Energi and Environment at NTNU-AB

ENERGI-KLIMA: Utfordringer og Muligheter
Er nordisk samarbeid en plattform for fremgang i å møte utfordringene?
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Every single choice you make
as an architect, engineer and planner
has consequences for
climate change mitigation and adaptation
and resource scarcity

even if you’re not ’interested’ in the issue

Energi and Environment at NTNU-AB: Examples of Co-operation across Boundaries

Cross-Disciplinary

Architecture, planning, engineering, industrial ecology, socio-cultural studies, art, product design, climate, geography, economy etc

Cross-Institutional

Researchers, students, industry, end users, municipalities, Norwegian Research Council, ENOVA, Norwegian State Housing Bank etc

International

Global – European – Nordic

Examples

FME-Centre on Zero Emission Buildings
http://www.zeb.no

Brøset Low Carbon Neighbourhood
Cities of the Future www.broset.com
http://www.framtidensbyer.no

MSc in Sustainable Architecture
http://www.barekraftigarkitektur.no

Solar Decathlon Europe 2012
http://www.sdenorway.no

IEE IDES-EDU
http://www.ides-edu.eu

COST TU0902
http://iaforcities.org

NTNU
Det skapende universitet

1. Shared Environment

Climate, Society, Genius Loci

IDES-EDU (2010 – 2012)

IDES-EDU

IEE Intelligent Energy Europe http://www.ides-edu.eu

The IDES-EDU project educates, trains and delivers specialists, both students and professionals, in Integral Sustainable Energy Design of the Built Environment.

15 Universities:

Zuyd University (Netherlands)
Lund University (Sweden)
University of MINHO (Portugal)
University of La Rochelle (France)
Vilnius Gediminas Technical University (Lithuania)
Warsaw University of Technology (Poland)
University of Zagreb (Croatia)
University of Ljubljana (Slovenia)
Czech Technical University Prague (Czech Republic)
Pecs Technical University (Hungary)
National and Kapodistrian University of Athens (Greece)
Norwegian University of Science and Technology (Norway)
Fachhochschulestudiengänge Burgenland (Austria)
Politechnico di Torino (Italy)
Aalborg University (Denmark)
Cauberg-Huygen (Netherlands, leader)
Federation of European Heating and Air-Conditioning Associations (REHVA, EU)

Architectural Quality
Sustainable Building
Building and Renewable Energy Concepts
Integrated Design Process
Market and Cost Benefit
EPBD
Indoor Environment
Heating, Cooling, Lighting, Ventilation
Energy Production
Cross-Disciplinary Teamwork

Nordic Master Programme?

FME-Centre on Zero Emission Buildings (ZEB)

http://www.zeb.no

WP-1:
Advanced materials technologies
WP-2:
Climate-adapted low-energy envelope technologies
WP-3:
Energy supply systems and services
WP-4:
Energy efficient use and operation
WP-5:
Concepts and strategies for zero emission buildings

One of 8 new national Centres for Environment-friendly Energy Research (FME), hosted by the Faculty of Architecture and Fine Art at NTNU in co-operation with partners in Norwegian industry and public management.

FME-Centre on Zero Emission Buildings (ZEB)

Norwegian Partners

NTNU
SINTEF
Skanska
Weber
Isola
Glava
Protan
Hydro Aluminium
YIT
DuPont
Multiconsult
Brødrene Dahl
Snøhetta
ByBo
Forsvarsbygg
Statsbygg
Husbanken
Byggenæringens landsforening
Norsk Teknologi
Statens Byggetekniske Etat
Nordan

International Partners

VTT (Finland)
Chalmers (Sweden)
Fraunhofer (Germany)
TNO (The Netherlands)
LBL (USA)
MIT (USA)
University of Strathclyde (Scotland)
Tsinghua University (China)

Contributes to the development of good technologies for environmentally friendly energy, and generates new industrial activity and jobs.
Develops competitive products and solutions for existing and new buildings that will lead to market penetration of zero emission buildings related to their production, operation and demolition.

