Deliverable 8.6

Newsletters and publications: Overview report

Deliverable Report D8.6 Final version

Streamer - Optimised design methodologies for energy-efficient buildings integrated in the neighbourhood energy systems.
The Streamer project is co-financed by the European Commission under the seventh research framework programme FP7.EeB.NMP.2013-5; GA No. 608739

Deliverable 8.6

Newsletters and publications: Overview report

Issue Date	24 August 2017
Produced by	DEMO Consultants B.V. (DMO)
Main author	Oana Schippers-Trifan (DMO)
Co-authors	Ania Jankowska- Bichta (MAE)
Reviewed by	Annemarie Mahieu (TNO), Andre van Delft (DMO)
Approved by	Marc Bourdeau (CSTB), Freek Bomhof (TNO)
Dissemination	Public
Type of deliverable	Report

Document history

Version	Date	Status	Produced by	Comments
1	02-08-2017	Draft	DMO	
2	16-08-2017	Final draft	DMO	
3	20-08-2017	Reviewed	DMO (Andre van Delft)	
4	23-08-2017	Final version	DMO, MAE	
5	24-08-2017	Approved	TNO, CSTB	

Colophon

The Streamer project is co-financed by the European Commission under the seventh research framework programme with contract No.: 608739 - FP7-2013-NMP-ENV-EeB. The information in this publication does not necessarily represent the view of the European Commission. The European Commission shall not in any way be liable or responsible for the use of any such knowledge, information or data, or of the consequences thereof.

Publishable executive summary

Within STREAMER is dissemination and stakeholder engagement central to the success of the results, which is why the dissemination activities have been an essential and pervasive activity throughout the project's life, and have been integrated within all its work packages.

The overall objective of the STREAMER dissemination strategy since the beginning of the project was to identify and reach as many stakeholders that will be involved within the STREAMER's research activities in order to raise their awareness regarding the findings of the project and to encourage them to support and adopt the STREAMER's solutions and recommendations regarding participatory design/ design optimisation. The intent here was to create an impact that will last beyond the end of the project by making the results of the research known to those who could benefit from them (i.e. identification of the issues, opportunities and challenges surrounding the participatory design within the healthcare sector). This would enable STREAMER to strengthen the research and knowledge base of stakeholders by facilitating the presentation of the work and results of STREAMER precisely and effectively to as wide a stakeholder audience as possible.

In this respect, the dissemination of the project results and activities took place through a set of initiatives around the project: website; Implementers Community, meetings, conferences, software seminars, design workshops, demonstrations, networking activities on European, national and local scale, as well as publications in scientific journals and other promotional materials such as newsletters, leaflets, posters, etc.

This deliverable (D8.6) consists of all knowledge dissemination materials developed during the whole lifespan of the project (M1-M48). It represents the documentation part of the respective dissemination and communication initiatives performed within STREAMER, and describes shortly the dissemination and communication strategy and channels STREAMER used in order to spread the word about its results.

This report is one of the final results of Work Package 8 (Dissemination and Standardisation). Next to D8.1, D8.2, D8.3, D8.5, D8.7 and D8.8 the main aim of D8.6 is to create an overview of all dissemination materials and publications developed along the way. This overview works as an instrument to communicate and promote further the projects results through the developed promotional materials and chosen publication channels for the future commercial exploitation of the knowledge gained and the tools/solutions developed during this project.

List of acronyms and abbreviations

- BIM Building Information Model
- CMS Content Management System
- DoW Description of the Work
- EC European Commission
- EDC Early Design Configurator
- EeB Energy Efficient Buildings
- EIP European Innovation Partnerships
- ESS Exploitation Strategy Seminar
- EU European Union
- GIS Geo Information System
- HVAC Heating, Ventilation and Air Conditioning
- IC Implementers Community
- IFC Industry Foundation Classes (open-standard exchange format for BIM)
- IPD Integrated Project Delivery
- IPR Intellectual Property Rights
- MEP Mechanical, Electrical, Plumbing
- RTD Research Technology Development
- WP Work Package

Contents

1. INTRODUCTION 6

1.1 About STREAMER 6

1.2 WP8 – Dissemination and standardisation 6

1.2.1 T8.1 Implementers Community (IC) and valorisation 6

1.2.2 T8.2 Wider knowledge dissemination 7

1.2.3 T8.3 EeB design standardisation for new and retrofitting buildings 8

1.2.4 T8.4 BIM. GIS, Semantic Web open-standardisation 8

1.3 Scope of this document 9

2. DISSEMINATION TOOLS, CHANNELS AND ACTIVITIES 10

2.1 Objectives 11

2.2 The STREAMER Dissemination Plan 11

2.3 Dissemination instruments 11

2.3.1 Project identity (logo, graphical layout, dissemination toolkit) 11

2.3.2 Public Website 12

2.3.3 The Implementers Community 13

2.3.4 Newsletters 13

2.3.5 Flyer 15

2.3.6 Posters 15

2.3.7 Leaflet 16

2.3.8 Presentations 17

2.3.9 Publications of best practices, case studies and design examples 17

2.3.10 Design Workshops 17

2.3.11 Events and Meetings (Networking events) 17

2.3.12 Professional implementation training materials (for more information refer to D8.5) 17

3. DISSEMINATION OVERVIEW 19

3.1 List of publications 19

3.2 Presentations 20

3.3 Organisation and Participation in Dissemination Events 22

APPENDIX 1 – 1ST, 2ND, 3RD STREAMER NEWSLETTER

APPENDIX 2 – STREAMER FLYER

APPENDIX 3 – STREAMER POSTERS

APPENDIX 4 – STREAMER LEAFLET

APPENDIX 5 – STREAMER INVITATION 2ND DESIGN WORKSHOP29

1. Introduction

1.1 About STREAMER

STREAMER is an industry-driven collaborative research project about the construction of efficient healthcare centres. Main aim of the project is to reduce by 50% the energy use and carbon emission of new and retrofitted buildings in healthcare districts. In this respect, it is evident that, throughout its lifecycle, an extension project of a hospital is of key importance and has significant impact on the whole daily processes within that hospital. For that reason, STREAMER focuses on developing and implementing innovative solutions for the design, engineering and co-ordination of new construction, extension and the renovation of hospitals and healthcare centres.

STREAMER will enable designers, contractors, clients and end-users to integrate Energy-efficient Buildings innovations for: 1) building envelope and space layout; 2) medical, MEP and HVAC systems; and 3) building and neighbourhood energy grids.

STREAMER results have been validated in the 4 real projects involved in the STREAMER Implementers Community. The outcome will be used to extend the standardisation in EeB design and operation, open BIM–GIS (IFC–CityGML), and Integrated Project Delivery (IPD).

1.2 WP8 – Dissemination and standardisation

The overall objective of STREAMER Work Package 8, within which this deliverable is developed, is to perform knowledge dissemination and knowledge valorisation of the results of STREAMER; to optimise the synergy with EeB-related EU activities, as well as to ensure the board and sustainable impact of embedding the new knowledge in design, energy, and ICT open standardisation.

1.2.1 T8.1 Implementers Community (IC) and valorisation

The goals, main subjects and activities within task 8.1 are:

- To establish and empower an Implementers Community (IC) that includes the stakeholders, design actors and interested parties which are associated with the 4 demonstrations cases in WP7. This activity will be led by the 4 hospital organisations (RNS, APH, TRF, AOC), which are the owners/clients of the demonstration cases. The immediate knowledge dissemination and valorisation through the IC will be conducted in conjunction with the demonstration and validation activities, i.e. planning, design and decision-making workshops; providing feedback on the functionalities of STREAMER's design methods and tools, potential market, and direct and future impacts.
- To organise an Exploitation Strategy Seminar (ESS) with the support from the European Commission, and to generate an Exploitation and IPR Plan. The STREAMER ESS was organized in June 2015 (M18 of the project). In this seminar, all partners have been actively engaged in preparing the Exploitation and IPR Plan for STREAMER results. This activity is now being finalised by TNO (D8.3 due at M48). The ESS and Exploitation Plan respectively have guided the STREAMER consortium partners to: a) learn a methodology for analysing and self-assessing their RTD results; b) acquire knowledge on the main non-technical issues of their project; c) draw up an action plan to increase the chances of successful exploitation; d) acquire the main elements to approach a business plan; e) be able to prepare an adequate and useful knowledge

management in accordance with contractual obligations; and f) become aware and understand the complexity of co-ownership in a collaborative research project. Actual commercial exploitation and related marketing activities will start after the end of the project (starting with September 2017) and will be dealt by interested partners within the consortium in accordance with contractual obligations. More information is to be found in D8.3 (Exploitation and IPR Plan).

- To perform the knowledge valorisation activities through the synergy with ECHAA, EuHPN, EERA Smart Cities, KIC InnoEnergy, E2BA, and ECTP. This activity is led by TNO, CSTB, CEA, BOU, MOW. Knowledge valorisation in STREAMER is defined as tailoring applied knowledge and skills and exploiting the full potentials of the research outcomes for use by businesses and societies at large. It includes the utilisation in economic terms and the possibility of creating greater social or cultural value towards future implementation. STREAMER will use EeB-related networks and EU activities for knowledge valorisation in the following ways:
  - by contributing to SET-Plan through the existing participation in EERA Joint Programme on Smart Cities (TNO leads SP4 on Urban City-related Supply Technologies), KIC InnoEnergy, Energy-Efficient Building Association E2BA (TNO, Mostostal, CEA, CSTB are [board] members) including its National Liaison Points;
  - by valorising knowledge of energy-efficient building design and operation through the synergy with the EU platforms for healthcare assets (ECHAA and EuHPN through TNO and Locum) and EIP AHA (Healthy Ageing);
  - by addressing the EU construction industry at large through the European Construction Technology Platform (ECTP). Mostostal, CEA, CSTB and TNO are involved in the Stakeholders Platform of Smart Cities and Communities that will implement the European Innovation Partnerships (EIP) Smart Cities.

1.2.2 T8.2 Wider knowledge dissemination

The main goals, subjects and activities of this specific task are:

- To design, launch, host and manage an open Public Website and a secured Project Website. DMO is the responsible partner for the design, development, maintenance and hosting of the STREAMER Public Website. Content management (CMS) is done by the project coordinator (TNO) with contribution from all consortium partners. Information on the website design, logo and templates for project reports, presentations can be reviewed in D8.4
- To publish and distribute electronic and printed newsletters (1 each year); and to publish articles in professional and scientific journals (at least 2 each year).
- To present STREAMER research and results at professional and academic conferences (at least 2 each year); and to hold seminars or presentations at conferences of E2BA, ECTP, KIC, EERA, EuHPN, IFHE (at least 4 times).
- To summarise all knowledge dissemination materials in an overview report (at the end of the project).
- To prepare training materials for energy-efficient and low-carbon hospitals (based on Master Class by DuCHA/TNO) and for university curriculum in the field of BIM/GIS/Semantic Web (as organised by KIT).

1.2.3 T8.3 EeB design standardisation for new and retrofitting buildings

Based on the identification of the differences in the processes of design for new EeB and retrofitted objects, a similar approach to EeB standardisation will be taken for new and retrofitted buildings respectively.

The main goal of this task is to determine the technologies used in the processes of increasing the energy efficiency in buildings in order to reach the standard of the building with the progressive extent of: energy-efficient, passive, zero energy. In this context, the main activities are:

- Making an overview of legislation (laws), building codes, standards and best practices for retrofitted energy efficient buildings in the EU, and whenever relevant also in the USA and Canada, Japan and China.
- Determine the specific requirements for the design of healthcare buildings under national and the EU laws, including the efficiency and reliability of energy supply.
- Determine the influence of specific local conditions, including climate, on the selection of the proposed technology to improve energy efficiency and to define the level of quantitative criteria; review the available standards and regulations (e.g. comfort, air quality, fire safety) applying to design, construction, operation and maintenance; examine required evolutions of the existing regulations and standards.
- Define the need for the preparation of future design standards by reflecting on: best practices, guidelines, standards, special Internet tools, e-learning, numerical simulation and design programs.
- Assess and implement the most relevant means to leverage existing processes and foster BIM breakthrough Europe-wide –e.g. best practices dissemination, 'code of practice', regulatory constraints, etc.

This task will contribute to the strong shift at European level towards BIM and ICT-intensive design practices, which will result in significant cost-efficiency and time-to-market improvements, and in an increased competitiveness of the European AEC industry respectively. Based on outcomes from the demonstration activities, this task will elicit and shape the specific EeB design methodological guidelines based on semantic typologies in the scope of new healthcare buildings / districts design.

1.2.4 T8.4 BIM, GIS, Semantic Web open-standardisation

In the area of standardisation, STREAMER pursues to the harmonization of open standards for modelling of buildings (BIM), neighbourhood/urban areas (GIS), especially with the purpose of integrated energy calculation and simulation. During the project's duration it has also explored the new possibilities of XML and Semantic Web, especially in cases where knowledge was developed and known by several disciplines and at several locations.

Key successes in the harmonization of open standards will be guaranteed by the leading position and network of STREAMER consortium partners within the open standardisation bodies at European and international levels, i.e.:

- BuildingSMART provides IFC (Industry Foundation Classes), an open data model for the lifecycle of a building.
- The OpenINFRA initiative is currently looking how the civil infrastructure sector can benefit from an open standard like IFC.
- The Open Geospatial Consortium (OGC) is the leading international organisation for standardisation of spatial data. OGCs Geography Mark-up Language (GML) is the base for many data models e.g. the 3D city model CityGML or the German standard for spatial planning XPlanGML. GML is also the basis for the European INSPIRE initiative.

- Another standardisation stream is LandXML from LandXML.org, an Autodesk initiated initiative focusing on modelling civil infrastructures sitting somewhere between the BIM and GIS worlds of BuildingSmart and OGC.
- There are also initiatives like the Dutch VISI and COINS that try to add Systems Engineering (SE) aspects in the mix to make it possible to specify requirements in the early lifecycle phase for building artefacts and later validate potential solutions from the design phase.

STREAMER standardisation effort addresses all actual “streams” within the relevant domains of BIM, GIS and Semantic Web in building, civil infrastructure, and energy sectors.

1.3 Scope of this document

The aim of the STREAMER dissemination activities is to assure the sustainable knowledge transfer and implementation of STREAMER results to clients, the healthcare construction industry, and other stakeholders in order to stimulate new market opportunities and knowledge development. The dissemination of the STREAMER projects and its results started directly after the start of the project and will continue after the completion of the project (M48/ 31 August 2017).

This present report has been developed under ***task 8.2 - Wider knowledge dissemination*** wherein ***D8.4 Public Website and Project Consortium Website*** has been previously submitted (M6). This document describes shortly the project's strategy and activities carried out in relation to the dissemination and communication of STREAMER results. In particular, an overview, on one hand of the published and digital promotional (newsletters; leaflets; posters), and on the other hand the scientific materials (conference and journal papers) will be presented.

In this respect, a very brief description of the STREAMER Dissemination and Communication Plan is being outlined. This plan has been fundamental throughout the whole project's duration for a good coordination of all initiatives and also for defining the messages targeted to different audiences (stakeholders).

Effective communication during the project has encouraged interested stakeholders to actively participate in the project and enhance the visibility of the project results. This will continue beyond the project to still play a crucial role in up taking of the results.

The STREAMER Dissemination and Communication Plan consists concretely of:

- Outlining the main objectives of the dissemination actions;
- Identifying the target audiences for each communications objective;
- Defining the tools and channels to be used and the activities required to reach targeted audiences;
- Explaining how the dissemination activities will support the exploitation activity;
- Illustrate how the project will cooperate with other EC-funded projects and/or initiatives;
- Define how the dissemination activities will be administrated.

2. Dissemination tools, channels and activities

Many dissemination activities have been planned and carried out to enable smooth communication and knowledge transfer and sharing among the project partners but also with:

- Other innovation projects supported by the EC under the same call (e.g. GREEN@Hospital, HOLISTEEC, eeEmbedded, Design4Energy);
- The stakeholders involved in the Implementers Community (APH, TRF, AOC, RNS);
- Other external stakeholders.

The aim of these activities is not only to assure the sustainable knowledge transfer but also to ensure the implementation of STREAMER results and to stimulate new market opportunities and knowledge development. In this context, the main activities were focused on informing and instructing interested parties, among which involved STREAMER stakeholders and design engineers on the innovative knowledge resulting from STREAMER, create synergies with similar EU initiatives and projects and organise events where results can be demonstrated and disseminated.

During the implementation of the research work, we have strived to maintain a user-centred approach. We have had our IC members and other stakeholders closely involved in a collaboration that was focused on user requirements, planning of the research work, testing, validating and evaluating the work progress. During this collaboration our stakeholders were enabled to acquire theoretical and technical knowledge about the STREAMER scope. They determined how to use the results, and they've learn about the impact that the results can make on their work and organisation.

The dissemination of the STREAMER project and its results started directly after the start of the project (1st of September 2013) and will continue after the completion of the project (31 August 2017). The dissemination took place through a set of initiatives around the project: public and restricted website, Implementers Community, technical meeting, conferences, design workshops, software demonstrations, and networking activities on national, local and European scale as well as publications in scientific journals.

In this present report we will report about these initiatives with regard to the STREAMER dissemination of results. In the next section, the STREAMER Dissemination Plan will be briefly described that has been carried out (and still do so at the moment) followed by chapter 3 where we will go into detail by presenting an overview of all the events and publications the STREAMER consortium has participated at, initiated and developed throughout the whole project duration.

2.1 Objectives

To focus the dissemination and communication activities on the overall goal of STREAMER, the following main objectives have been established right at the start of the project:

- To define the actions that will be carried out during the project's duration;
- To ensure effective and appropriate communication towards the involved stakeholders (IC);
- To gather feedback from relevant stakeholders and other networking activities;
- To ensure the involvement of stakeholders and other interested parties to guide planning, prototyping and evaluation;
- To offer support to other work package leaders to ensure a good level of communication around their activities;
- To facilitate internal (between project partners) and external communication;
- To plan, coordinate and monitor communication and dissemination activities;
- To transfer knowledge gained within the project to others at an internal and external level.

2.2 The STREAMER Dissemination Plan

The STREAMER dissemination Plan and strategy have been designed to make the results of our up to date research and technology development available to targeted communities, to attract a larger and active client community and to prepare for a possible, future adoption of the developed technologies and solutions.

For achieving this goal, the following objectives have been defined:

- Raising awareness for the STREAMER approach and project results;
- Active involvement of potential stakeholders [healthcare institutions and managers, healthcare government and research organisations (EuHPN), experts and developers of open-standards in BIM (IFC), GIS (GML) and Semantic Web, construction companies, energy engineers, etc.;
- Dissemination through publication and communication of results in scientific journals.

2.3 Dissemination instruments

The instruments to realize these objectives are outlined in the STREAMER Description of the Work (DoW) as follows:

2.3.1 Project identity (logo, graphical layout, dissemination toolkit)

The first communication activity deployed, necessary for coherent and effective communication, was the creation of a dedicated project identity composed of:

- a project logo;
- guidelines for the graphical layout of all project documents;
- a toolkit (documents, presentations, etc.) useful to spread the knowledge of the project.

2.3.2 Public Website

A website has been developed for the STREAMER project at the beginning of the project to serve as the main dissemination platform for the interested parties.

The website, structured following the European Commission best practice guidelines will be continuously updated in contents and structure throughout the project duration and beyond (up to two years). Detailed information on the graphical layout, project identity, and STREAMER logo used for dissemination materials can be reviewed in deliverable report ***D8.4 Public website and project consortium*** (M6).

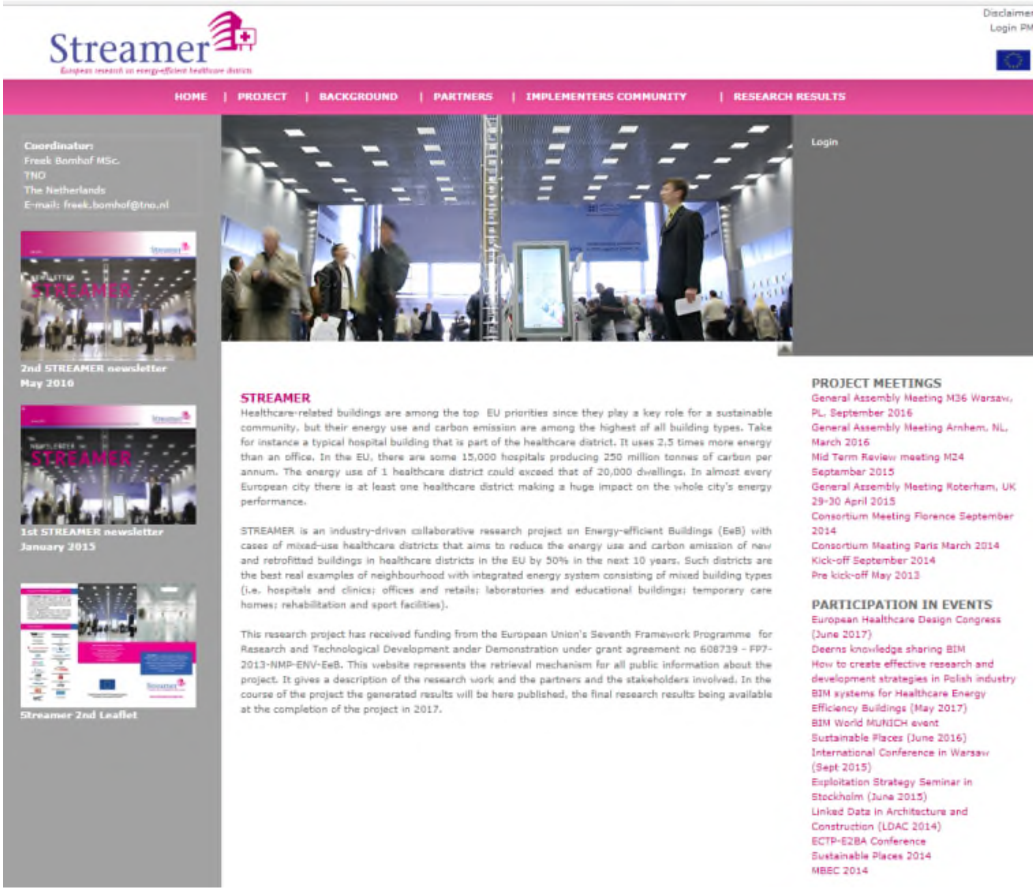


Figure 1: STREAMER Public Website

2.3.3 The Implementers Community

Effective dissemination usually results in the establishment of contacts and interconnection of networks – a legacy that often outlives the project. In this context, among the external objectives of the STREAMER's dissemination strategy was the establishment of an Implementers Community that would act as an important vehicle to commit current and future stakeholders, connect researchers, practitioners and policy-makers, but which would also serve as prime and sound example of energy-efficient healthcare districts addressing both new developments and retrofitting projects in this sector. This established IC would facilitate the collaboration among different groups of stakeholders to enhance uptake of the project's results and integration of different and diverse end-user knowledge. Up to this moment in time, there has been an Implementers Community established in Poland (through the Polish partners). A similar initiative has started in Sweden as well, where the first meeting workshop will take place after the project has ended.

The consortium, among which the 4 large hospitals involved in STREAMER (representing the initial IC members), have placed particular emphasis on facilitating this collaboration, establishing important links and closely integrating with other organisations carrying out similar or related research and analysis, or facing the same challenges. This integration and collaboration effort will not only strengthen the research and knowledge base for the research activities carried out in STREAMER, but also open up possibilities of enhancing future cooperation, as the STREAMER findings and solutions are based on realistic stakeholder contexts, interests and drivers. To this respect, the STREAMER dissemination strategy aimed from the beginning of the project to identify and establish contacts with other relevant projects, studies and initiatives, to increase awareness of the consortium's work and research results, apprise them of STREAMER and enable the integration of the range of research activities about participatory design for healthcare building constructions in Europe and in the world at large.

2.3.4 Newsletters

A periodic Newsletter, intended to be issued every year of the project, provides information on project progress and results, as well as contains links to public deliverables and articles and interviews for external communications. They are made available on the project website in order to improve visibility of the project via electronic means and have been sent to consortium partners and other registered stakeholders.

The first newsletter was issued after the first year of the project (January 2015) with the aim of improving the visibility of the project by giving an overview of the objectives and to present the partners involved (refer to Annex 1 for complete review of the newsletters).

Figure 2: STREAMER 1st digital newsletter

The second newsletter, foreseen at the mid-term of the project (May 2016), has focused on the activities carried out during the first years of the project and was used to announce the first STREAMER Implementers Community Design Workshop to be taken place in Arnhem, the Netherlands in June 2016 (refer to Annex 1 for complete review of the newsletters).

The last newsletters, 3 and 4 have been combined and released at the end of the project (August 2017) and contains an outline of the project achievements to date, introducing the next IC Design Workshop in September 2017.

The digital version of the project newsletter is available for download on the project website. Hard copies of the newsletters have been printed out for distribution at events, workshops and expert conferences (e.g. Sustainable Places 2015, 2016, 2017, Design Workshop June 2015, Design Workshop September 2017).

