January 2015

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Streamer

European research on energy-efficient healthcare districts

NEWSLETTER STREAMER

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1. PROJECT DESCRIPTION

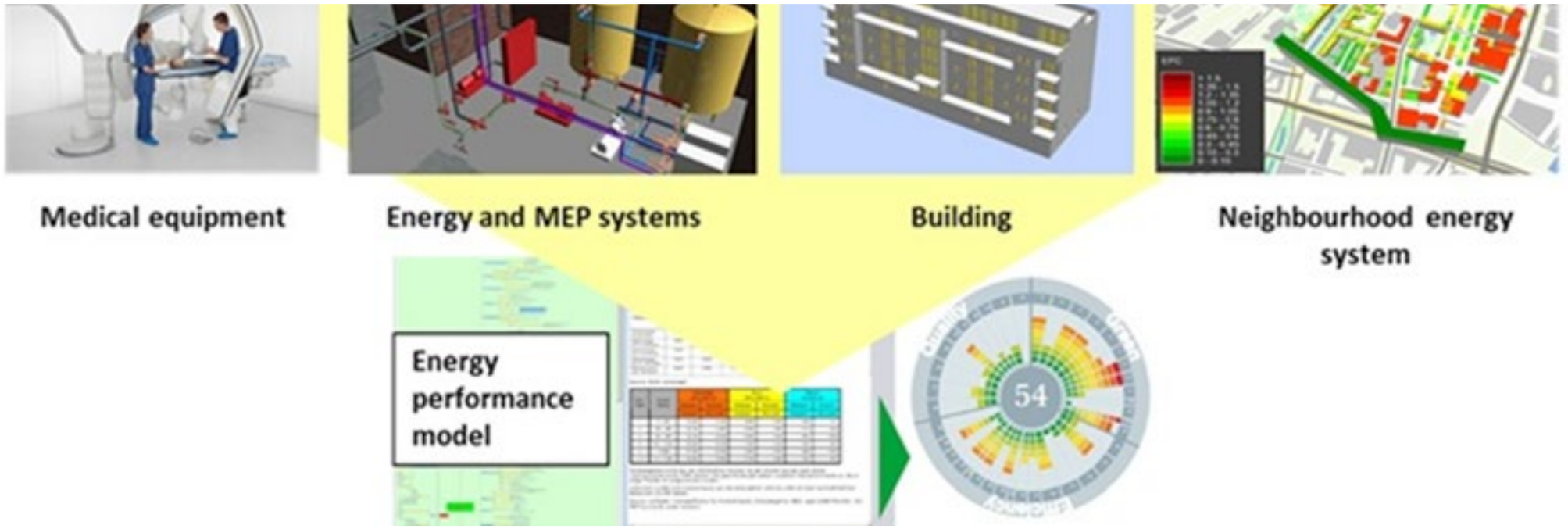
Both in terms of societal as well as environmental impact, the healthcare buildings sector plays a key role as the world faces demographic and climate changes. Ageing population puts a great demand on the healthcare facilities. By the year 2015, the world population aged over 60 years will be nearly 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.

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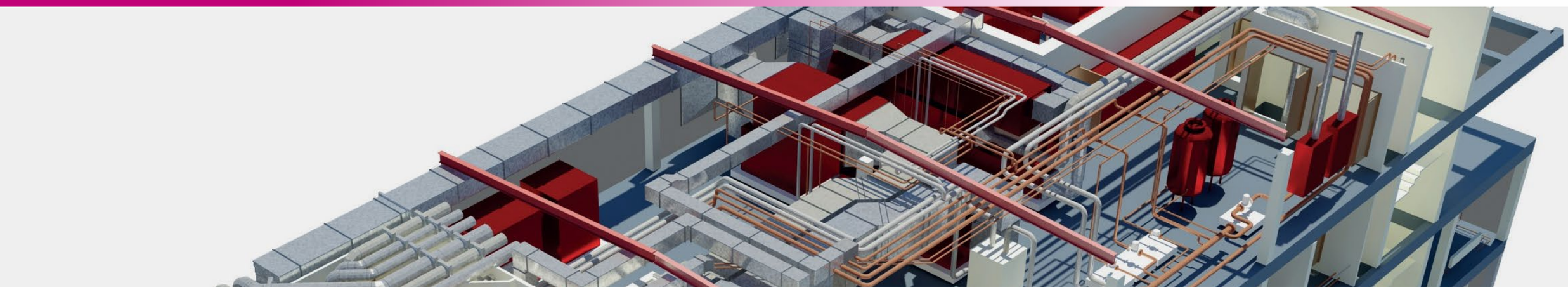
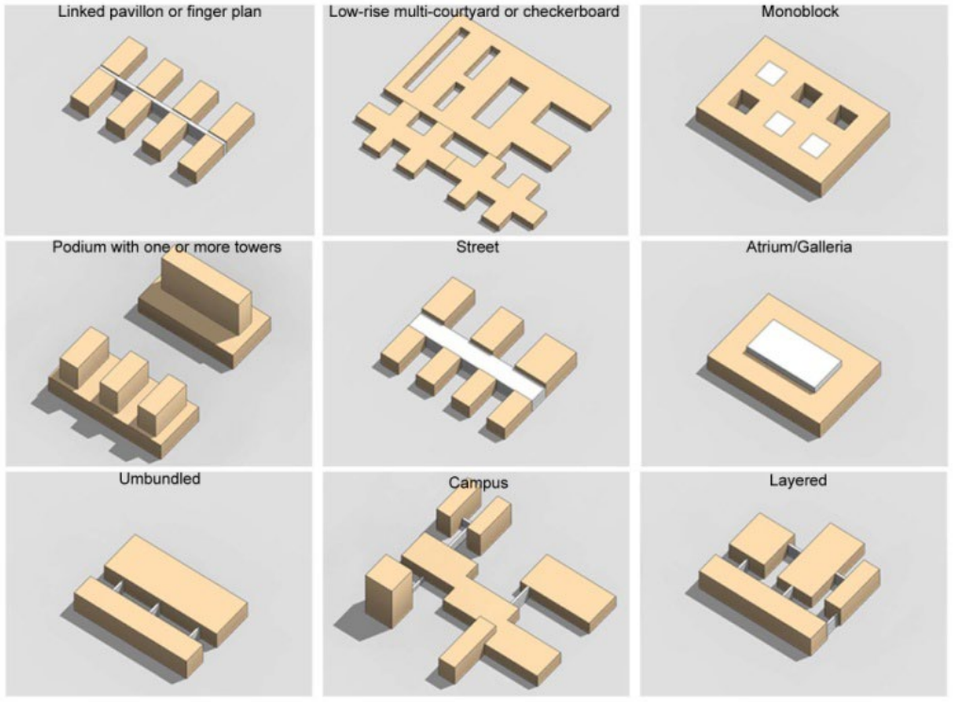


