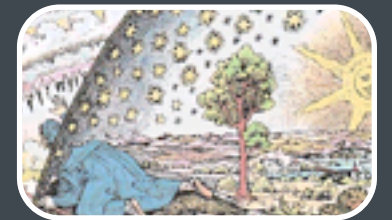


Simulation

L5: Theory, Experiment, and Simulation

Definition • Examples



L6: Simulation and Design

Digital Chain • Monte Rosa • Future Cities Project



L7: Computation and Complexity

Simulation of Complex Systems



Philosophy of Science



Experiment



Theory

Philosophy of Science



Simulation:

Design Perspective



Animation • Renderings • Models • Why PC? • Digital Chain

Simulation As An Assistance

Simulation As Visualisation

Science View



Theory • Experiment • Simulation

Simulation As An Experiment

Simulation As Visualisation

2000 Watt continuous average per person --> 17'520 kWh per person per year (not only electricity)

2000 Watt Society

„In the last 125 years, the carbon dioxide concentration in the atmosphere has risen by 35 percent. A reorientation is urgently necessary. The vision of the 2000-watt society calls for a continuous reduction in energy needs to 2000 watts pro person. This target should be achieved as quickly as possible. By the year 2050, the amount of fossil energy sources can be cut in half from the current figure of 3000 watts to 1500 watts per person. There are good reasons for the extended time horizon: the change requires rigorous adjustment of the infrastructure and an intelligent lifestyle, otherwise the 2000-watt society will remain merely a vision.“

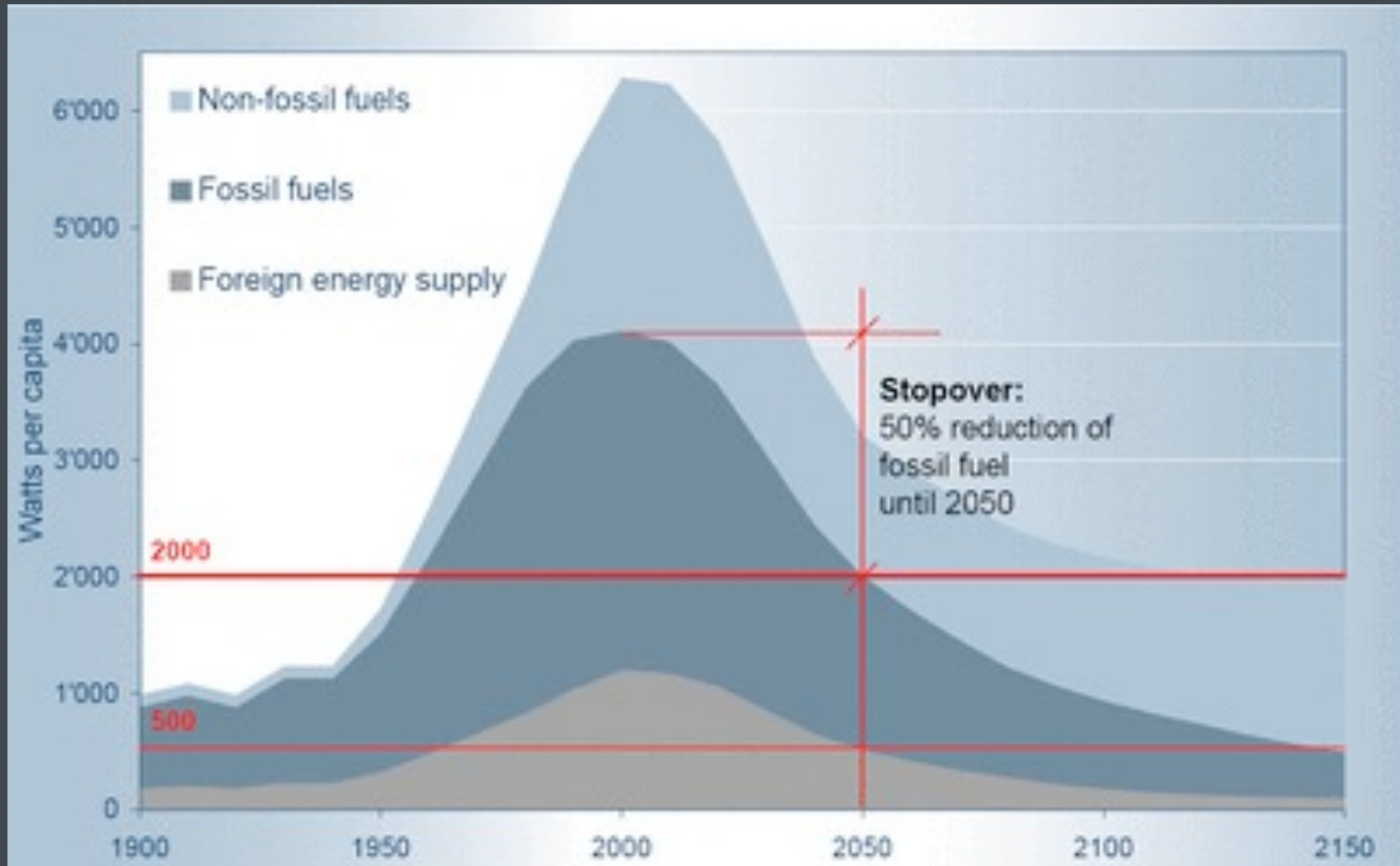
<http://www.novatlantis.ch/index.php?id=26&L=1>



Chair for Information Architecture

2000 Watt continuous average per person --> 17'520 kWh per person per year (not only electricity)

2000 Watt Society



2000 Watt continuous average per person --> 17'520 kWh per person per year (not only electricity)

1 Ton CO₂ Society

„A CO₂ output of one ton per capita a year is also an applicable long-term goal for Switzerland. This limit corresponds to a consumption of around 500 watts of fossil fuels. If the fossil fuel energy needs are reduced at the pace specified in the 2000-watt vision, the ambitious CO₂ target can be achieved in the second half of this century or at the very latest, in the course of the next century.“

<http://www.novatlantis.ch/index.php?id=26&L=1>



Chair for Information Architecture

2000 Watt continuous average per person --> 17'520 kWh per person per year (not only electricity)

1 Ton CO₂ Society

- Enhancement of **material** and energy efficiency
- Substitution of **renewable energy sources** for fossil fuels and reduction in CO₂ intensity of other use of fossil fuel energy
- **New forms of lifestyle** and entrepreneurship – according to motto: using instead of owning
- **Professionalism in planning and investment as well as in the operation of buildings and facilities.**

Mumbai, April 2010

0.3

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Chair for Information Architecture

Wednesday, April 14, 2010

Mumbai, April 2010

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Chair for Information Architecture

Wednesday, April 14, 2010

Mumbai, April 2010

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Mumbai, April 2010

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Monte Rosa exhibition, March 2010

2.0

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Chair for Information Architecture



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Chair for Information Architecture

Habitat Centre, New Delhi, India

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Chair for Information Architecture

Singapore, October 2009

12.0

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Chair for Information Architecture

Wednesday, April 14, 2010

Riyadh, Saudi Arabia, January 2010

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Chair for Information Architecture

Simulation:

