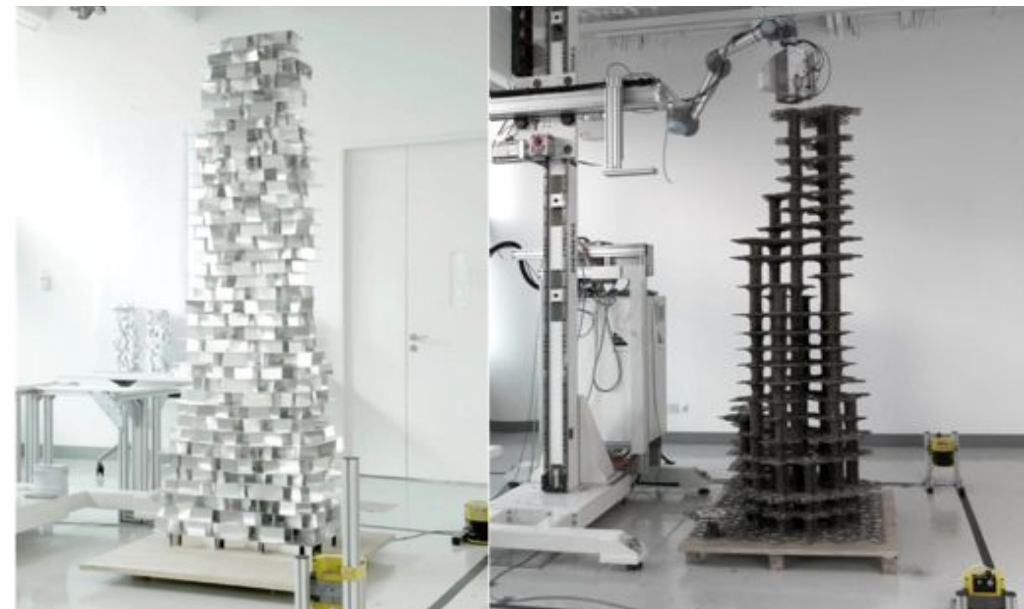


## ACHIEVEMENTS

Investigations into the potentials and implications of robotic fabrication on high rise typologies



Design of robotic fabricated high rises





# Housing

Prof. Sacha Menz

An Interdisciplinary Case Study  
on the Development of Singapore  
Public Housing Typologies (1960-  
Present).

Image source: Module X





# Research Modules

Transforming & Mining Urban  
Stocks

Prof. Dr Uta Hassler

Exploring the preservation and  
conservation of heritage  
buildings.

Image source: Module III

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# Research Modules

Urban Design Strategies &  
Resources

Prof. Kees Christiaanse

Investigating the notion of  
centralities in the city, and the role  
of the airport with respect to  
mobility, migration and  
infrastructure.