2.3.5 **Flyer**

Figure 3: STREAMER flyer (refer to Annex 2)

2.3.6 **Posters**

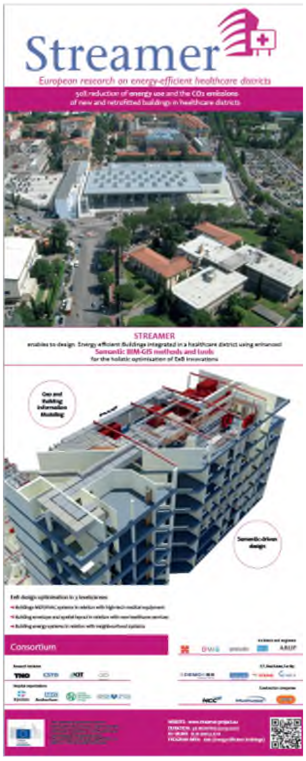


Figure 4: STREAMER posters (refer to Annex 3)

2.3.7 **Leaflet**

How can the STREAMER results help?

The STREAMER results have been developed and demonstrated in direct collaboration with four large hospitals in Italy, France, The United Kingdom and the Netherlands where the methodologies and tools have been tested and evaluated.
While the STREAMER results have been created with hospitals as application domain in mind, the results have a broader application. We believe any complex building can benefit from the STREAMER approach.

Project partners

TNO, the Netherlands
Mostostal Warszawa SA, Poland
Ipostudio Architetti, Italy
Stichting Rijnstate Ziekenhuis, the Netherlands
De Jong Gortemaker Algra Architects and Engineers, the Netherlands
APHP Paris, France
Becquerel Electric, Italy
The Rotherham NHS Foundation Trust, United Kingdom
DWA B.V., the Netherlands
AOC Careggi, Italy
AEC3 LTD, United Kingdom
Mazowiecka Agencja Energetyczna, Poland
Karlsruher Institut fuer Technologie, Germany
Commissariat a l'énergie atomique, France
Demo Consultants, the Netherlands
Centre Scientifique et technique du batiment, France
Bouygues Construction, France
Locum AB, Sweden
NCC AB, Sweden

More information and contact

For more information, refer to our website at
www.streamer-project.eu
where the public deliverables are found.
Coordinator: Freek Bomhof MSc
TNO, The Netherlands
E-mail: freek.bomhof@tno.nl

STREAMER - an industry-driven collaborative research project on Energy-efficient Buildings (EeB) with cases of mixed-use healthcare districts that aims to reduce the energy use and carbon emission of new and retrofitted buildings in healthcare districts in the EU by 50% in the next 10 years.

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 608739

Streamer
European research on energy-efficient healthcare districts

www.streamer-project.eu

STREAMER: Designing energy-efficient hospitals

Hospitals are among the buildings with the highest energy consumption – in average a hospital consumes 2.5 times more energy than an office. This is mainly due to the complexity of the building and utility systems in a hospital in order to accommodate energy-intensive medical equipment and processes.
The STREAMER project focuses on the design phase of hospitals, because design decisions evidently have a large impact on the energy efficiency of the newly constructed or refurbished hospital buildings. STREAMER has generated methodologies and tools which assist interdisciplinary design teams to analyse and select the most energy-efficient design solutions. STREAMER methodologies and tools are innovative for their applicability in the early design phase where traditional design methods falls short in term of semantic and holistic insight.

STREAMER results

The STREAMER methodologies and tools are developed to be complementary with each other when applied in design practice.
The STREAMER methodologies comprise:

- **The 'semantic labels' design concept.** This concept allows the designer to attach design-related semantic properties to space units (i.e. rooms) in the early design phase even though much detailed information is still unknown. These semantic labels express the 'design rules' which capture the knowledge of designers, and in turn are useful to create and validate design alternatives.
- **Guidelines** enriched with best practices for design teams. These guidelines also incorporate the viewpoints of various stakeholders (i.e. hospital manager, medical staff, patients, local authorities) who are involved in an optimal decision-making concerning design quality, energy efficiency, cost effectiveness. These guidelines also contain organizational approaches to speed up the design process for new buildings and retrofit situations.

The main STREAMER tools that complement the methodologies are:

- **An Early Design Configurator (EDC) and Design Validator** for creating and tentatively validating design alternatives based on the end-user's Programme of Requirements. Using the EDC, the design alternatives in Building Information Model (BIM) are automatically generated based on the design rules within predefined boundary conditions, such as building's outlines and geographic location.
- **A Decision Support Tool (DST)** for comparing various design alternatives and performing multi-criteria analysis against a set of STREAMER Key Performance Indicators (KPIs) which address energy efficiency, total cost of ownership, and quality.

Along with these main results, many supporting project outcomes are available to facilitate the achievement of creating energy-efficient hospitals. Among these outcomes, there are tools for: preliminary calculation of energy demand in early-design and developed-design phases; validation of IFC files (open standard of BIM) which are exchanged during the design process; document management and collaboration process steering; and capturing best practices into semantic design rules.
On the engineering side, STREAMER has created a comprehensive overview of various solutions for MEP (Mechanical, Electrical and Plumbing) systems and building envelopes for energy-efficient hospitals. Additionally, STREAMER has also developed practical approaches to analyse energy-related aspects at campus and district scale with a particular aim to explore possible optimizations between various buildings within a hospital campus and the local district concerning energy production, consumption, distribution and storage.

STREAMER impact

In a **STREAMER - supported design process**, more design options are kept open and they can all easily be evaluated in terms of energy, cost and quality. This enables design teams to choose the best alternative. Optimal choices can be made for room placement and selection of HVAC equipment, in relation to choices for facade technologies. As an example: a poorly designed ventilation system has been seen to account for 40% of the total hospital's energy bill – that is just for moving air, not even including heating or cooling!

Figure 5: STREAMER leaflet (refer to Annex 4)

2.3.8 Presentations

During the four-year duration of the project, STREAMER has been participating in many events to increase the visibility of the project towards a wider public and help ensure the transfer of the knowledge. The overview of all the presentations presented during various events is listed below in ***Chapter 3 -Dissemination Overview.***

2.3.9 Publications of best practices, case studies and design examples

To share the project progress with the scientific community, the consortium have drafted articles and other contributions for the technical literature and dedicated journals. Such contributions have been written by academic and technology partners, through peer-reviewed journals and magazines and also through papers presented at conferences and other events. The overview of all the publications published during the project duration is listed below in ***Chapter 3 -Dissemination Overview.***

2.3.10 Design Workshops

During the project duration, several hospital demonstrator workshops have been planned. One Design Workshop in particular, has been organised by the Rijnstate Hospital in Arnhem, in the Netherlands in March 2016. The idea behind this workshop is to show the stakeholders how the STREAMER tools can be used in practice. At the same time, they had the chance to test the tools, methods themselves and give straight feedback to the developers present. The second session (planned as a follow-up of the first one) of the Design Workshop Rijnstate will take place in September 2017 (refer to Annex 5 for the invitation to the event) where results and advanced technologies will be tested again. Moreover, similar workshops have been held in Italy (AOC), France (AP-HP) and United Kingdom (TRF) as well. Refer to following reports for a detailed overview of these events: D7.2, D7.4, D7.6, and D7.8. Further information on other kind of workshops can be found below in ***Chapter 3 -Dissemination Overview.***

2.3.11 Events and Meetings (Networking events)

During the four years of the project, STREAMER has been participating in many events to increase the visibility of the project towards a wider public and help ensure the transfer of the knowledge. All the meeting, events, conferences where the project has been participated are listed below in ***Chapter 3 -Dissemination Overview.*** For a more extensive overview of knowledge sharing refer to ***D8.2 Knowledge dissemination in cooperation with other EU programmes***.

2.3.12 Professional implementation training materials (for more information refer to D8.5)

The STREAMER training materials provide shortly introductions into the EU project STREAMER and some other related EU projects, and offer descriptive information materials on the basic technologies on which STREAMER is based.

The STREAMER training documentation contains material for training courses for two target groups (hospital communities and university students) and is structured as follows:

- Part 1 is relevant for both target groups;
- Part 2 is mainly relevant for university students;
- Part 3 and 4 are mainly relevant for hospital communities.

The STREAMER results have been and will continue to be disseminated by bi-lateral contacts, meetings, conferences and through the STREAMER public website.
In this context, the dissemination activities of the STREAMER project focus on the following target groups:

Internal target group:

- The project partners
- The other projects selected under the same call (HOLISTEEC, Design4Energy, eeEmbedded, GREEN@Hospital);
- The stakeholders involved in the IC;

External target group:

- The European Commission and professional associations (E2BA; EERA, KIC InnoEnergy, EIP Smart Cities);
- Healthcare institutions and centres;
- Construction companies and energy engineers (ECTP, IFHE);
- Healthcare government and research organisations (EuHPN);
- Local authorities;
- Technical universities or other academic groups;
- Experts and developers of open standards (BuildingSMART, OGC, W3C);
- Public opinion.

3. Dissemination overview

3.1 List of publications

Scientific (peer-reviewed) journal articles and conference papers

- Sebastian, R., Böhms, H.M., Bonsma, P., van den Helm, P.W. (2014). *Semantic BIM and GIS Modelling for Energy-Efficient Buildings Integrated in a Healthcare District* in ISPRS Proceedings; 8th 3DGeoInfo Conference. Vol. II-2/W1, 27 – 30 November 2013, Istanbul, Turkey
- Haefele, K.H., Casper, E., Kaden R. (2014). *OGC Standard CityGML Opens Up New Applications in Energy Simulation* in Journal of the National Institute of Building Science, December 2014, Vol. 2, No. 6, pp.30-32
- E. Iadanza, B. Turillazzi, F. Terzaghi, L. Marzi, A. Giuntini, R. Sebastian (2014). *The STREAMER European project. Case study: Careggi hospital in Florence"* in Lacković, I. and Vasic, D. (Eds.), 6th European Conference of the International Federation for Medical and Biological Engineering – IFMBE Proceedings 45 - MBEC 2014, 7-11 September 2014, Dubrovnik, Croatia, Springer International Publishing, Switzerland, pp. 649-652, DOI: 10.1007/978-3-319-11128-5_162
- Geiger, A., Benner, J., Haefele, K.H. (2014). *Generalization of 3D IFC Building Models* in 3D Geoinformation Science, 11-13 November 2014,pp. 19-35, Springer
- Marzi, L. (2014). *Tools and methods for the management of healthcare real estate assets: The experience of the multidisciplinary laboratory of the Careggi University Hospital* in TECHNE Journal of Technology for Architecture and Environment: Florence, Italy, pp.241-249, Firenze University Press
- Benner, J.; Häfele, K.H.; Bonsma, P.; Bourdeau, M.; Soubra, S.; Sleiman, H.; Robert, S. (2014). *Interoperable tools for designing energy-efficient buildings in healthcare districts* in Proceedings of ECPPM - eWork and eBusiness in Architecture, Engineering and Construction,17-19 September 2014, CRC Press, the Netherlands
- Di Giulio, R., De Hoogh, S., Turillazzi, B., Quentin, C., Sebastian, R. (2014). *Hospital campus design related with EeB challenges* in Mahdavi, A., Martens, B. and Scherer, R. (Eds.), ECPPM 2014 – eWorks and eBusiness in Architecture, Engineering and Construction", Proceedings of the 10th European Conference on Product & Process Modelling, Vienna 17-19 September 2014, eeBDM Workshop, CRC Press/Balkema - Taylor & Francis Group,London, UK, pp. 907–915.
- Koster, M., Van Nederpelt, S., Sebastian R. Schippers-Trifan, O. (2015). *STREAMER Semantic BIM design approach for hospitals: research case of Rijnstate Hospital in Arnhem, the Netherlands* in Sustainable Places Conference Proceedings, September 2015, pp.121-129, Savona, Italy, Sigma Orionis; http://www.sustainableplaces.eu/wp-content/uploads/2017/01/SP2015_Paper-Proceedings.pdf
- Hempel, S., Benner, J., Haefele, K.H. (2015). *Generating Early Design Alternatives based on formalized requirements and geospatial data* in Proceedings of the 32nd International Conference of CIB W78, pp.255-264, 27-29 October 2015, Eindhoven, the Netherlands
- Nouvel, R.; Kaden, R.; Bahu, J.M.; Kaempf, J.; Cipriano, P.; Lauster, M.; Benner, J.; Munoz, E.; Tournaire, O.; Casper, E. (2015). *Genesis of the CityGML energy ADE* in Proceedings of CISBAT Future Buildings & Districts Sustainability from Nano to Urban scale, Vol. 2, September 9-11, 2015, pp.931-936, Ecole Polytechnique Federale de Lausane (EPFL), Switzerland

- Haitz D., Geiger A. (2015). *Konvertierung von CityGML-Gebäudemodellen in gbXML für energetische Betrachtungen* in Forum Bauinformatik 27, pp. 28-36. 21-23 September 2015, Wichmann, Germany
- Nouvel R., Bahu J.-M., Kaden, R., Kaempf, J., Cipriano P, Haefele, K.H. (2015). *Development of the CityGML Application Domain Extension – Energy for Urban Energy Simulation* in Proceedings of 14th Conference of International Building Performance Simulation Association IBPSA. 7-9 December 2015, pp.559-564., Hyderabad, India
- Marzi, L., Di Giulio, R., Turillazzi B., Terzaghi, F., Giuntini, A. (2016). *Integration of BIM-GIS systems for energy-efficient hospital buildings. The Streamer research and the case study of the Careggi Polyclinic (Florence); in* Italian Society of Science, Technology and Engineering or Architecture (ISTeA): Back to 4.0 Rethinking the Digital Construction Industry, 30 June -1 July 2016, Naples, IT
- Traversari, A.A.L. (2016). *Semantic Labels for Energy Efficient Building Design enabling Early Design evaluation* in the International Journal Entrepreneurship and Sustainability Issues
- Hempel, S.; Benner, J.; Geiger, A, Haefele, K. H. (2016). STREAMER Early Design Configurator- a Tool for Automatic Layout Generation in Hájek, P., Tywoniak, J., Lupíšek, A. and Sojková, K. (Eds.), CESB16 Proceedings 22- 24 June 2016, Prague, Czech Republic, pp. 221-222.
- Benner, J, Geiger, A., Häfele, K.H. (2016). *Virtual 3D City Model Support for Energy Demand Simulations on City Level – The CityGML Energy Extension*. REAL CORP 2016. 21st International Conference on Urban Planning, Regional Development and Information Society, Hamburg, 22-24 June 2016, pp.777-786, CORP, Schwechat
- Di Giulio, R., Turillazzi, B., Marzi, L., Pitzianti, S. (2017). *Integrated BIM-GIS based design for high energy efficiency hospital buildings* in TECHNE Journal of Technology for Architecture and Environment, Vol.13, pp.243-255, Firenze University Press, DOI: 10.13128/Techne-19728
- Traversari, A.A.L., Den Hoed, M., Di Giulio, R., & Bomhof, F.W. (2017). *Towards Sustainability through Energy Efficient Buildings‘ Design: Semantic Labels*, the International Journal Entrepreneurship And Sustainability Issues, Vol.4, Number 3, pp. 243-256; http://jssidoi.org/jesi/
- Sleiman, H. A., Hempel S., Traversari R., Bruinenberg, S. (2017). *An Assisted Workflow for the Early Design of Nearly*, MDPI AG Journal Energies, 10(7), 993, Multidisciplinary Digital Publishing Institute http://www.mdpi.com/1996-1073/10/7/993/pdf

3.2 Presentations

Conference presentations

- ECTP-E2BA Conference, June 2014, Brussel, Belgium
- ECPPM 2014 Conference, September 2014, Vienna, Austria (IAA, TNO, DMO, AEC)
- MBEC 2014 – 6th European Conference of the International Federation for Medical and Biological Engineering-MBEC 7-11 September 2014, Dubrovnik, Croatia (AOC, DMO)
- Sustainable Places 2014, Nice, France
- Building SMART User Day, May 2014, Taunus, Germany (DJGA, AEC3)
- 27th Forum Bauinformatik, September 2015 in Aachen, Germany
- Sustainable Places September 2015, Savona, Italy

- 3D GEOInfo 2014, November 2014 Dubai, UAE
- CIB W78 Conference, October 2015, Eindhoven, the Netherlands
- IBPSA (International Building Performance Simulation Association) Building Simulation Conference 2015, November 2015, Hyderabad, India
- CESB 16 (Central Europe towards Sustainable Building 2016) 22-24 June 2016, Prague, Czech Republic
- Sustainable Places 2016, 29 June 2016 Anglet, France

Other presentations

- Presentation EuHPN 2013 Workshop: Reinventing the Hospital – Europe's Challenge, 7-9 October 2013 , Budapest, Hungary (TNO)
- Presentation at the 5th National Congress of the SIAIS (Italian Society of Healthcare Architecture and Engineering); theme: "Healthcare in (times of) crisis", Florence, Italy, October 2013 (AOC)
- Presentation at the national Dutch Hospital meetings (NVZ), November 2013, Amersfoort, the Netherlands (TNO, DMO)
- Presentation at the Internal conference 3DGeoInfo(TNO), 27-30 November 2013, Istanbul, Turkey
- Workshop presentation on High Tech Health Outreach February 2014, University of Twente, the Netherlands (TNO)
- Presentation Hospital owners meeting 20 February 2014, Paris, France (All partners)
- Presentation provided by MAE at event organized by British Embassy in Warsaw, PL on *Building Information Modelling - the revolution is coming! The impact of BIM on Poland's construction sector,* March, 2014
- Presentation at the internal meeting 13 May 2014, Rijnstate, The Netherlands (RNS)
- Linked Data in Architecture and Construction event organized by Aalto University and Tekla, May 2014, Espoo, Finland (AEC3, TNO)
- Presentation Green@Hospital 4th plenary meeting 14 March 2014, Rijswijk, the Netherlands (TNO)
- Presentation Workshop Impact of the Energy-efficient Buildings PPP April 2014, Brussels, Belgium
- Joint EuHPN-TNO seminar and presentation, April 2014, Leiden, the Netherlands (TNO, RNS)
- Internal event presentation by Rijnstate Hospital, May, 2014, Arnhem, the Netherlands (RNS)
- Presentation during European Health Property Network Workshop: *Thinking differently about healthcare buildings: Innovative infrastructure planning and design to improve the quality and safety of care*, October 2014, Edinburgh, United Kingdom (TNO, RNS, DJGA)
- Presentation and Discussion round about enhancements with BIM and Streamer for design methodology 18 September 2014, Vienna Austria (DJGA)
- CLICKNL-Energy event presentation, January, 2015, Rotterdam, the Netherlands (DJGA)
- Presentation on STREAMER 15 September 2014, Goteborg SE (NCC)
- Presentation on STREAMER project during workshop event organized by the Municipality of Karlstad, March 2015, Goteborg and Karlstad, SE (NCC)
- Internal event at MAE on Energy optimization in hospital buildings, May 2015, Warsaw, PL (MAE)
- Guest Lecture presentation provided by TNO: Evidence Based Hospital Design; master course Evidence Based Facility Management at the Wageningen University in the Netherlands, September 2014

- Presentation at the seminar Energy Storage in Smart Hospitals Districts September 2015, Warsaw, PL (TNO)
- Presentation on STREAMER developments at internal corporate DWA Inspiration Day, November 2015, Amersfoort, the Netherlands (DWA)
- Development of the CityGML application domain extension energy for urban energy simulation 7 November 2015, Hyderabac, India (KIT, CSTB)
- Project presentation at the EeB-PPP Impact Workshop, 2014, 2015, 2016, 2017, Brussel, Belgium (TNO)
- Presentation Deerns knowledge sharing BIM 8-9 November 2016, Paris, France (TNO)
- Presentation Meeting BIM 8-9 November 2016, Paris, France (TNO)
- Presentation Vastgoedontwikkeling & beheer (real estate development and management) 13 March 2017, Rotterdam, the Netherlands (TNO)
- Presentation at the NVTG Congres 2017, 13 May 2017, Nijkerk, The Netherlands (DWA)
- Presentation EeB PPP Impact Workshop 2017 16 May 2017, Brussels, Belgium (CSTB)
- Sviluppo di sistemi BIM per il contenimento dei consumi energetici degli edifici ospedalieri. La ricerca STREAMER e il caso studio dell'Azienda Ospedaliero-Universitaria Careggi a Firenze (BIM systems for Healthcare Energy Efficiency Buildings. The STREAMER project and the Careggi case study) 29 May 2017, Bologna, Italy (AUOC)
- Presentation at the Sustainable Places 2017 28 June 2017, Middlesborough (CSTB, RNS)
- French Hospital Engineers Congress, June 2017, Paris-Villejuif, France (AP-HP)

3.3 Organisation and Participation in Dissemination Events

Targeted knowledge dissemination

- Development of the digital STREAMER Newsletters (January 2015, May 2016, August 2017; all partners contributed)
- Development of STREAMER promotional materials: flyer, posters, leaflet (all partners contributed)
- Development of the STREAMER Video (August 2017; all partners)
- Article on BIM in the Swedish Magazine Digital Energieffektivitet in Rum (LOC), February 2014
- Interview on ex-post evaluation and impact assessment of funding in the NMP thematic area, (TNO) May 2014
- Article in Dutch corporate newsletter introducing STREAMER project (DWA), June 2014
- Article in newsletter Denkwerk (DWA), July 2014, The Netherlands
- Article in Dutch corporate newsletter introducing STREAMER project (DMO), July, 2014Article in the corporate magazine Kronika Mazowiecka introducing the STREAMER project (MAE), September 2014
- Article Semantic BIM and GIS modelling for energy-efficient buildings integrated in a healthcare districts 27-30 November 2014, Istanbul, Turkey (TNO)
- Article 3D GeoInfo 2014, 12 November 2014, Dubai, UAE (KIT)
- Article in Polish Magazine ECOLOGY introducing STREAMER project (MAE), June 2015
- Article in the Italian Magazine Rivista HPH published by Societa Italiana dell'Architectura e dell'Ingegneria per la Sanita on the STREAMER demonstration case Careggi Hospital in Florence (AOC, DMO), June 2015

- Interview at the Polish Science Day in the Polish Pavilion at the EXPO in November 2015, Milan, IT
- Introduction STREAMER for the final meeting of Green@Hospital in Ancona, February 2015
- The Careggi Hospital: the "Streamer" research project for the energy efficiency 31 May 2016, Italy
- Description STREAMER project in the ECTP EeB PPP Yearly Project Overview 2014, 2015, 2016, 2017
- Article in a hospital national review (Techniques Hospitalieres) May, June, July 2017 (APHP)
- Article in Polish Magazine CZYSTA ENERGIA „*Standaryzacja warunków efektywności energetycznej w szpitalach*" (MAE), December 2016
- Newsletter PROJEKT STREAMER - EFEKTYWNE ENERGETYCZNIE I EKONOMICZNIE KOMPLEKSY SZPITALNE – DOŚWIADCZENIA MIĘDZYNARODOWE" 25 April 2017, Warsaw, Poland (MAE)

Exhibitions/Conferences/Congress

- Attendance at HESMOS FP7 project public workshop in Amsterdam, the Netherlands , November 2013 (AEC, TNO, DMO, DWA)
- Attendance and distribution of STREAMER leaflet at the 1st International Congress Hospital Build and Infrastructure, Poznan, PL, February, 2014 (MOW)
- Attendance at the 6th European Conference of the International Federation for Medical and Biological Engineering- MBEC 2014 in Dubrovnik, Croatia, (AOC; DMO)
- Attendance at the Sustainable Places 2014 Conference, Nice, France, October 2014 (ARUP, DMO TNO, CSTB)
- Attendance at the Zorgtotaalbeurs in Utrecht, the Netherlands, 18 March 2015 (TNO, DJGA)
- Attendance at BIM World Munich, 30 November 2016, Munich, Germany (AEC3)
- 7th ECTP Conference – Innovative Built Environment 17 November 2016, Brussels, Belgium (MOW)
- Conference "PROJEKT STREAMER – EFEKTYWNE ENERGETYCZNIE I EKONOMICZNIE KOMPLEKSY SZPITALNE – DOŚWIADCZENIA MIĘDZYNARODOWE" 25 April 2017, Warsaw, Poland (MAE)
- Presenting Streamer flyer at the How to create effective research and development strategies in Polish industry? Conference organised by National Contact Point 17 May 2017, Warsaw, Poland (MOW)
- Attendance and distribution of posters by European Healthcare Design 11-14 June 2017, London, UK (DJGA, TNO)
- Workshop ***Four steps closer to a full set of interoperable tools for designing energy efficient buildings*** during Sustainable Places Conference on 29 June 2017, Middlesbrough, UK (DMO)

Workshops

- Workshop on BIM for management and maintenance of hospitals June 2014, Delft, the Netherlands (DMO)
- Energy storage in smart hospitals districts seminar in Warsaw, PL, September 2015 (MAE)
- Design Workshop 30 March 2016 organised by Rijnstate Hospital Arnhem, the Netherlands (RNS)
- EBB Cluster Impact workshop (TNO) 18 April 2016, Brussels, Belgium
- Workshop (exchange study days) on the STREAMER project - Effective Energy and Economic Hospital Complexes - International Experience, 28-29 June 2017 at the University Hospital of Cracow (MAE)

