Streamer
European research on energy-efficient healthcare districts

D7.6

Real case in Italy Validation through participatory design session

Deliverable Report: D7.6 Final version

Streamer - Optimised design methodologies for energy-efficient buildings integrated in the neighbourhood energy systems.
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D7.6

Real case in Italy Validation through participatory design session

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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.

Abstract

The deliverable reports on the **validation workshop** organised by the Italian partners and carried out in Careggi as case study in the STREAMER project.
The real case in Italy deals with retrofitting process.
Multidisciplinary stakeholders, advisors and observers were involved to appreciate and react to the results obtained processing the case study during the research project.
A detailed description of the technical work done during the last two years (**outputs**, as design models, performance simulations and assessment tools) introduces the minutes of the workshop and the feedback received (**outcomes**).
Based on the feedback generated during the validation workshop, mostly focused on the possibilities and potential to apply the STREAMER tools in the Italian scenarios, the deliverable highlights the opportunity and the possible way for improving and enhancing tools and functionalities of the SACS© system – a database implemented by AOUC for accessing and managing information and data related to the all single spaces of the Careggi Hospital District – applying methodology and tools developed in STREAMER.

Publishable executive summary

The Deliverable reports on the **validation workshop** organised by the Italian partners and carried out in Careggi on the 28th of November 2016 as a case study in the STREAMER project.

The previous Deliverable (D7.5) described the aims and goals pursued by the Italian partners and the work done to achieve them:

- the use of the STREAMER knowledge to guide the choice between **retrofitting** and demolition/rebuilding of the older building of the San Luca complex; the complex consists of three different buildings of different age, and one of them is taken as a use case for validating the research results;
- the development of the **SACS© system** - according to the STREAMER results - to take into account energy, applied on a single building at first, then possibly extended to the entire district;
- the optimisation of a better district-level planning and management of energy production.

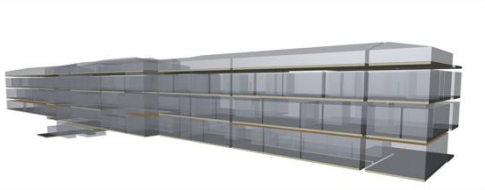
After the submission of the report, the technical work had to be kept on due to issues related to:

- data entry and data exchange in the Dashboard;
- current inability of the Early Design Configurator to handle a retrofitting process.

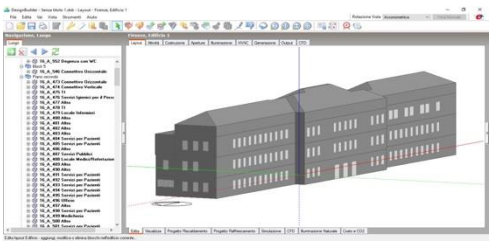
Therefore this Deliverable contains a general description of the scientific work and achievements related to the "objects" (tools and procedure) to be validated during the meeting.

The **outputs** validated during the workshop have been achieved according to the following process:

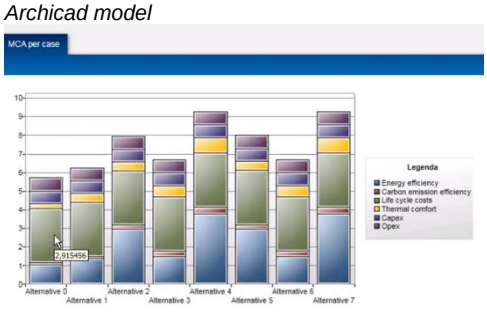
- modeling with Archicad;
- exporting IFC from Archicad;
- importing and processing in Revit;
- exporting gbXML from Revit;
- energy simulation with Design Builder (Energy Plus);
- processing of the IFC file with SimpleBim;
- use of the Dashboard;
- use of the enhanced SACS© system.



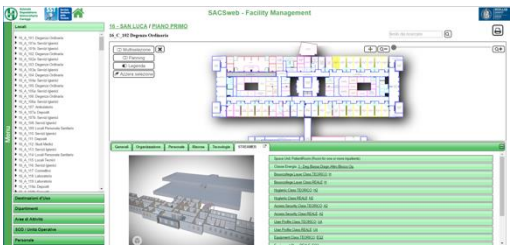
Archicad model



Design Builder energy simulation



Dashboard



STREAMER inside SACS©

The **workshop** was held on the 28th of November 2016 within the AOC premises. AOC organized the workshop and was supported by IAA and BEQ. Lecturers and chairmen were personnel and researchers from AOC, IAA and BEQ. The seminar was in Italian language.

The themes were:

- Presentation of the STREAMER project and the role of AOU Careggi: the perspective of the «STREAMER enhanced» BIM approach in the healthcare field.
- Demonstration of new processes and new tools validated on the Careggi case study and development of the functionality of the SACS© system according to the STREAMER results: exchange of the knowledge between the Italian STREAMER partners and other Italian professionals and actors.

Participants, belonging to companies/institutions operating in the field of health, architecture and engineering, were 46 and their interest was positive and active.


Streamer

Gentile collega,

l'Azienda Ospedaliero-Universitaria Careggi, Ipostudio architetti e Becquerel Electric sono lieti di invitarla al **workshop**:

IL PROGETTO STREAMER
STRUMENTI E METODI PER IL MIGLIORAMENTO DELL'EFFICIENZA ENERGETICA DEI DISTRETTI OSPEDALIERI:
SISTEMI INTEGRATI BIM-GIS NELLA PROGETTAZIONE DI INTERVENTI DI EDILIZIA SANITARIA

che si terrà la mattina di
lunedì 28 novembre (9:00-12:30)
presso l'aula 8, padiglione 3, Nuovo Ingresso Careggi
a Firenze.

La sua partecipazione sarebbe molto gradita.

arch. Filippo Terzaghi
prof. Roberto Di Giulio
prof. Giacomo Bizzarri

RSVP

Azienda Ospedaliero Universitaria Careggi
ipostudio architetti srl
beq

Invitation

Picture of the event

According to the DoW, both the Deliverables, D7.5 and the D7.6, shows that all the activities carried out within Task 7.3 – Demonstration project in Italy, have been directly related to the RTD (WP1-WP6) and to the knowledge dissemination, valorisation and standardisation (WP8). The validation workshop has given the opportunity for knowledge dissemination and the validation output will be used as an input for the broader standardisation.

