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## Energy- and water-efficiency in buildings in the Luxembourg 'Cité des Sciences'

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## Overview

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- **The University of Luxembourg**
- **Planning and construction of the 'Cité des Sciences'**
- **A statement on 'Energy- and water-efficiency':**
  - A definition of 'comfort': the end-user assumes responsibility
  - Energy Grenzwert vs target value
  - Use of renewable energy
  - Watermanagement
  - Building materials
- **Implementing recommendations in the planning and construction process?**



## The University of Luxembourg

- Creation of the University of Luxembourg by legal decree on 12.8.2003

- Controlled growth (figures reached on 31/12/2007):

Students:	4137
Doctorands:	186
Different nationalities:	89
Personnel:	549
Faculty:	157
- Professors:	61
- Assistant-Professors:	74
Different nationalities:	26



- 3 official languages: French, German , English
- Mobility requirement for Bachelor students
- **Established a Group on 'Sustainable Development' in September 2006**



## The University of Luxembourg

- **3 campus sites:**

Limpertsberg



Kirchberg



Walferdange



- **Recycling and cleaning products to comply with Luxembourg laws**

- **3 faculties:**

**Faculty of Sciences,  
Technologie  
and Communication**

**Faculty of Law,  
Economics  
and Finances**

**Faculty of Language  
and Literature, Humanities,  
Arts and Education**

- 11 Bachelor programmes
- 16 Master programmes
- Structures based on Bologna system
- **Innovative project-based teaching in some subjects**



## Research

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- 12 Research Units
- The current 4-year plan (2005-2009) lists 9 priorities:



1. Security and reliability in information technology;
2. Material science;
3. Life sciences;
4. European law and commercial law;
5. International finance;
6. Educational Science;
7. Luxembourg studies;
8. Geodynamics and Seismology;
- 9. Resources and technologies for the environment;**
10. Economy and Enterprise;
11. Social Science

- **Goal of the Sustainable Development Group for next 4-year plan (2010-2014): regroup more diverse topics under a new high research priority 'Research and Education for Sustainable development'**



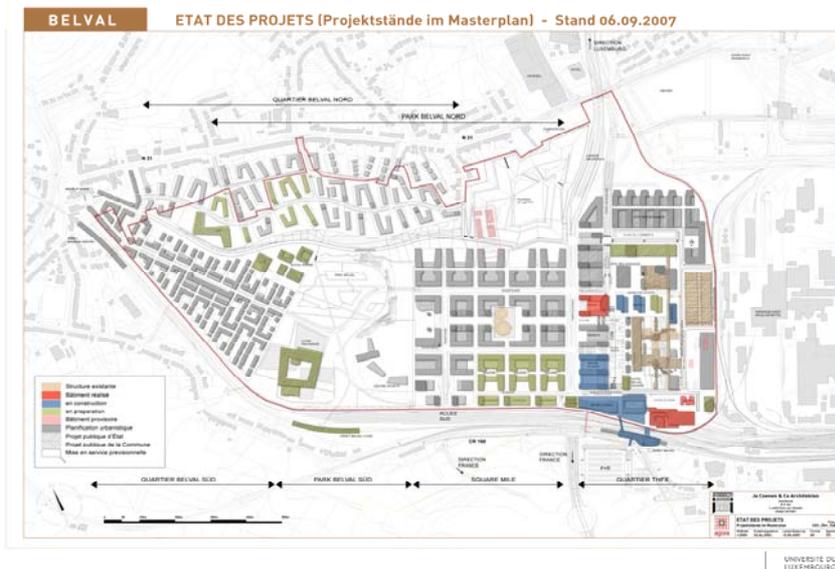
## Planning and construction of the 'Cité des Sciences' in Belval

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- **Brownfield redevelopment of a former steel production site from Arcelor-Mittal**
- **AGORA: private enterprise created by the state and the Arcelor group in 2000 'to redevelop [and sell] industrial wasteland, following the principles of sustainable development'**
- **The current urban design plan requires:**
  - ~ 1 300 000 m<sup>2</sup> on 69 ha land for construction
  - 30 % of the surface reserved for parkland and public spaces
  - Urban spaces, parc, mixed zones – walking distance
  - Organisation along railway line to Luxembourg, Metz, etc.
- **Fonds Belval: a public organisation created by legal decree in 2002 to act as constructor of the site**
- **Target date for the move of the University: 2014**



## Urban design – the Masterplan



## Running architectural competitions

The EU Directive 91/2002 is not as yet transposed for public buildings in Luxembourg

An integrated approach to energy considerations in building design is already a requirement for the competition and the evaluation in the préjury involves computermodelling (Büro Baseler).