- Workshop on BIM BASED DESIGN: ***ICT tools for building design simulation and assessment of high performance buildings*** during Sustainable Places Conference on 29 June 2016, Anglet, France
- Workshop on the STREAMER project - Effective Energy and Economic Hospital Complexes - International Experience, 30-31 August 2017 at the University Hospital of Cracow (MAE)

APPENDIX 1 – 1st, 2nd, 3rd STREAMER newsletter

January 2015
This research project has received funding from the European Union Seventh Framework Programme (FP7-2013-NMP- ENV-EeB) under grant agreement no. 608739

Streamer
European research on energy-efficient healthcare districts

NEWSLETTER STREAMER

January 2015

Streamer

European research on energy-efficient healthcare districts

NEWSLETTER

STREAMER

1. PROJECT DESCRIPTION

2. INTERVIEW WITH FORMER AND CURRENT COORDINATOR

3. OVERVIEW WORK RESULTS- YEAR 1

a. Taxonomy of healthcare districts focusing on EeB morphology and features

b. EeB technologies for building envelope and space of healthcare buildings

c. EeB technologies for MEP systems of healthcare buildings

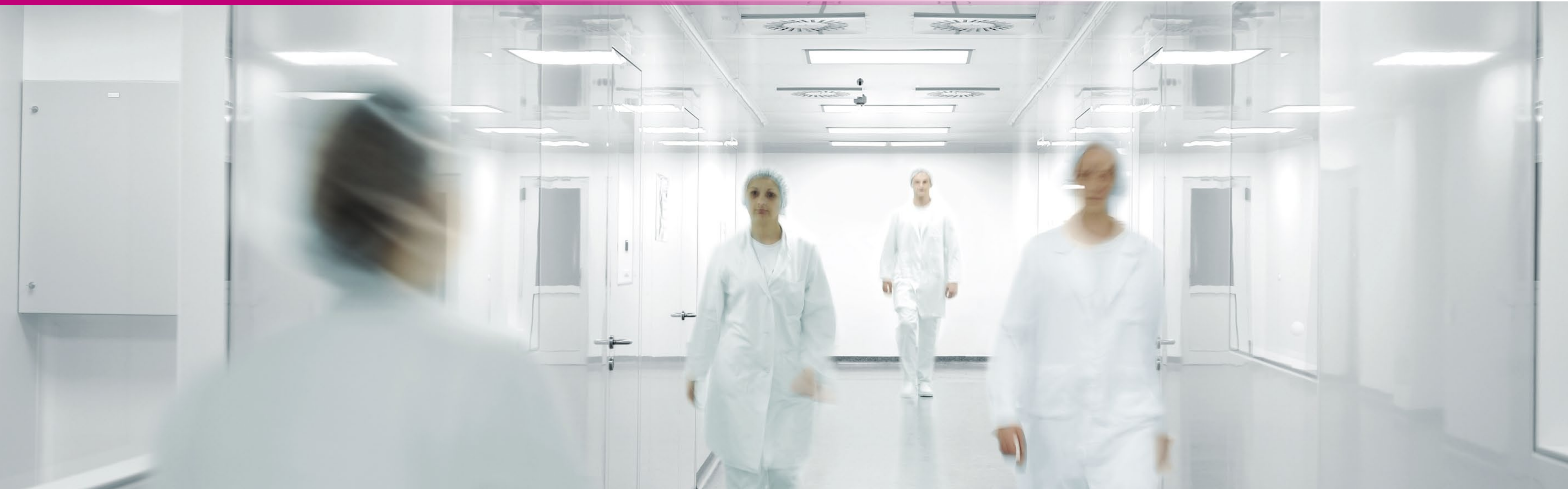
d. Building oriented EeB KPIs of newly designed and retrofitted buildings

4. DEMONSTRATION CASES

a. AP-HP in Paris, France

b. Careggi Hospital Florence, Italy

5. EVENTS PARTICIPATION



1. PROJECT DESCRIPTION

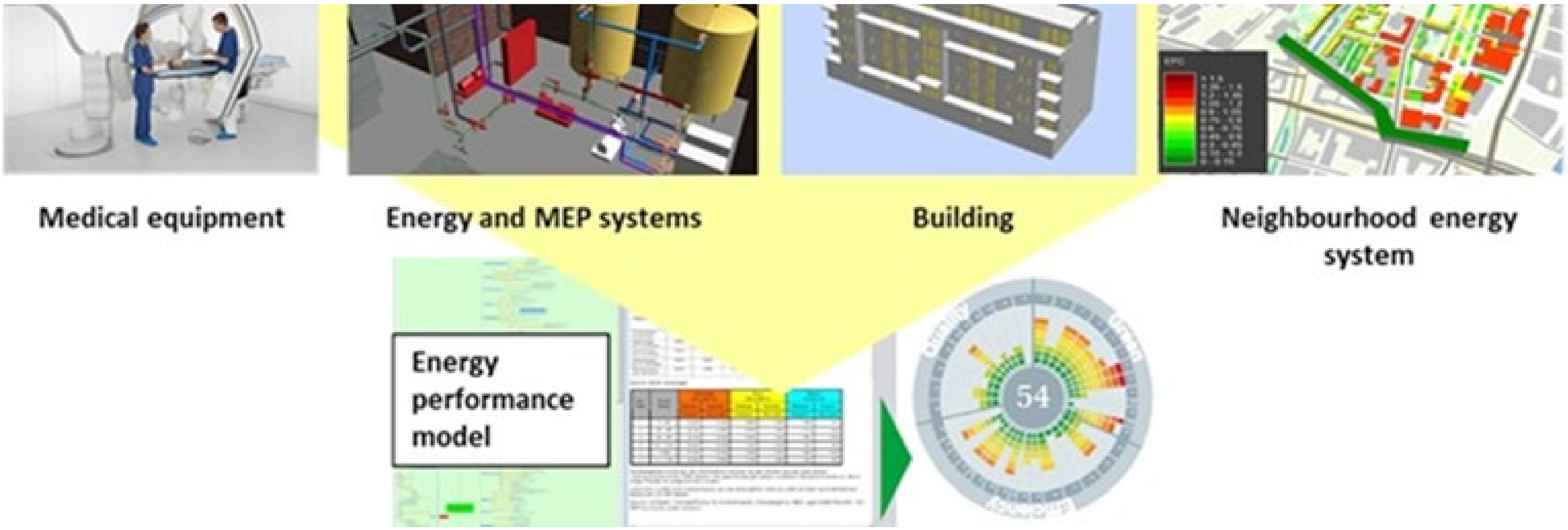
Both in terms of societal as well as environmental impact, the healthcare buildings sector plays a key role as the world faces demographic and climate changes. Ageing population puts a great demand on the healthcare facilities. By the year 2015, the world population aged over 60 years will be nearly tripled, leading to major increase in the number of potential patients. This phenomenon places the healthcare building sector among the top EU priorities since the healthcare sector plays a key role for a sustainable community. However, their energy use and carbon emission are among the

TARGETED KEY ACHIEVEMENTS

- Generic semantic BIM+ GIS EeB, typology models
- Framework for BEM (Building Energy Model)
- Design decision-support tool focused on energy

highest of all building types.
In order to cope with the energy, financial, political, societal and environmental crises, all healthcare districts in Europe are urgently seeking to substantially reduce their energy consumption and carbon emission by 30–50%. Therefore, they are planning new energy-efficient building projects as well as energy-efficiency retrofitting of the existing buildings. There is a strong need of a breakthrough in designing energy-efficiency buildings integrated in the healthcare districts.

STREAMER is an industry-driven collaborative research project on Energy-efficient Buildings (EeB) with cases of mixed-use healthcare districts that aims to reduce the energy use and carbon emission of new and retrofitted buildings in healthcare districts in the EU by 50% in the next 10 years. Such districts are the best real examples of neighborhood with integrated energy system consisting of mixed building types (i.e. hospitals and clinics; offices and retails; laboratories and educational buildings; temporary care homes; rehabilitation and sport facilities).



Rounding up the 1st year during Consortium meeting in Florence. Posing in front of the Italian case study- Careggi Hospital

2. INTERVIEW WITH FORMER AND CURRENT COORDINATOR

Former Coordinator Dr. Rizal Sebastian | DEMO Consultants BV, The Netherlands | rizal@demobv.nl | STREAMER Project Coordinator in 2013-2014

The STREAMER project was initiated in the end of 2012 in response of the FP7 Calls for Proposals in the area of “Optimised design methodologies for energy-efficient buildings (EeB) integrated in the neighbourhood energy system”. The project addresses the European Commission’s research goal to facilitate decision-making before the construction and refurbishment of energy-efficient buildings.

Aligned with this goal, the project's result will provide actors with holistic methods and tools to support the optimised design process, taking into account the whole lifecycle of the building.

The key innovation in STREAMER focuses on semantics-driven design using Building Information Model (BIM) and Geospatial Information Systems (GIS) for designing and refurbishing energy-efficient buildings integrated in hospital districts. In almost every European city, there is at least a hospital district whose energy use could exceed that of 20,000 dwellings each year. A hospital building uses in average 2.5 times more energy than an office. There are some 15,000 hospitals in the EU responsible for at least 5% of the annual EU's carbon emission. Therefore, the impact of energy-efficient hospital districts is very significant for the EU cities' energy performance.

The STREAMER project is carried out by collaboration between 20 partners that represent the whole value-chain of energy-efficient hospital districts. Among them there are 4 hospital institutions, 4 research institutions, 6 SMEs, and 6 large companies from 7 EU member states. The project covers research and demonstration activities within 4 years with EC contribution of EUR 8 million.
At time of publication of this newsletter, the first project's year has been completed. Within this period, design typologies of energy-efficient hospital districts as well as the key performance indicators have been consolidated. The demonstration cases directly linked with the 4 hospital partners have been defined, including the first development of STREAMER's BIM approach and the review of software tools for energy monitoring, facility management, and decision-support. Next to research, a large number of dissemination activities have been done, and the collaboration with relevant EU projects has been established.

Current Coordinator Freek Bomhof / TNO, The Netherlands/ freek.bomhof@tno.nl / STREAMER Project Coordinator 2014-2016 >

The first year of the STREAMER project has laid the groundwork: we know what technologies are available, we know where there are still gaps to be filled in, and we have a much more precise idea what we want to achieve.
An important achievement is the definition of the key performance indicators (KPI) that STREAMER will focus on. The central idea is that during the design process of a hospital, we will be able to estimate the value of each KPI. Each design decision can then be evaluated in an early stage. When more detail is added during the process, the precision of the calculated KPIs increases. The KPIs address not only energy efficiency, but also (life-cycle) costs and quality criteria (like staff and patient satisfaction, and operational efficiency).
This means that the design process needs to be elaborated: who needs what information in what stage? Where do we get this information from, and, very importantly, where do we store that information? Because ultimately, STREAMER will deliver a number of tools that help the design process by automatically calculating

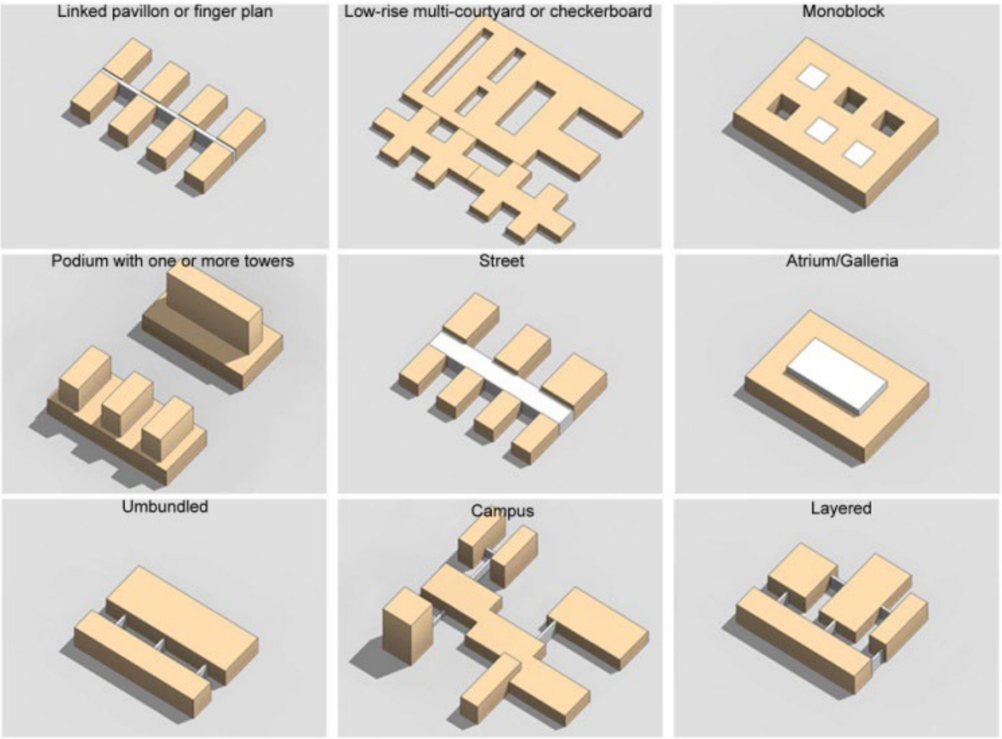
KPIs, evaluating alternatives and integrate information from various sources. These tools will be based on existing software, but will extensively build on semantic technology when gaps have to be filled in. For instance, linking BIM (Building Information Model) and GIS (Geographical Information System) information is important when designing a whole hospital campus.

The project is very happy to have a number of challenging real-world pilot cases in its consortium. The renovation and new building projects of APHP (Paris, FR), Careggi Hospital (Florence, IT), Rotherham (UK) and Rijnstate (Arnhem, NL) provides us with the real requirements that a design process needs. These projects vary considerably in their specific challenges, so they form the ideal place to test the insights and tools that STREAMER develops. Thus, the pilot cases interact with the research project in a 'push and pull' way: the researchers learn from the practical examples, and the practical examples learn from the researchers.

3. OVERVIEW WORK RESULTS Y1

a. Taxonomy of healthcare districts focusing on EeB morphology and features

During the first year, Streamers partners have investigated the criteria and methodologies to implement a taxonomy of healthcare districts focused on energy-efficient buildings morphology and features.
The scope of this task was to analyze, compare and implement approaches and methodologies to define and develop a model-based classification of hospital buildings fit to Streamer.
The taxonomy of healthcare districts and the classification of hospital buildings and spaces will become the basis for the development of semantic BIM 'template' for as-built models.



With this scope in mind the main targets of the analysis have been related to:

> the identification of factors that the "EeB typology models" depend on;
> the definition of the "energy-related features" that allow to compare different typologies and arrangements;
> the implementation of a methodology for classifying and labeling functional areas and spaces, compatible with and suitable for the semantic model.

Thus, it has been investigated some possible and compatible approaches and implements some criteria for a "STREAMER approach" to typology in relation to the energy related features.

The first achievement is the implementation of an approach to the typology definition that interrelates:

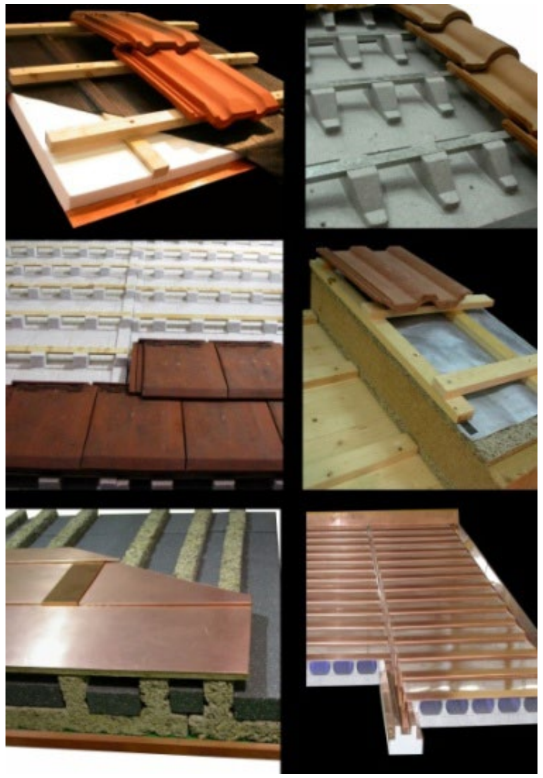
> the typological, technical, distribution and functional characteristics of each building type;
> the functional aggregative configurations based on the proximity and the interdependencies between spaces and functions;
> the energy-related features and characteristics corresponding to the different building typologies.
> The results achieved on this matter include:
> the definition of five levels to be considered to build up a healthcare district within Streamer;
> a breakdown method to be applied in the implementation of the semantic BIM model.

In particular, the breakdown system has been shaped in a flexible way so to be adaptable to different arrangements of existing HD and buildings and to be integrated into operating database and management tools. Moreover, the classification and labeling method implemented introduces a set of codes and references that allow to identify the spaces through the relations between spatial, functional and energy related features.

b. EeB technologies for building envelope and space of healthcare buildings

The task of reviewing state-of-the-art architectural solutions (i.e. building envelope and spatial design) for energy-efficient healthcare buildings has also been investigated within this first year of the project.

Is has been focused mainly on the identification of technologies and environmental design criteria that are feasible to implement



Roberto Di Giulio Ipostudio Architetti, Italy and to benchmark necessary energy performance standards for energy savings in healthcare districts. The data collected show the updated state-of-the-art of the EeB solutions for building space and envelope: it identifies strategies and opportunities for a significant energy reduction, both considering technical - related to the envelope - and spatial issues.

The choice has been made considering the suitability of a specific technology in healthcare buildings. The focus is both on new construction and retrofit actions: recommendations may be applicable to hospitals undergoing complete renovation, partial renovation, addition, remodeling, and modernization projects.

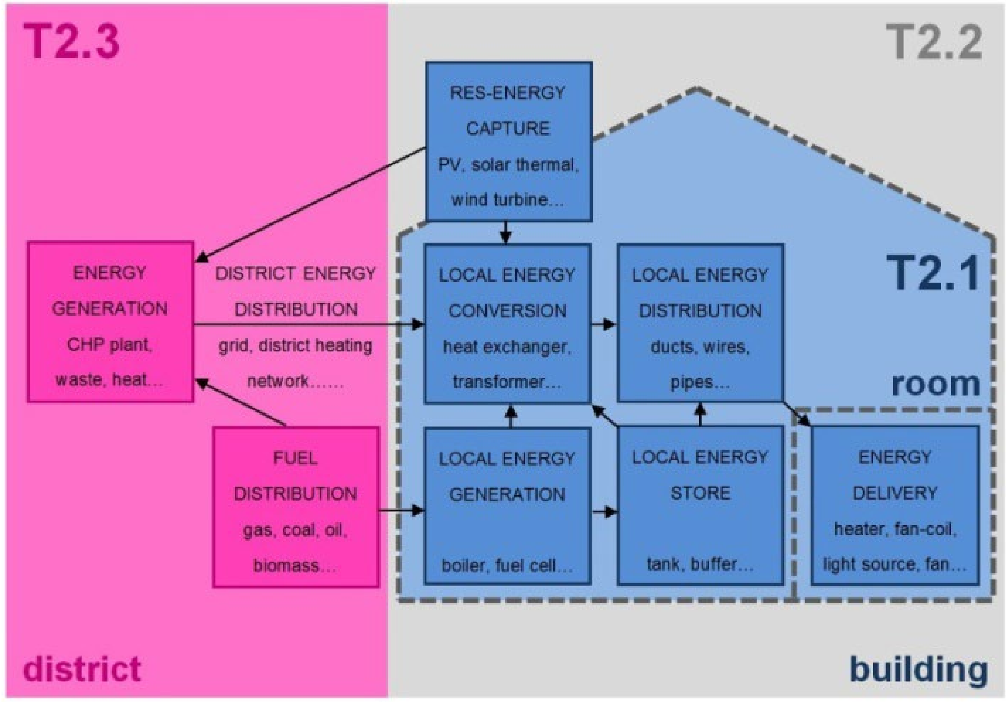
c. EeB technologies for MEP systems of healthcare buildings

During the first year of Project partners were working hard to expand the knowledge on hospital technologies for Mechanical Electrical and Plumbing systems (MEP`s). It wasn`t an easy issue as healthcare facilities have their own inner regulations and requirements such as indoor room quality parameters and pressure. That is why for engineers and architects designing a hospital is always a challenge.

As there is a constant need for improving the indoor comfort for patients and personnel, new equipment is installed in the rooms (e.g. air conditioning units), this causes increase of energy usage in the whole facility. The process is unavoidable while development of every economic sector. However when healthcare facilities are designed in a sustainable way it can be optimized taking into account not only costs of investment but the whole life cycle cost of the system, human behavior and comfort issues together with overall impact on the environment.

As a result of work done so far, State of the Art was prepared and it is included in deliverable 2.1. Information inside the document refers to an analysis of possible actions which can be taken while considering building an energy efficient facility. Additionally energy efficient technologies were divided into categories and described taking into account most important operation parameters. The knowledge gathered is an substantive input for creating a tool which will later support the decision making process during the first stages of the design.

First year of research in MEP field showed that there is a lot of energy efficient solutions for all installation available on the market but it has to be mentioned that buying low energy equipment in some cases is not enough. That is why further study on how this



solution should be implemented during the design process and which parameters are the most important for design and retrofitting stage will be done during the next years of project duration.

Figure 1 shows correlations between tasks in WP2. It can be noticed how complicated energy flows are. In healthcare center every system- generation, distribution, conversion or storage-- has to cooperate smoothly with other systems to keep required conditions within the served space. Systems also have to react correctly on human behavior.

As a conclusion of study done during the first year of research we can state that building of a (healthcare) district is efficient when all the functional, hygienic and comfort requirements are fulfilled and energy use is being kept at the most possible lowest level.

d. Building oriented EeB KPIs of newly designed and retrofitted buildings

The development of a key performance indicator

Many organisations use KPI's to measure the performance of their business. There is often however some confusion when developing these KPI's as there are other measures that can and often are used to gauge performance.

So the KPIs represent a set of measures focusing on those aspects of organisational performance that are the most critical for the current and future success of the organisation. As the STREAMER project is based on the need to significantly reduce energy use within the hospital estate/district, we can, therefore, select KPI's to inform owners how to make dramatic increases in energy performance.

An important consideration when we prioritise options specifically to improve the energy utilization should be the unintended consequences that can be produced. Some essential consequences to consider include the quality of the environment being produced. This can be directly aligned to occupant comfort (patients, staff and visitors) Also, the capital cost of the measures that are to be put into place as well as the flexibility (particularly important in new build projects) that is being integrated into the estate/district. There is little use in reducing the energy if the comfort conditions that are created are not supportive of a high level of staff performance or patient well-being. Similarly when we prioritise our options we need to ensure that the energy we are saving comes at a reasonable level of capital cost. Therefore by including both financial and qualitative measures we need to apply a cost benefit analysis approach or similar analysis tool. This balanced approach, originally developed by Kaplan and Norton's balanced scorecard shown in Figure 1 is an ideal explanation of the approach.

Financial Utilization of assets, optimization of working capital	**Customer Focus** Increase customer satisfaction, targeting customers who generate the most profit	**Environment/Community** Supporting local businesses', linking with future employees, community leadership
Internal Process Delivery in full on time, optimising technology, effective relationships with key stakeholders	**Employee Satisfaction** Positive company culture, retention of key staff, increased recognition	**Learning and Growth** Empowerment, increasing expertise and adaptability

Figure 1 Six perspective Balanced Scorecard

In order to have the wording within the balanced scorecard in Figure 1 completely focused on the use of energy in the healthcare district/estate we have amended it to support the aims of the STREAMER project. Figure 2 offers a possible amended scorecard that supports the aims of the STREAMER project. Of major significance is the Environment/Community section which highlights the reduction in energy use and carbon emissions. However, energy is embedded in 5 of the 6 sections which is the key focus of the STREAMER project.

In this context, the following 3 KPIs that address the potential for saving energy within the existing healthcare estate /district have been developed:

Energy Performance and Efficiency.

Financial Analysis

Quality of the Environment and Operational Efficiency.

For full report on the KPIs developed within STREAMER check our website: www.streamer-project.eu.

Financial Utilization of assets, optimization of working capital directed towards energy efficiency	**Patient Focus** Developing spaces of wellbeing to improve patient satisfaction through care and effective recovery	**Environment/Community** Reducing the use of energy and carbon emissions within the district
Internal Process Empower staff to deliver low energy solutions, optimising technology, improve efficient working practices	**Employee Satisfaction** Create low energy organisational culture, retention of staff through quality working environments	**Learning and Growth** Increasing expertise in energy issues, creating flexible and adaptability facilities for future healthcare needs.

4. DEMONSTRATION CASES – CONSORTIUM MEETINGS

Assistance Publique – Hopitaux de Paris (AP-HP), Paris, France

Assistance Publique – Hopitaux de Paris is the largest university hospital in Europe. It employs 90,000 professionals including 20,000 physicians and 70,000 staff members in 37 hospitals. The extensive and diversified real estate spans 3.5 million square meters of built area. AP - HP offers a capacity of 23,000 beds including 350 intensive care beds and has served more than 7 million patients per year.