List of acronyms and abbreviations

AHU	Air Handling Unit
AOC	Azienda Ospedaliera Careggi (STREAMER acronym)
AOUC	Azienda Ospedaliero-Universitaria Careggi
BEQ	Becquerel Electric
BIM	Building Information Modeling
CAD	Computer-Aided Design
CityGML	City Geography Markup Language
CSV	Comma Separated Value
DEM	Digital Elevation Model
DoW	Description Of Work
DST	Decision Support Tool
DWG	AutoCAD Drawing Database
EDC	Early Design Configurator
EIFS	Exterior Insulation and Finishing System
gbXML	green building eXtensible Markup Language
GIS	Geographic Information System
HVAC	Heating, Ventilation and Air Conditioning
IAA	Ipostudio Architetti
IFC	Industry Foundation Classes
KIT	Karlsruhe Institute of Technology
LoD	Level of Detail
MEP	Mechanical, Electrical, Plumbing
RTD	Research and Technology Development
SACS©	System for the Analysis of Hospital Equipment
SQL	Structured Query Language

Definitions

Building Information Model

To be meant as the whole of the digital information relating to a given building. This wording especially applies to the digital information built and maintained at design time, but not only – it is relevant to the whole life cycle.

CEN Tool

Energy Simulation tool according the NEN52016. Is capable of using label information as input for simulation. Requires an IFC file to calculate the energy KPI.

Dashboard

It is a visual representation of the most important information required to reach one or more goals, consolidated and arranged in a single screen so that the information can be viewed all at once. Within the Streamer tool, the screens have a similar function.

Early Design Configurator

The Early Design Configurator, EDC for short, is an application developed by the Karlsruhe Institute of technology that iteratively generates possibly design layouts that conform to the program of requirements, building form and the design rules. The generated designs are then exported as IFC files for further evaluation in the STREAMER project.

Eureka©

It is a web-based search engine developed in ASP.NET that allows users to perform free-text queries on the data stored in the SACS© database, performing real-time reports.

KPIs

Key Performance Indicators.

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. KPIs quantify a performance category. In STREAMER, KPIs are selected taking into consideration the design solutions.

PoR

It is an ordered collection of data about an organization's spatial needs and the performance required in respect of the site, building, rooms, parts of the building and facilities in the building and on the site [Voordt 2005].

SACS©

It is an Italian acronym that means system for the analysis of the hospital spaces.

It is a software that drives Autocad to manage and analyse digital plans of hospital buildings coded on specific layers. It maps Departments, destinations of use, healthcare technologies and environmental comforts, grouping the information by single room and homogeneous area. System outputs can be used by top-management as a decision-support aid to assess parameters to improve the hospital structure and organization.

Contents

1. Introduction and scope

The Task 7.3 – this report and the previous one (D7.5) are its outcomes - is targeting a demonstration project in Careggi Academic Hospital in Florence (Italy) focusing on the optimisation of the district-level planning and management of energy production.

A prototype Semantic BIM-GIS model - based on the (design and lifecycle) information from AOC for the purpose of case study - has been developed.

STREAMER tools integrated into the **SACS© informative system** will facilitate and validate both the design decisions related to the energy related features and those ones related to the monitoring and management of the functional, technical and organizational information of the Careggi Healthcare District.

The aims and goals of the Task are:

- the use of the STREAMER knowledge to guide the choice between retrofitting and demolition/rebuilding of the older building of the San Luca complex; the complex consists of three different buildings of different age, and one of them - the San Luca Vecchio building - is taken as use case for validating the research results;
- the development of the SACS© system - according to the STREAMER results - to take into account energy, applied on a single building at first, then possibly extended to the entire district;
- the optimisation of a better district-level planning and management of energy production.

This deliverable includes two main sections reporting respectively the output achieved working on the demonstration project and the results of the workshop carried out in Careggi on the 28th of November 2016.

The first section (Chapter 2) reports the results achieved so far applying the STREAMER tools in the Careggi case study and testing procedures and protocols for the integration of the STREAMER tools into the SACS© system.

The second section (Chapter 3 and Appendices) is focused on the results reached and the feedback generated during the validation workshop organized by the Italian partners and carried out in Careggi.

2. Output from STREAMER Italian case study

2.1 Background

The information contained in this paragraph has been extracted from D7.5 “Real case in Italy: Description and outlined design plan” (delivered on the 28th of February 2015).

The technical work done after that delivery date is described in the remaining paragraphs of section 2.2 onwards.

Six months after the beginning of the STREAMER research, considering the planning of future interventions on the estate, the AOUC has chosen to use the oncology centre named “San Luca”, which consists of three buildings, as the case study for validating the research results (Fig. 1).

The oldest of the three buildings, the San Luca Vecchio, has been built in the 1960’s and it is arranged according to a simple layout on three floors. The plan is characterized by a core and two opposite wings. This allows a proper distribution of functional areas within the building, and an easy implementation of the MEP systems, which trace the functional organization of spaces. The other two buildings, San Luca Nuovo and San Luca Volano, have been built in recent times (15 years ago the first one, and around 2012 the second one).