Image source: Max Hirsh

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SINGAPORE



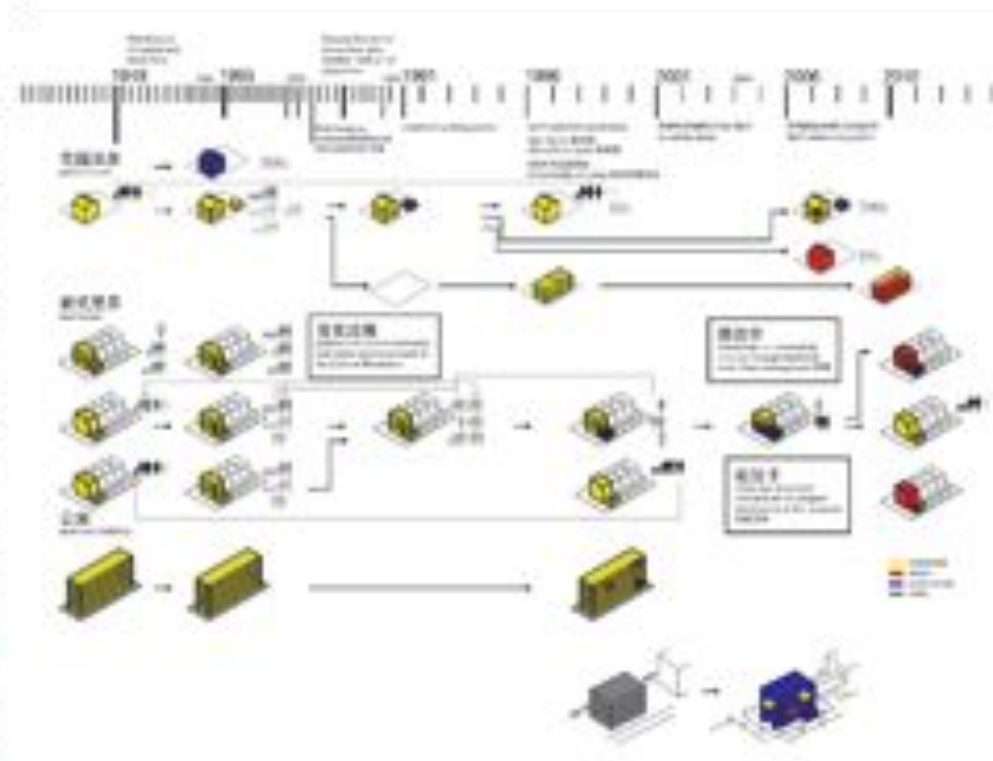
SHANGHAI



SHENZHEN



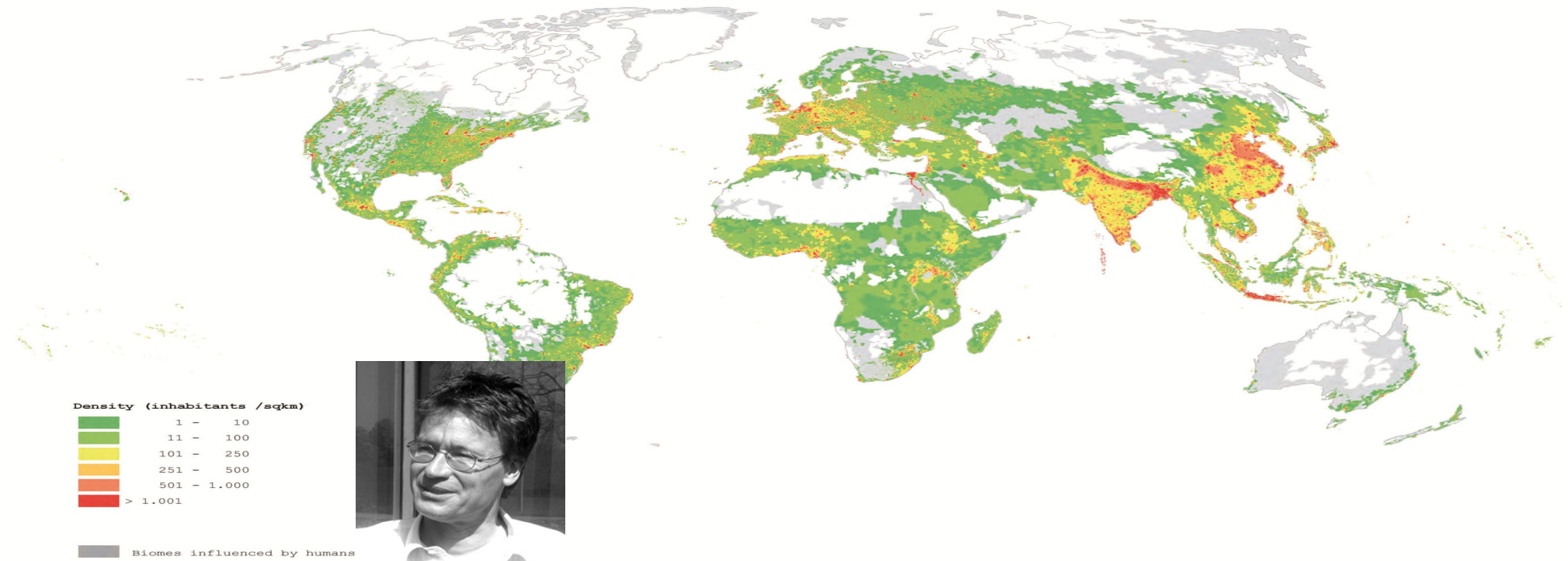
BANGKOK



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# Research Modules

Urban Sociology

Prof. Dr Christian Schmid

Comparative studies of cities.

Image source: Module V

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# Research Modules

Territorial Organisation

Prof. Dr Marc Angélil

Mitigating poverty through building  
sustainable towns.

