Cities and Buildings

A Presentation
By

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Four themes:

- Urban Issues
- Buildings
- Materials & Equipment
- Energy

Entrance to the Louvre

City lights - Dallas
Organisation

Leadership
NECSO - Saint-Gobain

4 Themes

Urban Issues
ACE

Buildings
NECSO

Materials & Equipment
Saint-Gobain

Energy
CSTB - EdF

Membership Includes:

Covers a Range of Matters:

- Land Use
- Territorial Planning
- Development Policy
- Design
- Lifestyle
- Participation
- Governance

Nightfall over Europe
CITIES ARE THE MOST DESIRABLE PLACES TO LIVE AND WORK

Attractive, Healthy and Sustainable
Optimal Management - Minimal Impact
Social Cohesion - Significant Prosperity
Coherent Policies - Equitable Land Use
Equilibrium of Needs

A Glasgow Street
Challenges

- Unravel the Interlinked Influences That go Into the Making, Maintenance and Management of Cities.

- Understand how the Identity of a City is Developed and how it is Perceived.

- Study Land Use Patterns and Develop Sustainable Strategies for Future Land Use Policy.
Challenges

- Better Understand the Interrelationships Between Buildings, Squares, Parks and the Spaces Between them.

- Undertake Holistic Studies of the Relationship Between Location, Type and Access to Facilities that are Required by Society.
Challenges

- Examine the Means by Which the Views of Those who use the City can be Harnessed and Devise ways to Ensure Their Input to Planning, Building and Maintenance.

- Investigate the Ways in Which Resources are Used in Cities and Identify how to Best Manage this so that Cities sit Lightly on the Earth.
Breakthroughs - 2010

- **Increased Understanding of the City as a System.**
  New Tools for Professionals and Decision-Makers to Understand Urban Systems

- **Systematic Adoption of Holistic Approaches.**
  Methodologies for Integration of Relevant Factors and Indicators in Policies

- **Significant Involvement of Citizens in Decision Making.**
  New Modes of Governance to Inform and Involve all Citizens
Breakthroughs - 2020

- Implementation of Sustainable Urban Policies that Ensure Holistic Development. Innovative Tools and Technologies to Empower the Actors in the Chain.

- Noise and Air Quality Significantly Improved. Shorter, Cleaner Construction Processes and Near-silent Transportation

- Citizen Involvement in City Management. Innovative Sociological Approaches that Educate and Empower the Citizen
Breakthroughs - 2030

Cities are the Most Desirable Places to Live.
Full range of Technologies that Permit the Creation of Truly Attractive, Efficient, Well-resourced, Dynamic, Vital and Prosperous Cities.
The Buildings of Europe are Healthy, Safe, Attractive and Accessible Places to Live and Work in

They are Built and Maintained in a Sustainable and Smart Way, Through new Forms of Alliances Between the End-users and the Construction Industry in its Broadest Sense.
Challenges

- Devise and Implement new Construction and Management Processes
- Address the Logistical Problems of Transporting Big Elements
- Devise Reliable Jointing Systems for Assemblies

Photo: Rob’t Hart
Hagen Island - The Netherlands
MVRDV
Challenges

- Reduce Energy Consumption in all Processes
- Reduce Health and Safety Issues - Particularly Indoor Air Quality
- Devise Low-intrusive Renovation Techniques
- Utilise Virtual 3D and 4D in Building Design and Development

Curved Street - Dublin
Breakthroughs - 2010

- Benign Construction Techniques are in Use

- Construction Methods and Techniques are Closer to High-Tech Industrial Approaches

- The Construction Industry Workforce Enjoys a Structured Career Path
Breakthroughs - 2020

- Buildings are Safe Against Natural Disasters
- Time to Market Drastically Reduced
- Buildings are Energy Self-sufficient
- Renovation Techniques are Low-intrusion and Employ High Technology Methods

The Duomo - Florence
Breakthroughs - 2030

- Smart Procurement and Techniques are Widely Used
- Buildings are Built and Maintained in a Sustainable Manner
- New Management Techniques for Buildings Make the EU the World Leader
To maintain and develop high living standards for our citizens:

We have to:

- Reduce dependence on energy imports
- Reduce contribution to climate change
- Increase construction productivity
- Add new properties to our existing materials/products/equipment (MPE)
- Develop new MPE to ensure we meet European challenges: durability, lower energy use, sustainability, multifunctionality…
On Materials:

*Understanding Chemistry and Physics* should expand the limits of advanced materials and improve existing materials. *Nanotechnologies* will change materials sciences drastically. *Biotechnology* should lead to the design of original materials with fascinating possibilities. *Modeling and Simulation* will help design-to-purpose materials creation and virtual testing.