Design Perspective



Animation • Renderings • Models • Why PC? • Digital Chain

Science View



Theory • Experiment • Simulation

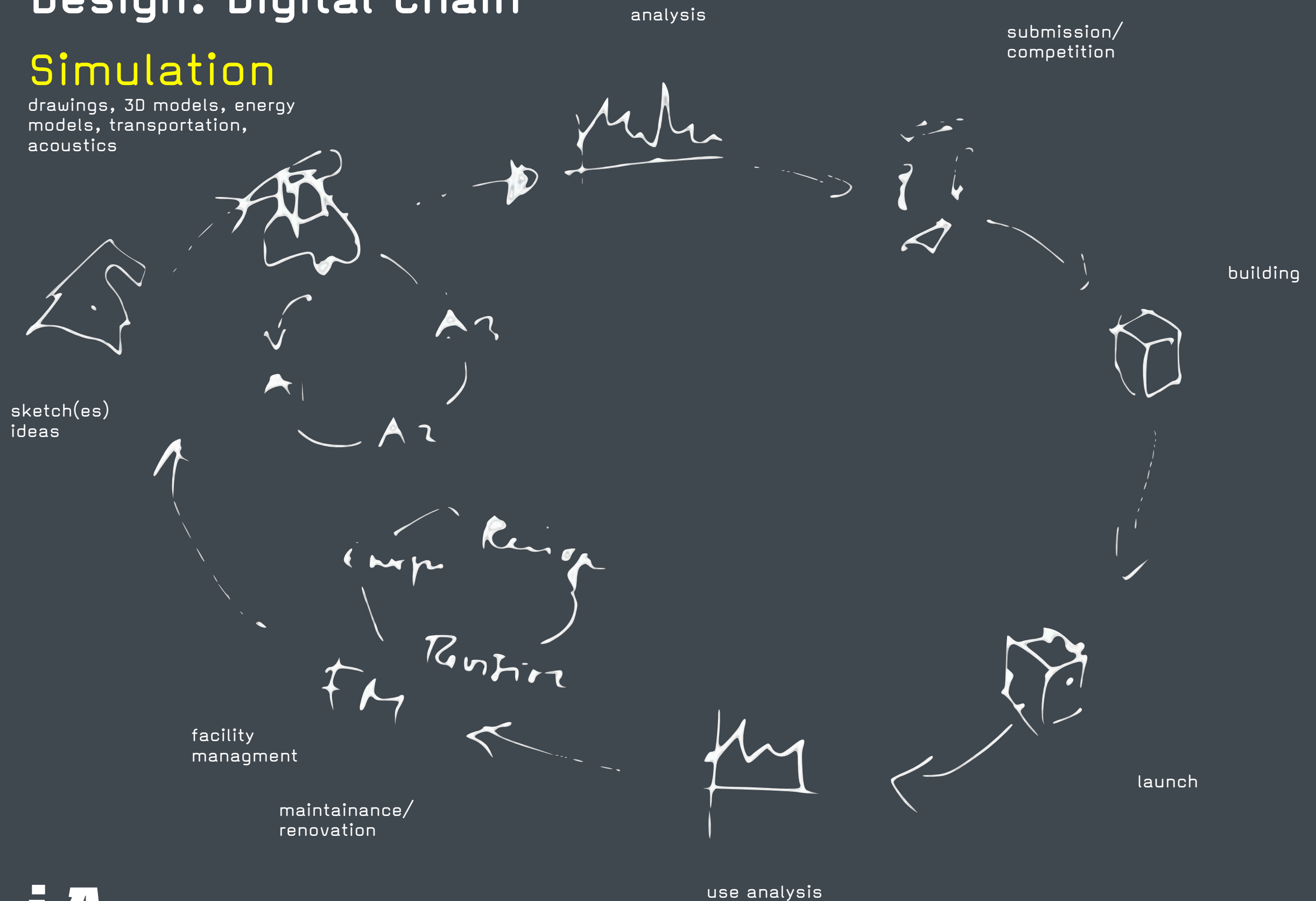
Simulation As An Assistance

Simulation As Visualisation

Design: Digital Chain

Simulation

drawings, 3D models, energy
models, transportation,
acoustics

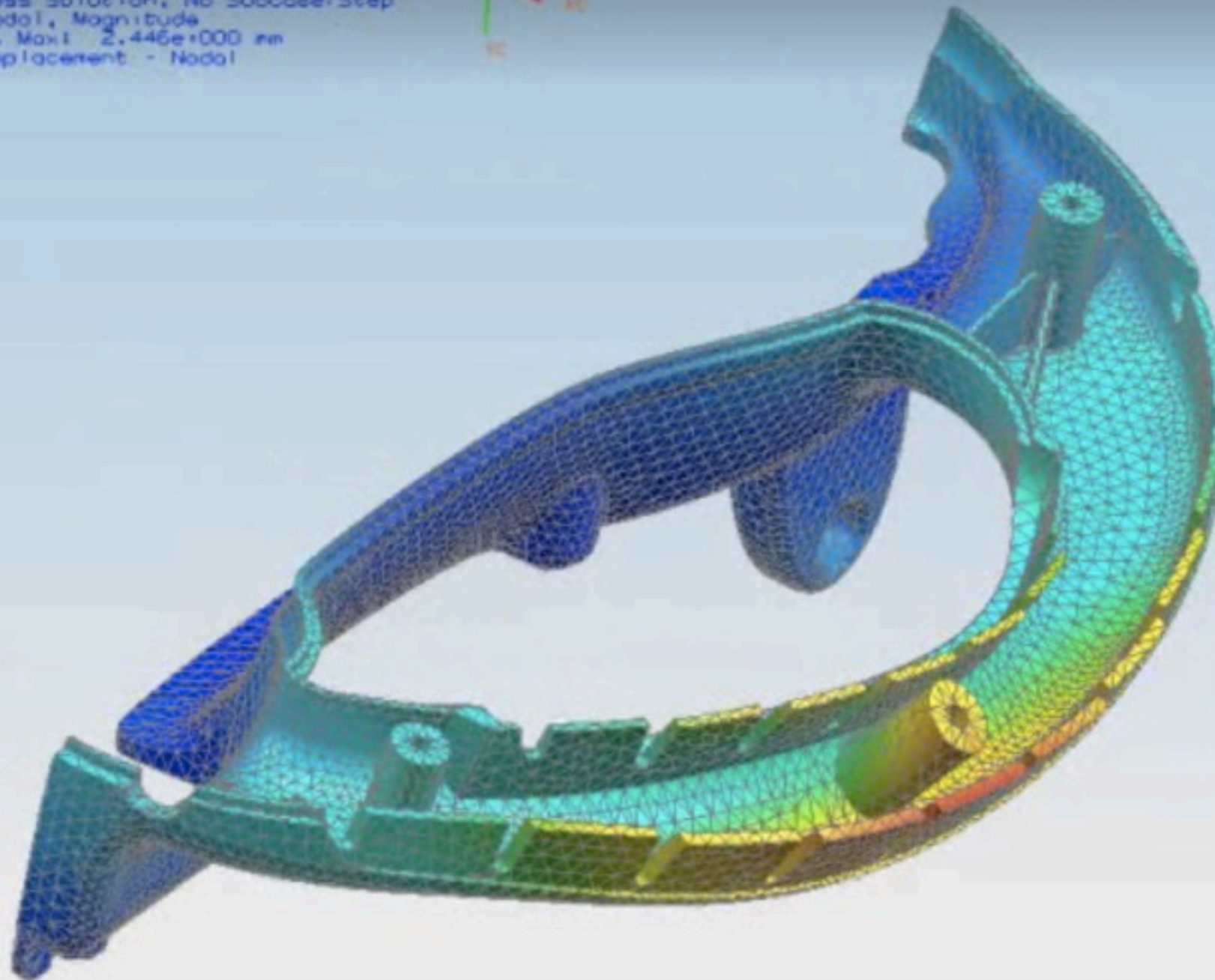
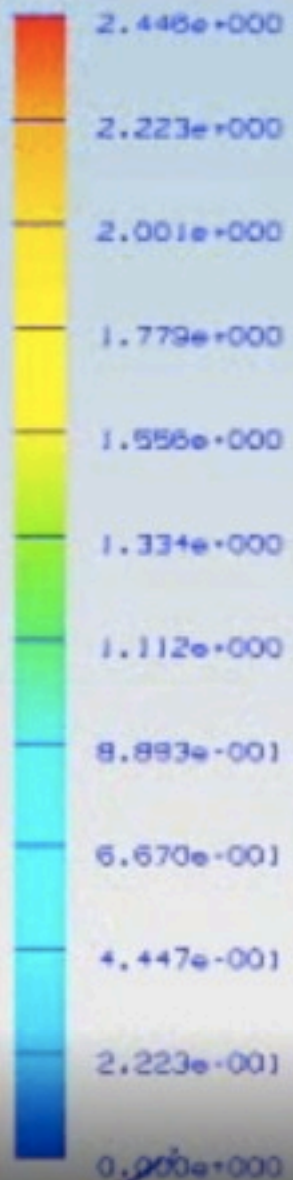


Simulation

Choose next to continue

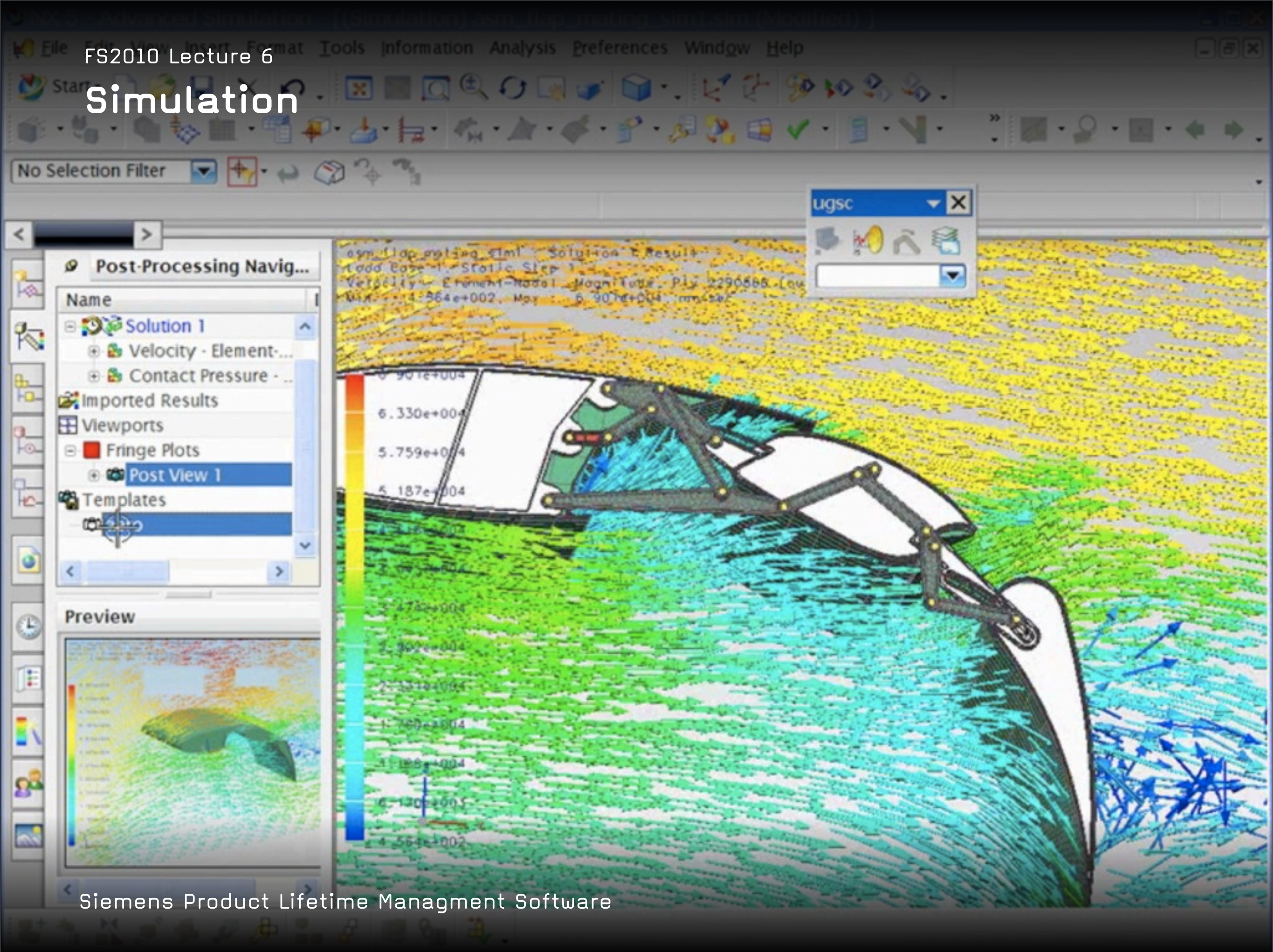
< NX CAE Stress Wizard >

torque_test, Stress Solution, No Subcase/Step
Displacement - Nodal, Magnitude
Min: 0.000e+000, Max: 2.446e+000 mm
Deformation: Displacement - Nodal



Siemens Product Lifetime Management Software

Simulation



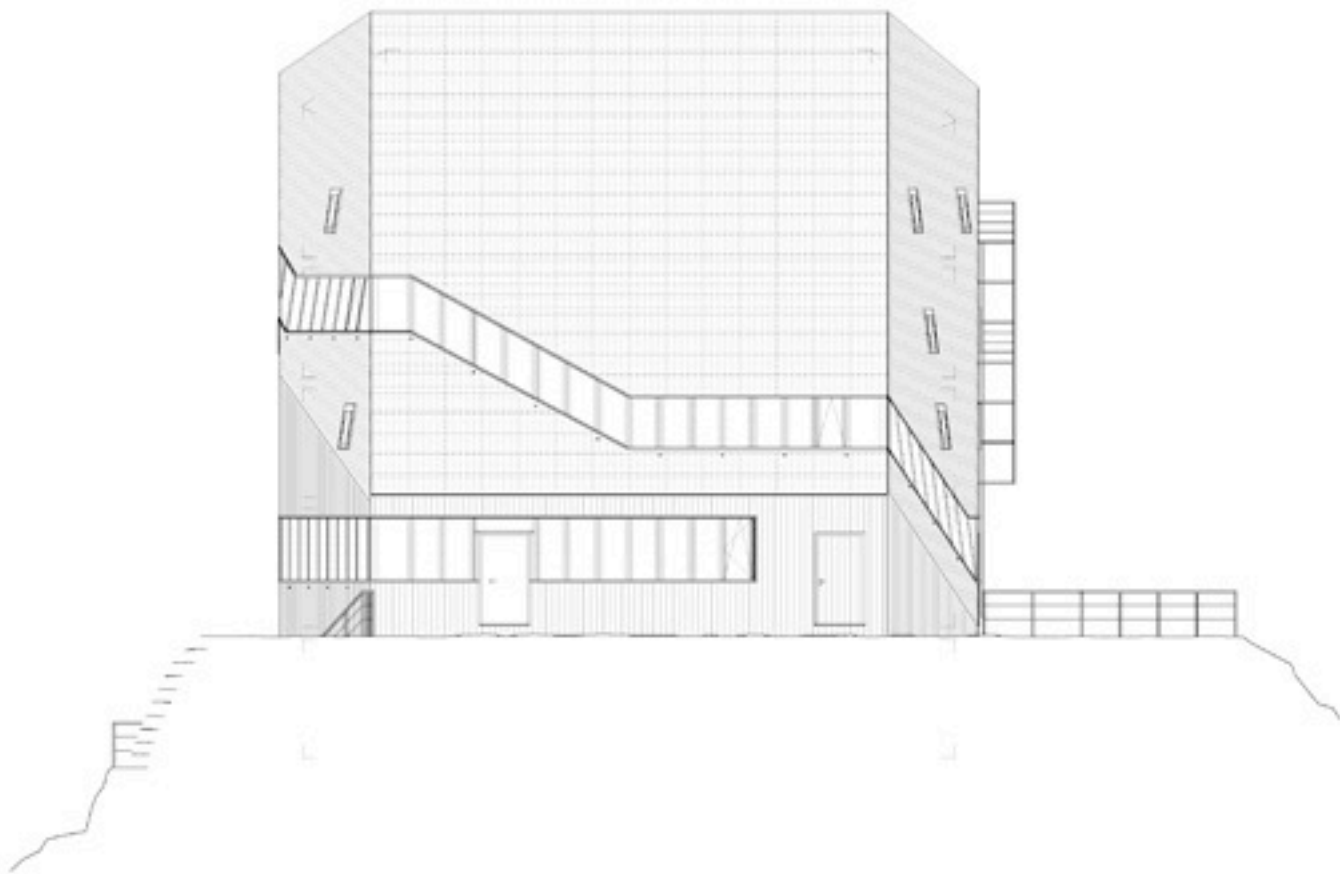
Siemens Product Lifetime Managment Software