AP-HP's annual energy bill is EUR 80 million, and therefore, energy-efficiency receives much attention at all management levels. The AP-HP is in the process of optimizing the design, operation and management of the hospital at the district level within the high-density urban area of Paris. Energy-efficiency goes along with efficient logistic and waste management, the use of alternative energy sources (e.g. biomass) and the realisation of new energy infrastructures (e.g. power plants).

La Pitié Salpêtrière University Hospital district, Paris, France

Buildings integrated in the Salpêtrière – C. Foix University Hospital district in Paris with 1,600 beds in medicine, surgery, acute care and long-term care represents the scope of the energy-efficient demonstration case for STREAMER. They are located on two sites covering a total area of 450,000 m^2. The project focuses on the Gaston Cordier building with 26,000 m^2 floor area and all emergency and surgery facilities .

Azienda Ospidaliero-Universitaria Careggi, Florence, Italy

The Azienda Ospidaliero-Universitaria Careggi healthcare district covers 74,000 m2, 170 health and administrative facilities, 25 Pavilions, 1,650 beds. The hospital has 5,670 employees and 130,000 visitors each year and is part of the large and internationally renowned university. The annual energy use is equivalent to that of 21,000 dwellings. Energy-efficiency and low-carbon emission are addressed by the new natural gas power trigeneration plant, which produces electricity, heat and chilled water for air conditioning. It meets the today's highest energy saving and environmental standards. For validating the research results of the Streamer project, the oncology center "San Luca" has been chosen, which consist of complex of three buildings. Each of the building is different age and size with different assignment. The Streamer knowledge will be used to guide the choice between retrofitting and demolition/rebuilding of the other building from the point of view of the energy efficiency and the lay-out functionality. For the other buildings instead (and possibly later for the whole district), the aim is to extend the existing facility management software (SACS system), especially to better reflect energy and efficiency aspects, in relation with the KPIs. Streamer, therefore becomes a strategic to make this choice based on energy efficiency criteria.

'Loggia' entrance of AOU Careggi Hospital

Trigeneration Plant of Careggi Hospital

5. EVENTS PARTICIPATION

The knowledge achieved within the first year of research has been valorized through the participation of partners within the consortium to conferences and articles in scientific journals. Among important European conferences focused on energy-efficiency at building and districts level attended by STREAMER partners were:

- ECTP-E2BA Conference in Brussels (BE), between 17-19 June 2014
- European Conference of the International Federation of Medical and Biological Engineering MBEC 2014 in Dubrovnik (HR), between 7-11 September 2014.
- ICT for Sustainable Places in Nice (FR) between 9 -11 September 2014
- European conferences on product and process modeling in the buildings industry (ECPPM) Vienna, (A) 17-19 September 2014

Streamer
European research on energy-efficient healthcare districts

CONTACT:

Name:	Freek Bomhof
Organisation:	TNO
Role:	Project Coordinator
Address:	PO Box 5050, 2600 GB Delft
Telephone:	+31 88 86 67 046
E-mail:	freek.bomhof@tno.nl

STREAMER WEBSITE

PRINT

CROSS RELATED PROJECTS

GREEN@Hospital
HOLISTEEC
eeEmbedded
Design4Energy

May 2016

Streamer
European research on energy-efficient healthcare districts

NEWSLETTER STREAMER

This research project has received funding from the European Union's Seventh Framework Programme for Research and Technological Development ander Demonstration under grant agreement no 608739 - FP7-2013-NMP-ENV-EeB.

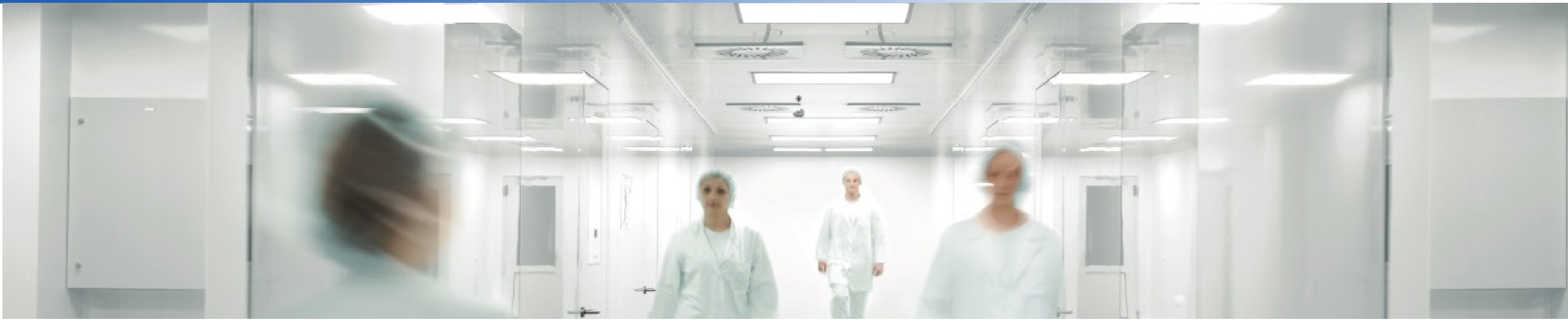
May 2016

Streamer
European research on energy-efficient healthcare districts

NEWSLETTER
STREAMER

1. WORD FROM THE COORDINATOR OF STREAMER
2. OVERVIEW - WORK RESULTS
3. SOME RESULTS PRESENTED IN MORE DETAIL
   a. THE STREAMER LABELS
   b. PARTICIPATORY DESIGN PROCESS
   c. TECHNIQUES FOR KNOWLEDGE RETREIVAL
4. DEMONSTRATION CASES
5. IMPLEMENTERS COMMUNITY
6. MAJOR EVENTS

Streamer
European research on energy-efficient healthcare districts



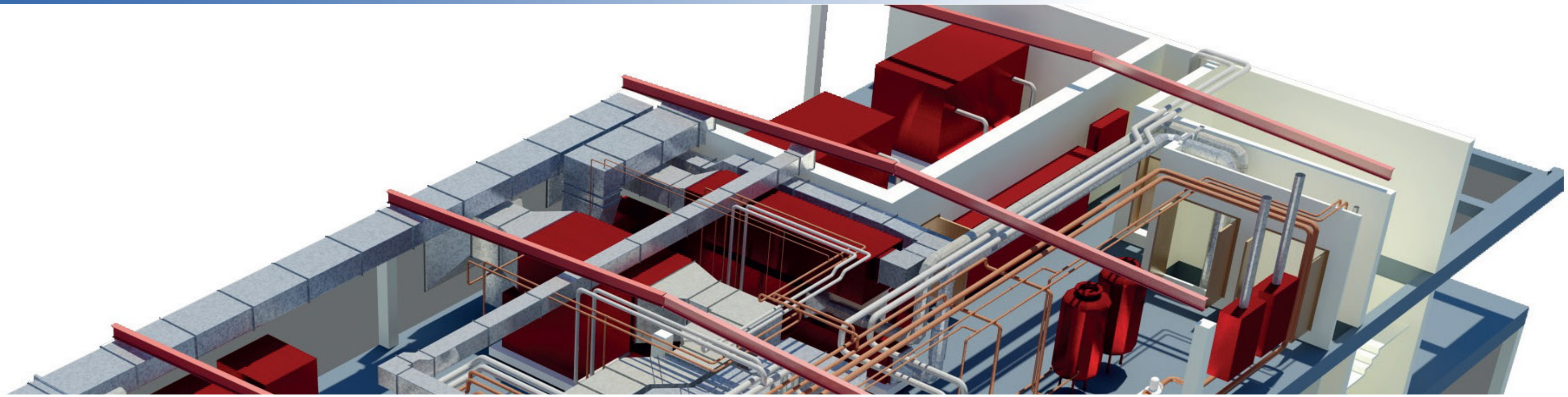
1. WORD FROM THE COORDINATOR OF STREAMER

This is the second broad newsletter from the STREAMER project. The project results are becoming clearer so expect to hear more often from us, with more exciting results. The STREAMER project is now focusing more and more on the elaboration of the end results, after the groundwork has been laid in the first two years.

One of the STREAMER challenges is to support the design process in an early stage. This is a difficult task because in such an early stage, almost everything is unknown. To quote Donald Rumsfeld: "There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know."

For experienced designers, the early design stage is mainly a matter of "known unknowns", but still it is not an easy task. Many people firmly believe though, that in this early design phase the room for optimization is much larger than we think so it is crucial to take the right decisions here. The STREAMER researchers have created a number of concepts that help decision makers in this situation: the STREAMER semantic labels, the Early Design Configurator, and tools for early assessment of energy, quality and cost KPIs. You can find more on these concepts in this newsletter.

freek.bomhof@tno.nl
Freek Bomhof - TNO, the Netherlands



2. OVERVIEW - WORK RESULTS Description of main results achieved

General Overview

STREAMER aims at 50% reduction of the energy use and carbon emission of new and retrofitted buildings in healthcare districts. Healthcare-related buildings are among the top EU priorities since they play a key role for a sustainable community, but their energy use and carbon emission are among the highest of all building types. Take for instance a typical hospital building that is part of the healthcare district. It uses 2.5 times more energy than an office. In the EU, there are some 15,000 hospitals producing 250 million tons of carbon per annum. The EeB design complexity is extremely high; and therefore, both holistic and systemic approaches are crucial. STREAMER will resolve this by optimizing Semantics-driven Design methodologies with interoperable tools for Geo and Building Information Modelling (Semantic BIM and GIS) to validate the energy performance during the design stage. STREAMER will enable designers, contractors, clients and end-users to integrate EeB innovations for: 1) building envelope and space layout; 2) medical, MEP and HVAC systems; and 3) building and neighborhood energy grids. STREAMER results will be validated in the 4 real projects involving Implementers Communities. The outcome will be used to extend the standardization in EeB design and operation, open BIM–GIS (IFC–CityGML), and Integrated Project Delivery (IPD).

read more

Work performed and main results achieved so far

Within the STREAMER project so far we have investigated the criteria and methodologies to implement a taxonomy of health-care districts focused on energy-efficient buildings morphology and features: how do we see and categorize the built environment in healthcare districts This comprises methodologies to define and develop a model-based classification of hospital buildings and spaces that will become the basis for the development of semantic BIM ‘templates’ for models. STREAMER extends the existing high-level Layer Model into Semantic Labels, that are used to characterize hospitals at level of buildings, functional areas or space units, and therefore fills the gap between the high level and detailed approaches. In this way, the design process can incorporate energy efficiency effects of design decisions in a much earlier stage.

Work has been done to expand and integrate the knowledge on hospital technologies for Mechanical, Electrical and Plumbing systems (MEP). Many energy efficient solutions for installations are available on the market, but this is not enough to reach the overall goals, so the project has to define additional measures. Also, an analysis of energy optimization possibilities at inter-building level by considering the interaction of buildings within a health-care district and in relation with the surrounding neighborhoods has been made.

A set of KPIs relevant for hospital design has been defined. This is the basis for a dashboard that informs all stakeholders during a design process on the expected performance of a specific design, and gives an early indication of the impact of a design decision. The most important category is the energy performance; for this, a number of energy simulation software packages have been assessed on their suitability to be incorporated in the STREAMER platform, especially regarding their level of integration with building information models (BIM). A second group of KPIs is in the Life Cycle Cost field, and the third group of KPIs addresses the (operational) quality of the building.

The design of complex buildings like hospitals needs to take into account many different viewpoints from different stakeholders. This calls for a well-defined process that has been defined by STREAMER.The project has defined methods to make the knowledge of all stakeholder groups explicit, so that it can be turned into verifiable requirements.

To verify the requirements during the design process, it must be possible to process them automatically for a specific design. For this, an analysis of semantic technology has been conducted, both for technology development and standardization. For incorporating neighborhood designs, techniques to integrate BIM (build-

read more

ing level) and GIS (neighborhood level) have been explored and demonstrated. Tools are created to apply the rules (expressed in semantic models) to a design, in order to validate a design against requirements and design rules. Tools that are able to store requirements have been assessed on their suitability to adapt them into STREAMER. Additionally, software concepts have been created that assist the designers, by making automatic configurations of design elements that conform to the requirements and design rules. Each of the four pilot hospitals (in NL, UK, IT and FR) has selected and described the buildings that will be the subject of demonstrations during the project, refined the case studies that will be considered for STREAMER, and defined the expected improvements, including the KPIs chosen in each case. Additionally, BIM models have been developed for the selected buildings.

Expected final results, impact and use

The STREAMER results will be validated in the 4 real projects involving Implementers Communities. The outcome will be used to extend the standardization in EeB design and operation, Open BIM-GIS (IFC-CityGML) and Integrated Project Delivery (IPD). The demonstration cases are: NHS Rotherham (UK), Rijnstate healthcare district (NL), University Hospital Campus of Careggi (IT), Assistance Publique – Hôpitaux de Paris (FR).

The knowledge dissemination and valorization towards the exploitation of projects results will take place in and through the Implementers Community (IC). The flagship projects – the 4 large scale projects - are the most important vehicle to commit current and future stakeholders.

EeB solutions, ICT approaches, design methods and tools to be integrated and optimized in STREAMER are based on reliable technologies and prototypes, which have been proved to be on Technological Readiness Level (TRL) of 6 to 8. The STREAMER results will be exploited in 4 levels, from the individual product development to the market and value-chain integration in the field of EeB. At the end of the project, all energy efficiency goals will be met, and the follow-up towards energy neutrality can commence.

The result of tool and software development will be an operational prototype that is to be tested by consortium partners and other potential users. The prototype will be further developed after finishing the project. The exploitation model will use the contributions of launching customers and development partners to finance the remaining work.

go back

SOME RESULTS PRESENTED IN MORE DETAIL

In this section, some results are described in more detail. Of course, the underlying deliverables provide much more information – most deliverables are public so these can be downloaded from the website. *click here to go to the website*

3a. THE STREAMER LABELS

One of the conceptual innovations from STREAMER is the labelling approach that forms a semantic bridge between the everyday practices of healthcare design, and the ICT tools that optimize designs in BIM. Labels can be used for assessment of energy performance and KPIs calculation in the early design process. The label methodology can help the design by identifying problems and optimization opportunities and design rules can be expressed using labels.

STREAMER has created a semantic model of existing healthcare buildings and districts containing the morphology of buildings/districts and the multi-dimensional representation of existing objects.

During designing, these semantic models will be used as a baseline design, adapted and enriched with as-built information the actual, performance data, and the building operators' and occupants' knowledge.

The semantic typology model is built up by all the elements that define a healthcare district at the different levels.

read more

Looking at the spatial organization and the functional aggregative configurations of the existing typologies, five main different levels can be considered to build up a Healthcare District within STREAMER. These levels are: District level (level 5), Building level (level 4), Functional area level (level 3), Space unit level (level 2), and Component level (level 1).

The breakdown of healthcare districts in different levels is crucial for the definition of a semantic typology model as at each level, inherent parameters and factors can be identified. Thereby it is possible to operate design decisions at the most appropriate level and to identify the different KPIs in order to tackle the energy-related issues.

Within the scope of STREAMER, the specific characteristics of the elements of the semantic typology model have been identified by the use of the labels, which allow each element to be informed by the performance requirements (boundaries, minimum or maximum values, acceptable levels) it should meet.

By attaching (using the labels) properties and characteristics to the different spatial entities of the semantic model, it will be possible, in the early design stage, to understand the implications of design choices, when optimizing for instance those ones influencing the energy efficiency of the buildings.

Thus, the main aim of the semantic model is to provide design teams, building operators, clients and occupants with a common set of references for evaluating and assessing the performances expected from healthcare districts. Considering the main objectives of the STREAMER research project, it is crucial to highlight the factors that most influence the energy consumption of a healthcare district.

The data will be then implemented in the model as semantic information that allows the professionals in an early design stage to:

- highlight the incoherencies between performance requirements of functions and actual performances of spaces and identification of possible retrofitting intervention in the case of existing building;
- make use of knowledge from other important KPIs and boundary conditions to influence the outcomes of the energy performance optimization;
- make use of the knowledge on the developed MEP compliance matrix to find out which type of solutions are or are not available in specific situation for specific levels and label combinations;
- be provided with guidelines for the design of energy efficient healthcare districts.

read more

Therefore, the objects of three levels (Level 2/Space Units – Level 3/Functional Areas – Level 4/Buildings) have been analysed and listed through specific characteristics, since those levels are suitable to be labelled and listed as objects of a semantic model. The list of labels has been re-arranged as well, defining how the labels can be applied to the objects at the different levels.

This table will generate a set of tables, one for each level if applicable, which will cross the semantic objects of each typology level with the labels indicating the corresponding scale and values through knowledge collected from case studies.

It is important to consider that these lists are a work-in progress inventory. It means that they are not fixed and that, during the development of the research project, they could be subject to changes according to the work and results of the other WPs.

Levels / Labels	DISTRICT Level 5	BUILDING Level 4	FUNCTIONAL AREA Level 3	SPACE UNIT Level 2	COMPONENT Level 1
Bouwcollege layer	not applicable	not applicable	applicable	applicable	not applicable
Hygienic class	not applicable	not applicable	applicable	applicable	not applicable
Access and security	not applicable	not applicable	applicable	applicable	not applicable
User profile	not applicable	not applicable	applicable	applicable	not applicable
Equipment	not applicable	not applicable	not applicable	applicable	not applicable
Construction	not applicable	not applicable	not applicable	applicable	not applicable
Comfort class	not applicable	not applicable	not applicable	applicable	not applicable
Layout	not applicable	applicable	not applicable	not applicable	not applicable
Compactness	not applicable	applicable	not applicable	not applicable	not applicable
Mass	not applicable	applicable	not applicable	not applicable	not applicable
Form typology	not applicable	applicable	not applicable	not applicable	not applicable

Fig.1 Applicability of labels to the objects of the five levels

CATEGORY	OBJECTS	LABELS B	LABELS H	LABELS A	LABELS U
DIAGNOSTIC TREATMENT	Diagnostic imaging	HF	H2	A3	U3
	Nuclear medicine	I	H3	A3	U4
	Radiotherapy	I	H2	A3	U1
	Pre-hospitalization	O	H3	A3	U1
	Endoscopy	O	H3	A2	U1
	Blood sampling/testing	O	H3	A3	U1
	Transfusion centre	O	H3	A2	U1
	Rehabilitation	O	H2	A3	U4
	Outpatient department	O	H2	A2	U1
WARD	Intensive care ward	HF	H4	A2	U4
	High care ward	H	H3	A2	U4
	Low care ward	H	H3	A2	U4

Fig.2 Extract of the table analysing the relationships between functional area objects and labels

read more

Since the Component level (including building components and the MEP components) is not a “spatial level” the objects cannot be related to the labels in the same way used for the other levels.

The technical MEP solutions will be used to verify how much they contribute to the performance requirements of spaces. The designer will use the STREAMER tools for comparing the possible solutions looking (also) at their effect related to energy efficiency.

Thus the technical characteristics of the components will be interfaced with the class of the labels assigned to spaces as “coefficients” able to upgrade or downgrade their condition.

To be able to do that we should give to the technical solutions a “coefficient” that determines an improvement or a reduction of energy efficiency through specific labels (and scores) assigned to the technical solutions.

In order to attach label’s value to objects of the semantic model, it is crucial to define how rules and values of labels are established. In order to do so, the link between the calculation of the KPIs, the design itself and the semantic label approach, should be established.

The labels have a number of different categories adding a value to the room for that specific category (label level). With these label levels a specific room in a hospital can be defined based on the activities that will take place in that room. If however additional information is available the default values of the labels can of course be adapted and the information enriched.

The labels can play an important role in identifying problems and optimization opportunities. Shortly, when the semantic labels are attached to buildings, functional areas and rooms, these activities and properties are allocated to a specific location. Visualization provided by BIM software makes all this information easily accessible, which enables the design team to identify problems. Design rules can be used to identify optimization opportunities.

The label methodology can be used to find out whether certain functional areas can be accommodated by a certain building structure.

Design rules are used by the design team to support design decisions. Some design rules are related to names, others to the labels. Design rules related to names allow the formalization of relations that cannot be expressed by the labels.

The relation with the KPIs is input to prioritize design rules. This leads to a very important conclusion: by varying the KPI importance values, different designs can be made which are all based on the same design rules.

These outcomes cannot yet be considered as fixed results. The system defined should be first applied and tested in the model in order to validate its use and expanded for other KPIs that co-determine the boundaries for the optimisation of the energy performance. Depending on the functionality of it within the software, it might undergo changes in the next research steps.

go back

SOME RESULTS PRESENTED IN MORE DETAIL

In this section, some results are described in more detail. Of course, the underlying deliverables provide much more information – most deliverables are public so these can be downloaded from the website. *click here to go to the website*

3b. PARTICIPATORY DESIGN PROCESS

Healthcare district refurbishment or new construction projects are usually both complicated and complex. Not only are there technical challenges to be faced, the different actors involved represent different perspectives and each with different agendas. The traditional design process is characterized by a relay of handing over results and documents to the next actor in line, often leading to a non-transparent decision making process and loss of information as well as minimal learning between teams and projects. The STREAMER project addresses these challenges through a collaborative, semantically-driven design process framework. The goal of this is to support the key actors (i.e. client, facility managers, designers and engineers) in making the right design decisions at the right time, using the right information and informing them about the consequences of design decisions. The framework focuses on POP, i.e., the product (the building(s)), the organization (the actors and their roles in defining, designing, constructing and operating the product) and the process (how the organization collaborates and the steps necessary to reach the aims).

Participatory design reflects a process in which envisioned users of the end result are being actively involved in designing. In case of health care districts, the end-users are not easily listed and not a mono-disciplinary group of people. Nevertheless, the active in-

read more

volvement of end-users in the design process means careful organization and preparation of the involvement of various end-users groups or representatives. The crucial questions are: Who are the end-users, what level of involvement is being pursued, what information is crucial in the design process? It holds the premise of resulting in more robust, sustainable and cooperative way of designing, taking into account the expectations of particular users that involve in care and cure operations logistics, maintenance etc. (i.e. patients, staff, visitors, facility managers etc.). An interesting finding in our work, based on a case-study from the activities of partner Locum, was the use of a special clinic design unit which worked as a link between different actors (real-estate management organization, hospital staff, designers and specialists). By understanding and translating the different needs, a design that was more cost effective as well as added value (shortened treatment time, improved staffs' working condition, improved patient safety etc) was obtained.

As mentioned above, effective collaboration and communication are essential in order to obtain the objectives of the project. The number of actors involved is one of the complications of the design process. Indeed, this number could lead to inconsistencies and wastes in terms of time and money during the design phases when the collaboration among professionals is usually not well structured from the organizational and technical perspective. But, in complicated and complex situations, decision-making support tools will help decision-makers making the optimal decision. BIM and GIS models form the back bone in such situations and can generate a visual conceptualization at an early stage that helps also non-experts understanding technical problems. By digitalization, the process not only becomes more transparent and structured, it also has the possibility to generate a design that fulfills the important necessities of a multi-actor group.

The above considerations on design processes, especially when information becomes even more abundant than it used to be with more traditional design tools, have been applied to a framework for management of information flow, design actors and collaboration in virtual construction environments.

go back

SOME RESULTS PRESENTED IN MORE DETAIL

In this section, some results are described in more detail. Of course, the underlying deliverables provide much more information – most deliverables are public so these can be downloaded from the website. *click here to go to the website*

3c. TECHNIQUES FOR KNOWLEDGE RETRIEVAL

In order to design an optimal health care building, the exchange of information and knowledge in the design process is evidently one of the most essential conditions for incorporating all relevant perspectives in the design models. The partners of STREAMER have carried out a study generating an overview of the current state of the art of the techniques that help to retrieve relevant information and knowledge from experts and users by the design team. The form and type of information can range from legislation, codes and directives, up to experience levels of various end-users (i.e. patients, staff, visitors, service providers such as caterers, maintenance operators etc.). Each of the techniques is elaborated by relevant partners who use, develop or enhance the technique in the STREAMER project.

The essential questions that were dealt with are: How can crucial information for the design process be gathered, and, how can knowledge be retrieved by design team members, codified and used throughout the design process?

read more

Six techniques were elaborated based on their ability to retrieve knowledge, from experiences or information sources elsewhere, and feed this knowledge into the design process. The automation of a traditional Programme of Requirements (PoR), helping design team to validate and interpret the actual design layout of a hospital, use of prediction models that calculate the performance of the design layout against selected criteria (i.e. patient well-being, staff efficiency, and safety), and procurement methods in formalizing the collaboration act of design team are examples of such techniques.

Successful application of techniques requires a particular cooperation and social practice between design team members themselves, as well as the client and representatives. For example, the application of state of the art software for developing a PoR requires the design team to make use of compatible modelling software, and also some agreements on the way of cooperation and validation. This example is a good illustration of how techniques for knowledge retrieval are of added value for the design process only if the implementation of the technique in working culture, procedures and cooperation is organized effectively as well. It is not just about novel software for transforming the PoR into graphical outline, but it requires that design disciplines work together with regard to interpretation of the outcomes and how to optimize the inputs. In the end, the changes in design procedure, the iteration cycles, and interpretation of results produced by a particular technique are as essential in the creation, integration and re-use of knowledge and experience as is the technique itself.