2. Green Entrepreneurship

Student-Driven Innovation & Research

Solar Decathlon Europe 2012

NTNU competes with 19 other universities to build the best solar-powered zero energy house in Madrid in September 2012, in co-operation with national industry and public management:

- High-Quality Architecture & Engineering
- Market appeal & Communications
- Comfort & Energy Balance
- Affordability, Usability & Liveability

www.sdenorway.no

http://www.sdeurope.org

Other Nordic participant: DTU (Denmark)
http://www.solardecathlon.dk

MSc in Sustainable Architecture

http://www.sustainablearchitecture.no

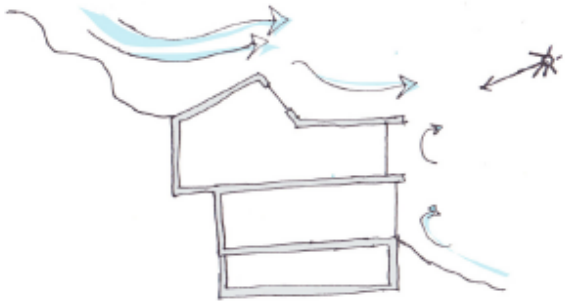
Semester 1: Climate and built form

Concepts and strategies related to energy efficient, sustainable and zero emission buildings and built environment (theory 7.5 credits)

> Terminology, principles and challenges related to sustainable architecture; a broad scope of issues ranging from insight in the history of sustainable architecture to a discussion of the most up-to-date concepts of zero-emission buildings and built environment.
>Levels ranging from building to community and urban areas are discussed, including an introduction to issues such as land use, green infrastructure, traffic, and urban storm-water management and the corresponding challenges and strategies related to mitigation and adaptation to climate change and resource scarcity.
>Policy and economic challenges posed by innovative building s trategies in society.

Climate and built form
(project 15 credits + theory 7.5 credits)

>Project design related to the resources and limitations posed by local site conditions, indoor and outdoor climate; to analyse local site and climate and their consequences for built form, along with an in-depth study of building physics and human comfort requirements.
>Different building shapes, functional programmes and site types are addressed, with focus on indoor as well as outdoor areas.
>Importance of daylight, solar access and shading, ventilation, heating and cooling heating strategies, wind and precipitation.



"Centre for recuperation and rest" - climate adaptation sketches. Master Thesis in Architecture, NTNU 2010, Anne Solbraa

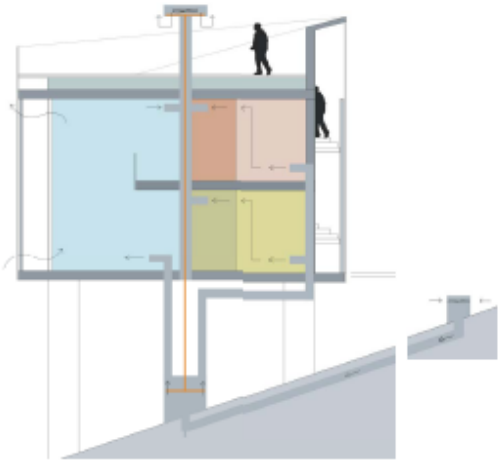
Semester 2: Integrated Energy Design

Integrated energy design (project 15 credits);
Energy systems and services and their integration in architectural design (theory 7.5 credits)

> Building systems and services and their integration in architecture to provide a good indoor climate in a resource-efficient manner.
>Interdisciplinary procedures necessary to ensure a successful functioning of these systems in architecture.
> Integrated design methodology, evaluation tools and user behaviour
>Challenges related to the renovation of existing buildings and cultural heritage sites.
>Project design with focus on integrated energy design and interdisciplinary co-operation between building professionals.
Projects addressing domestic and non-domestic buildings, as well as new and existing building structures.

Sustainable building materials and components
(theory 7.5 credits)

>Building materials, construction and detailing, ranging from vernacular building materials to innovative nano-materials,
>Environmental labelling and consequences on GHG emissions during the building's life cycle.
>Specify construction materials in a brief, compare materials' performance using different criteria, critically analyse product information.
evaluate materials´ effect on user health and indoor climate.