FS2010 Lecture 6

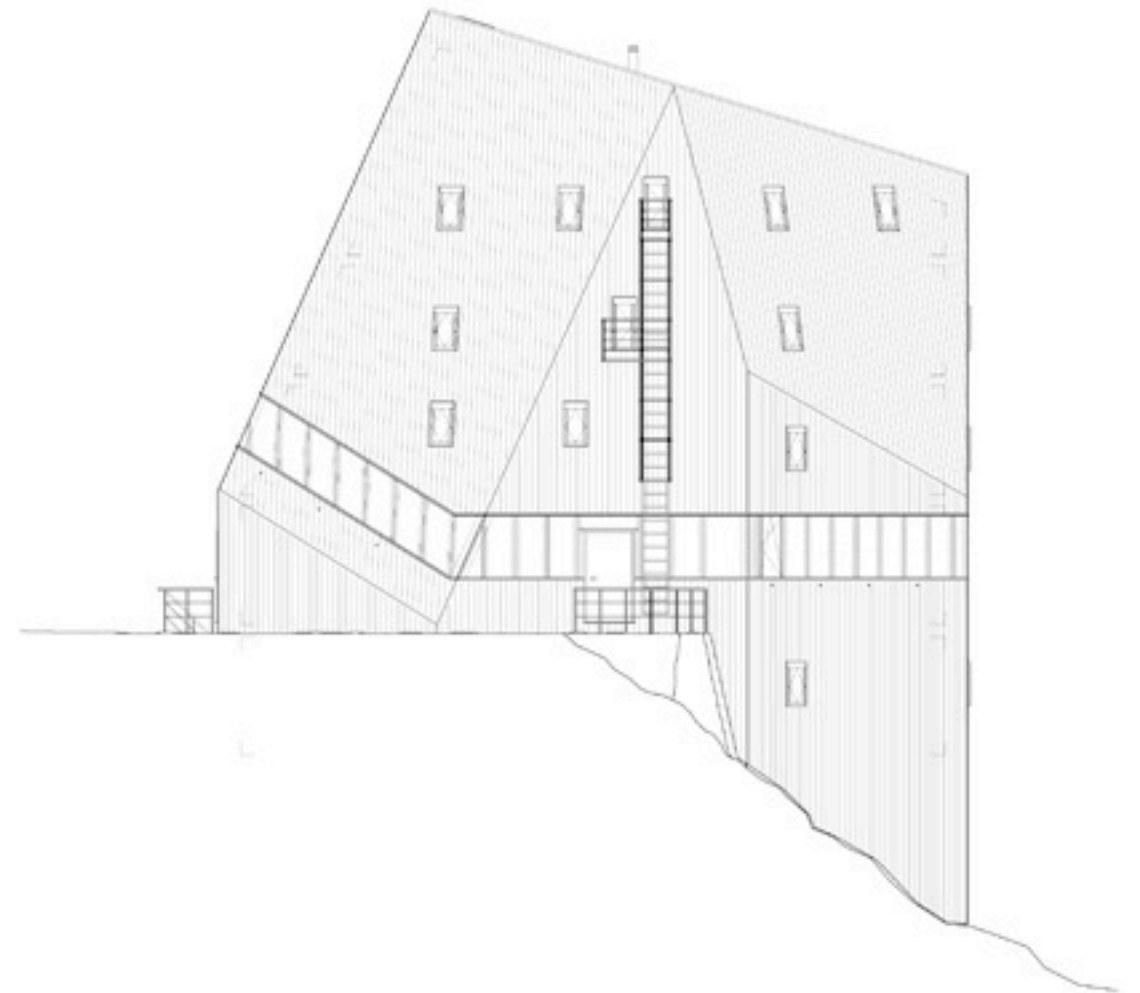
Monte Rosa Project



Monte Rosa

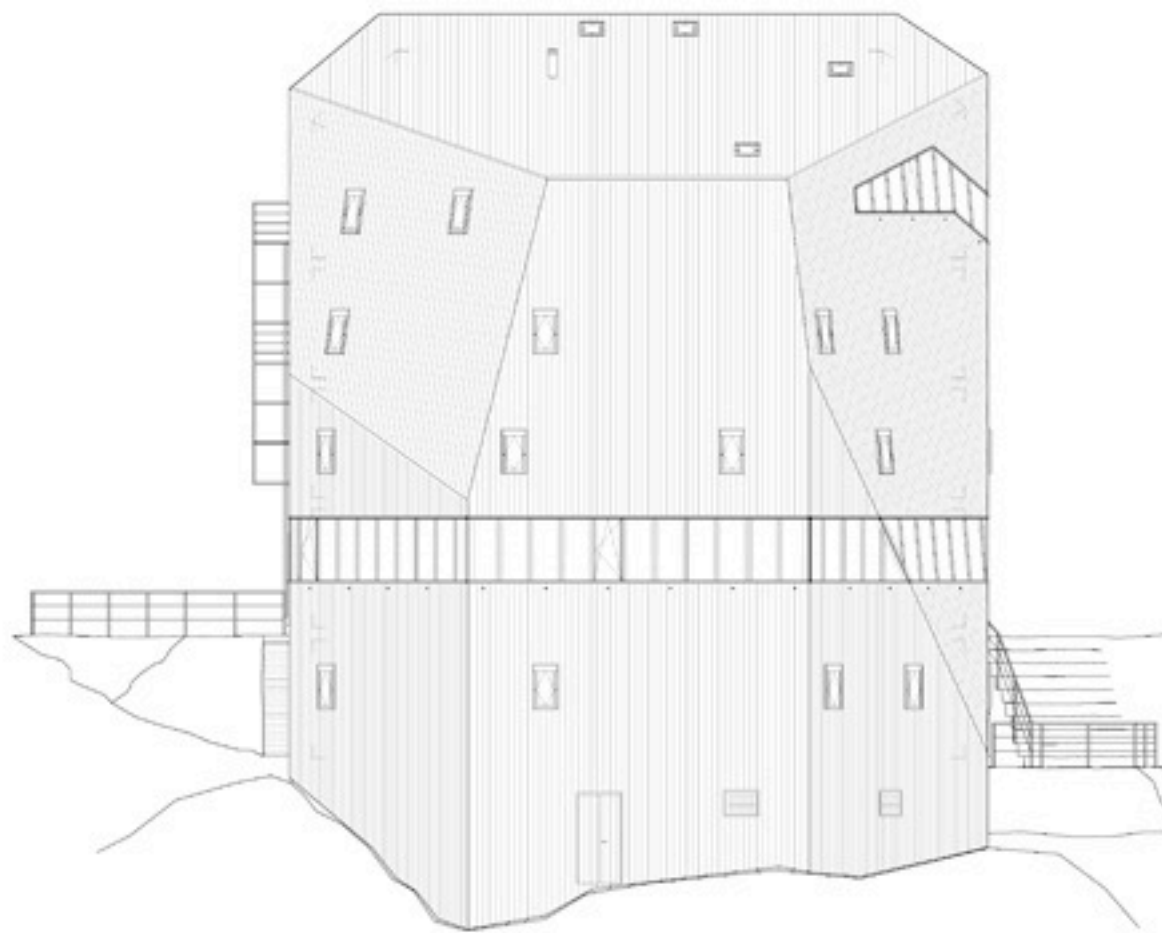


south elevation

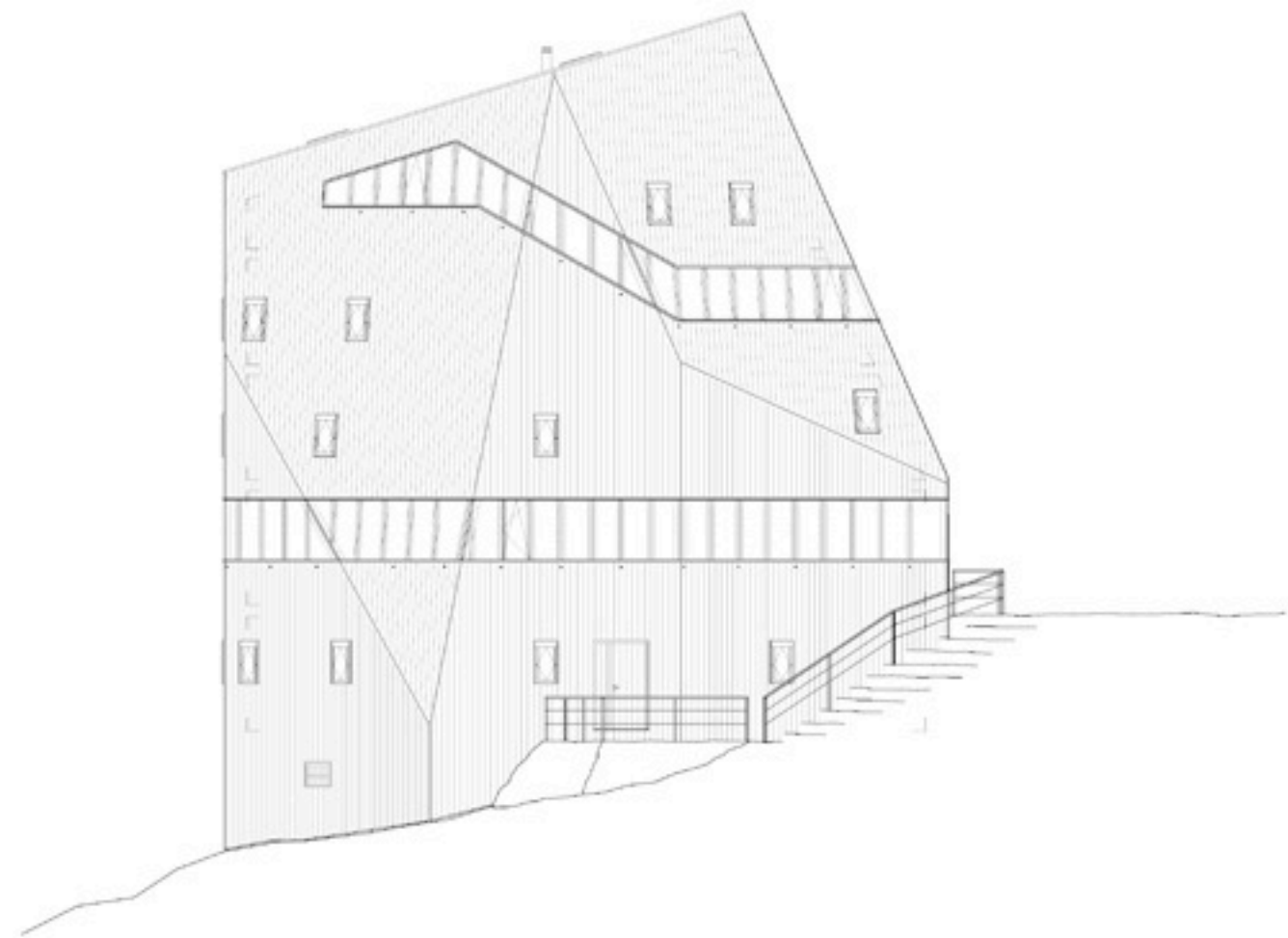


east elevation

Monte Rosa

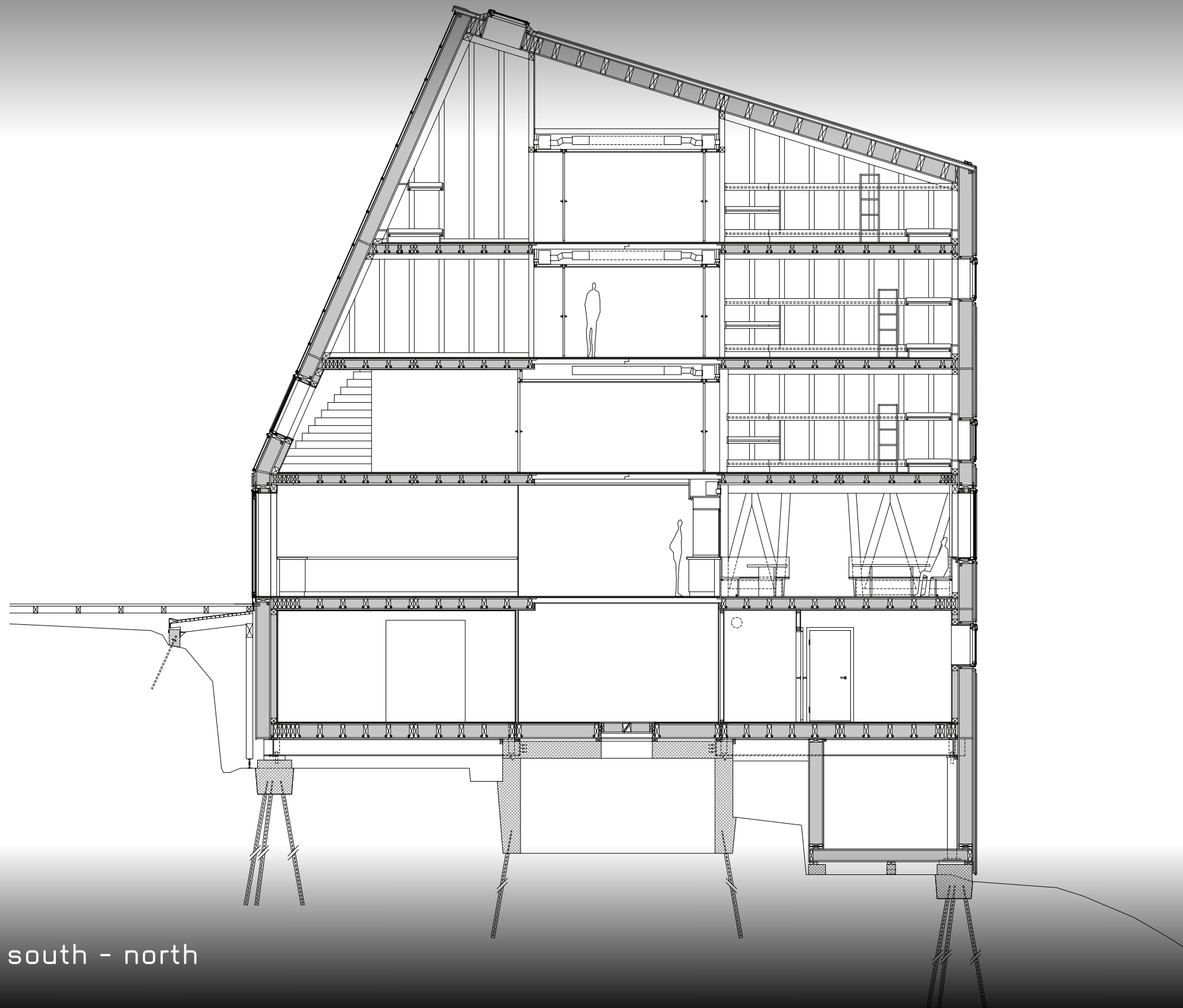