What can we learn from the discussion of applying knowledge retrieving techniques, is that experience from contributing partners implies that the using a technique in itself is not going to be knowledge retrieving automatically. It needs agreement on ways to do things, or even organization commitment of certain process steps. Knowledge retrieving and management of information flows require more than just installing a certain software tool, or saving your design in a specific output file. It requires a change in approaching cooperation between partners in a design team for instance, or the way to formulate the strategic requirements with representatives of patient, staff and visitor organizations.

A further abstraction of the above findings teaches us that the knowledge retrieval techniques are addressing different aspects of Knowledge Management. The aspects considered are:

- Tools / Applications
- Physical settings
- Procedures
- Social practices

go back

4. DEMONSTRATION CASES

UK demonstration site:

This demonstration case includes two areas, namely: Outpatients Department and Ward B6 (Ophthalmology). The hospital already has a building management system (BMS), which is currently being upgraded, and major improvements of the overall building fabric are being planned. Currently, energy models are being developed and energy data is being collected using an acquisition model.

Implementer's Community (IC) workshops are being formulated where specialists from the design, construction and engineering fields will be invited and it is intended to encourage the exchange of knowledge between these specialists and other stakeholders whilst also incorporating Building Information Modelling (BIM) and newly developed software from the Streamer project.

SBEM_AnnualEnergyDemand_UK - SBEM Delivered energy demand per m2 UK (IfcPropertySet)

Name	Value	Description
HeatingAnnualEnergyDemand	2815.87 MJ	Heating energy demand per m2
CoolingAnnualEnergyDemand	0 MJ	Cooling energy demand per m2
AuxiliaryAnnualEnergyDemand	18.9216 MJ	Auxiliary energy demand per m2
LightingAnnualEnergyDemand	920.142 MJ	Lighting energy demand per m2
HotWaterAnnualEnergyDemand	136.791 MJ	Hot water energy demand per m2
EquipmentAnnualEnergyDemand	1428.98 MJ	Equipment energy demand per m2
CHP_DisplacedAnnualEnergyDemand	0 MJ	Displaced combined heat and power energy demand per m2

SBEM_FuelAnnualEnergyConsumption_UK - SBEM Fuel energy consumption per m2 UK (IfcPropertySet)

Name	Value	Description
NaturalGasAnnualEnergyConsumption	2952.67 MJ	Natural gas energy consumption per m2
LiquidPetroleumGasAnnualEnergyConsumption	0 MJ	Liquid Petroleum Gas energy consumption per m2
BioGasAnnualEnergyConsumption	0 MJ	BioGas energy consumption per m2
OilAnnualEnergyConsumption	0 MJ	Oil energy consumption per m2
CoalAnnualEnergyConsumption	0 MJ	Coal energy consumption per m2
AnthraciteAnnualEnergyConsumption	0 MJ	Anthracite
SmokelessAnnualEnergyConsumption	0 MJ	Smokeless energy consumption per m2
DualFuelAnnualEnergyConsumption	0 MJ	Dual fuel energy consumption per m2
BiomassAnnualEnergyConsumption	0 MJ	Biomass energy consumption per m2
GridSupplyAnnualEnergyConsumption	939.065 MJ	Grid Supply Electricty energy consumptions per m2
WasteHeatAnnualEnergyConsumption	0 MJ	Waste Heat energy consumption per m2
DistrictHeatingAnnualEnergyConsumption	0 MJ	District heating energy consumption per m2

SBEM_ACTNOT_UK - SBEM Actual and notional kgCO2 equivalent per m2 UK (IfcPropertySet)

Name	Value	Description
AnnualCarbonDioxideEmission	312.542 Kg	Actual kgCO2 equivalent annual emission per m2
NotionalCarbonDioxideEmission	231.267 Kg	Notional (baseline) kgCO2 equivalent annual emission per m2

Figure 1: Preliminary results collected at the UK demonstration site

NL demonstration site:

The NL case includes a new wing, an outpatient department of 5000 m² surface and the replacement of MEP systems for the hospital. This life case is a so-called 'shadow engineering' project. This means that the actual design has been done in 2D, and this design is done over again in the STREAMER project in BIM. Requirements have been collected for the new building in order to be able to execute the energy simulation. Simulation tools are being used for the MEP. The Program of Requirement (PoR) has been uploaded in the Early Design Configurator (EDC) and an IFC file has been produced using the EDC. By using the EDC different lay out alternatives can be tested. At present the building has been realized.

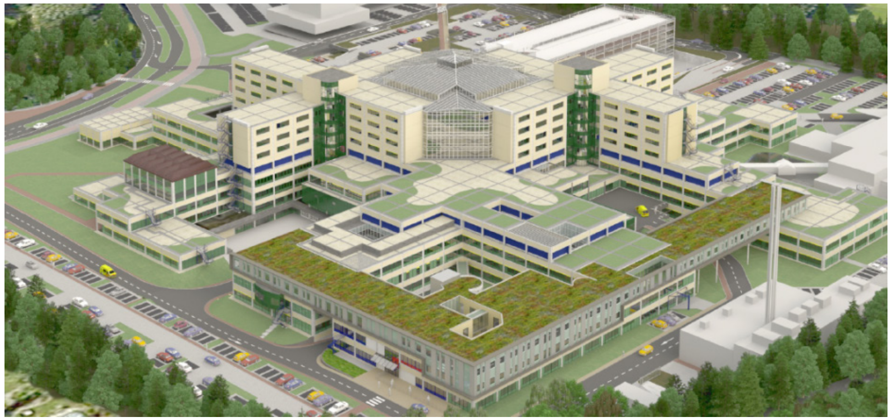


Figure 2: Rijnstate hospital site

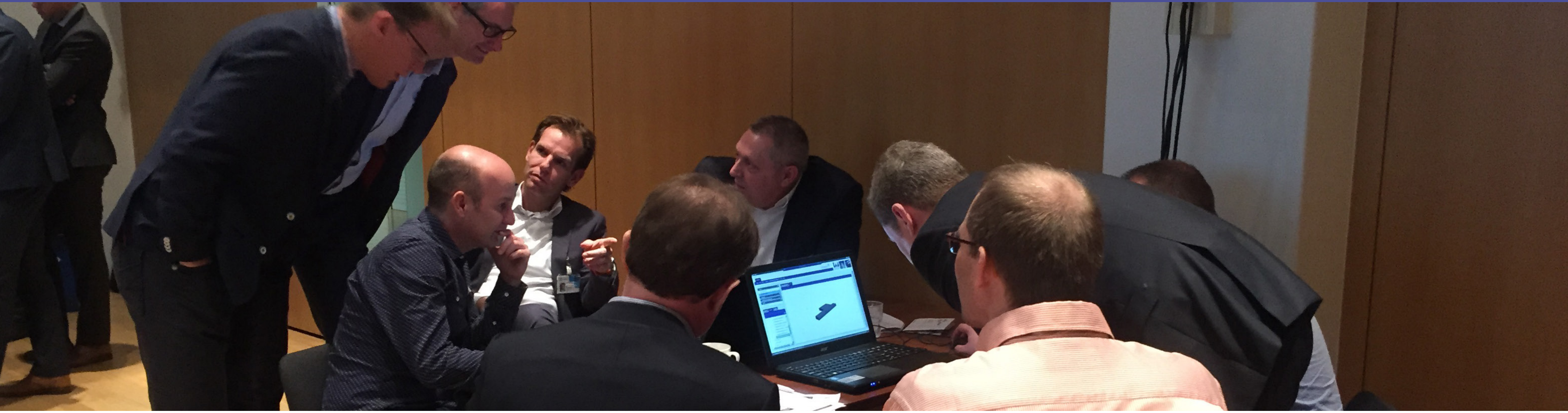
Streamer
European research on energy-efficient healthcare districts

5. IMPLEMENTERS COMMUNITY

As part of the STREAMER project, the four participating hospital organisations, supported by other partners from the STREAMER consortium will create a local STREAMER Implementers Community. The four hospitals will then set up local workshops, known as the Implementer's Community (IC) workshops to further discuss the topic in a wider audience. Dissemination of knowledge, and in particular the discussions and outcomes of the IC workshops, is an integral and important part of the process for the STREAMER project. Invited specialists and stakeholders will be involved in the IC workshops and it is intended to connect researchers, practitioners and policy makers through formal and informal collaborative activities. The Implementer communities will serve as prime and sound examples of energy efficient healthcare districts, addressing both new development and retrofitting. Hereto the four hospital organistions invite you to join the local Implementer Communities for a workshop in 2016.

read more

Streamer



Objectives of the workshops:

1) To illustrate to the professional specialists and building operators of health premises the opportunities provided by BIM, boosted by the newly developed Streamer software

2) To encourage the exchange of knowledge between partners of the demonstration cases and other companies with expertise in BIM, showing new design processes, the new instruments and the relationships between them especially IFC (Industry Foundation Classes) – the standard format for exchanging data in the construction industry

3) To utilise a scenario where each group are allocated a notional sum of money and are requested to invest in areas that will, in the group's opinion, maximise energy and carbon reduction and provide best value financial return

Programme and type of the workshops:

The local IC workshops will comprise of meetings in the respective national languages. Although all four case studies differ substantially the methodology to verify all or part of the solutions that are required is the same; i.e. to validate and share the results

Future Events

The other local IC plan to host their respective workshops.

Please *click here* for detailed information.

go back

6. MAJOR EVENTS (dissemination)

The knowledge received within two years of research has been valorized through the participation of STREAMER partners in conferences, publication of results in journals and peer-revied publications. Among the most important dissemination events during the last year were:

- 27th Forum Bauinformatik in Aachen, September 2015
- Impact of the Energy-efficient Buildings Public-Private Partnership (paper) –Brussels July 2015
- STREAMER semantic BIM design approach for hospitals: research case of Rijnstate Hospital in Arnhem, The Netherlands (Sustainable Places 2015 –in Savona)
- 3D GeoInfo 2014 in Dubai , November 2015
- Zorgtotaalbeurs 2015 in Utrecht, March 2015
- Introduction to STREAMER for the final event Green@Hospital in Ancona, February 2015
- Presentation Energy optimization in hospital buildings - the project STREAMER in Warsaw, May 2015
- Il caso studio italiano nel progetto di ricerca europeo Streamer: l'Azienda Ospedaliero-Universitaria Careggi - HPH journal (year VII, number I, January-June 2015,
- Energy storage in smart hospital districts seminar in Warsaw, September 2015

May 2016

Streamer

European research on energy-efficient healthcare districts

CONTACT:

Name: Freek Bomhof
Organization: TNO
Role: Project Coordinator

Address: PO Box 96800, 2509 JE Den Haag
Telephone: +31 88 86 67 046
E-mail: freek.bomhof@tno.nl

DOWNLOAD PDF
STREAMER WEBSITE

CROSS RELATED PROJECTS:

GREEN@Hospital
HOLISTEEC
eeEmbedded
Design4Energy

August 2017

Streamer

European research on energy-efficient healthcare districts

NEWSLETTER STREAMER

This research project has received funding from the European Union's Seventh Framework Programme for Research and Technological Development ander Demonstration under grant agreement no 608739 - FP7-2013-NMP-ENV-EeB.

August 2017

Streamer
European research on energy-efficient healthcare districts

NEWSLETTER

1. INTRODUCTION

2. STREAMER APPROACH

3. MAIN RESULTS

3A. METHOD: DATABASE OF REQUIREMENTS FOR HOSPITAL ROOMS

3B. METHOD: SEMANTIC LABELS DESIGN METHODOLOGY

3C. METHOD: DATABASE OF DESIGN RULES

3D. TOOL: EARLY DESIGN CONFIGURATOR (CONFIGURATOR OF PARAMETRIC DESIGN SOLUTIONS)

3E. TOOL: MEP / EEB SELECTION

3F. TOOL: RULE-BASED CHECKING TOOLKIT

3G. TOOL: TNO ENERGY CALCULATION TOOL (TECT)

3H. TOOL: ENERGY INTERMEDIATE TOOL (EVEBIM-TRNSYS)

3I. TOOL: DESIGN DECISION-SUPPORT AND LIFECYCLE VALIDATION TOOL

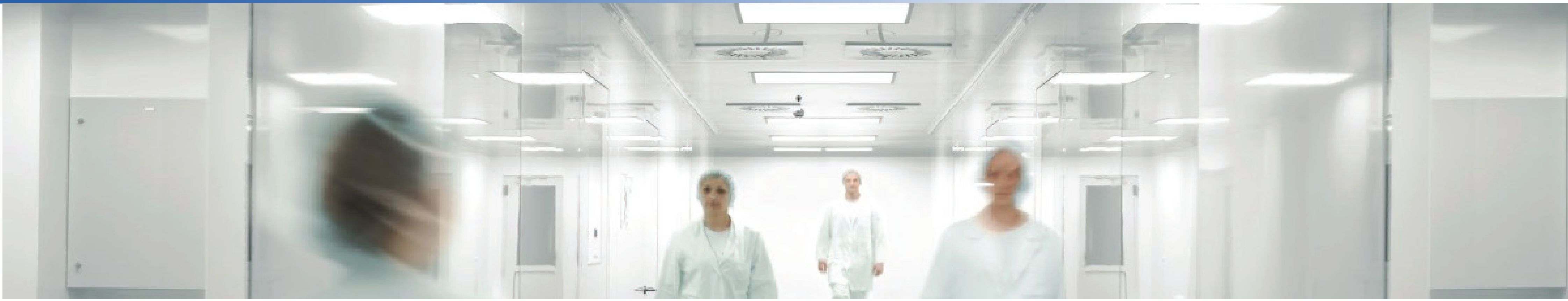
3J. TOOL: PLM SOLUTIONS INTEGRATED WITH BIM & GIS

3K. TOOL: BIMQ REQUIREMENTS MANAGEMENT AND MVDXML-BASED MODEL CHECKING

3L. TOOL AND METHOD: ENERGY MAPPING VIEWER (QGIS)

4. MORE INFORMATION

Streamer
European research on energy-efficient healthcare districts



1. INTRODUCTION

You just opened the last newsletter from the STREAMER project. As you may recall, the STREAMER project has addressed the design of energy-efficient hospitals. Designing is a complex task since many decisions have to be made, both major and minor. The multitude of stakeholders with various interests does not make this task easier.

Designing hospitals is even more challenging! When I started working on this wonderful project 4 years ago, of course I knew about hospitals because I had visited a number of them – either as a visitor, or, fortunately not too often, as a patient. It is hard to really appreciate the complexity of such a building when you are just a visitor, or even when you are just a patient. I have really come to admire the men and women who run these communities on a daily basis, and I have also come to admire the people who can design such complex buildings. The amount of information, aspects, and considerations to take into account is simply overwhelming.

Fortunately, the STREAMER project did not have to start from scratch. Many work had already been done on developing BIM, both standards and tools, a lot of experiences and insights on hospital design was available, and specifically for the energy aspect, we had access to information on many technological solutions to reduce energy consumption. However, bringing all this together really took some time. I think the consortium has managed to do this in a beautiful way.

This last newsletter cannot do justice to all of STREAMER's insights and results. However, a short introduction into the STREAMER approach is given. Additionally, we will give an overview of the results that we are most proud of. These are the results that will be exploited by the individual STREAMER partners; the results will be maintained, expanded and applied in real-world projects whenever possible.

Freek Bomhof

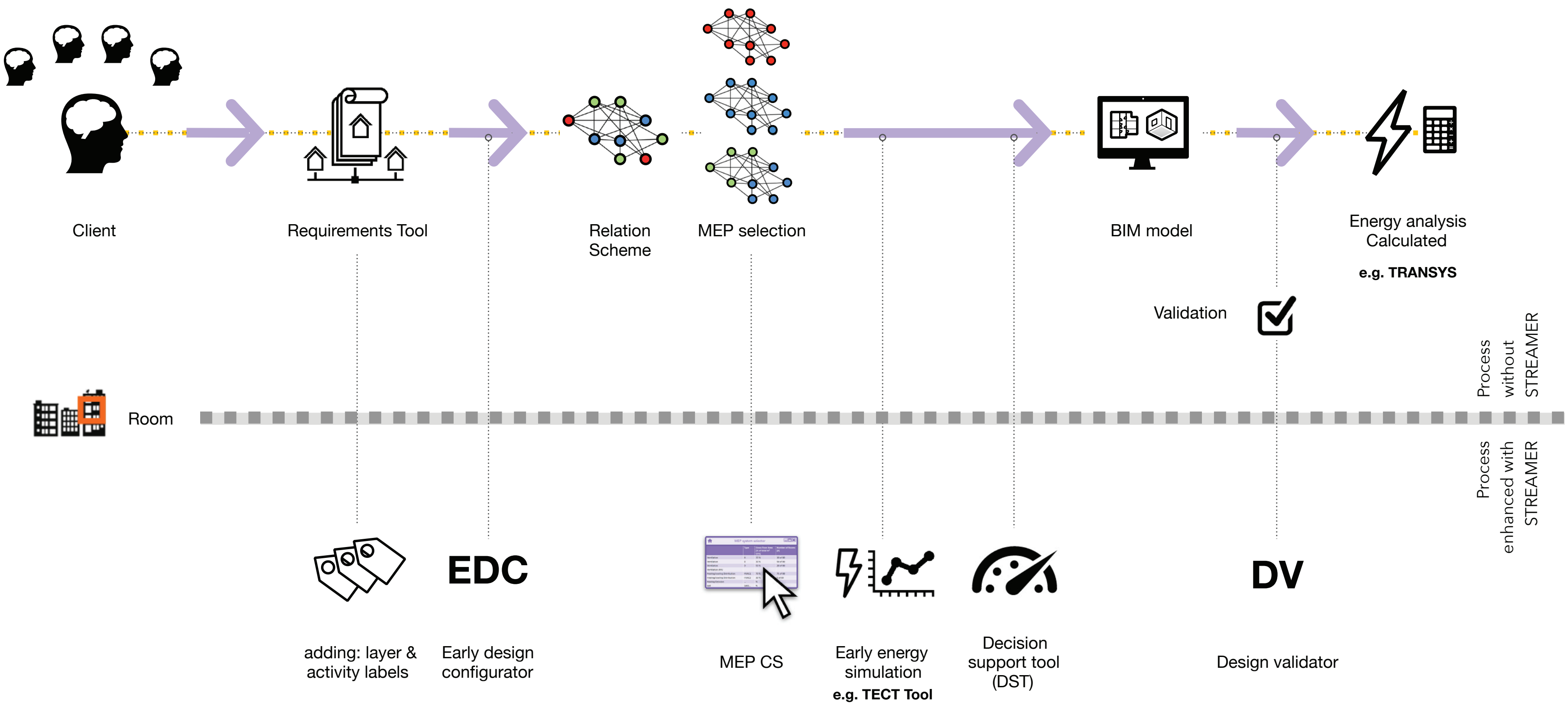
2. STREAMER APPROACH

The official goal of the STREAMER project is to help achieve up to 50% energy reduction in hospitals. Discussing this goal, some experienced designers in the STREAMER team remarked that in many cases, this 50% reduction was easily reached. You just had to make the right decisions regarding choice of technology – there are so many Energy Efficient Building technologies and efficient Mechanical Electrical & Plumbing technologies available!

However: in practice, design teams do not have the time to make such optimal decisions because elaborating all possible choices is just too costly. Or, design decisions made in earlier stages inhibit the usage of optimal solutions in later stages. This observation caused the STREAMER project to focus on early design stages, and to help design teams create design alternatives that can quickly be compared and evaluated.

A 'participatory design process' has been defined that outlines the steps needed to involve all relevant stakeholders.

read more



The STREAMER design process starts with the Program of Requirements (PoR), that defines how many rooms of which types are needed; some 'standard' sets of requirements have been identified for hospitals, which will speed up this part of the process. The STREAMER approach enhances this PoR with Semantic Labels: these labels are a way to already attach default or standard values to rooms. This is important because it enables subsequent algorithms to 'reason' about the design. This 'reasoning' is done using Design Rules, stored in a database. A process has been defined on knowledge capturing: how to proceed when experts from various sides are interviewed?

An important tool in the STREAMER approach is the Early Design Configurator (EDC). This tool automatically produces designs for floorplans, taking the PoR as a starting point, applying the Design Rules, and respecting the spatial constraints (building outer shell, fixed rooms or corridors).

read more

Based on the floorplan layout, choices can now be made for Mechanical, Electrical & Plumbing (MEP) systems, and Energy Efficient Building (EeB) façade technologies. A tool has been designed to help the design team create optimal clusterings and choices for these technologies. At this stage, Semantic Labels that apply to MEP and EeB technologies have been defined as well, just as design rules that can apply designers' knowledge to the actual choice of technologies.

These design variants can then be simulated using energy calculation tools. Traditionally, this would have been very difficult due to lack of detailed information, but thanks to the STREAMER Semantic Labels, appropriate standard values can be used to reach a best estimate of energy performance in this early design stage.

Finally, the Decision Support Tool can compare all design variants and evaluate them based on a set of Key Performance Indicators (KPI). In the STREAMER project, most attention has been paid to the energy-related KPIs, but also financial (Life Cycle Costing) and Quality-related KPIs can be taken into account.

The STREAMER approach heavily relies on data exchange between tools. This makes it imperative that the data can be trusted and that the tools can work with it. The BIM Q tool can check that the data in IFC files can be validated: is the right information contained in it?

One last aspect is the placement of the building in the neighbourhood. Since a building never operates on its own, a lot can be won when smart combinations of energy production, storage, transmission and usage are identified. We developed a process using the QGIS viewer to methodically identify any energy-related opportunities in the neighbourhood, based on available Geographic Information System (GIS) data.

Using the methods and tools in this way, a design team is able to create design variants in a much quicker way, and is supported to take decisions in early design stages, thus maximising the possibility to actually reach the 50% energy reduction. The methods and tools have been tested and validated in various combinations at the four pilot project locations in Italy, France, UK and the Netherlands.

The following section in this newsletter takes a closer look at the tools and methods that implement the STREAMER approach.

go back

MAIN RESULTS

This section describes the major results of the STREAMER project. Most of these tools and methods work together, and they address different steps and aspects of the STREAMER approach outlined in chapter 2.

3A. METHOD: DATABASE OF REQUIREMENTS FOR HOSPITAL ROOMS

When working on the pilot projects, it has become apparent that requirements gathering is a time-consuming process. In some cases, requirements are based on regulations, sometimes on former experiences, or sometimes just because it was best practice at the time.

STREAMER Partner RNS has identified that a lot of time can be won by using a standard list of requirements that are relevant in a hospital setting, as is already in use in Sweden. They started to explore if such standards can be developed for use in (at least) the Netherlands, thus leading the way in this field. Eventually such a list may be handed over to an emerging group of collaborating hospital facility managers. The databases of Sweden and the Netherlands may then serve as examples for wider European uptake.

The advantage of such a database is that it captures expert knowledge, reduces time consuming data collection for requirements, and reduce risk for development of projects as requirements are commonly accepted and proved to be sufficient. Additionally, employees of hospitals will have lesser need for adaptation when employed in another hospital because of standardization. In operation theatres, this can reduce risks in wayfinding for a surgeon for example.

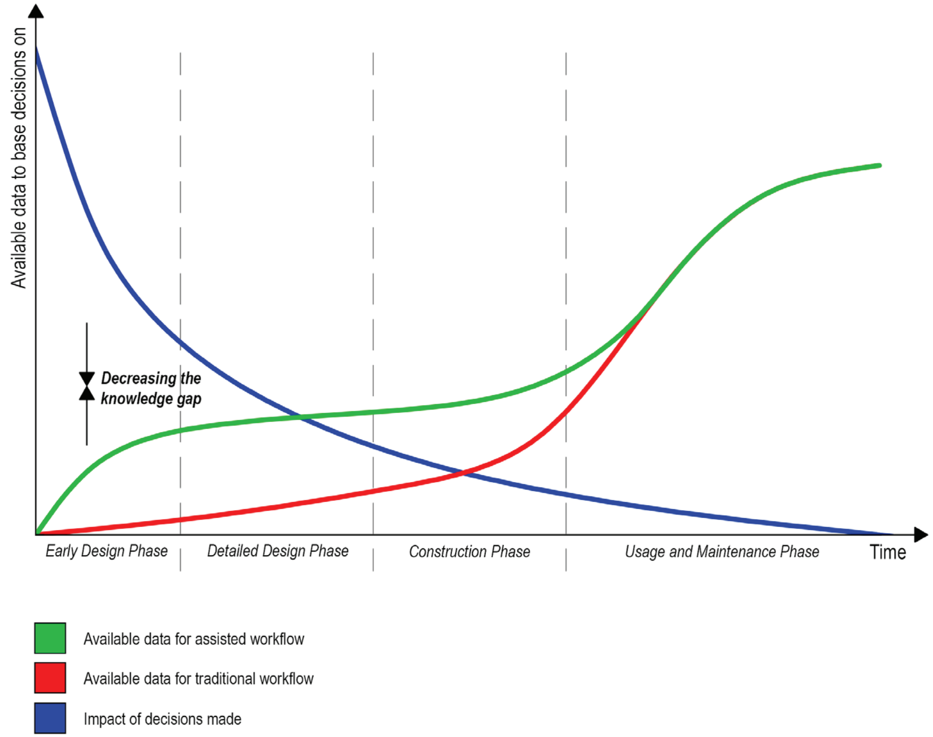
3B. METHOD: SEMANTIC LABELS DESIGN METHODOLOGY

The Semantic Labeling approach is one of the methodological core concepts introduced by STREAMER. In short, the semantic labels fill the gap between the (often very coarse) requirements and characteristics used in early design stages on one hand, and the much more detailed specifications that are usually only known in much later design stages. This makes it possible to evaluate a design in the early design stage.

