HOSPITAL CAMPUS DESIGN RELATED WITH EEB CHALLENGES
Overall objectives

- on the basis of typologies of buildings and districts (WP1), technologies for envelope and MEP (WP2) and aims in terms of energy consumption (WP3),
- define the processes with right level of information & new contracting method (WP4),
- research and develop optimised semantics-driven Design methods (WP5) and interoperable tools for building and geo Information Modelling (WP6),
- apply all on real demonstration and validation projects across Europe (WP7),
- and secure the results by knowledge dissemination and standardization (WP8)
Crucial topics

a) the priority for the design phase integrated in the neighbourhood energy systems;

b) the empirical validation of sustainable EeB solutions and new design tools using 4 real projects from 4 different EU countries:

c) the latest advancements in BIM, GIS, Semantic and Parametric modelling and optimization techniques;

d) the active participation of industrial partners and direct synergies with other EeB research, demonstration and standardization projects.

NHS Rotherham (UK) - Rijnstate Ziekenhuis Arnhem (NL) - AOUC Firenze (I) - AP-HP Paris (F)
Context: Hospital campus – mixed-use area with an integrated energy system, consists of various buildings (e.g. hospitals and clinics, research and educational buildings, offices)

Focus: Building design – design optimization of new and existing buildings in 3 areas: MEP/HVAC systems; building envelop and spatial layout; energy grid in campus and surroundings.
First targeted key research achievement

Generic semantic typology models of energy-efficient buildings in healthcare districts adjustable semantic design models templates for new design and retrofitting.
Key areas

New design methodology is required in three key areas

1. building envelope and space layout
2. medical, MEP and HVAC systems
3. building and neighbourhood energy grids

The new methodology needs to rely on interoperability between:

Building Information Modelling (BIM)
Geospatial Information Systems (GIS)

BIM Model, source: Arup
Streamer approach to typology

**methodology** for organizational, distribution and functional aspects of healthcare buildings

**typology** in relation to **energy related features** to define design criteria for models and tools.

data and parameter gathered should be suitable for the **semantic typology models** of existing buildings and districts.

nine general arrangements of healthcare districts, source: *De Jong Gortemaker Algra*
Streamer approach to typology

Single Spaces (S)

Functional Area (U)

Building (B)

District (D)
Streamer approach to typology

a top-down
  • “outside/in” approach
  • or “designer view”

a bottom-up
  • “inside/out” approach
  • or “engineers view”
top-down

“outside/in”
starts from the definition
of the main typologies
of healthcare district.

main types
hot floor
hotel
offices
industry

Typologies, matrix of relationships, interdependencies and functional aggregative
configurations are analysed starting progressively from the district level to the single
spaces level.

Bernhoven hospital, source: De Jong Gortemaker Algra
bottom-up

“inside/out”

takes definition of spaces and units as starting point for design methodology.

Based on categorization of units depending on the relationships, interdependencies and functional aggregative configurations of single spaces in each unit.
**Streamer approach to typology**

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<th>OUTSIDE – IN Approach</th>
<th>INSIDE – OUT Approach</th>
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<td><strong>Energy-related features</strong></td>
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<td><strong>SuF</strong> Space unit “Hot Floor” Energy Efficiency required E1</td>
<td><strong>Su</strong> Space unit</td>
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<td><strong>Su</strong> Space unit</td>
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*Categorization of Spaces in the Outside/In and Inside/Out approaches*
Space units _ Classification based on Functional and Energy-related features

- **Patient Room**
  - H/Pr
  - Classification of Su related to the function (F)
  - H/Pr
  - F/typology = Hotel (H)
  - Space Unit = Patient room (Pr)

- **Operating Theatre**
  - C1/Ot
  - Classification of Su related to the energy features (E)
  - C1/Ot
  - E/typology = Class 1 (C1)
  - Space Unit = Operating theatre (Ot)

- **Patient Room**
  - C2/Pr
  - Classification of Su related to the energy features (E)
  - C2/Pr
  - E/typology = Class 2 (C2)
  - Space Unit = Patient room (Pr)

- **Operating Theatre**
  - F/Ot
  - Classification of Su related to the function (F)
  - F/Ot
  - F/typology = Hot Floor (F)
  - Space Unit = Operating Theatre (Ot)

- **Patient Room**
  - C2/H/Pr
  - Classification related to functional and energy features
  - C2/H/Pr
  - E/typology = Class 2 (C2)
  - F/typology = Hotel (H)
  - Space Unit = Patient room (Pr)

- **Operating Theatre**
  - C1/F/Ot
  - Classification related to functional and energy features
  - C1/F/Ot
  - E/typology = Class 1 (C1)
  - F/typology = Hot Floor (F)
  - Space Unit = Operating Theatre (Ot)

*Categorization of Spaces according to the crossing methods*
Conclusion

STREAMER design methodologies will turn around the existing approach

a) Decision-making will be based on inclusiveness in the design phase of both new and retrofitting projects, from the initial brief to the final design implementation.

b) The common parameters and the average energy use will be modelled according to the functional classification, space allocation and building configuration.

c) At inter-building, neighborhood and urban levels, the typological meta-design will be used in order to define the most effective strategy for energy-efficiency improvements.