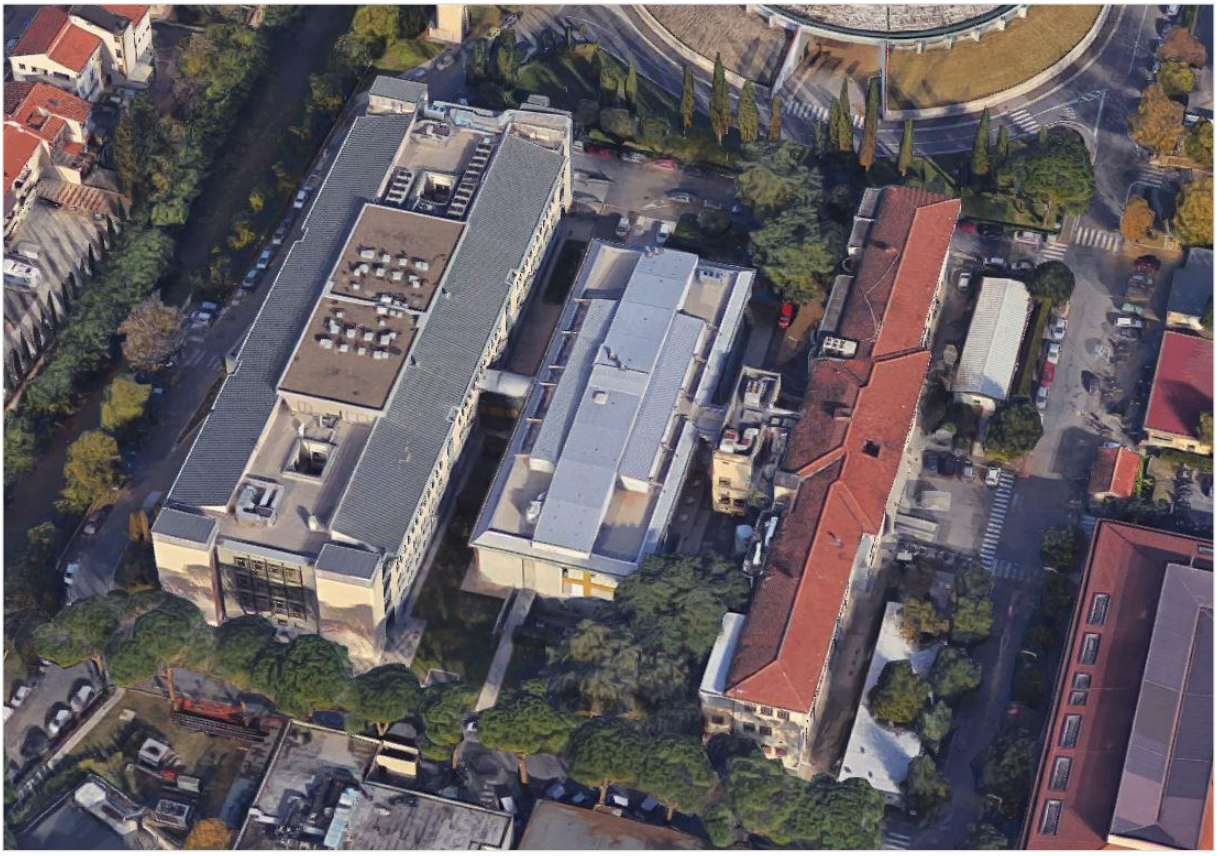


Fig. 1 - San Luca complex aerial view today

The STREAMER knowledge has been used to achieve the following objectives:

1. the enhancement of the SACS© (see paragraph 2.2) to take into account energy, applied on a single building at first, then possibly extended to other ones,
2. the evaluation of the older building, relying on BIM (definition and planning of building intervention),
3. the development of a better district-level planning and management of energy production.

The work has been settled according to a four-step approach defined within the Florence technical session report of WP7, which lists the steps as here follows:

Step 1: Identify buildings and use cases.

Step 2: Identify and define the information for BIM necessary for the uses cases.

Step 3: Choose the KPIs.

Step 4: Map the STREAMER tools and third-party tools that will be used.

Therefore, STREAMER becomes a strategic tool to make the choice between renovation or demolition/rebuilding of the San Luca Vecchio, based on energy efficiency criteria. To build up the tool, it was firstly necessary to generate BIM and GIS models of the entire health district, and then to model the three buildings that constitute the oncology centre, according to different Levels of Detail (LoD). Thanks to the availability of data and plans contained in the SACS© database, a first model was developed and delivered to the partners of KIT – Karlsruhe Institute of Technology.

In order to get a LoD 1 block model of the complete health care district of the Careggi hospital in Florence, two different approaches were tested by KIT:

1. creating a city model according the CityGML standard;
2. creating a set of buildings according the IFC standard (Fig. 2).

Due to the different processes especially while assigning the geometry to the building (manually or automatically) and due to the different target models, there were differences between the models.

Fig. 2 - IfcBuilding and IFC BuildingStorey (KIT)

The next stage focused on the preparation of the three-dimensional model with LoD2 of the three buildings that constitute the San Luca complex, to be used as the basis for the implementation of BIM.

The AutoCAD Architecture 3D model of the three pilot buildings (containing the “architectural” layer and the “windows/doors” layer) was made and transferred into Archicad (Cigraph), the BIM software chosen to model the Careggi case study.

The BIM model contains the data obtained during the desk and field survey carried out on the chosen pilot site building regarding the MEP systems, building space and envelope (link to WP2), and on the layout (link to WP1). The survey was crucial as the information and data collected provide the basis for the development of the BIM-GIS model for the purpose of case study, practical validation and demonstration.

All the data related to energy consumption, dimension, equipment, etc., of the three buildings were listed, the desk survey was done and the field survey took place only for missing data such as the type of windows, the type of lamps, etc.

Each group of elements has been identified and all the different typologies of each element have been listed and described according to its characteristics. Therefore, a classification of these elements has been realized in order to define a coding system that could inform the space with relevant information for the STREAMER aim (the relevant information are attached to the spaces represented in the BIM). This work aimed to create a database of information that informs the BIM elements of the model with the codes defined within the table. Each code is assigned to each BIM element for providing useful data for the elaboration of future work such as an energy simulation.

The description of the hospital state of the art is enhanced by the adopted Key Performance Indicators (KPIs): this is true both for the strict correlation between KPIs description and BIM approach and for the potential that an evaluation of KPIs supports:

1. a better management of the facilities,
2. the supply of an effective tool to assist the designers,
3. the resulting benefits in terms of energy savings and emission abatement that can be achieved from a comprehension of KPIs.

The fundamental – and agreed - KPIs are completed with others (deliverable D3.1). The choice of a wide range of KPIs shall be related to the awareness that an acute-care healthcare district is a complex system that always requires a multi-faceted/multi-discipline approach. It is true that from the energy point of view, there are many precise tools available for the designer/energy manager to allow a strict control in real time of the variables that depend on the energy balance of the same district.

Finally, one of the main targets in the development of the demonstration case in Careggi District is the opportunity to improve, applying methodology and tools implemented in STREAMER, the SACS© system, including the assessment and management of energy efficiency and, potentially, some others management tools (for example a more effective management and control of the maintenance activities).

With this aim, the on-going work concentrates on the implementation of the BIM model, currently referred to one of the three buildings of the San Luca Complex, that is based on the data, information and CAD files available in the SACS© database.

During the implementation of the BIM model it has been analysed the possibility to develop its configuration (i.e. structure, classification and level of details of the BIM data) according to the possibility to increase and improve tools and functionalities of SACS©.

Within the plan for the development of the Careggi District, several areas and compounds will be analysed – taking into account both functional and financial aspects – to define strategies and policies.

It is expected that the knowledge and the tools implemented in STREAMER will also be used in the interventions to develop the San Luca Complex, for guiding the choice between retrofitting and demolition/rebuilding of the older building and to assess its suitability for the next destination considering the energy efficiency and the lay-out functionality.

For the other two buildings included in the case study (and later for the whole district), the aim is to enhance functionalities of SACS© including into its tool box data and procedures for assessing, validating and managing the energy efficiency during the planning and design stage.

2.2 BIM modeling

The modeling of the BIM and GIS of the Careggi case study was defined and made according to the needs of the research project and to the available data contained in the management system in use.