north elevation



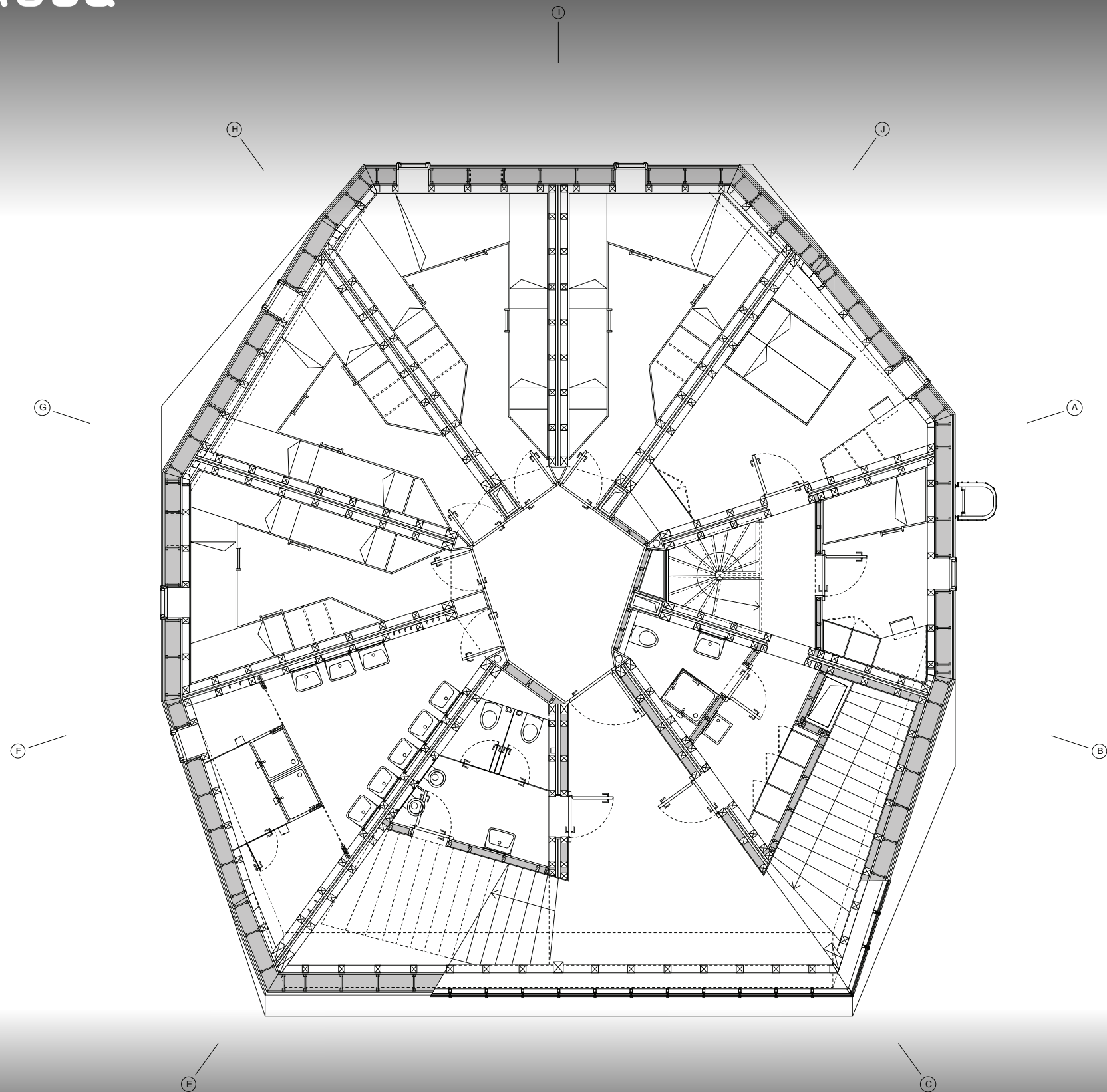
west elevation

Monte Rosa



section south - north

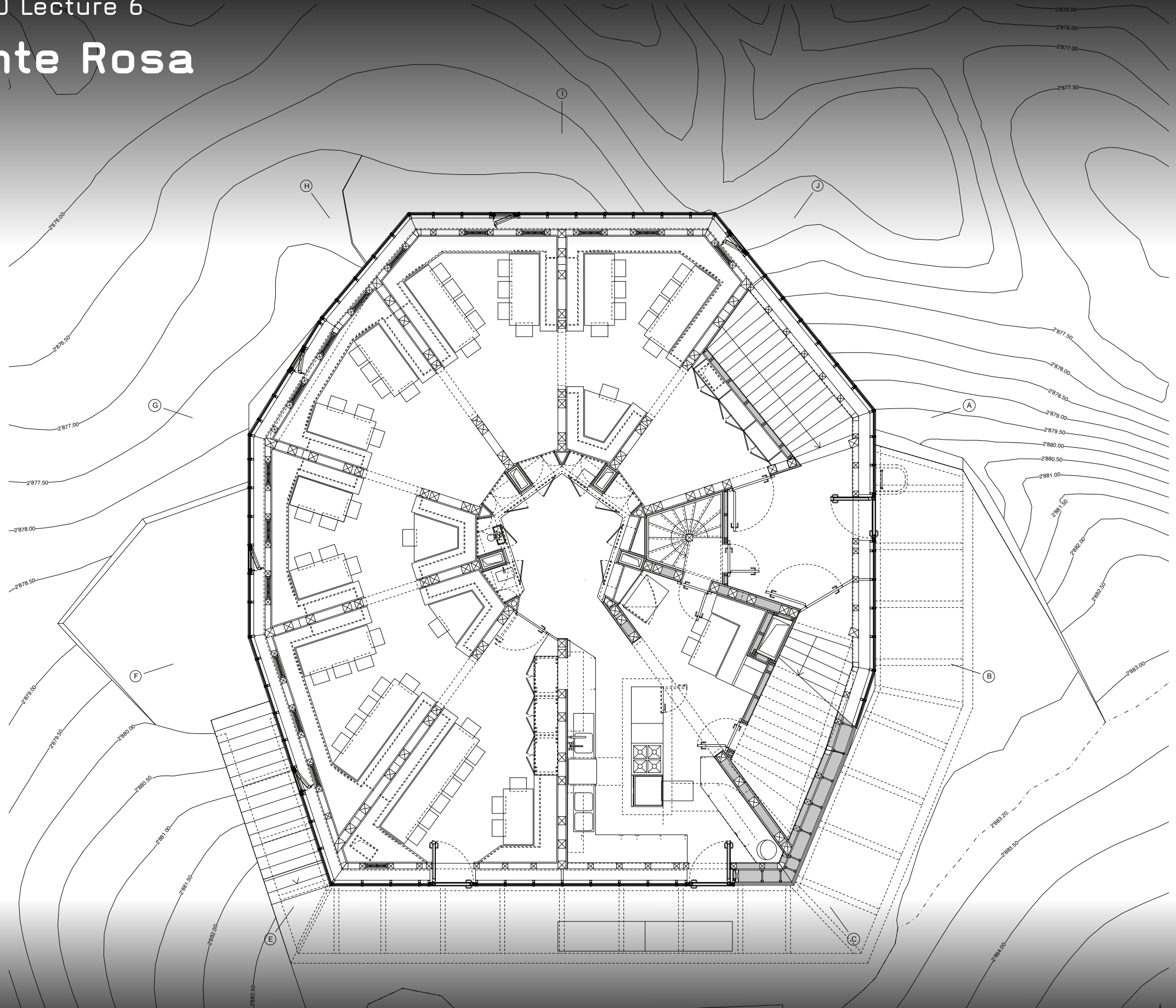
Monte Rosa



1.0G

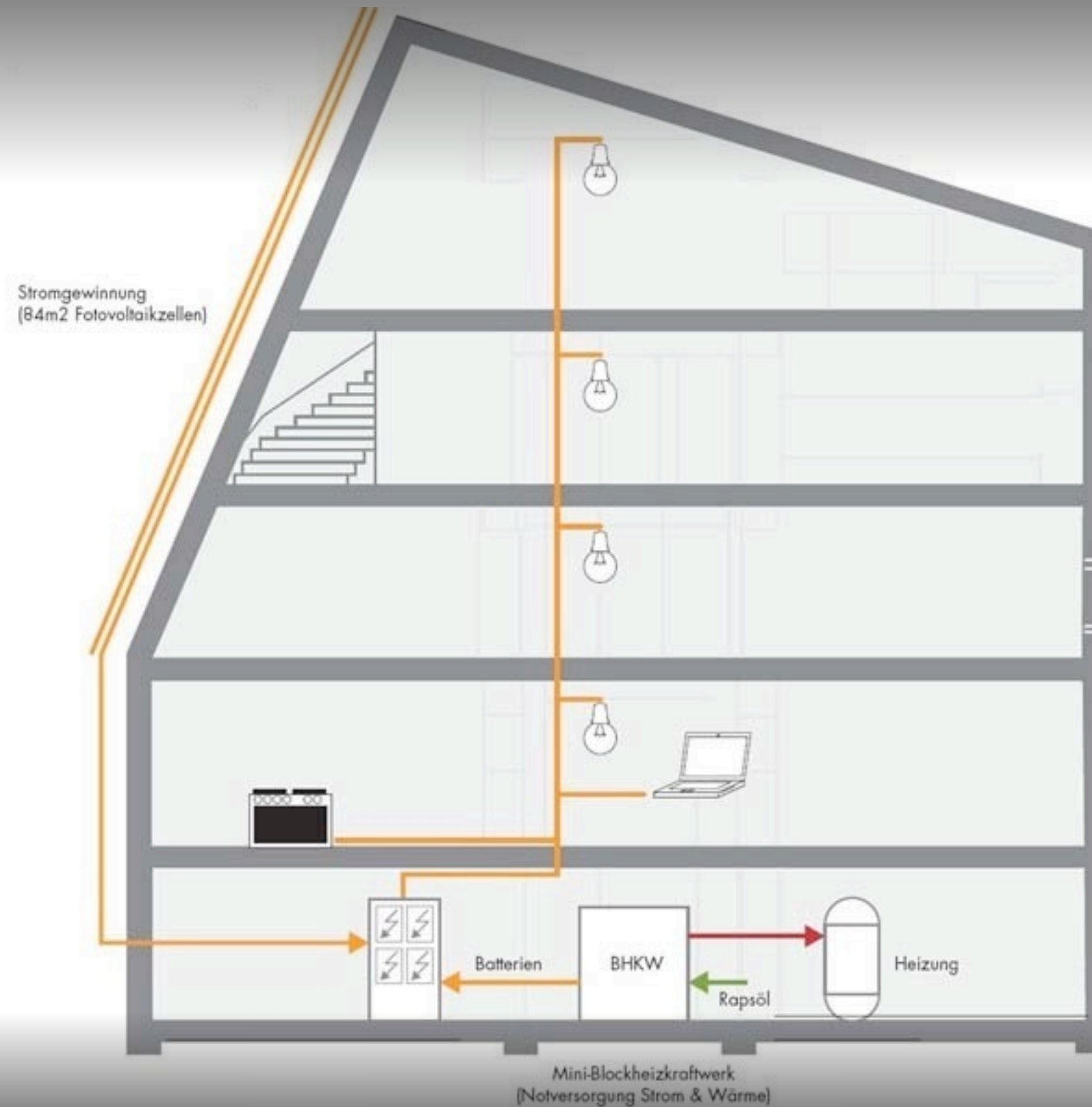
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Monte Rosa