The main selection criteria in the Prejury are:

- Building form
- Quality of the technology
- Use and comfort
- Fraction of energy consumption from renewable energy over total energy consumption
- Passive solar gain and building orientation
- Cost of technical installations compared to overall building cost
- % of translucent surfaces of the facade

### Statement on:

#### 'Energy- and water-management in buildings in Belval'

**Objective:** More visible target values and measures for energy- and water efficiency. A process for coordinated goal setting and improved communication between actors involved in planning and developing Belval.

**Target audience:** Constructors, architects, investors (eg European Investment Bank), public administration, and politicians

**Participants:** ,hand-picked' experts from 3 organisations (UL, CRP HT, Agora) – with input from Fonds Belval

**Process:** 3 meetings of the main expert group to achieve final product (18.1.; 11.3.; 6.5.2008) – (architectural competitions for first buildings already running – Rush!)



## Structure and content

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### Structure:

- An accessible overview of all topics
- Topic annexes with more technical detail on implementation

### Topics:

1. Definition of a standard of natural comfort
2. Target values for the end-energy of the district heating and consumption of electricity
3. Production and use of photovoltaic energy
4. Watermanagement
5. Building materials



## Summary of requirements for future buildings in the Cité des Sciences

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Theme	Requirement	Values*
A) Comfort	Acceptable temperatur range	20-26 C° + 15 h < 28 C°
	Isolation: average heat passage coefficient of the Fassade	U = 0.2-0.25 W/ m²K
	Aeration: Flow volume of external air	0.7 m³/hxm²
	Illumination of offices	400 lux

\*Zur Berechnung sind die neuesten Europäischen Normenpakete (EN und CEN) und die DIN Normen zulässig.  
\*\*Die Bezugsgröße ist das Bruttogebäudevolumen



## Achieving energy efficiency

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Theme	Requirement	Values*
B) Energy consumption	End-energy from district heating Target value:	14 kWh/(m³a)**
	Elektric current consumption – Target value:	8kWh/(m³a)**

- Integration of Photovoltaic cells in the roof and/or fassade elements



## Water management

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Theme	Requirement
D) Watermanagement	<ul style="list-style-type: none"><li>-Watersaving and appliances</li><li>-Substitution of drinkingwater with rainwater for toiletflushing or cooling</li><li>-Green roofs</li><li>- Avoidance of groundwater drainage to avoid moisture in buildings</li></ul>



## Building materials

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Theme	Requirement
E) Selection of building materials	Evaluation of building materials using the Oekobilanz method



## Implementation

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- **Selection process:** Distribution of position statement to all participants in the competitions. Evaluation of the criteria in the préjury phase and consideration in the préjury and the jury.
- **Planning and construction:** definition of points at which actual values and measures are cross-checked with target values and measures
- **Monitoring:** Public display of energy- and water-consumption for individual areas for awareness building, learning and improvement



## Challenges and open questions

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- Information flow between FB, Agora and the UL still needs to be improved
- Next steps: develop and carry out a dissemination and implementation strategy



## Participants

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- Yves Biwer (Agora)
- Manfred Greger;
- Ariane König;
- Stefan Maas;
- Frank Minette (CRP-HT);
- Michael Scheuern;
- Jean-Jacques Scheuren;
- Paul Schosseler (CRP-HT);
- Susanne Siebentritt;
- Bianca Schmitt (CRP-HT);
- Andreas Thewes
- Daniele Waldmann



## BACK UP SLIDES

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## Maison du Savoir



**Diethmar Eberle the lead architect works on sustainability in building design since 1970's and teaches on it at the ETH Zuerich.**

**Main principles reflected in the Maison du Savoir include:**

- **Care in choice of building materials**
- **Use of natural ventilation and light is preferred**
- **Minimise structural elements that divide spaces in order to maximise flexibility of room use over the building's life time.**