The semantic labels provide characteristics of the major components of the hospital, grouped in more or less 'standard' categories. The STREAMER tools are then able to 'reason' with these categories, for instance the Design Rules make heavy use of these. Also, two tools use the Semantic Labels for initial estimation of energy demand.

Using the semantic labels in the so-called 'assisted workflow' (making use of additional information and tooling) leads to better information in early design stages, where the impact of design choices is usually high.

Semantic labels are defined for Access and Security (to identify rooms that are public, or restricted access), for Comfort class (in terms of noise, temperature and light), Construction (minimum dimensions), Equipment (being able to support specialized equipment), Hygienic class (very high for operating theatres, for instance) and User profile (office hours, 24/7).



3C. METHOD: DATABASE OF DESIGN RULES

The Design Rules are used in the Early Design Configurator and the Rule-based checking toolkit. Design rules are meant to capture experience and knowledge in a way that can be 'calculated' by computer programs.

A design rule works upon the rooms in the Program of Requirements and its associated characteristics. For instance, using a design rule it is possible to specify that patient rooms and offices should not be mixed. Or, that a preparation room should be close to a surgery room.

The database of design rules thus captures expert knowledge, and as such it is complementary to the other STREAMER result 'database of requirements'.

Examples of these design rules are:

- Functional area with (name equals "Admission") must be contained in the lowest story;
- Functional area with (name equals "MedicalArchive") must be contained in the highest story;
- Functional area with (name equals "LowCareWard") must be clustered horizontally and vertically;
- Traveling distance between space with (name equals "PatientRoom") and space with (name equals "NursingStation") is less than 20.0 m;
- Space with (HygienicClass equals "H5") must be clustered horizontally and vertically;

The design rules are meant to be readable by humans, while at the same time easily interpretable by computers.

3D. TOOL: EARLY DESIGN CONFIGURATOR (CONFIGURATOR OF PARAMETRIC DESIGN SOLUTIONS)

The Early Design Configurator has emerged to become one of the most prominent results of STREAMER. The tool is based on the observation that in early design, usually choices are made that cannot be easily changes later on, but which have a considerable impact on the building's performance – notably energy efficiency, but other aspects as well. Usually, an experienced architect can make an early design that is expected to fit the customer's requirements. However, making such a design is costly; only one variety is usually made. The Early Design Configurator automates this process to a high degree, so it is easy to create multiple designs that can be evaluated and compared.

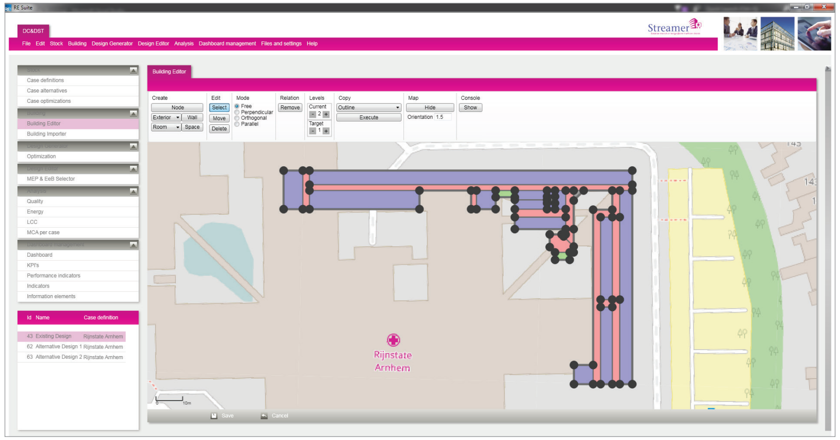
The Early Design Configurator takes input from three sources:

- The Program of Requirements identifying the customer's requirements: how many rooms, how large, which characteristics. This PoR is enhanced with the STREAMER Semantic Labels: these provide a shorthand way to quickly identify the main characteristics of rooms, even when more detailed specifications are not yet available.
- The building's outer shell (the form), and any restrictions in the floor plan. The size of the building is usually already defined (otherwise, the designer first has to make a choice for this) for instance in a refurbishment scenario. Also, some rooms, corridors, stairs, elevators or other elements are fixed and cannot be changed.
- Design rules that have encapsulated the architect's knowledge. These design rules are expressed using the STREAMER semantic labels and may contain specific experiences, wishes or principles. For instance, a rule can state that the distance between specific rooms may not be more than a maximum, or that some rooms should be on the same floor, or near to the elevator, or that office rooms and patient rooms should not be mixed.

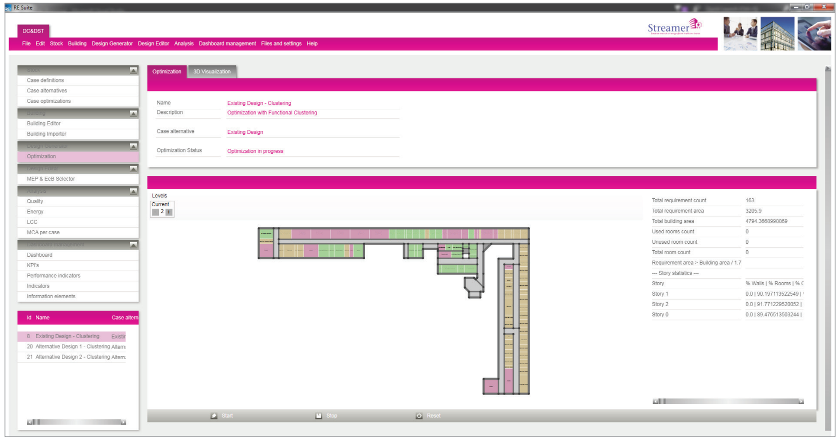
Based on these inputs, the EDC starts making designs automatically. A design should fullfill the outer shell and fixed room restrictions as a hard condition, and makes successive new design variants that fulfill the PoR and the design rules increasingly well. The algorithm used for this optimization is known as „Evolutionary Programming", a technique from the field of Artificial Intelligence that optimizes a solution by continuously "trying" different designs.

Design variants can be created by re-running the algorithm with adjusted preferences in design rules (which rule should take precedence).

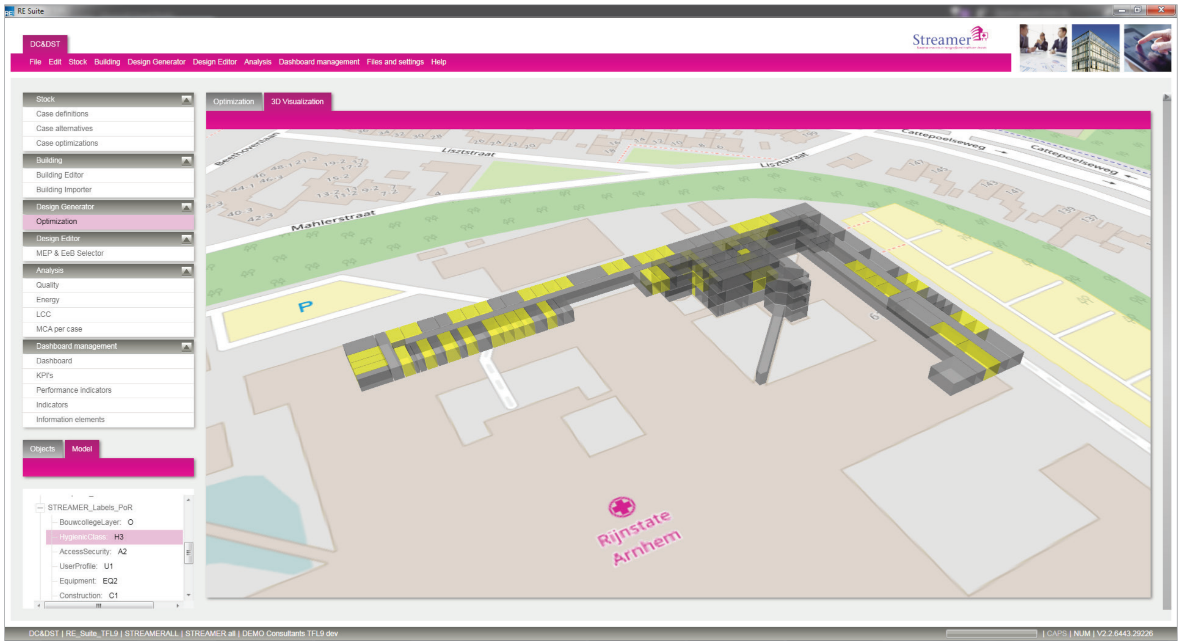
read more



Defining the building outer shell, and fixed rooms.



The optimizer at work. The colors indicate different space types.



The optimized building model exported to IFC.

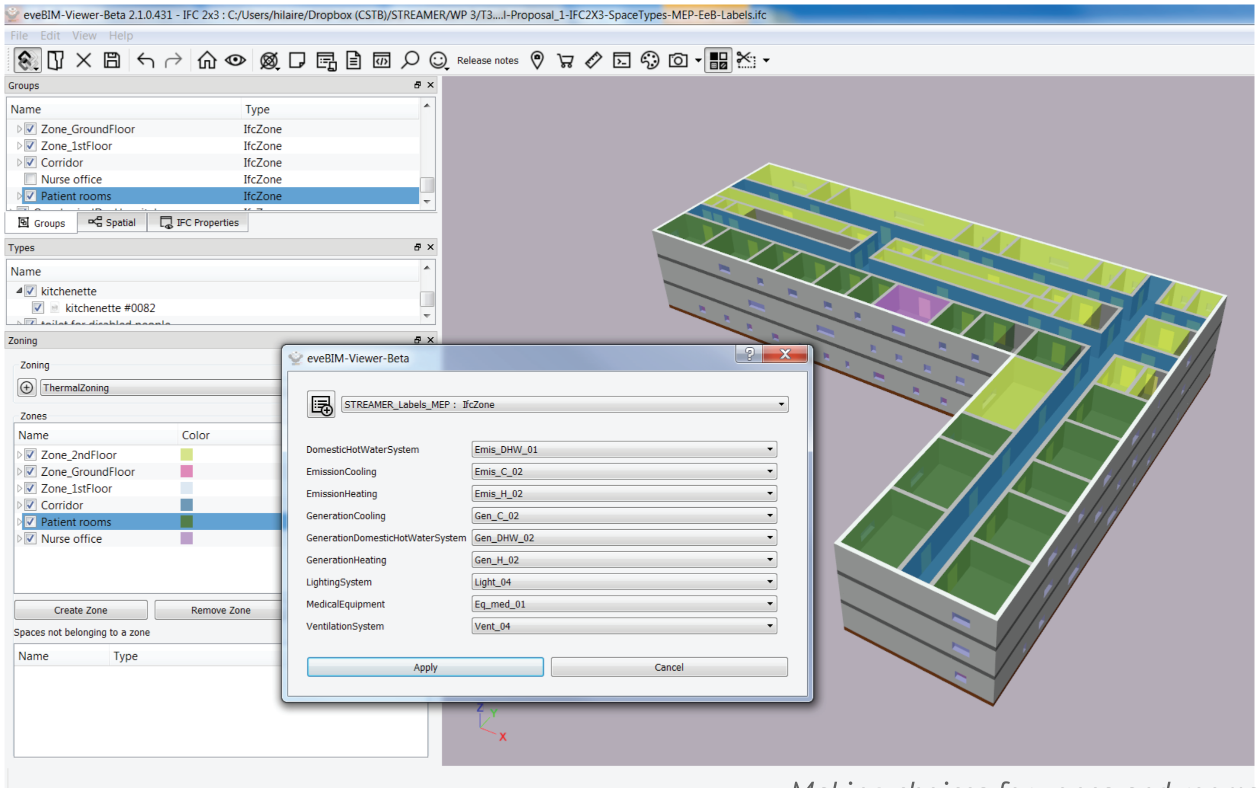
go back

3E. TOOL: MEP / EEB SELECTION

One major result of the STREAMER project is to be able to assess a design in an early phase, when normally not much information is yet available. This is especially true for MEP (Mechanical, Electrical and Plumbing) systems, that have a huge impact on the energy performance of a building, but which are usually taken into consideration in relatively late design stages.

One piece of information that STREAMER has added in early design stages, is a Semantic Label for each room, which gives basic information on the way this room will be used. This label already indicates a first way to make the choice for MEP systems smaller: some MEP systems are simply incompatible with the future usage of rooms. For instance, radiators (for heating) are usually not allowed in surgical theatres because they cannot be cleaned satisfactorily. The same goes for natural ventilation (opening the window).

Both for EeB and MEP systems, the STREAMER project has defined labels as well. These labels enable the energy calculation tools to make much more educated guesses (using default or standard values) with respect to energy characteristics of rooms, MEP and EeB Façade technologies.



Making choices for zones and rooms

3F. TOOL: RULE-BASED CHECKING TOOLKIT

The rule-based checking toolkit uses the Database of Design Rules to verify that a design is still valid. During the design, the designers may have made changes to the output of the Early Design Configurator that may violate some rules. The Early Design Configurator creates an automatic design that is as much as possible according to the Design Rules, but subsequently it may be needed to adapt the design manually. Maybe because of the choice of MEP systems, maybe because of other considerations that were not included in the design rules.

This tool is complemented with another tool which enables editing the set of design rules. This editor is rather basic; it helps the user to formulate design rules that are syntactically correct, but it does not have an extensive Graphical User Interface, since it is expected that the information will be entered by IT specialists and will not be updated very frequently.

3G. TOOL: TNO ENERGY CALCULATION TOOL (TECT)

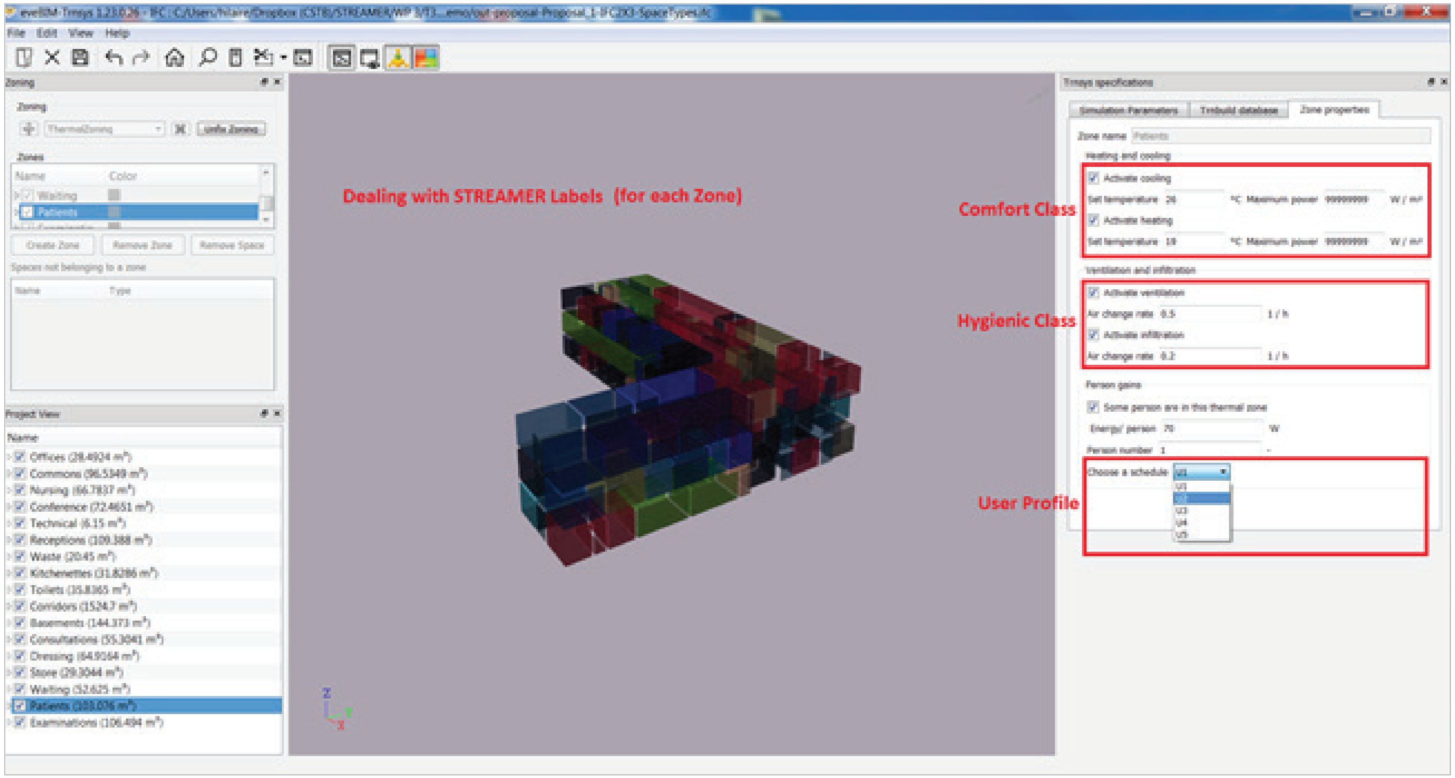
In order to evaluate the energy performance of buildings, a tool has been created that is exactly based on the relatively recently defined standard EN ISO 16798-1. The tool that has been used for STREAMER makes explicit use of the Semantic Labels. The tool calculates the energy demand for each room and for each hour in a year, and it takes as inputs:

- The IFC file that contains the design of the building, also containing the STREAMER Semantic labels for each room so that default values can be used;
- A configuration file, also containing default values for spaces and façade;
- Climate conditions as defined by EN ISO 16798-1.

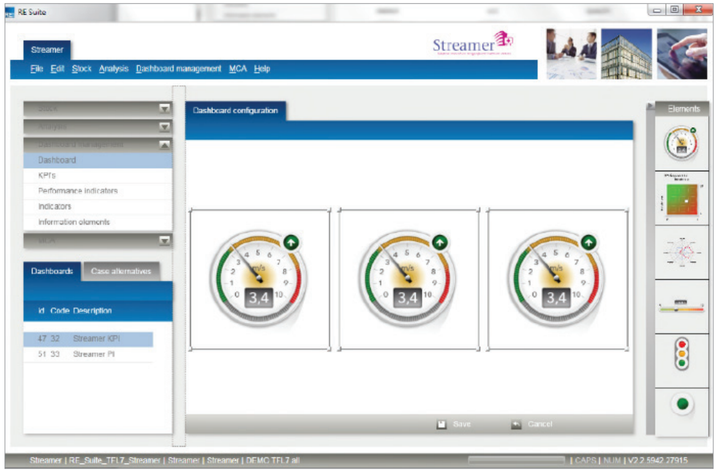
The energy demand information is written back into the IFC file, and the information can be read and evaluated in the Decision Support Tool.

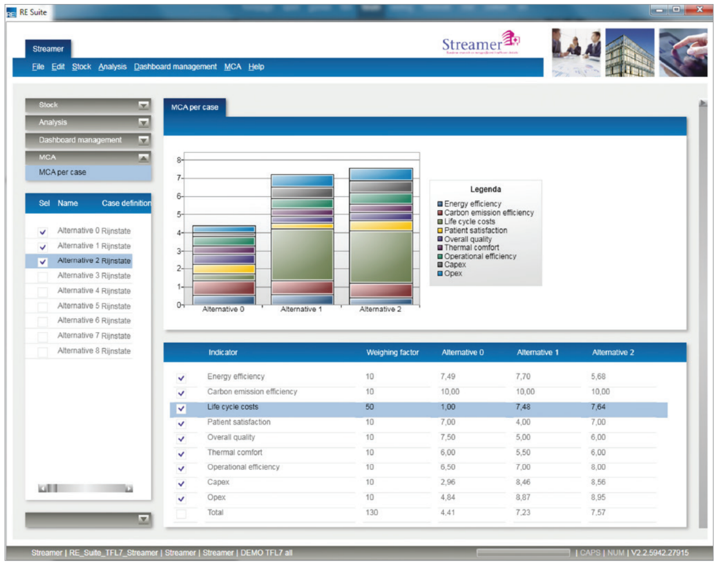
3H. TOOL: ENERGY INTERMEDIATE TOOL (EVEBIM-TRNSYS)

A special tool has been developed in order to enable two existing tools (eveBIM, a viewer, and trnSYS, an energy calculation tool) to make use of the STREAMER labels.



31. TOOL: DESIGN DECISION-SUPPORT AND LIFECYCLE VALIDATION TOOL





The Decision Support tool helps design teams to evaluate different design alternatives. The tool reads information from many different sources and can perform multi-criteria analysis against a set of STREAMER Key Performance Indicators, addressing energy efficiency, total cost of ownership, and quality.

The tool contains a user-configurable dashboard that enables the selection of different KPIs. It also contains extensive viewing capabilities to study the different design alternatives in more detail.

The tool integrates information from all other STREAMER tools. It can read building designs in the IFC standard format, including information that has been added by energy simulation tools. Financial information (Life Cycle Costing) is calculated based on key figures. The tool is designed in such a way that other relevant information that can be included in a BIM, such as operational quality or safety, can also be included in the definition of Key Performance Indicators.

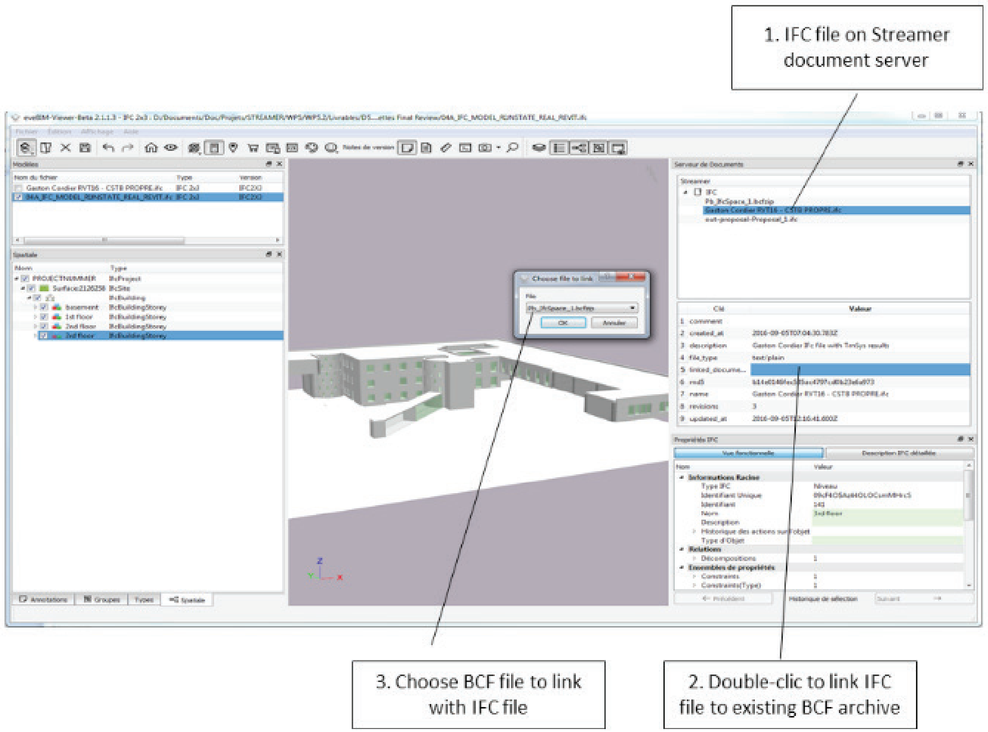
3J. TOOL: PLM SOLUTIONS INTEGRATED WITH BIM & GIS

PLM, or Product Lifecycle Management, is the glue between all the different tools and data. All the documentation, models, computation results are stored on the server, accessible at any time by any actor and will be visible through any solution that will implement the PLM API. One of the main advantage of combining PLM and BIM is that PLM solution supports validation processes. Each kind of document can be integrated into a completely customizable circuit. Only PLM administrators can have access to such processes definition.

The PLM tool is based on existing software that has been enhanced in a number of ways:

- An API has been defined that enables other tools (specifically the STREAMER tools) to directly access the PLM functionality.
- A possibility to work with the BIM Collaboration Format (BCF) has been included. BCF enables the tracking of changes to designs.