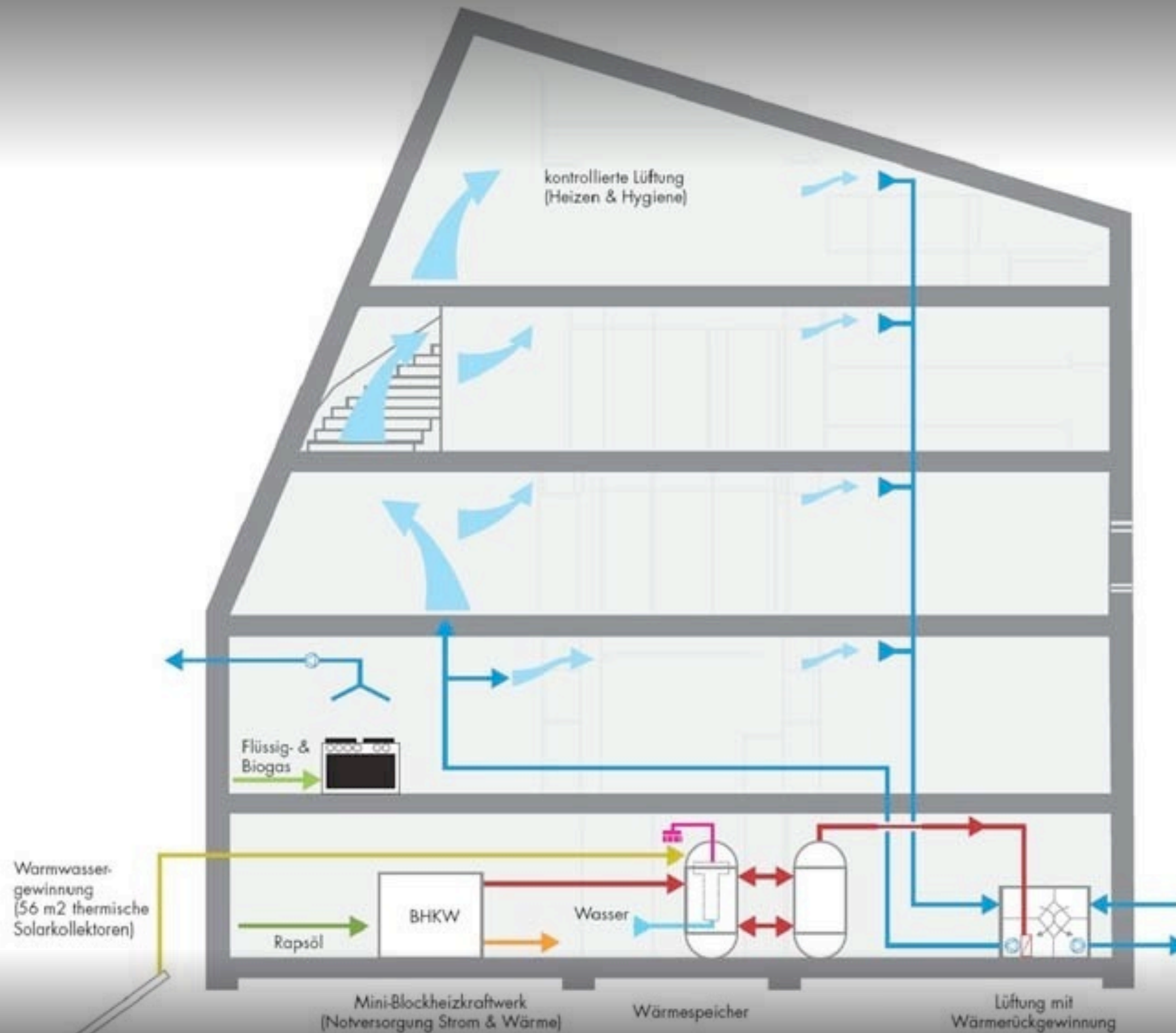
EG

Monte Rosa: Electricity



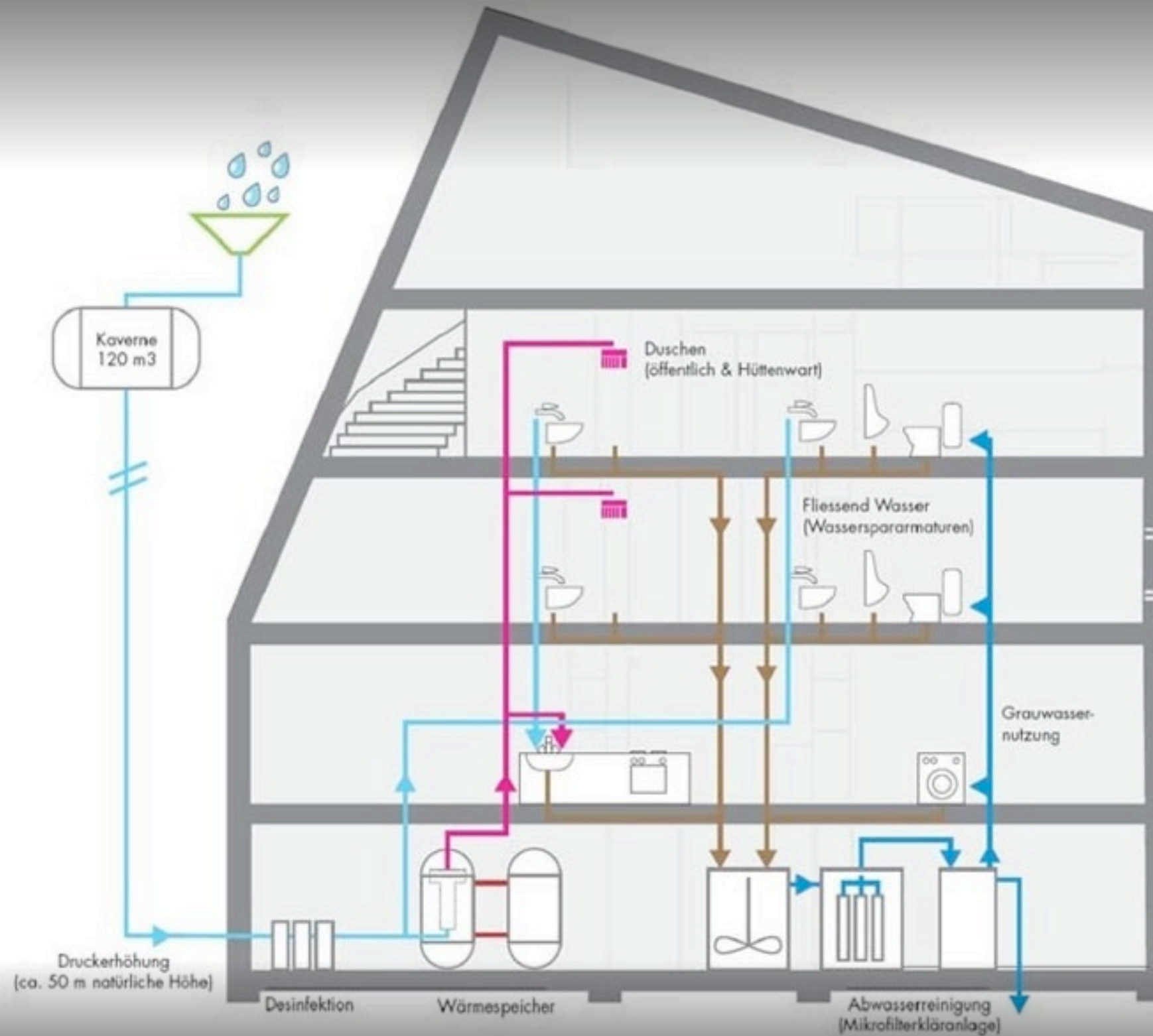
Electricity

Monte Rosa: Heat



Heat Management

Monte Rosa: Water



Water Circulation

New Monte Rosa Hut

Climate Change

New Monte Rosa Hut, Switzerland, Andrea Deplazes
In May 2009 construction has started on one of the world's largest and highest altitude building sites.

Monte Rosa



Finished in August 2009. It is a symbol for autonomous, sustainable, comfortable housing technology.

FS2010 Lecture 6

Monte Rosa

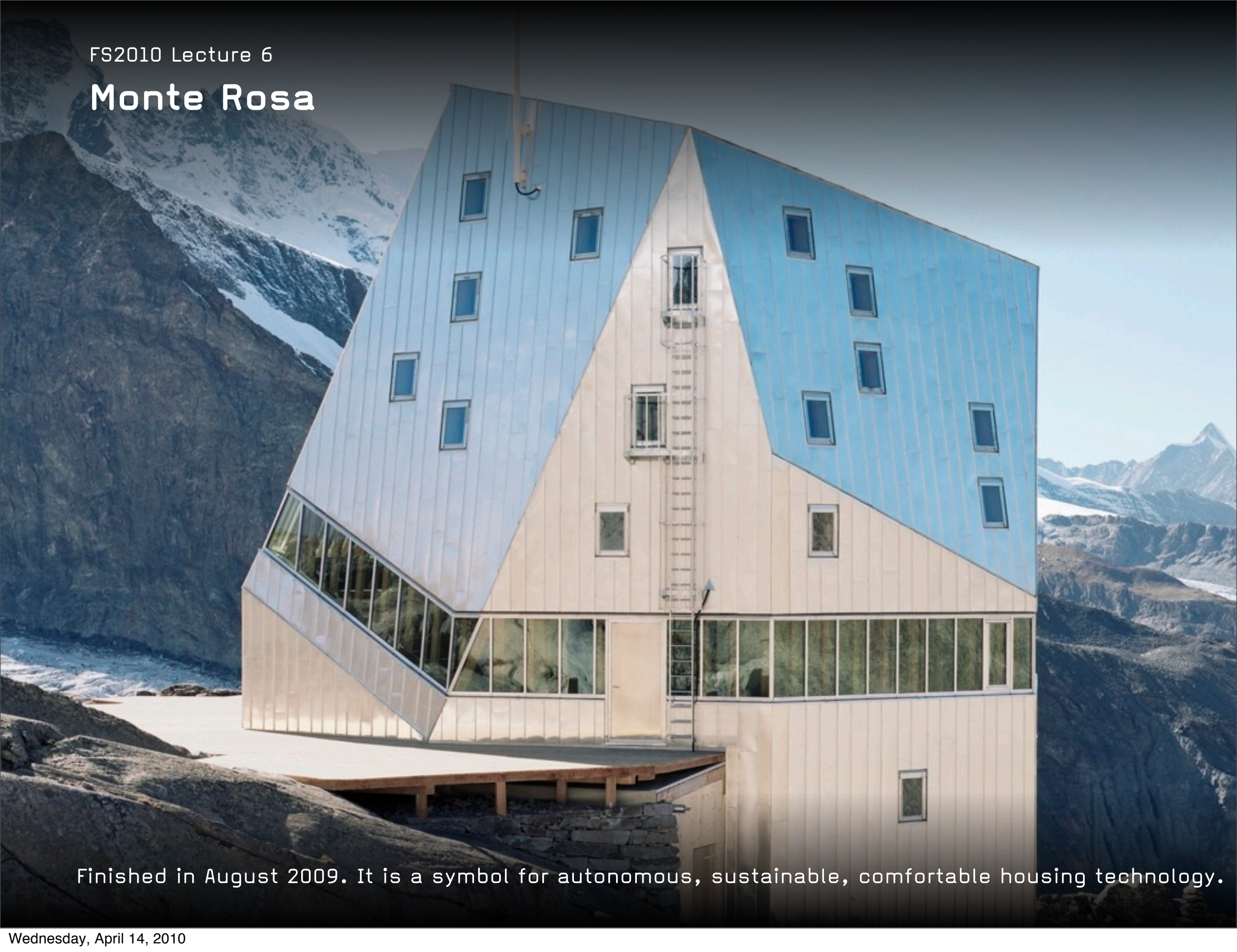


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Chair for Information Architecture

FS2010 Lecture 6

Monte Rosa



Finished in August 2009. It is a symbol for autonomous, sustainable, comfortable housing technology.