"Campushotel - short exercise". Collaboration project between engineering and architect students. Energy- and environmental friendly architecture, master course, spring 2007, NTNU. Andrea Poli, Finn Volle Karlsen, Håvard Houen, Kristian Hegle Kluge, Kristina Noren, Trond Fossen.

Semester 3: Zero emission building

Design of zero emission buildings (project 15 credits);
Use and operation of zero emission buildings (theory 7.5 credits);

>Project design that integrates strategies for energy, emissions, materials and users into high-quality architecture.
>Environmental management, planning and procurement of the construction site and building project, as well as user participation in the design and operation of low-energy architecture.
>Evaluation criteria of environmental classification tools, along with specific quality control and documentation methodology.
>Contracting alternatives and their effect on the overall environmental and economic performance of the project.

Elective Course (theory 7.5 credits)

>To be chosen in dialogue with teaching staff, at other faculties at NTNU or another educational institution, in order to prepare the student in the best possible manner for their thesis work.
>May for example be related to environmental policy, economics, project management, or user participation.

Semester 4: The M.Sc. Thesis

>During the final semester of the curriculum, the students work on their thesis project, based on their individual professional interest and the elective course they have taken earlier. The scope and topic of the thesis is adapted to the particular professional background of each of the students.

"Passivehouse Lineasya". Student project spring 2010, Energy- and environmental friendly architecture, master course, NTNU.
Ingrid T. Helleve, Elisabeth Langrusten, Truls Y. Kanneløenning

3. Nordic Performative City-Scapes

Pictures: Team COWI (left); Team SLA (right)

Environmental Quality +
- CC Mitigation
- CC Adaptation
- Resource Scarcity

Architectural Quality +
- Functionality
- Flexibility
- Aesthetics

Quality of Life
- Security
- Health
- Well-being

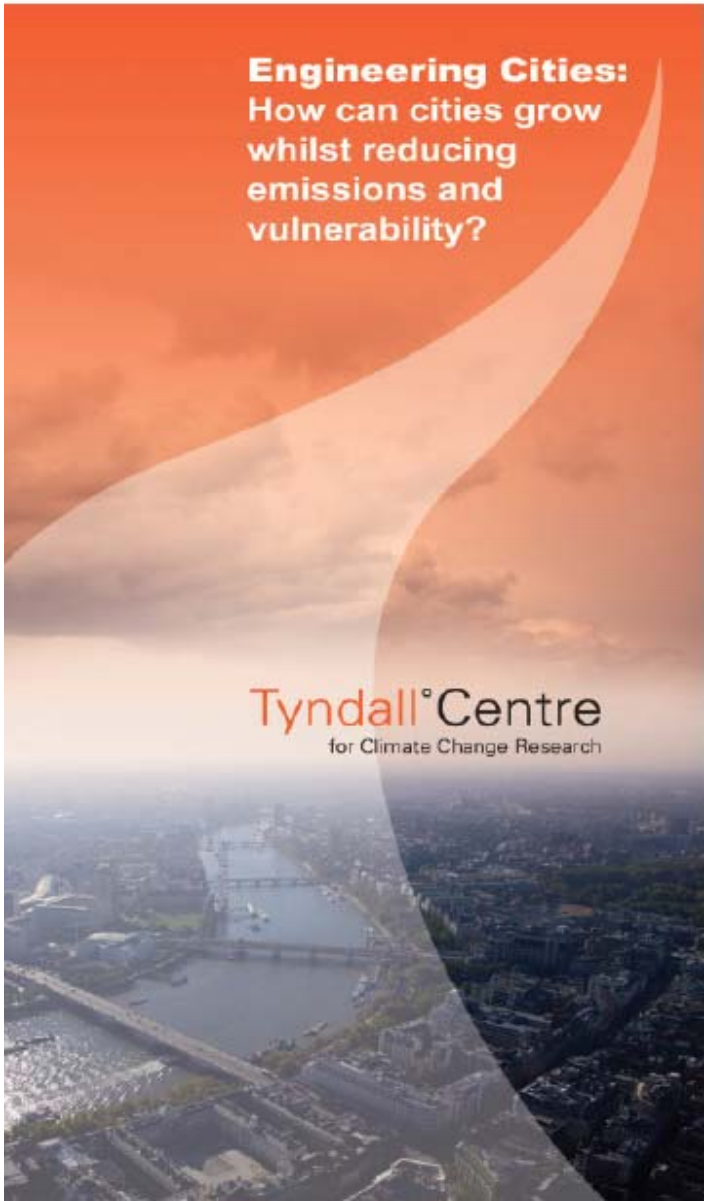
COST TU0902 Integrated Assessment To Support the Sustainable Development of Urban Areas