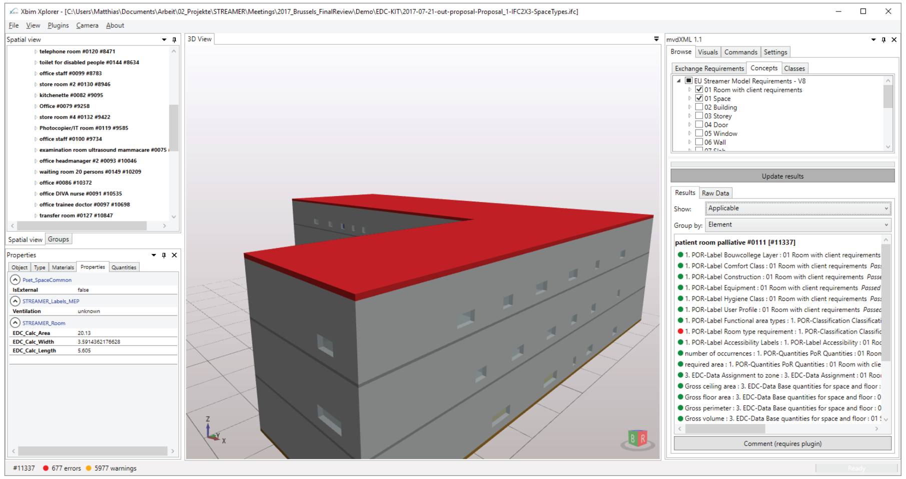
Integration with the eveBIM tool (of CSTB) is tight. Various plugins allow for the usage of BCF connected to IFC files.



3K. TOOL: BIMQ REQUIREMENTS MANAGEMENT AND MVDXML-BASED MODEL CHECKING

The STREAMER workflow is a typical example of Architecture, Engineering & Construction (AEC) design processes that require collaboration of different domains. Data exchange between different tools is enabled by the use of Building Information Modelling (BIM) and open standards, namely IFC and the BIM collaboration Format (BCF). An increasingly important aspect of BIM-based projects is quality control of shared BIM models. A set of tools have been developed to (1) specify and manage BIM data requirements, also known as Level of Development (LOD) and Level of Information (LOI), and (2) automatically check BIM-IFC files against those requirements based on the open mvdXML format.

The BIMQ Guide was developed by the partner AEC3 (http://www.aec3.com/de/kompetenzen/BIM-Q-Database.htm) and is a web-based solution used to capture Exchange Information Requirements (EIR, see also ISO 19650-1) within the STREAMER workflow (early design of hospitals). The tool itself is very flexible and can be used from simple requirement configurations based on predefined specifications to full complexity starting from scratch including the needs to provide technical details such as the mapping of end-user requirements to the BIM-IFC data structure.



A prototype implementation for mvdXML-based model checking has been developed as a plug-in for the xBIM IFC viewer (http://docs.xbim.net/downloads/xbimxplorer.html). The implementation is mainly designed to allow individual stakeholders to independently verify the conformity of received and produced BIM-IFC models against the agreed exchange requirements and concept roots in a user friendly visual 3D environment as shown in the screenshot.

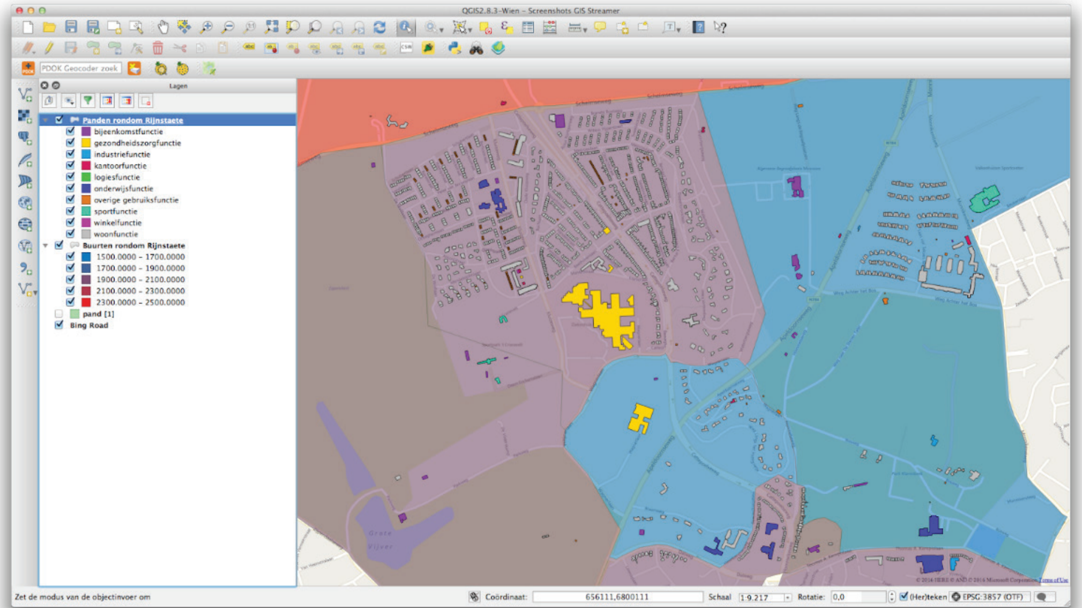
To enable a complete collaboration workflow between stakeholders the MVD user interface component has been designed to allow the interactive analysis of models Visual color coding styles have been developed to allow rapid traffic-light model inspection in the 3D viewer of passing and failing requirements.

3L. TOOL AND METHOD: ENERGY MAPPING VIEWER (QGIS)

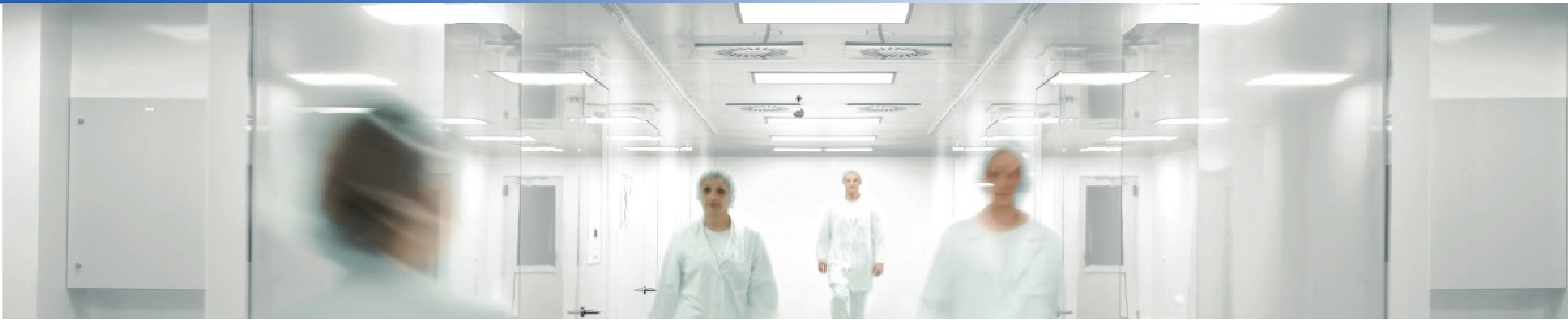
A method has been developed, working with an existing tool (QGIS) which is intended to enhance the workflow around using the tool in situations where various energy sources or users are present in a larger area.

It is possible to view characteristics of a neighbourhood without having to interview people or companies. This means the decision field can be narrowed beforehand. As an extra bonus, lower governments such as provinces or municipalities are in need of this kind of data visualization to be able to make decisions regarding the energy transition. Usually these actors have GIS data but do not combine them themselves for analyses.

The method follows a step-by-step approach in which publicly available (open) data is used, along with GIS and BIM information, and where energy supply, energy demand and energy transportation opportunities are compared, in order to be able to select a number of combinations that can then be analysed in cost-benefit scenarios, also taking into account other (non-technical) parameters.



Streamer
European research on energy-efficient healthcare districts



4. MORE INFORMATION

Of course, you can refer to our website for much more detailed information: www.streamer-project.eu

Also, we have created a short (about 4 minutes) video that gives an overview of the STREAMER project in a way that can be understood by non-experts. A link to this video can be found on our website.

DOWNLOAD PDF
STREAMER WEBSITE

For other information, you can contact the coordinator:

Name: Freek Bomhof
Organization: TNO
Role: Project Coordinator

Address: PO Box 96800, 2509 JE Den Haag
Telephone: +31 88 86 67 046
E-mail: freek.bomhof@tno.nl

APPENDIX 2 – STREAMER Flyer

Streamer

European Research for Innovative Healthcare Districts

Semantics-driven Design through Geo and Building Information Modelling for Energy – efficient Buildings Integrated in Mixed-use Healthcare District

COORDINATOR: Dr. Rizal Sebastian, TNO, The Netherlands; rizal@demobv.nl
TELEPHONE: **+31 15 750 2520 / +31 6 538 141 18**
WEBSITE: www.streamer-project.eu

DURATION: 48 months
EU GRANT: EUR 8 million
PROGRAM AREA: EeB (Energy-efficient Buildings)

SUMMARY

STREAMER is an industry-driven collaborative research project on Energy-efficient Buildings (EeB) with cases of mixed-use healthcare districts. This research will enable architects, contractors, clients and end-users **to design** new EeB. as well as retrofit existing buildings integrated in a healthcare district using enhanced **Semantic BIM-GIS** methods and tools for the holistic optimisation of EeB innovations.

Healthcare-related buildings are among the top EU priorities since they play a key role for a sustainable community, but their energy use and CO2 emissions are among the highest of all building types. The energy use of 1 healthcare district could exceed that of 20,000 dwellings. STREAMER aims at 50% reduction of the energy use and CO2 of new and retrofitted buildings in healthcare districts in the next 10 years.

RESEARCH:

EeB design optimisation in 3 levels/areas:

- **Buildings MEP/HVAC systems** in relation with high-tech medical equipment
- **Building envelope and spatial layout** in relation with new healthcare services
- **Building energy systems** in relation with neighbourhood systems (e.g. electricity, grid, heat storage, etc.)

TARGETED KEY ACHIEVEMENTS:

- **Generic semantic BIM+GIS typology models** of EeB in healthcare districts: adjustable semantic BIM+GIS design models as templates for new design and retrofitting;
- **Framework for BEM (Building Energy Model)** lifecycle model inter-connecting BIM, BAM, BOOM;
- **Design decision-support tool** as an interactive tool which accommodates: interoperable BIM and GIS models; Analysis of energy performance, lifecycle-cost, and functional optimisation and Stakeholder's user's requirements, decision criteria and priorities.

WORK PLAN

The research in STREAMER will proceed in the following 10 work packages:1. EeB building typologies, 2. EeB energy typologies, 3. EeB performance optimization, 4. Participatory design framework, 5. Semantics-driven design method, 6. Interoperable design tools, 7. Demonstration and validation, 8. Dissemination and standardization, 9. Technical management, 10. Project management.

Empirical validation of sustainable EeB solutions and new design tools will be done through 4 real projects/hospitals from 4 different EU countries:

- **NHS, Rotherham, UK (**Upgrade of Building Management Systems and Major improvements in overall building fabric)
- **Rijnstate, Arnhem, NL** (Mid-life renovation to replace MEP systems and 10,000 m2 extension and new buildings)
- **Careggi (AOUC), Firenze, Italy** (Overhaul of electricity and heat distribution and the Optimisation of inter-building functions)
- **AP-HP, Paris, France** (Improvement of logistic and waste systems and Re-arrangement of building spaces).

The STREAMER consortium consists of 13 industrial partners (6 large companies + 6 SMEs + 1 non-profit private hospital), 4 research organisations, and 3 public bodies (hospital institutions). In total 20 partners from 7 EU members states representing 5 European regions:

- *TNO, the Netherlands*
- *Ipostudio Architetti, Italy*
- *De Jong Gortemaker, the Netherlands*
- *OVE ARUP, United Kingdom*
- *Becquerel Electric, Italy*
- *DWA B.V., the Netherlands*
- *AEC3 LTD, United Kingdom*
- *Karlsruher Institut fuer Technologie, Germany*
- *Demo Consultants, the Netherlands*
- *Bouygues Construction, France*
- *NCC AB, Sweden*
- *Mostostal Warszawa SA, Poland*
- *Stichting Rijnstate Ziekenhuis, the Netherlands*
- *APH Paris, France*
- *NHS Rotherham, United Kingdom*
- *AOC Careggi, Italy*
- *Mazowiecka Agencja Energetyczna, Poland*
- *Commissariat a lénergie atomique, France*
- *Centre Scientifique et technique du batiment, France*
- *Locum AB, Sweden*

This research project has received funding from the European Union's Seventh Framework Programme for Research and Technological Development and Demonstration under grant agreement no 608739 - FP7-2013-NMP-ENV-EeB

TARGETED KEY ACHIEVEMENTS

- Generic semantic BIM+ GIS EeB, typology models
- Framework for BEM (Building Energy Model)
- Design decision-support tool focused on energy

FLAGSHIP PROJECTS

- NHS, Rotherham, UK
- Rijnstate, Arnhem, NL
- Careggi (AOUC), Firenze, IT
- APH Paris, FR

PARTNERS

APPENDIX 3 – STREAMER Posters

Streamer

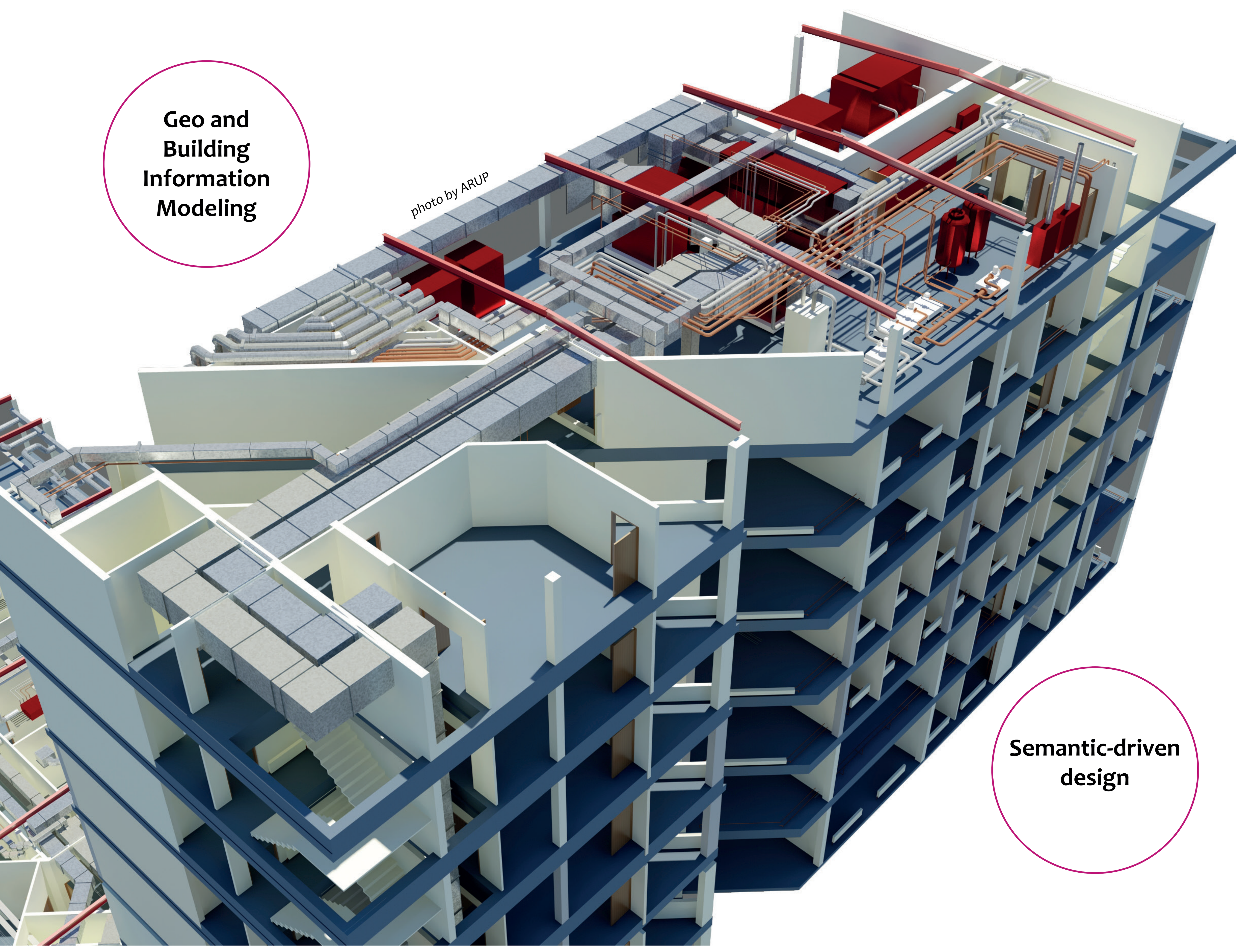
European research on energy-efficient healthcare districts

50% reduction of **energy use** and the **CO_2 emissions**
of new and retrofitted buildings in healthcare districts

STREAMER

enables to design Energy efficient Buildings integrated in a healthcare district using enhanced
Semantic BIM-GIS methods and tools
for the holistic optimisation of EeB innovations

Geo and Building Information Modeling



Semantic-driven design

EeB design optimisation in 3 levels/areas:

- Buildings MEP/HVAC systems in relation with high-tech medical equipment
- Building envelope and spatial layout in relation with new healthcare services
- Building energy systems in relation with neighbourhood systems

Consortium

Architects and engineers

DWA ipostudio ARUP

Research Institutes

TNO CSTB KIT cea

ICT, Real Estate, Facility

DEMO CONSULTANTS locum MAE AEC3

Hospital organizations

Rijnstate NHS Rotherham Azienda Ospedaliero Universitaria Careggi ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

Construction companies

NCC Mostostal BOUYGUES

European Commission

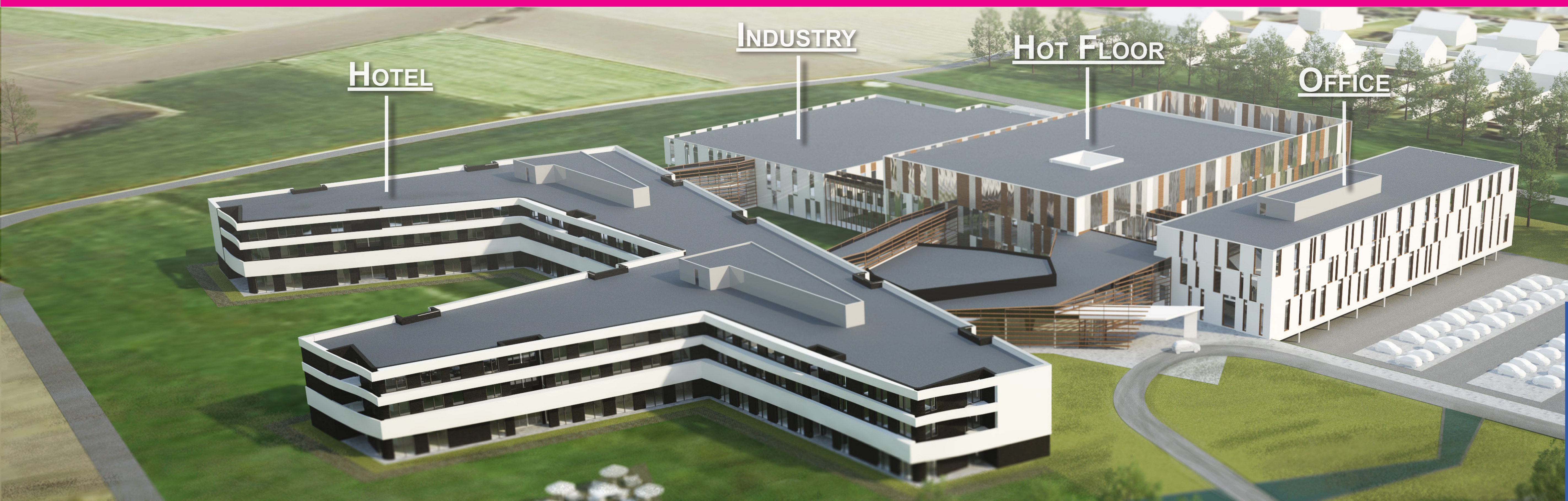
This research project has received funding from the European Union's Seventh Framework Programme for Research and Technological Development and Demonstration under grant agreement no 608739 - FP7-2013-NMP-ENV-EeB

WEBSITE: www.streamer-project.eu
DURATION: 48 MONTHS (2013-2017)
EU GRANT: EUR 8MILLION
PROGRAM AREA: EeB (Energy-Efficient Buildings)

Streamer

European research on energy-efficient healthcare districts

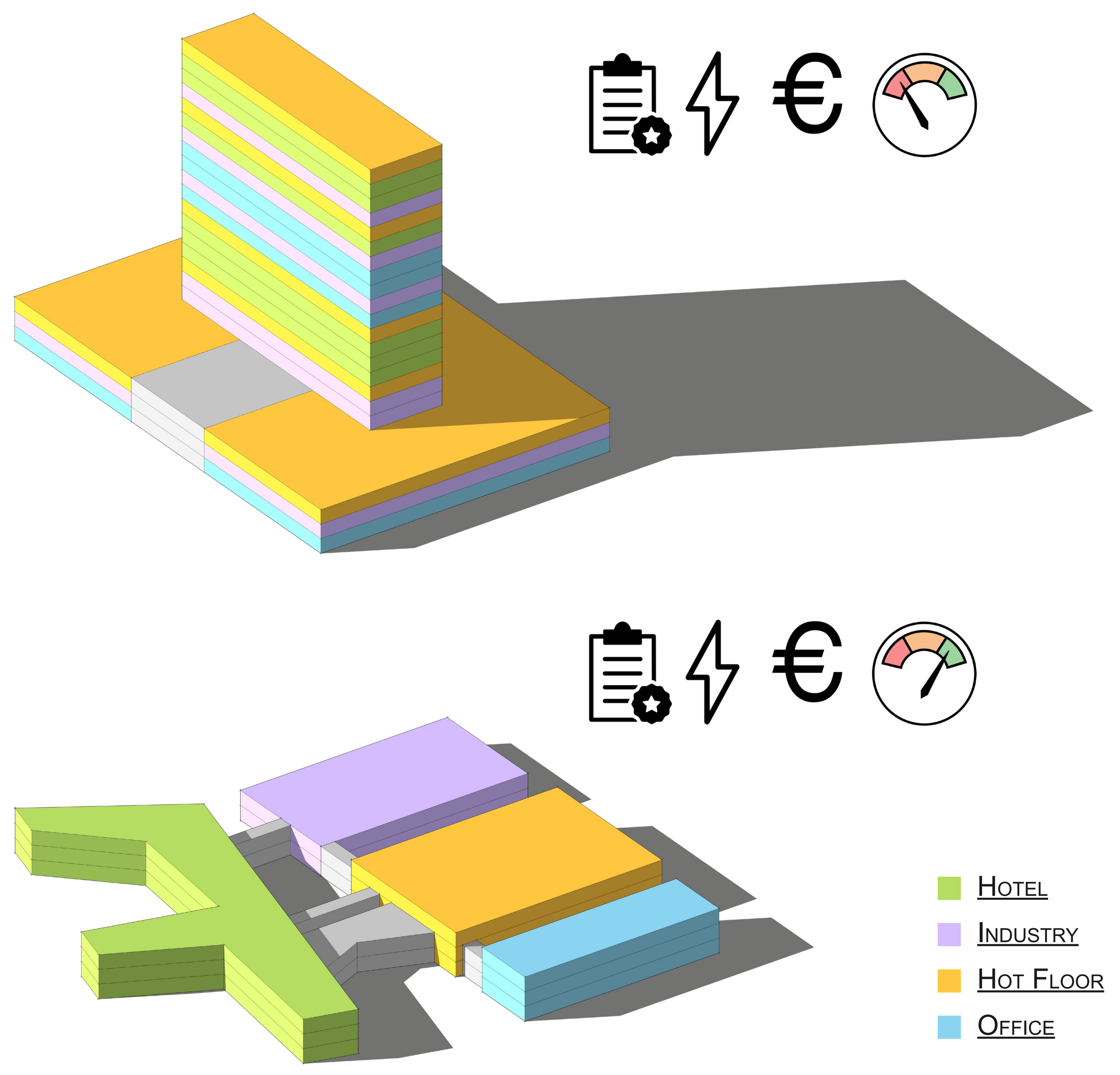
Optimised design methodologies for energy-efficient buildings



Hospital *Maas en Kempen* in *Maaseik, Belgium*, design de Jong Gortemaker Algra Architects - Example of a hospital according the Layer Methodology from Bouwcollege

STREAMER - an industry-driven collaborative research project on Energy-efficient Buildings (EeB) with cases of mixed-use healthcare districts that aims to reduce the energy use and carbon emission of new and retrofitted buildings in healthcare districts in the EU by 50% in the next 10 years.

STREAMER provides a integrated interdiciplinary design approach with tools to optimise a building layout during the design stages. The tools will also support several decision support moments during the design proces.



From Breitfuss model to Bouwcollege layers

Many hospitals are build according a one size fits all philosophy, with accordingly a generic structure and generic climate systems.

For a large quantity of functions this means they are placed in an over dimensioned building, using more energy than actual needed and are missing some specific qualities for specific functions.