FS2010 Lecture 6

Monte Rosa



FS2010 Lecture 6

Monte Rosa



FS2010 Lecture 6

Monte Rosa



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Chair for Information Architecture

Monte Rosa: Use of Technology

Monte Rosa: Use of Technology



FS2010 Lecture 6

SEC Future Cities Laboratory

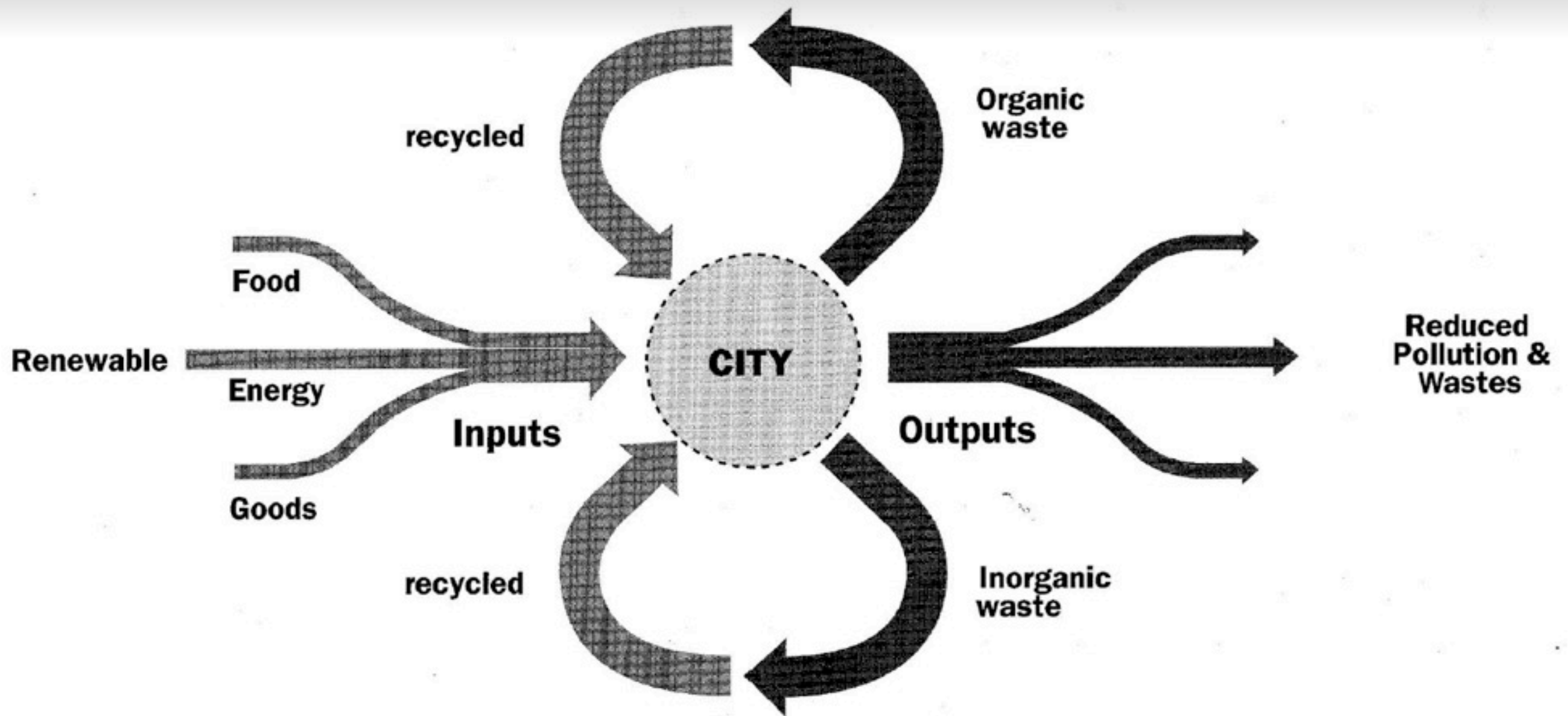
Prof. Dr. Armin Gruen
Prof. Franz Oswald
Prof. Dr. Marc Angélil
Prof. Kees Christiaanse
Prof. Dr. Gerhard Schmitt

April 12, 2010

Grand Challenges that FCL addresses

- Cities as the major providers of living space with high density
- Open Cities as dominant economic and cultural/educational hubs
- Cities as the major producers of CO₂, dominant users of materials and producers of waste
- Conflict and competition between urban and rural
- Today's Cities are not sustainable

Urban Metabolism



source: Richard Rogers, Cities for a Small Planet, 1996

Overall Goal

- **Design of sustainable cities**
- Maintain and increase the quality of urban living, within various densities and open space
- Increase economic value creation, resource efficiency and social cohesion
- Transform cities towards Greenhouse Gas neutrality – 1 Ton CO₂ Society
- Develop urban-rural (Hinterland) partnership

Uniqueness of FCL

- Digital Chain concept for urban planning
- High impact research based on experience of PIs, Government Agencies and industries
- Unrivalled toolbox of opportunities on the Swiss and Singapore side
- Unique global intellectual and local economic and environmental benefits
- Combining design methods and knowledge from moderate and cold climates

ETH Principal Investigators and Singapore partners: An international and interdisciplinary team

- Prof. Franz Oswald, Director SEC: Urban Networks (Switzerland, USA, ETHiopia)
- Prof. Kees Christiaanse: City Planning (Amsterdam, London, Zürich, Shenyang China)
- Prof. Dr. Kai Axhausen: Transportation and Mobility
- Prof. Christophe Girod: Landscape and Water (France, USA, Switzerland)
- Prof. Dr. Armin Grün: Photogrammetry
- Prof. Dr. Gerhard Schmitt: Urban Simulation
- Prof. Fabio Gramazio/Matthias Kohler: Digital Chain
- Leading researchers from ETH, NUS and NTU

Research Question and Methods

- Question: What feasible means, techniques, and methods can be brought into play in an innovative manner to increase the sustainable performance of cities?
- Methods as three trajectories: in-depth disciplinary and interdisciplinary research, design research studios, construction site as laboratory (Monte Rosa, nesTown)

Research Fields

S-LAB
BUILDING TECHNOLOGY

M-LAB
URBAN DESIGN

L-LAB
TERRITORIAL PLANNING

STOCKS AND FLOWS OF PEOPLE

URBAN SOCIOLOGY

Christian Schmid / HO Kong Chong / Marc Angélil / Malone-lee Lai Choo / Kee Yong Lim / John Harrison / etc.

STOCKS AND FLOWS OF ENERGY

LOW EXERGY

Hansjörg Leibundgut / Tham Kwok Wai / Soh Yeng Chai / Cai Wenjan / Chiew Sing Ping / Lino Guzzella
Ludger Hovestadt / Andrea Deplazes / Chandra Sekhar / Nirmal Krishnani / etc.

STOCKS AND FLOWS OF WATER

LANDSCAPE ECOLOGY

Christophe Girot / Jorg Rekittke / Adrienne Grêt-Regamey / Chris Robinson / Janet Hering /
Lo Yät-Man, Edmond / Ng Wun Jern / David Higgitt / etc.

WATER INFRASTRUCTURE

Janet Hering / Ong Say Leong / Max Maurer / Wouter Pronk / Ng Wun Jern / Karina Gin / etc.

CONSTRUCTION MATERIALS

Andrea Deplazes / Joseph Lim / Hansjörg Leibundgut / Chen Yan / Chiew Sing-Ping / Cheah Kok Ming / Kwah Harn Wei / etc.

STOCKS AND FLOWS OF MATERIALS

DIGITAL FABRICATION

Fabio Gramazio / Matthias Kohler / Shinya Okuda
Huang Guangbin / Leong Kah Fai / Patrick Chia / etc.

TRANSFORMING AND MINING URBAN STOCKS

Franz Oswald / Kua Harn Wei / Stefanie Hellweg / Susanto Teng / Wang Jing-Yuan / etc.

STOCKS AND FLOWS OF CAPITAL

URBAN DESIGN STRATEGIES AND RESOURCES

Kees Christiaanse / Heng Chye Kiang / Hee Limin / Renate Schubert / Roland Scholz /
Shahidur Rahman / Thomas Rutherford / Malone Lai Choo / Erwin Viray / etc.

TERRITORIAL ORGANIZATION

Marc Angélil / Wong Yunn Chii / Tay Kheng Soon / Ian McLoughlin / John Harrison / Erwin Viray / etc.

STOCKS AND FLOWS OF SPACE

MOBILITY AND TRANSPORTATION PLANNING

Kay Axhausen / Paul Barter / Michel Bierlaire / Henry Fan / Xu Jian Xin / Der-Hong Lee / etc.

SPATIAL DENSITY

Vittorio Lampugnani / Heng Chye Kiang / Chen Yu / Lim Kee Yong
Suresh Sethi / Hee Limin / Wong Yunn Chii / Zhu Jieming / etc.

STOCKS AND FLOWS OF INFORMATION

SIMULATION PLATFORM

Gerhard Schmitt / Tan Beng Kiang / Benny Raphael / Cham Tat Jen / Wolfgang Müller-Wittig / Ian McLoughlin / Armin Grün / Christophe Girot /
Adrienne Grêt-Regamey / Boi Faltings / Ludger Hovestadt / Ian Smith / Luc Van Gool / Stephen Wittkopf / Zhou Zhiying / Leong Keong Kwah / etc.