- COST project (networking) 2010 – 2013 http://iaforcities.com

- To develop better representations of urban system interactions and dynamics as well as new configurations of urban areas so that they consume fewer resources, emit less pollution, are more resilient to the impacts of climate change and are more sustainable in general.

- Some Nordic participants: NTNU, SYKE, DTU – more?

- WG1: Integrated Assessment Methods & Technologies
- WG2: Adaptation, Mitigation and Climate Change Feedbacks in Cities
- WG3: Resource Flows and Urban Ecosystems Services in Cities
- WG4: Strategic Urban Planning and Governance



Brøset: Low Carbon Neighbourhood

The Norwegian programme "Cities of the Future"
including the 13 largest cities in Norway,
led by the Ministry of Environment 2009 – 2014

Brøset project: Development of zero emission urban area
(1200 housing units + mixed functions) in Trondheim

Infrastructure & Transport
- Climate package
- Private transp.
- Public transp.

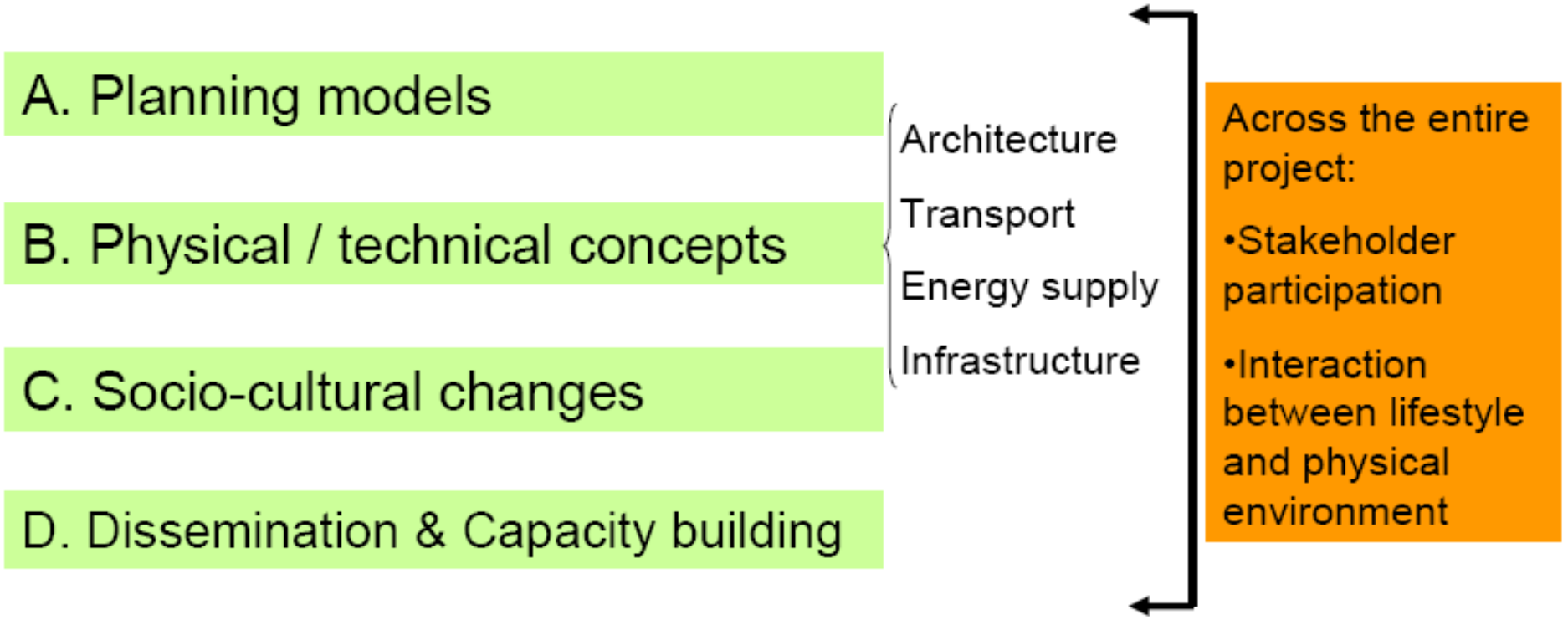
Stationary energy
- District heating
- Public buildings
- Private sector