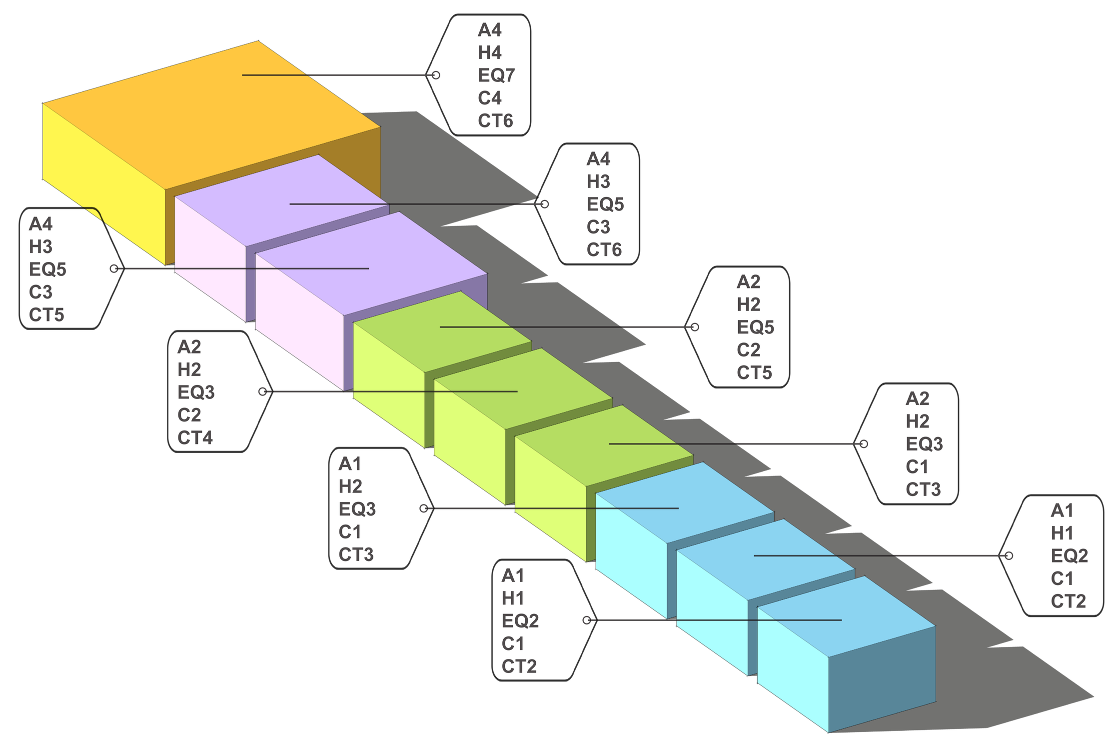
The layer methodology developed by the former Bouwcollege (now integrated within TNO), opts for a more specific approach. By developing more tailor fitted buildings, the building are more specified to the needs of the specific functions.

The specific buildings cost less to build, can achieve a quality fitted to specific function and will use less energy.

For the balance of too specific and too generic the program is divided into four layers:

Hotel - which includes the larger part of the patient accommodations
Industry - which accommodates those functions that are capital intensive, such as the laboratories and the production kitchen
Hot Floor - i.e. the capital intensive high-tech functions that are unique to the hospital
Office - with the outpatient units, accounting, management and training functions

INNOVATION 1



Enriching the Programme of Requirements with the label methodology

This concept allows the designer to attach design-related semantic properties to space units (i.e. rooms) in the early design phase even though much detailed information is still unknown.

These semantic labels express the knowledge and experience of designers and experts, and in turn are useful to create and validate design alternatives.

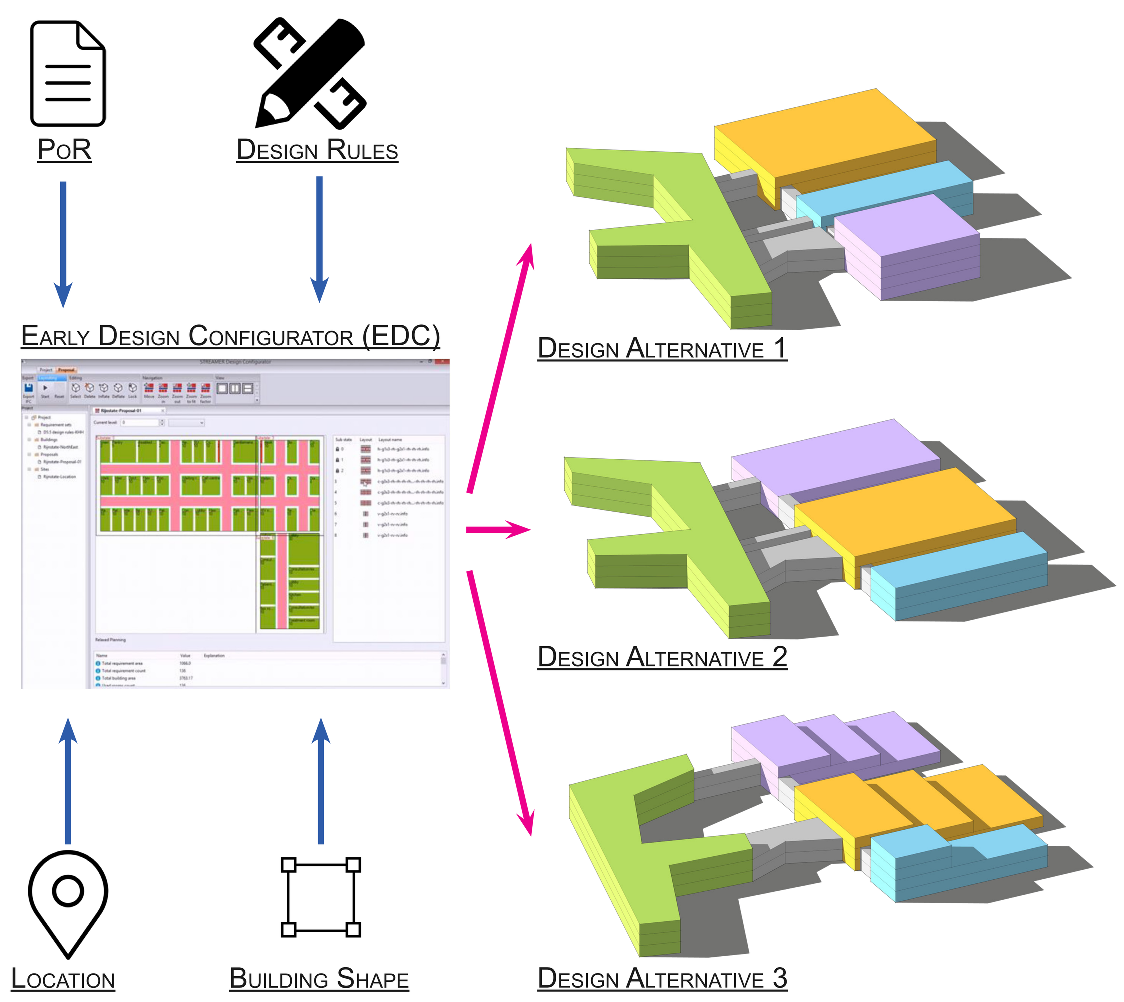
These labels are used as to cluster related functions with similar requirements. For instance functions with the same thermal requirements can be grouped.

In the case of a homogeneous group of functions regarding thermal requirements and opening hours, the energy transfer between rooms is not lost.

In a more heterogeneous situation the thermal requirements will differ greatly between adjacent rooms. With large energy transfers as a consequence.

The labels are divided in several groups such as comfort levels, user profile, construction class, hygienic class, accessibility and equipment.

INNOVATION 2



Creating multiple Design Alternatives using computer aided design.

Within STREAMER an Early Design Configurator (EDC) is developed. The EDC creates design alternatives based on the end-user's Programme of Requirements and the so called Design Rules.

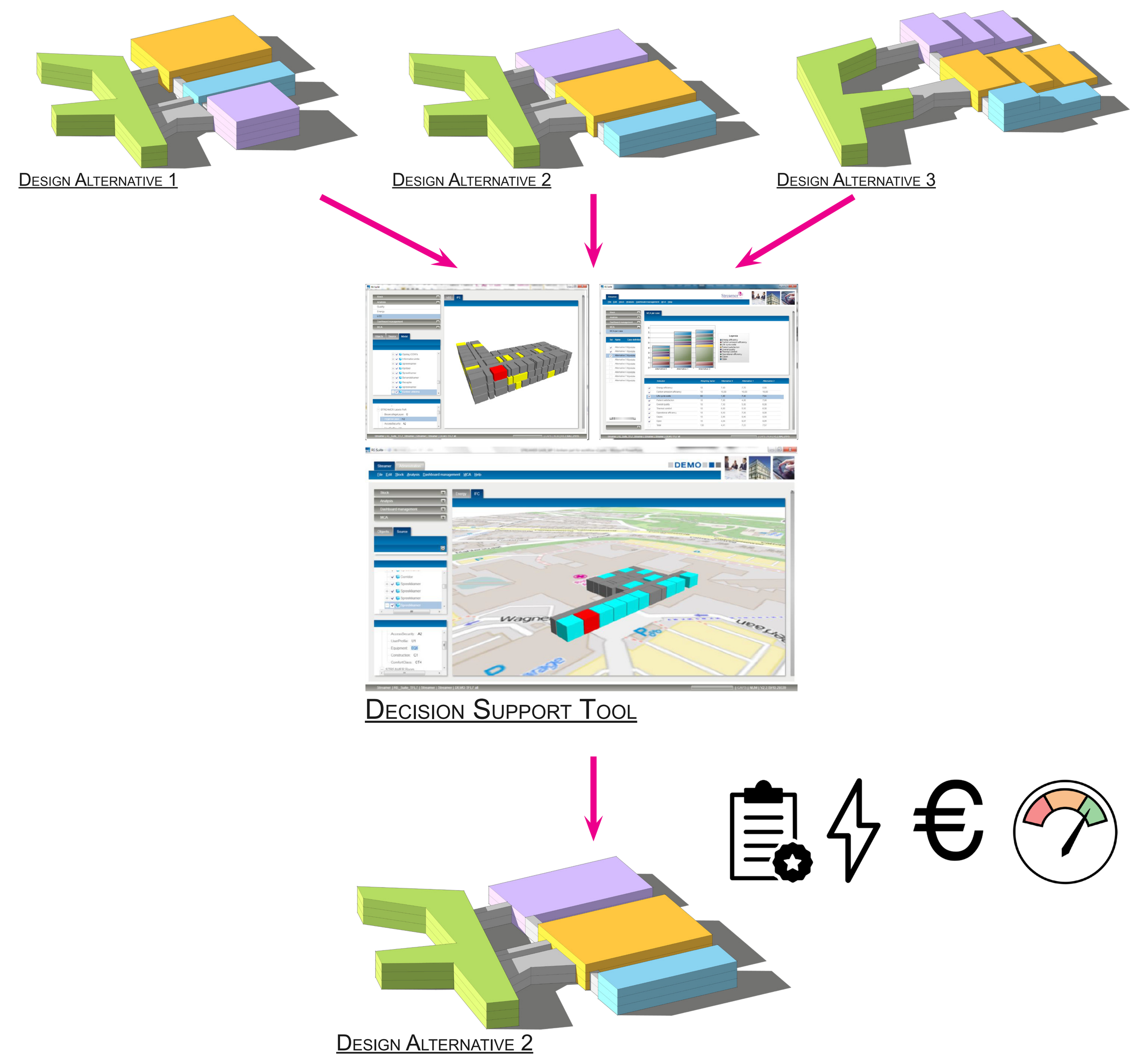
Design rules are basically defined relationships between functions of the PoR. The source can be anything, from expert knowledge to legislations.

Using the EDC, the design alternatives in Building Information Model (BIM) are automatically generated based on the design rules within predefined boundary conditions, such as building's outlines and geographic location.

These alternatives can be validated through several Key Performance Indicators (KPIs) in step 4.

When a design alternative is chosen as the one to proceed with, this alternative can be enriched with generic climate systems to make alternative simulations possible for the systems as well.

INNOVATION 3



Decision Support Tool

A Decision Support Tool (DST) for comparing various design alternatives and performing multicriteria analysis against a set of STREAMER Key Performance Indicators (KPIs) which address energy efficiency, total cost of ownership, and quality.

Along with these main results, many supporting project outcomes are available to facilitate the achievement of creating energy-efficient hospitals. Among these outcomes, there are tools for: preliminary calculation of energy demand in early-design and developed design phases; validation of IFC files (open standard of BIM) which are exchanged during the design process; document management and collaboration process steering; and capturing best practices into semantic design rules.

On the engineering side, STREAMER has created a comprehensive overview of various solutions for MEP (Mechanical, Electrical and Plumbing) systems and building envelopes for energy-efficient hospitals.

Additionally, STREAMER has also developed practical approaches to analyse energy-related aspects at campus and district scale with a particular aim to explore possible optimisations between various buildings within a hospital campus and the local district concerning energy production, consumption, distribution and storage.

INNOVATION 4

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 608739

Project Partners

TNO innovation for life
TNO, the Netherlands

ipostudio
Ipostudio Architetti, Italy

de jong gortemaker algra
de Jong Gortemaker Algra Architects and Engineers, the Netherlands

Becquerel Electric, Italy

DWA, the Netherlands

AEC3, United Kingdom

KIT Karlsruher Institut für Technologie
Karlsruher Institut für Technologie, Germany

DEMO CONSULTANTS
Demo Consultants, the Netherlands

BOUYGUES CONSTRUCTION
Bouygues Construction, France

NCC, Sweden

Mostostal Warszawa
Mostostal Warszawa, Poland

Rijnstate
Rijnstate Ziekenhuis, the Netherlands

Assistance Publique Hôpitaux de Paris
APH Paris, France

The Rotherham NHS Foundation Trust
The Rotherham NHS,United Kingdom

Azienda Ospedaliero Universitaria Careggi
AOC Careggi, Italy

MAE
Mazowiecka Agencja Energetyczna, Poland

cea
Commissariat a lénergie atomique, France

CSTB le futur en construction
Centre Scientifique et technique du batiment, France

locum. VÄRDEN FÖR VÅRDEN
Locum, Sweden

More information and contact

WEBSITE: www.streamer-project.eu
DURATION: 48 MONTHS (2013-2017)
EU GRANT: EUR 8MILLION
PROGRAM AREA: EeB (Energy-Efficient Buildings)
POSTER BY: de Jong Gortemaker Algra Architects
WEBSITE: www.djga.nl
E-MAIL: info@djga.nl

APPENDIX 4 – STREAMER Leaflet

How can the STREAMER results help?

The STREAMER results have been developed and demonstrated in direct collaboration with four large hospitals in Italy, France, The United Kingdom and the Netherlands where the methodologies and tools have been tested and evaluated.
While the STREAMER results have been created with hospitals as application domain in mind, the results have a broader application. We believe any complex building can benefit from the STREAMER approach.

Project partners

TNO, the Netherlands

Mostostal Warszawa SA, Poland

Ipostudio Architetti, Italy

Stichting Rijnstate Ziekenhuis, the Netherlands

De Jong Gortemaker algra, The Netherlands

APH Paris, France

Becquerel Electric, Italy

NHS Rotherham, United Kingdom

DWA B.V., the Netherlands

AOC Careggi, Italy

AEC3 LTD, United Kingdom

Mazowiecka Agencja Energetyczna, Poland

Karlsruher Institut fuer Technologie, Germany

Commissariat a lénergie atomique, France

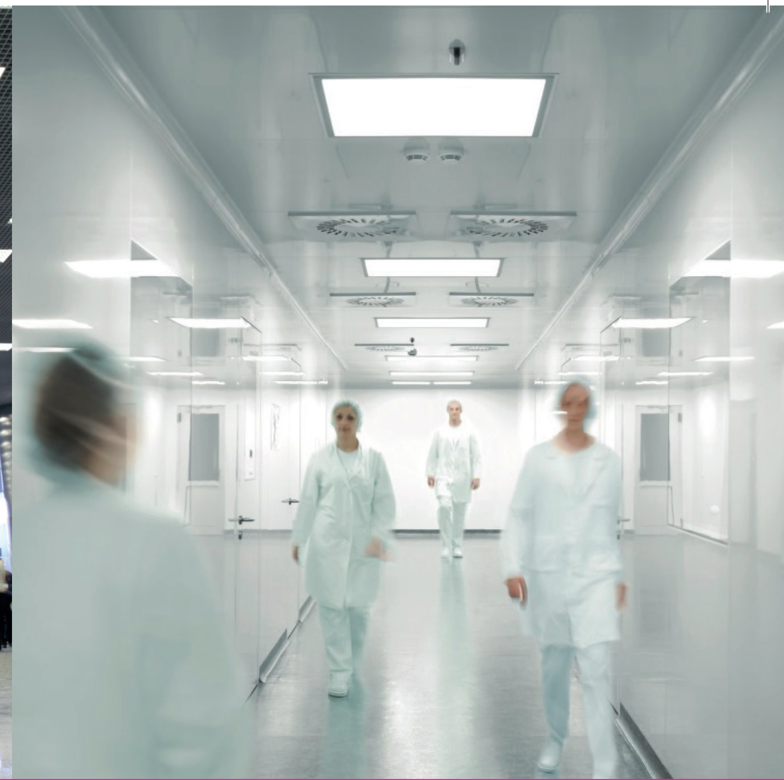
Demo Consultants, the Netherlands

Centre Scientifique et technique du batiment, France

Bouygues Construction, France

Locum AB, Sweden

NCC AB, Sweden



More information and contact

For more information, refer to our website at
www.streamer-project.eu
where the public deliverables are found.
Coordinator: Freek Bomhof MSc.
TNO, The Netherlands
E-mail: freek.bomhof@tno.nl

STREAMER - an industry-driven collaborative research project on Energy-efficient Buildings (EeB) with cases of mixed-use healthcare districts that aims to reduce the energy use and carbon emission of new and retrofitted buildings in healthcare districts in the EU by 50% in the next 10 years.

European Commission

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 608739

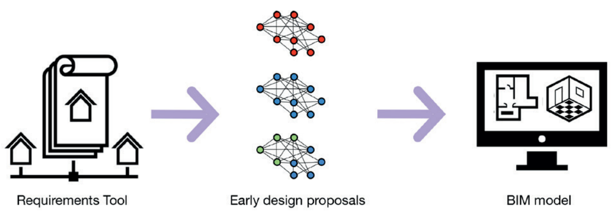
Streamer
European research on energy-efficient healthcare districts

www.streamer-project.eu

STREAMER: Designing energy-efficient hospitals

Hospitals are among the buildings with the highest energy consumption – in average a hospital consumes 2.5 times more energy than an office. This is mainly due to the complexity of the building and utility systems in a hospital in order to accommodate energy-intensive medical equipment and processes.

The STREAMER project focuses on the design phase of hospitals, because design decisions evidently have a large impact on the energy efficiency of the newly constructed or refurbished hospital buildings. STREAMER has generated methodologies and tools which assist interdisciplinary design teams to analyse and select the most energy-efficient design solutions. STREAMER methodologies and tools are innovative for their applicability in the early design phase where traditional design methods falls short in term of semantic and holistic insight.



STREAMER results

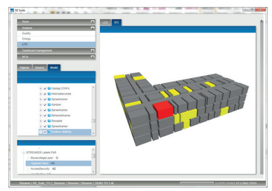
The STREAMER methodologies and tools are developed to be complementary with each other when applied in design practice.

The STREAMER methodologies comprise:

- **The 'semantic labels' design concept.** This concept allows the designer to attach design-related semantic properties to space units (i.e. rooms) in the early design phase even though much detailed information is still unknown. These semantic labels express the 'design rules' which capture the knowledge of designers, and in turn are useful to create and validate design alternatives.
- **Guidelines** enriched with best practices for design teams. These guidelines also incorporate the viewpoints of various stakeholders (i.e. hospital manager, medical staff, patients, local authorities) who are involved in an optimal decision-making concerning design quality, energy efficiency, cost effectiveness. These guidelines also contain organizational approaches to speed up the design process for new buildings and retrofit situations.

The main STREAMER tools that complement the methodologies are:

- **An Early Design Configurator (EDC) and Design Validator** for creating and tentatively validating design alternatives based on the end-user's Programme of Requirements. Using the EDC, the design alternatives in Building Information Model (BIM) are automatically generated based on the design rules within predefined boundary conditions, such as building's outlines and geographic location.



- **A Decision Support Tool (DST)** for comparing various design alternatives and performing multi-criteria analysis against a set of STREAMER Key Performance Indicators (KPIs) which address energy efficiency, total cost of ownership, and quality.

Along with these main results, many supporting project outcomes are available to facilitate the achievement of creating energy-efficient hospitals. Among these outcomes, there are tools for: preliminary calculation of energy demand in early-design and developed-design phases; validation of IFC files (open standard of BIM) which are exchanged during the design process; document management and collaboration process steering; and capturing best practices into semantic design rules.

On the engineering side, STREAMER has created a comprehensive overview of various solutions for MEP (Mechanical, Electrical and Plumbing) systems and building envelopes for energy-efficient hospitals. Additionally, STREAMER has also developed practical approaches to analyse energy-related aspects at campus and district scale with a particular aim to explore possible optimizations between various buildings within a hospital campus and the local district concerning energy production, consumption, distribution and storage.

STREAMER impact

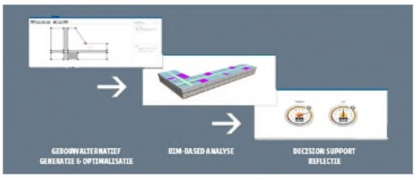
In a **STREAMER - supported design process**, more design options are kept open and they can all easily be evaluated in terms of energy, cost and quality. This enables design teams to choose the best alternative. Optimal choices can be made for room placement and selection of HVAC equipment, in relation to choices for facade technologies. As an example: a poorly designed ventilation system has been seen to account for 40% of the total hospital's energy bill – that is just for moving air, not even including heating or cooling!

APPENDIX 5 –

STREAMER invitation 2nd Design Workshop

Interactieve Streamer Design Workshop
Europees onderzoeksproject Streamer theorie en praktijk

print



Woensdag 20 september van 9:30 tot 16:30 uur
Bent u op zoek naar mogelijkheden om energie en kosten te besparen in uw ziekenhuis? En wilt u een effectiever ontwerpproces doorlopen bij renovatie en nieuwbouw? Graag nodigen wij u uit voor de design workshop in het kader van Energie Efficiënt Ontwerpen met BIM tools op woensdag 20 september 2017 in Arnhem. Deze workshop is het vervolg op de eerdere designworkshop begin 2016.

Tijdens deze workshop delen wij graag met u de resultaten van vier jaar durend internationaal onderzoek naar Energie Efficiënt Ontwerpen met BIM tools. Daarnaast geven we informatie over de hieruit voortgekomen aanpak en de software-instrumenten. U krijgt inzicht in internationale ontwikkeling en praktische toepassing van deze nieuwe kennis. Ook u kunt hiermee besparingen realiseren in uw ziekenhuis!

U kunt zelf oefenen met de tools!
Verder bieden wij u de kans om de unieke Streamer-workflow en de ontwikkelde softwaretools te leren kennen. U kunt zelf oefenen met de tools! Om iedereen in de gelegenheid hiervoor te stellen, is het aantal deelnemers beperkt tot zestig.

Tijd	**Onderwerp**
09.30 uur	**Inloop**
10.00 uur	**Introductie workshop** *Marc Koster (RNS, Manager strategisch Vastgoed Rijnstate)*
10.15 uur	**Story line Streamer** *Martjan den Hoed (DJGA, office manager)*
10.30 uur	**Programma van Eisen (BriefBuilder)** *Willem Jan Hanegraaf (hoofd bouwprojecten vastgoed in Rijnstate)*
10.45 uur	**Koffiebreak**
11.15 uur	**Labels** *Roberto Traversari (TNO, Senior adviseur/ onderzoeker)*
11.45 uur	**Validatie labels** *Jan Peter Pols (DWA, adviseur)*
12.15 uur	**Lunch**
13.00 uur	**EDC: Early Design Configurator** *Sander Bruinenberg (DEMO, Software developer/ onderzoeker)*
13.30 uur	**MEP selector: Mechanical Electrical Plumbing** *Jan Peter Pols (DWA, adviseur), André van Delft (DEMO, Directeur)*
14.00 uur	**TECT: TNO Calculating Tool** *Roberto Traversari (TNO, Senior adviseur/ onderzoeker)*
15.15 uur	**RE Suite**
16.00 uur	**Overige ontwikkelingen**
16.30 uur	**Afsluiting en netwerkborrel**

Meld u aan!

Locatie
Rijnstate
Auditorium (route 81)
Wagnerlaan 55
6815 AD Arnhem (link naar de routebeschrijving internet)

Organisatie en informatie
Congressen & Evenementen, Marketing & Communicatie
Telefoon: 088- 005 7840
E-mail: evenementen@rijnstate.nl

interactieve design workshops worden georganiseerd in samenwerking met:

de jong gortemaker algra

TNO innovation for life

DEMO CONSULTANTS

DWA