The healthcare district, indeed, is equipped with SACS© (an Italian acronym that means system for the analysis of the hospital spaces) together with a web-application called Eureka© which is a search engine for people and structures inside the hospital.

Eureka© is a web-based search engine developed in ASP.NET that allows users to perform free-text queries on the data stored in the SACS© database, performing real-time reports.

SACS© is a software that drives Autocad to manage and analyse digital plans of hospital buildings coded on specific layers. It maps Departments, destinations of use, healthcare technologies and environmental comforts, grouping the information by single room and homogeneous area. System outputs can be used by top-management as a decision-support aid to assess parameters to improve the hospital structure and organization.

The SACS© Microsoft SQL Server database includes different types of structured data, both structural and organizational. For each of the about 15.000 rooms of the 52 buildings of the hospital there is a detailed mapping of the surface, the volume, the electrical and air-treatment plants, etc. as well as the Department, the Activity Area (groups of physical spaces that share a healthcare activity) and the Operative Units (units that join together healthcare staff in relation to their medical activity) that make use of it.

SACS© has been the reference for defining the BIM of the case study and three different types of software were used - GIS, DEM and BIM - according to the different scale for the district and its buildings to be represented (fig. 3).

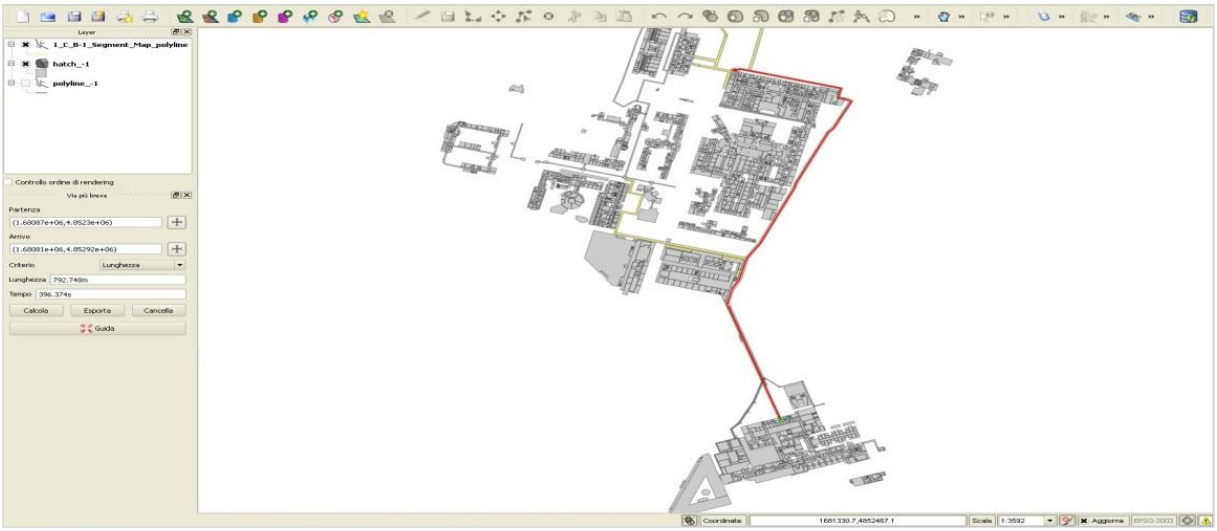


Fig. 3 - GIS modeling

Information contained in SACS© has been matched to the 3Dzone of the model: elements as medical equipment, HVAC terminals, etc. have been included in the model as data rather than single 3Dmodel objects.

The enriched and geo-referenced bi-dimensional SACS© files (dwg format) of each building of the district has been the base for building up the tri-dimensional model. The GIS and CityGML modeling has been useful for taking into account the orientation of the buildings and the types of networks of the district.

The San Luca Vecchio BIM model has been made using the software Archicad (Cigraph); it has been deepest detailed – for example libraries with all kind of walls and windows have been expressly made (fig. 4 and 5) – and, later, it has been simplified due to importing/exporting issues (fig. 6).