3. OVERVIEW WORK RESULTS Y1

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:

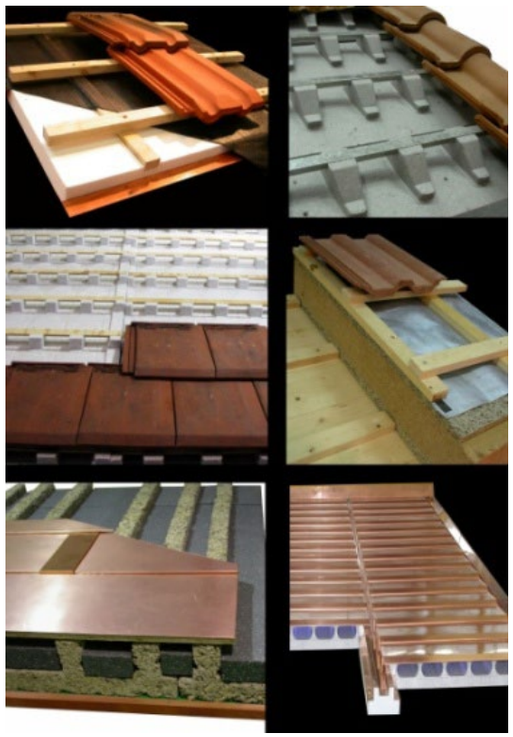
> the typological, technical, distribution and functional characteristics of each building type;
> the functional aggregative configurations based on the proximity and the interdependencies between spaces and functions;
> the energy-related features and characteristics corresponding to the different 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

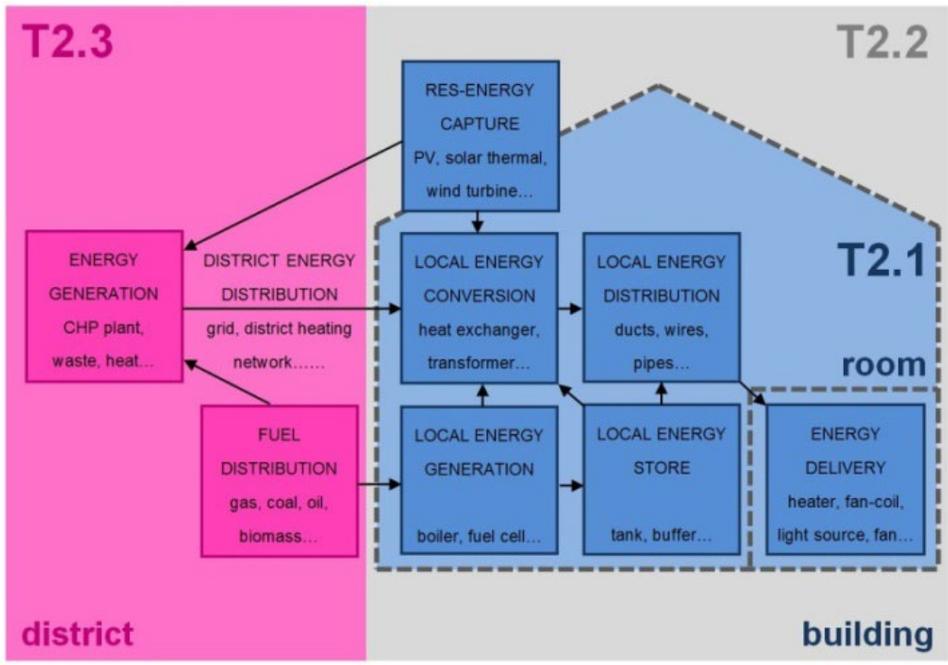


Roberto Di Giulio Ipostudio Architetti, Italy

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 m². The project focuses on the Gaston Cordier building with 26,000 m² 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

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