Building products and systems combine and exploit the intrinsic characteristics of different materials.

In order to meet the various needs of the users, Equipment should be adapted to take into account the main European objectives and goals.
Understanding chemistry and physics

⇒ Multi-functionality, fault-freedom, amorphy, high modularity and visco-elasticity…,

⇒ Surface treatment

⇒ Understanding transport of ions, water and gas in the structures of materials

⇒ Improvement of radiation and vacuum technologies

3-D image of cement paste
Nanotechnologies

⇒ Advanced bulk materials

such as corrosion resistant construction steel, low energy cement, novel binders, ductile cements and tougher concrete, nano-layers/coatings, bio-active surfaces, tougher ceramics, self-cleaning glass, nanofillers, molecular assembly of new polymers, modified wood for construction, photovoltaic surfaces and solar cells- roofs and cladding …

⇒ Novel construction materials

built from basic nano-scale components should allow extreme strength and toughness, no health hazard, acceptable degree of sustainability of resources, environmentally harmless on local/global scale, fire resistance
Biotechnology

⇒ **Bacteria**

can be used to resolve pollution problems and can vary the properties of materials

⇒ **In the biological house of the very future**

walls consisting entirely of living material will grow like plants to conform to the architect's initial design.

⇒ **Embedded Bio-electronics**

allow permanent control of the properties of materials
Building products and systems

⇒ **Industrialized construction**: Factory made tailored products and systems
⇒ **Rehabilitation / renovation**: New product / systems
⇒ **Demountable products / systems** to optimize their service life
⇒ **Multimaterials** combining advantages from each material

⇒ Products and systems using **IT technologies** become "active" components
Equipment

⇒ Rehabilitation / renovation: Heating, ventilation and cooling systems must be adapted to reduce the energy need and environmental impact.

⇒ Lighting to suit one's needs: personalised based on the occupiers, the time of day and night.

⇒ Heating and domestic hot water production.

⇒ High-performance, low GHG emitting cooling equipment.

⇒ New ways to store energy or heat are needed should lead to high performance skins.

⇒ “On board intelligence“: The house should become sensitive with useful integrated sensors, ambient connection and prevention systems.

⇒ Water supply improvement: Water savings (rainwater, recycling…), modulable layouts.
50% building stock (existing buildings) are retrofitted with high standards of energy efficiency

New buildings are low energy consumption buildings from self sufficient buildings to net energy producers (Positive Buildings)

Technical and organisation innovations are needed

Technical solutions are not the same for the two markets

Energy Efficiency is a common necessity for these two markets
• 2030: Existing building upgrade reduces the supplied energy needs by a factor of 2 to 3

• technical innovations are needed:
  • advanced insulation products adapted to retrofitting specifications
  • efficient system dedicated to existing buildings (active windows, compact/integrated HVAC [ventilation, specific heat pumps], heat and/or electricity storage units, combined photovoltaic/heat solar collectors)
  • energy management at building scale (ICT) using general public communication infrastructure (mass audiovisual and computer equipments)
  • energy production (especially renewable ones) and energy storage included in existing buildings and adapted to retrofitting actions

• organisation innovations are needed:
  • new business models for retrofitting markets

Sun protection
• imagine, design, build and evaluate super energy efficient “concept buildings”:
  * bio-climatic design and summer comfort
  * advanced thermal insulation techniques
  * air space heating

• affordability of solutions in order to reduce by 3 or 4 energy needs of new buildings:
  * 2010: over cost less than 15%
  * 2020: less than 5% over-costs
  * 2030: no over cost compared to today

• construction panels including energy production (especially renewable ones) and storage

• industrialisation of construction
  (manufactured envelope components)

• new buildings are a part energy network
  (consumption, production, storage, management)

Photovoltaic collectors
• to develop **synergy between national plans, code and regulations** and ensure convergence for all EU member states to high standards
• to promote **Energy Efficiency and Exergy optimisations** (local taxes and legislations) and EU common performance criteria (model code)
• to accelerate technologies, best **practices dissemination**, and changes in building industry in a large variety of cultures and situations
  
  • video-games-like soft-wares and low cost internet services
  • to build on IST for performance virtual evaluation of projects and new materials
  • to develop integrated, compatible, plug and play soft-wares
  • to develop data bases proposing typical solutions

• to organize a **continuous sociology survey** and adequate communication help managing acceptance of energy efficient solutions and adverse rebound effects (relaxed attention of users)
• to promote **PPP and cooperative schemes** in a local context
In 2030, our Buildings and Cities are the Most Desirable Places to Live

A Direct Result of our Research Over 30 years.