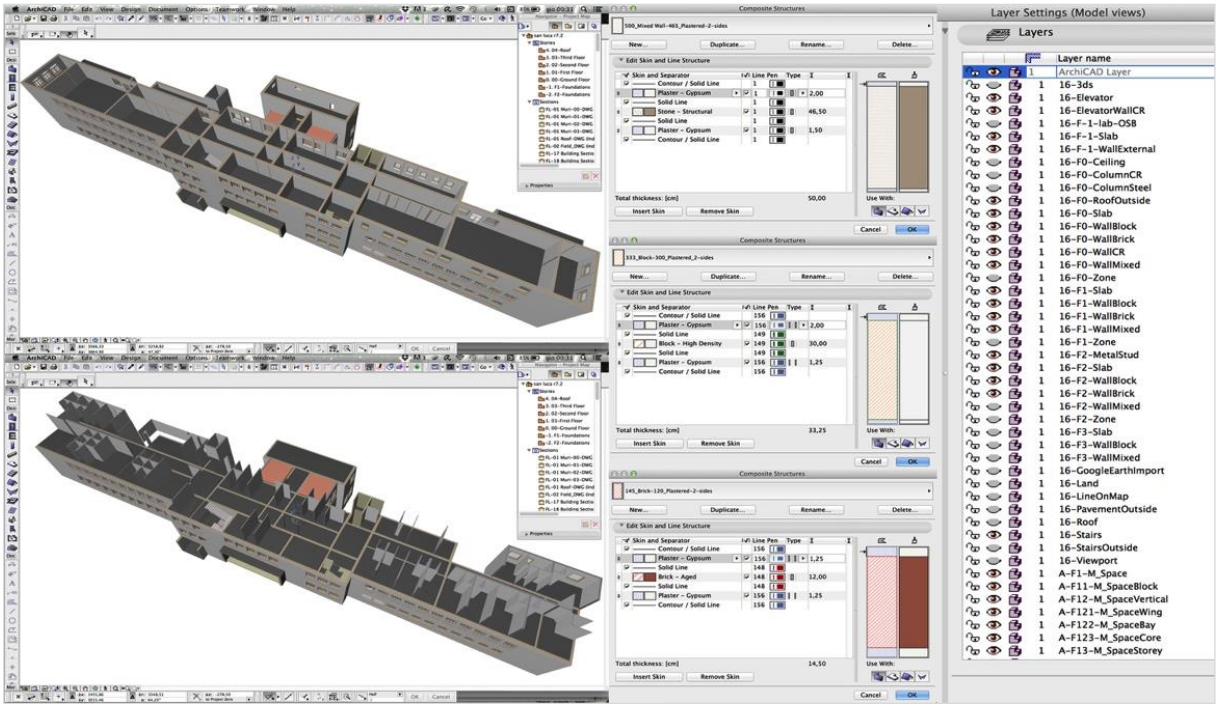


Fig. 4 – San Luca Vecchio first Archicad BIM model

Fig. 5 – San Luca Vecchio first Archicad BIM model

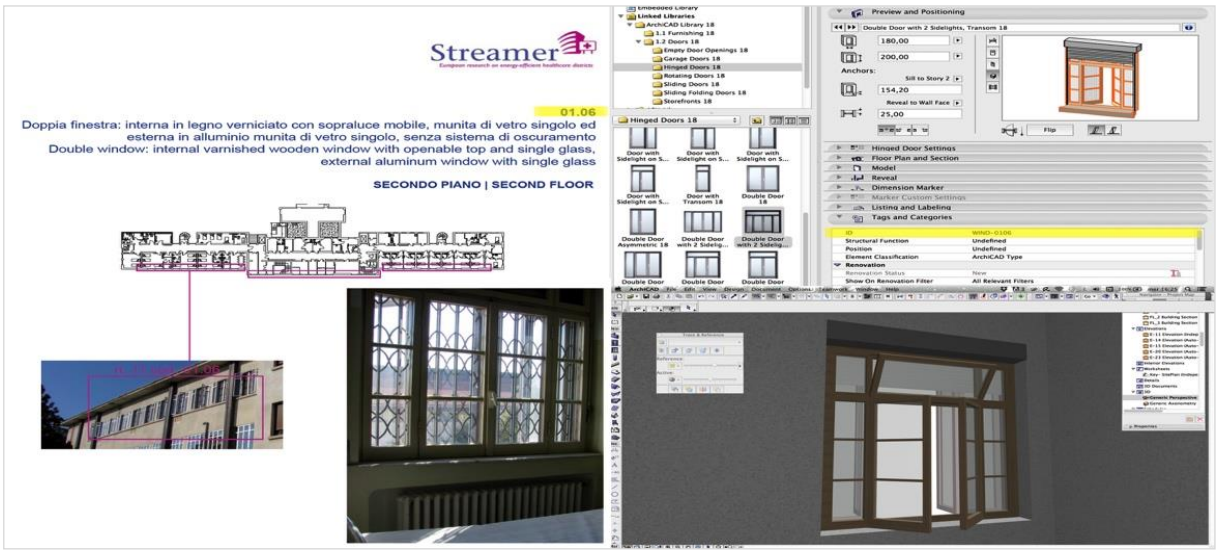


Fig. 6 – San Luca Vecchio simplified Archicad BIM model imported in Simergy Pro

2.3 PoR enriched by the STREAMER labeling system

The compatibility of the SACS© system with the STREAMER tools has been achieved matching the relevant classifications with clear correspondence. 284 types of room (named as “classi”) contained in SACS© have been paired to the 89 ones (named as “Room Type”) defined in the STREAMER vocabulary: thus the STREAMER standard label values (7 labels for each Room Type) are now describing the 15.000 rooms of the whole Careggi District (fig. 7).

CLASSE SACS	COD CLASSE SACS	STREAMER SPACE UNITS	Bouwcollege layer class	Hygiene class	AccessSecurity class	UserProfile class	Equipment class	Construction class	Comfort class
SO Chirurgia Generale	01_01	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
SO Chirurgia Specialistica	01_02	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
SO Ibrida	01_03	OperationTheatreHybrid	HF	H2	A3	U3	EQ6	C6	CT7
SO Chirurgia Ortopedica/Traumatologica	01_04	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
Preparazione Paziente/Risveglio	01_05	Holding	HF	H4	A4	U3	EQ5	C1	CT7
Preparazione Paziente/Risveglio	01_05	RecoveryRoom	HF	H4	A3	U3	EQ5	C1	CT7
Lavaggio e Preparazione Staff Chirurghi	01_06	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
Lavaggio Strumentario/Substerilizzazione	01_07	PreparationRoom	HF	H3	A5	U3	EQ1	C1	CT7
Filtro	01_08	AirLock	I	H3	A5	U4	EQ1	C1	CT6
Angiografia	01_09	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
Emodinamica	01_10	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
SO Sperimentale	01_11	OperationTheatreHybrid	HF	H2	A3	U3	EQ6	C6	CT7
Zona Relax Chirurghi	01_12	RestingRoomPersonnel	O	H2	A4	U4	EQ1	C1	CT3
Altro	01_99	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
T.I.	02_01	PatientRoomIntensiveCare	H	H2	A2	U4	EQ6	C1	CT4
Filtro	02_02	AirLock	I	H3	A5	U4	EQ1	C1	CT6
Lavaggio	02_03	PreparationRoom	HF	H3	A5	U3	EQ1	C1	CT7

Fig. 7 – Combination between SACS©® and STREAMER vocabularies

Then, a desk and field survey has been done to identify the seven existing label values of each room inside the San Luca Vecchio building. Both the default and the existing label values have been included in the BIM.

The survey pointed out the level of compatibility between the use and the characteristics of the rooms: the presence and the level of discrepancies have been considered during the definition of the refurbishment Programme of Requirements for satisfying the change of needs and the functional reorganization of the existing building.

The “concept design” defines the re-arrangement of the first floor (fig. 8), currently used as standard wards: a new layout is expected to host the following activities:

- Oncological Day Hospital (Haematology)
- Consultation and examination rooms for haematology and bone marrow transplantation

In addition to the change of lay-out, the refurbishment works include the retrofitting of facades and MEP systems for an improvement of the energy efficiency and the reduction of energy consumption. Facades will be retrofitted with an Exterior Insulation and Finishing System (EIFS) and the installation of new windows. Works on the MEP systems will include the installation of:

- heat pumps to replace the existing split system (including the complete removal of the old heat systems);
- an energy efficient lighting system.

The new PoR (fig. 8) and the expected label values have been included in the BIM (see D4.2 and D1.4 for further information related to the scenario and the approach of the case study).