Consumption & Waste
- Reduction
- Reuse
- Recycling

Climate adaptation
- Sea level rise
- Drainage
- Erosion

Brøset: The research project

Making the easiest choice also the most environment-friendly one



- Research project (2009 – 2012) in parallel with planning project by municipality
- 12.3 million NOK (ca 1.5 million Euros)

Financed by:

- Norwegian Research Council (75%) in co-operation with Trondheim municipality, the Norwegian State Housing Bank, TOBB Housing Co-operative, and Trondheim Energy

The Brøset Project

Goal: Facilitate low-impact lifestyles (3 tonnes per capita)

- 2006: Initiated by NTNU and SINTEF
- 2007: Adopted by Trondheim City
- 2009: Enrolled in Cities of the Future

- 2010-11: Parallel commissioning process => 4 masterplan proposals
- 2010-11: town meetings & exhibitions to inform & involve public

- 2011: Municipality develops holistic masterplan, co-operation with NTNU/SINTEF
- 2012: Extended user participation, environmental centre incl daily management, bioregional development, environmental assessment, capacity building

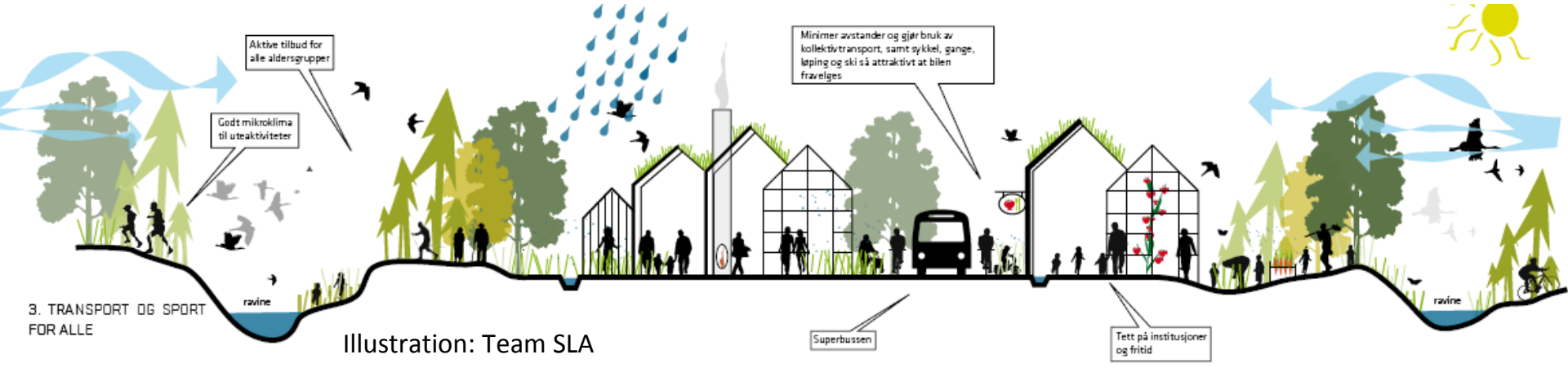


Illustration: Team SLA

Brøset: Potential for Nordic co-operation?

Platform for Experience Transfer

- KLIMAX breakfast seminars – industry, public management & research
- Supported by Partners for Innovation (NTNU, NTE & Sparebank 1 SMN)
- Nordic focus & language

Bioregional development

- Link local population and industry, knowledge and resources
- Create new and robust links between producers and consumers on a local/regional scale, based on local and renewable resources.

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