Future Cities Laboratory: Content

S-Lab: Building Design

Design a Landmark Building for Construction and Use, Monte Rosa

Research Focus: New Low-Exergy Buildings: Technology Prototyping Lab

M-Lab: Urban Design

Sustaining the Open City: Biennale Rotterdam. Creative Economy Spaces

Research Focus: New Scenarios for Future Neighborhoods and cities

L-Lab: Territorial Planning

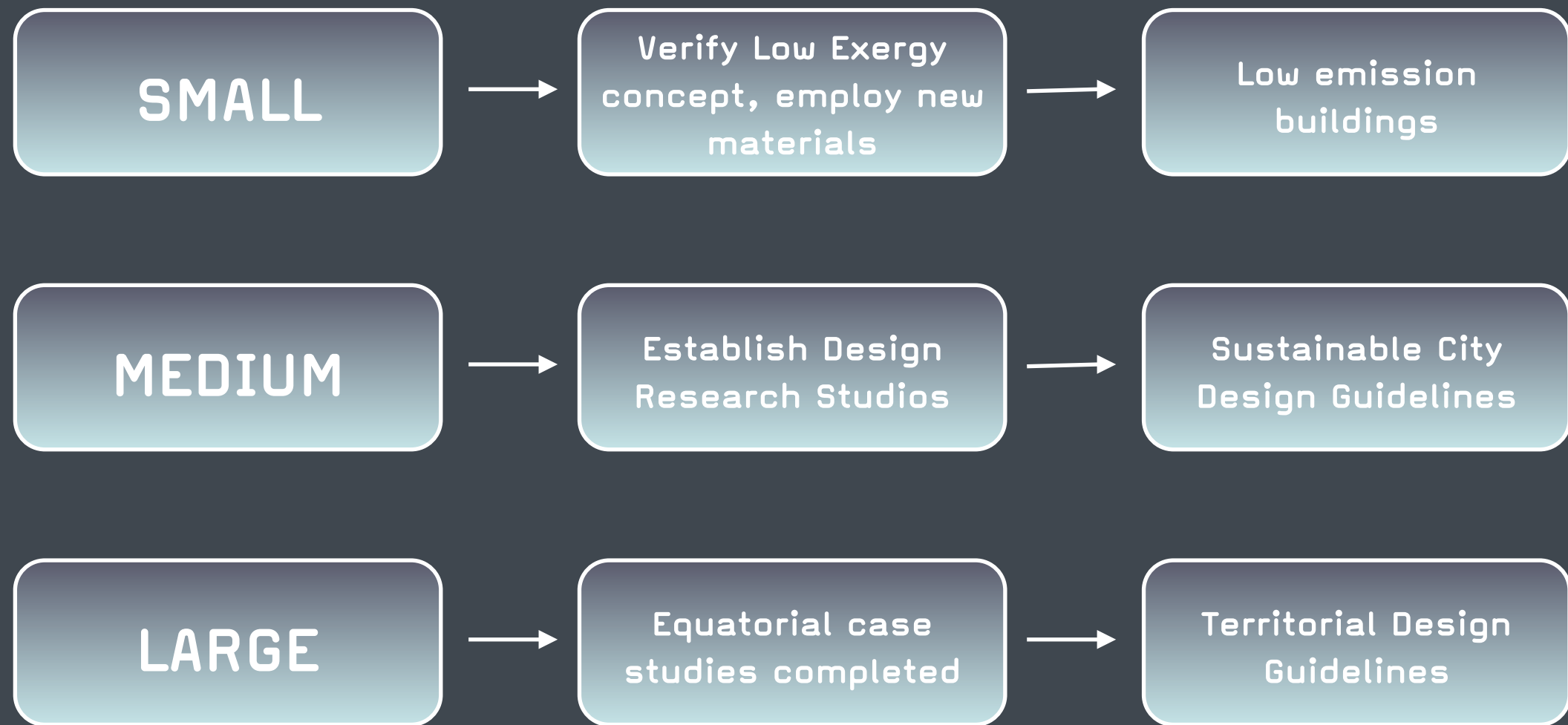
Rural Studio and first Design Research Studio in Singapore, NEST

Research Focus: New Scenarios for the Organization and Logistics of Large Territories

Research Results

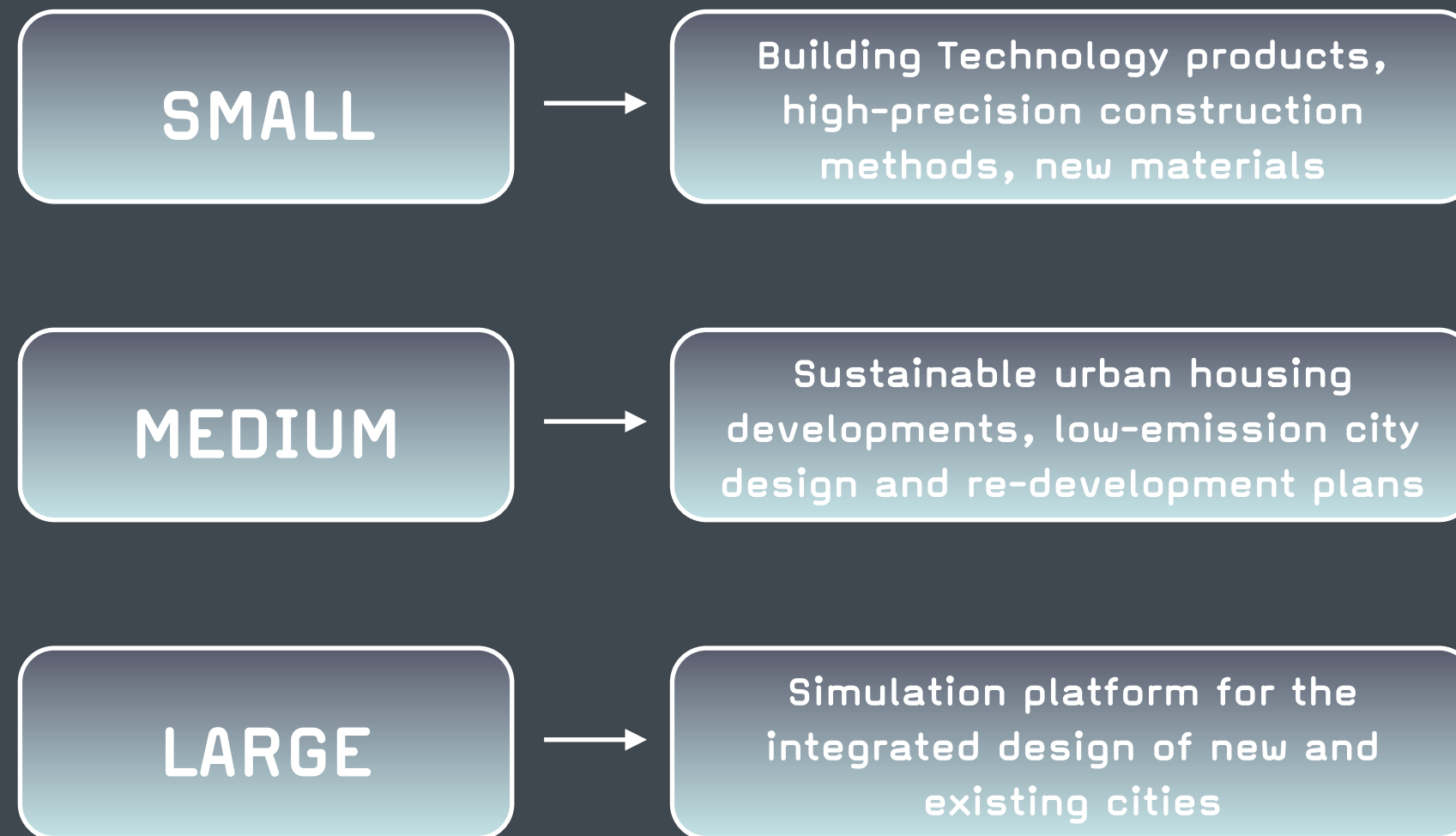
- **New products:** sustainable materials and technologies, equipment, energy systems, fabrication techniques, information management nano to macro;
- **Added Value Creation:** Product chains, instruments, tools, guidelines for planning and sustainable urban systems, spin-off companies
- **From small to large scale living labs:** Empirical assessment, experiments to abstraction and science
- **Future leaders and talents:** Research and teaching based education both in Singapore and Switzerland, has already started with the IARU summer schools

Future Cities Milestones (selection)



Future Cities Deliverables (selection)

BCA, NEA, HDB and URA have been approached in the past and will be approached to be actively involved

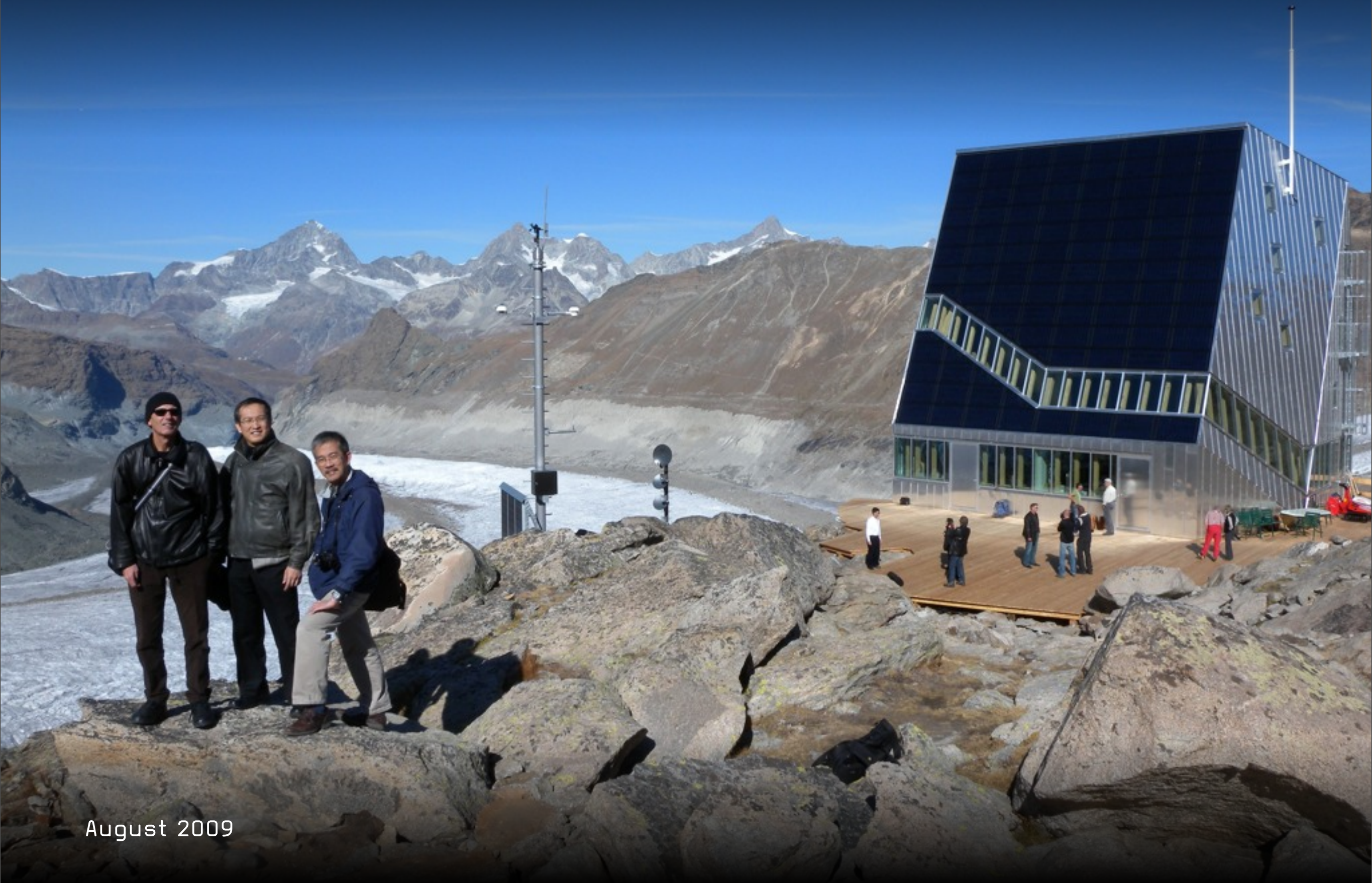


SEC FCL Status Spring 2010

- Small Scale: Monte Rosa (Andrea Deplazes)
- Medium Scale: nes Town Ethiopia (Franz Oswald, Marc Angélil)
- Large Scale: Biennale Rotterdam (Kees Christiaanse)
- Simulation Platform: ETH Value Lab (Gerhard Schmitt)