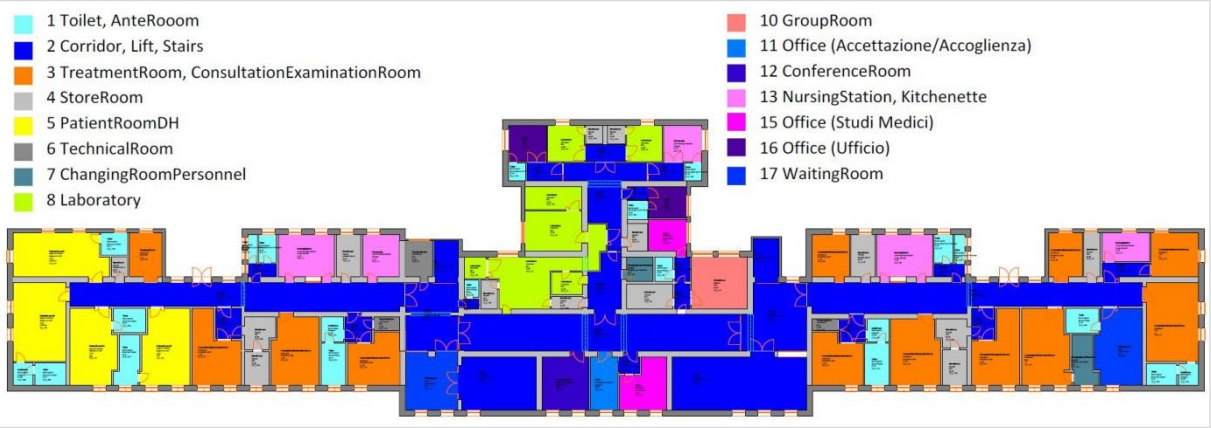


Fig. 8 – The new layout of the first floor of San Luca Vecchio building

2.4 Energy simulation and STREAMER tools

2.4.1 Introduction

The following software have been used and tested during the second and the last period of the research project; the long-lasting trial allowed to discard those ones ineffective or negative for the case study (fig. 9).

a. BIM modeling
   1. **Archicad** (importing *.dwg Autocad file format from SACS©)

b. Exporting - and processing - the output file
   1. **Revit** (importing IFC and exporting IFC+gbXML for the energy simulation) with Archicad Connection Plugin
   2. **SimpleBim** – Datacubist (importing IFC and exporting IFC validated and enriched with additional data)
   3. **Solibri** model Viewer – Optimizer (tool suited to reduce the IFC file dimension, required for the proper importation inside the Dashboard)

c. Energy simulation
   1. **Design Builder** (Energy Plus) – software selected for the case study
   2. Simergy – software tested - but not used - on the case study

3. Ida Ice – software tested - but not used - on the case study
4. ***CEN tool*** – TNO's software (still being processed and tested on the Careggi case study) aimed to be included inside the Dashboard

d. STREAMER tools

1. PoR

2. **Dashboard** (Decision Support Tool) – DEMO

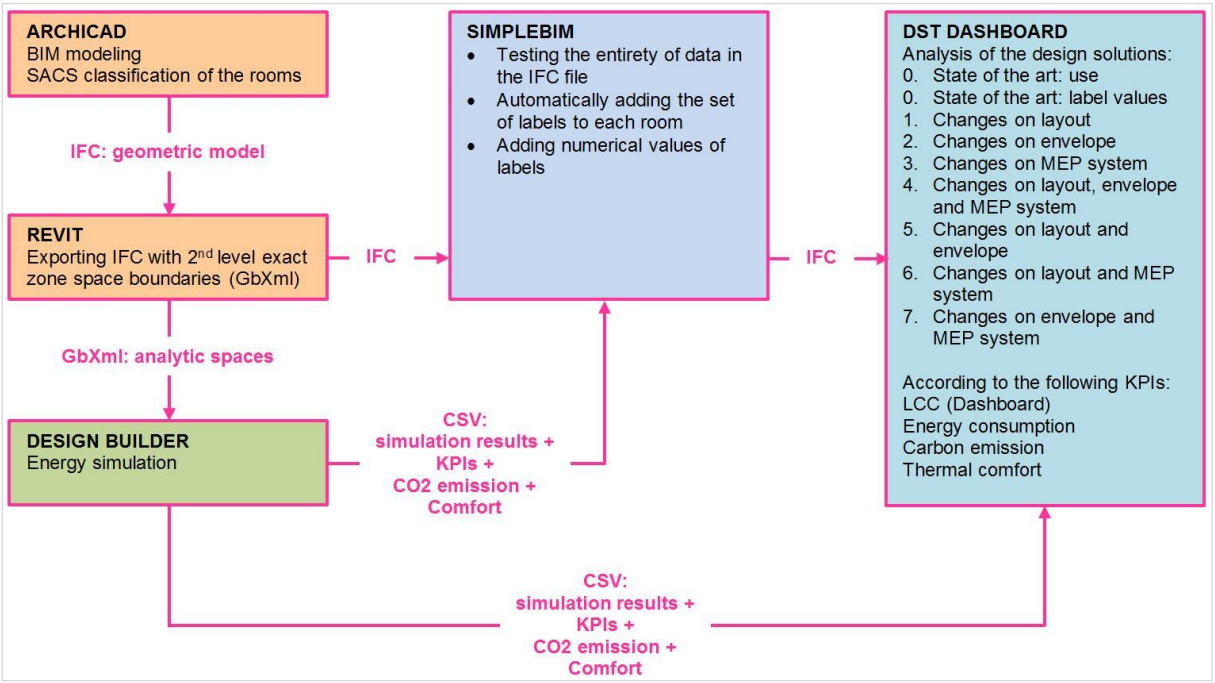


Fig. 9 – Process related to the exportation, energy simulation and KPIs addition for the case study

From a technical point of view, the Early Design Configurator could not be used for the Italian case study, because of its nature of retrofitting intervention. The EDC cannot import IFC files and existing constraints (stairs, lifts, bearing walls, etc.) cannot be settled.

The starting point was **not a simplified and standard model** made by the EDC but a **manually detailed model**. So, the goal of the case study turned into the merging of traditional tools with STREAMER innovative tools, EDC excluded.

The Dashboard, as part of the Decision Support Tools, has been designed to be able to import IFC files generated by the EDC. Those files currently comply with the IFC 2x3 standard, but with additional custom properties.