Image source: Module VI

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Baltimore



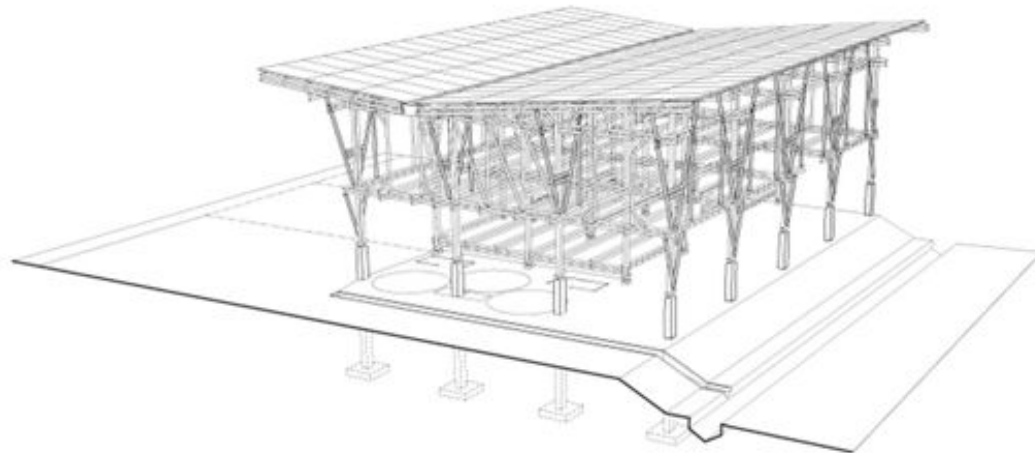
Dharavi



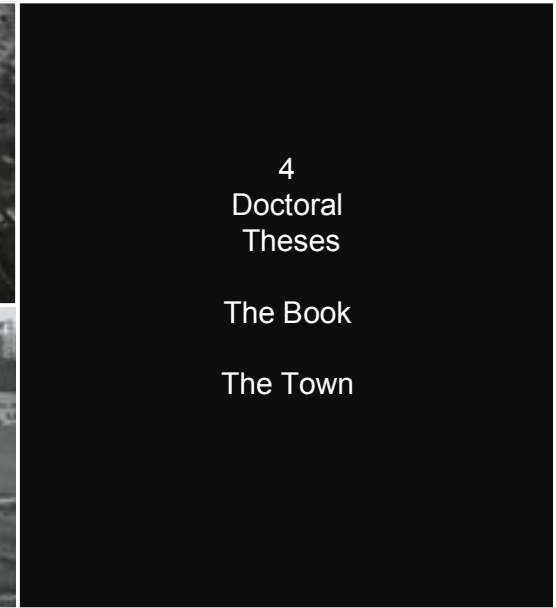
Addis Ababa



Egypt



NESTown



4  
Doctoral  
Theses

The Book

The Town

Achievements



Mirroring Effects:  
On the Political Economy of Territory

Marc Angélil and Cary Siress

OBJECTS IN MIRROR ARE CLOSER  
THAN THEY APPEAR





# Research Modules

Landscape Ecology

Prof. Christophe Girot

Understanding and improving the  
future of urban rivers.

Image source: Derek Vollmer

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## Module VII: Landscape Ecology

Singapore International Water Week (SIWW) co-hosted with the World Cities Summit, 2-4 July 2012 Marina Sands Expo and Convention Centre.

Display of work to date and forum for discussion

Semester-long research project with University of Indonesia and the National University of Singapore

43 undergraduate and graduate students

- 200 household surveys
- Groundwater table and river stage data for 3 months
- Design scenarios for future river improvements

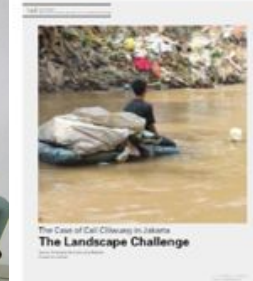
Meetings on data acquisition and possible collaboration



Collaborations

1 MOU and 2 LOAs with Institute of Technology, Bandung (ITB), Bogor Agricultural University (IPB) and University of Indonesia (UI)

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Formal Outputs

2 Journal publications

2 International Conferences

2 Invited talks

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# Research Modules

Mobility & Transportation  
Planning

Prof. Dr Kay Axhausen

Studying urban transport systems to  
maximize efficiency.

Image source: Module VIII

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# Research Modules



Simulation Platform

Prof. Dr Gerhard Schmitt

Supporting design- and decision-making processes with new data acquisition, information visualisation and simulation techniques.

Image source: Naomi Hanakata

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