FS2010 Lecture 6

Water • Material • Energy • Capital • Information

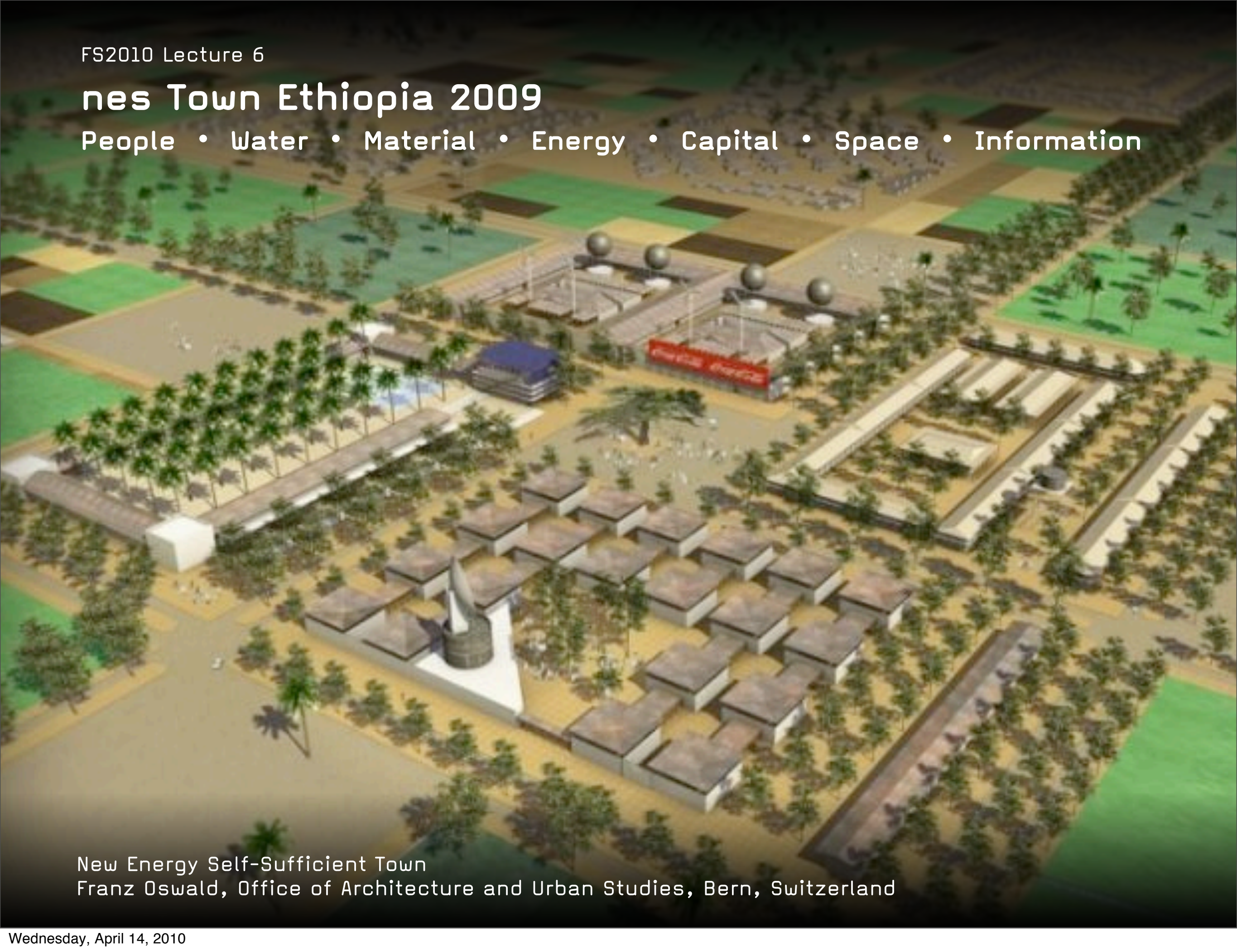


August 2009

FS2010 Lecture 6

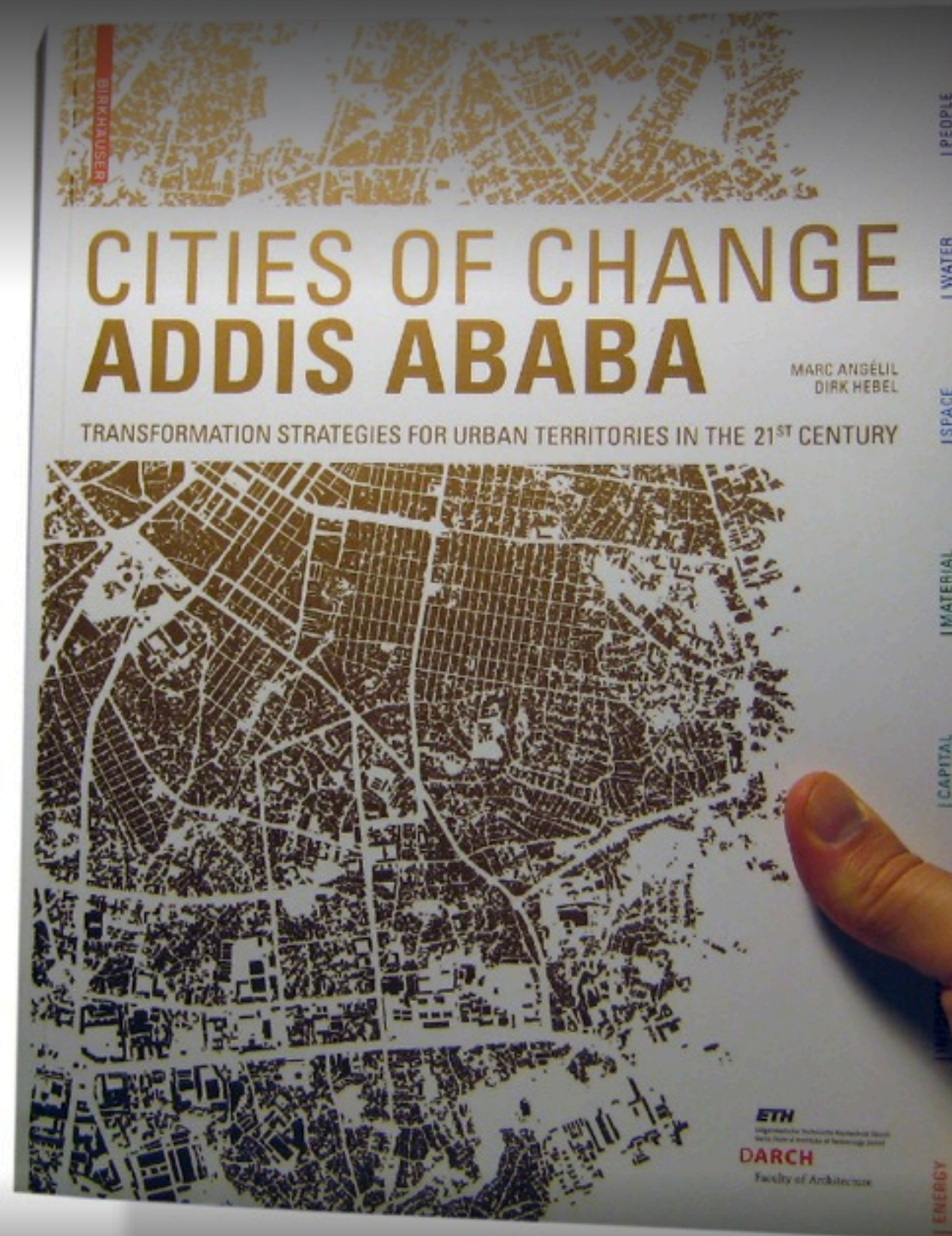
nes Town Ethiopia 2009

People • Water • Material • Energy • Capital • Space • Information



New Energy Self-Sufficient Town
Franz Oswald, Office of Architecture and Urban Studies, Bern, Switzerland

Addis Ababa



4th International Architecture Biennale Rotterdam

Exhibitions

[Urban Century - VPRO](#)

[Open City Event Program](#)

[Partner Program](#)

[Master Class](#)

[Publications](#)

[Calendar](#)

[Practical](#)

[Subsidizers & Partners](#)

[Organization](#)

[Credits](#)

[Press](#)

VPRO, Urban Century



How the World Becomes a City

From 13 September

We are living in the Urban Century. Currently, more than fifty percent of the world population is living in cities – many of them in slums - and cities are continuing to grow. The VPRO considers this reason to both look back and to look ahead, to connect thinking about the future of the city with experiences from the past. Which factors define the quality of life in cities? How does urban life take shape and how can we improve it? In a number of new productions, VPRO explores various new ideas and perspectives on the city.

During two weeks in September popular VPRO programs such as Buitenhof, Andere Tijden, Draadstaal, Tegenlicht, Villa VPRO, Metropolis and Holland Doc all focus on the issue of urbanization.

News

[Archive](#)

Urban Century Documentaries Available as Free Downloads

06 Oct 2009



After a successful television and radio program, Urban Century, the cross media program organized...

Lars Lerup: The American Suburb and "Foaming at the Edge"

Calendar

[Archive](#)

Open City Talk & Tour – Crimson Architectural Historians

24 Oct 2009



IABR

Open City: Designing Coexistence, 25 Sep 2009 - 10 Jan 2010 Rotterdam - Amsterdam

Simulation Platform 2009

People • Water • Material • Energy • Capital • Space • Information

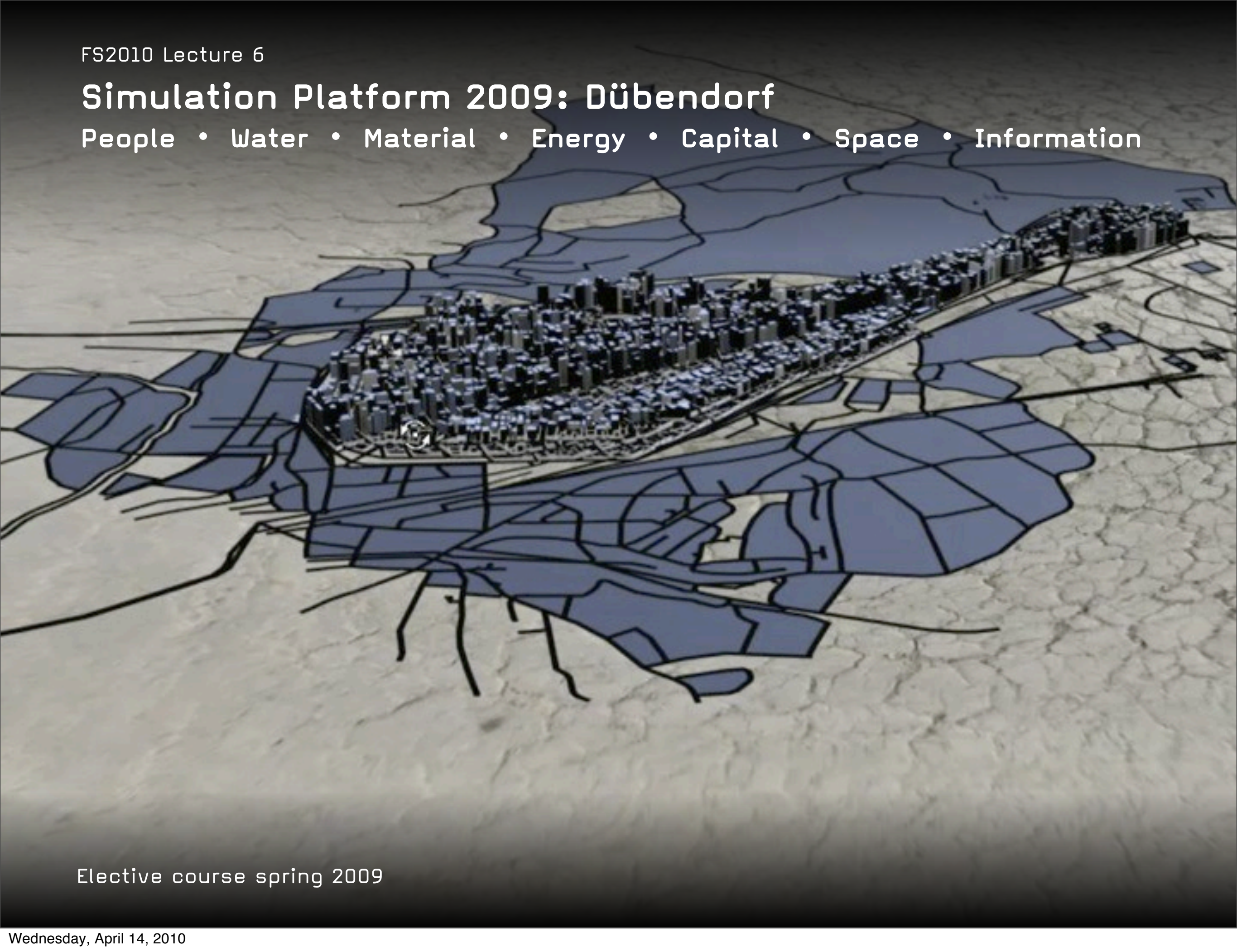


Value Lab, ETH Campus Hönggerberg, Zurich

FS2010 Lecture 6

Simulation Platform 2009: Dübendorf

People • Water • Material • Energy • Capital • Space • Information



Elective course spring 2009

Conclusions - Simulation II

- **Why?** Learning from the past to improve future architecture and city planning requires new, computer supported methods and instruments, due to the complexity of cities --> data bases and simulation
- **What?** Simulation in Architecture as important process between design and implementation - in analogy to the science process between theory and experiment
- **How?** Simulation in Architecture as part of the Digital Chain stretching from design to facility management --> simulation as an interactive and circular process

➡ **Sustainable Cities to address challenges and transformation both locally and globally**

Simulation

L5: Theory, Experiment, and Simulation

Definition • Examples



L6: Simulation and Design

Digital Chain • Monte Rosa • Future Cities Project



L7: Computation and Complexity

Simulation of Complex Systems