In order to carry on the work on the case study, a "bridge" software has been used to:

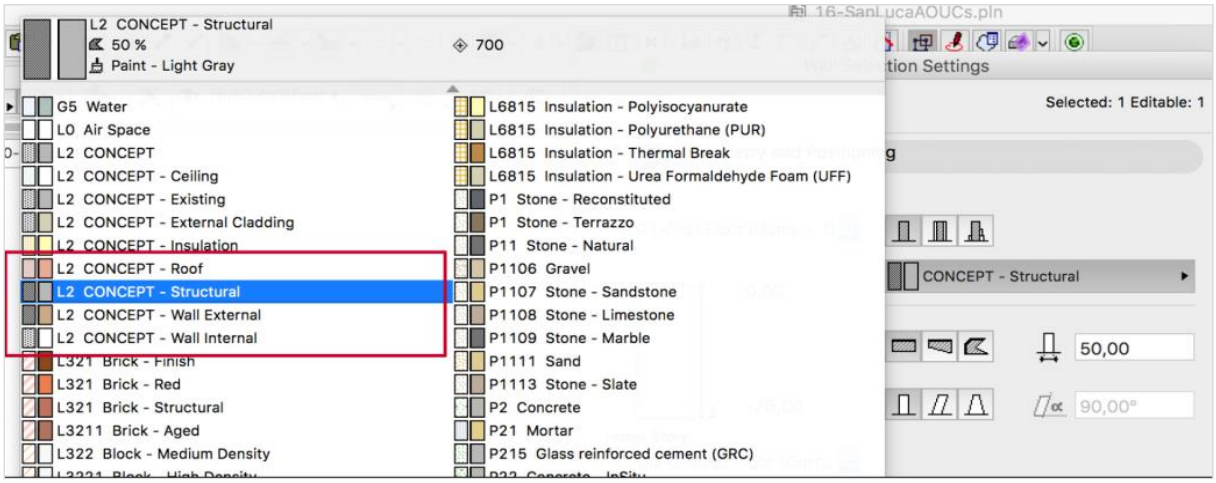
- verify the IFC exported from the BIM software (entirety of data),
- add automatically set of properties and properties to the IFC file in order to make it similar to the EDC exported file (see paragraph 2.4.7).

2.4.2 Archicad model

The first model of San Luca Vecchio has been made with Archicad. The resulting IFC were too different (more detailed) compared to the output of the Early Design Configurator therefore the model has been simplified. The easing process regards (fig. 10), for example:

- the use of simple frame for walls and floors (without layers);
- the division of the walls between outside and inside;
- the replacement of the windows and doors - manually made - with standard ones including the current features.

Fig. 10 - Distinction of the walls between outside and inside



2.4.3 Exporting IFC from Archicad

The settings shown in figure 11 have been used for the correct exportation of the IFC file.

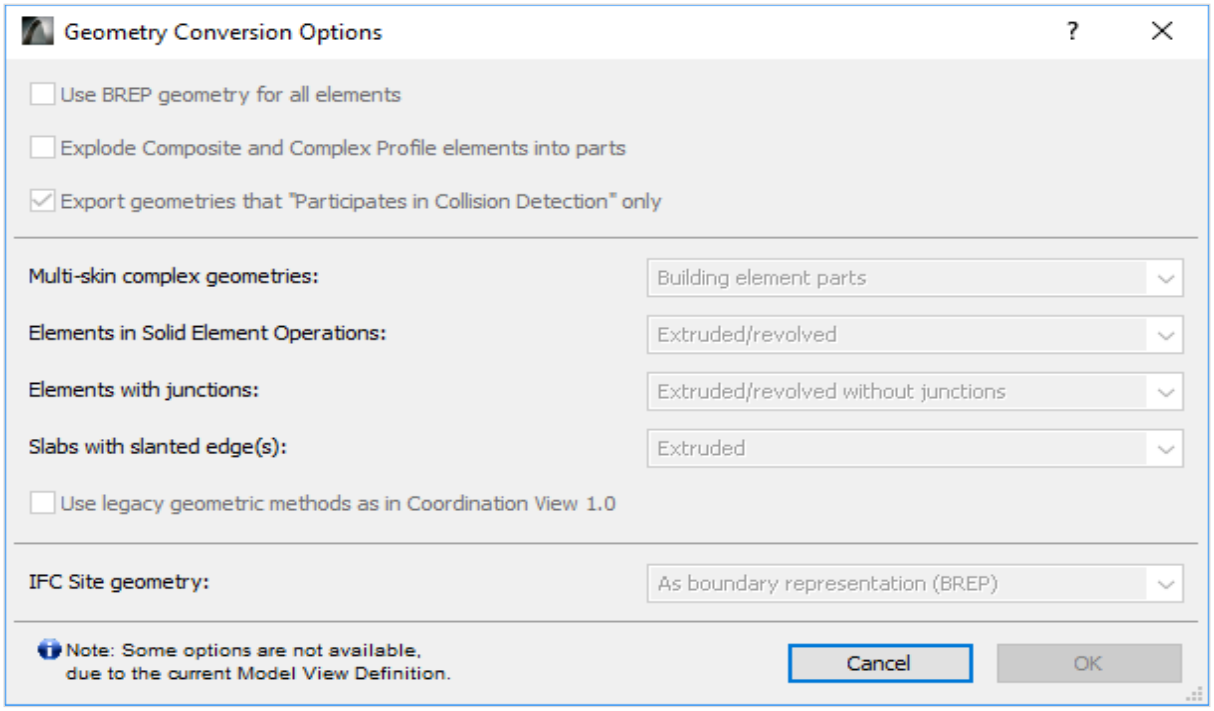


Fig. 11 – Options related to the geometry exchange

2.4.4 Importing and processing in Revit

Revit, instead of Archicad, has been the software used for the case study to:

- **exporting an IFC file containing the exact space boundaries** (feature suitable for almost the energy simulation software using IFC file format as input);
- **properly exporting the model made with gbXML analytical spaces** (feature required by Design Builder: energy simulation software chosen for the case study).

The model has been imported from Archicad to Revit via the Connection plugin (fig. 12) to preserve the IFC structure.

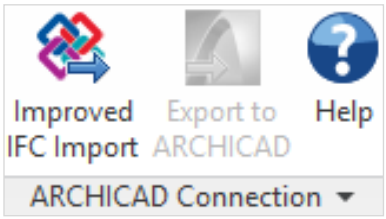


Fig. 12 - Improved IFC Import - Archicad Connection

2.4.5 Exporting gbXML from Revit

For being processed by Design Builder, the file exported in gbXML format from Revit (application unavailable in Archicad) has required the calculation of the analytical surfaces: that is the “collapse” of the layers of the materials in a single surface, usually corresponding with the center of the component itself. The physical characteristics and the performance of the component have been assigned to this theoretical surface via the energy simulation tool (fig. 13).

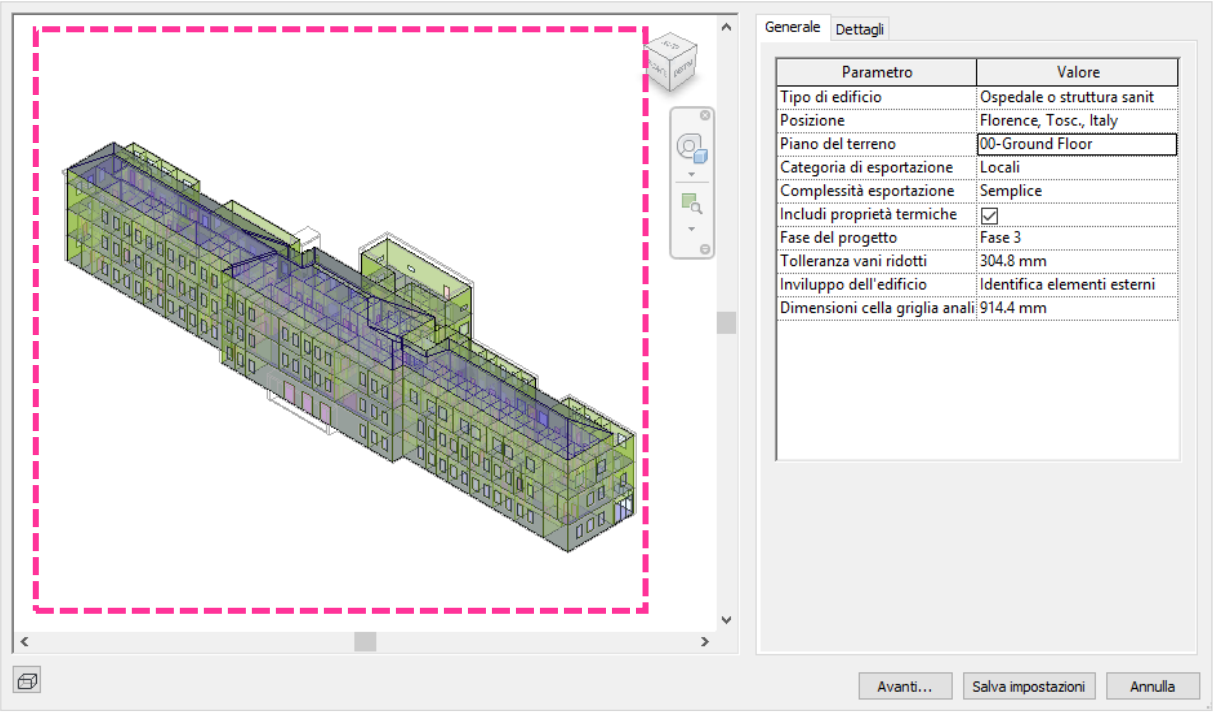


Fig. 13 - Exporting gbXML from Revit: in evidence the difference with the calculation of the analytical surfaces

2.4.6 Exporting IFC form Revit

Revit has also been used for exporting IFC with exact space boundaries to be processed by energy simulation tools as Simergy (fig. 14). Lots of tries has been made with Simergy but no certain results have been achieved due to its beta version and to the complexity of the model. The test related to the use of the only IFC file format for the entire process (using the CEN tool of TNO) is still in progress.

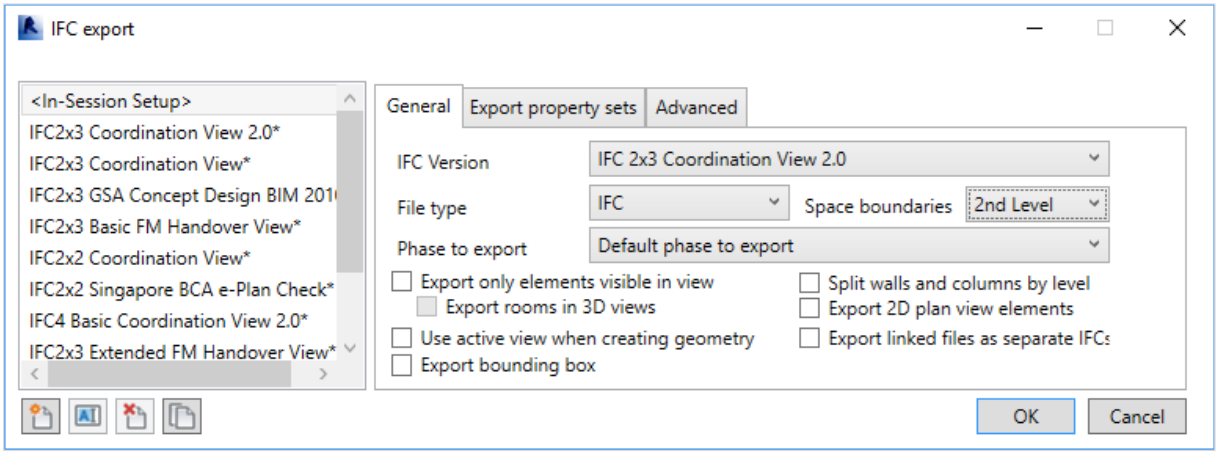


Fig. 14 – IFC Exporting window from Revit

2.4.7 Energy simulation with Design Builder (Energy Plus)

The energy simulation of an existing building is challenging due to interchange problems between BIM modeling software and energy simulation software.

In this case study, three applications have been tested to find the one mainly compatible with the process requirements:

1. **Simergy (Digital Alchemy) – (with Energy Plus simulation engine, the most common and accurate simulation** engine). **I**t has been developed to perform IFC format; the commercial version has been recently put on sale. It has been used to import simple models (it allows also the importing of space property-set, as energy simulation set point) but more complex models are uncontrollable especially regarding the boundaries of the rooms. It has been abandoned because of the outcome full of errors.
2. **IDA ICE**

   This software does not have the Energy Plus simulation engine. It has been tested to evaluate its capacity of importing the IFC file format: the result was lacking because only the geometry is imported.
3. **DESIGN BUILDER** – (with Energy Plus simulation engine)

   It is designed to be compatible with gbXML format, nor the IFC format. However, it is the only software able to manage properly the input from the BIM (BIM made with the only software - Revit - dealing with gbXML format). The gbXML format allows the correct and detailed energy simulation of a detailed model.

Therefore, the energy simulation has been done with Design Builder notwithstanding the importing issues. The exporting of the results has been made through .xls (or .csv) worksheet and, later, it has been associated to the IFC file with the Simple BIM software (see paragraph 2.4.8). Models regarding the occupancy, the use, the set point of temperature and the MEP systems (existing and based on the label values) have been made to ease the energy simulation (fig. 15 and 16).

The setting of requirements, occupancy and use related to each single zone have been combined and manually assigned to the San Luca Vecchio model based on the Bouwcollege Layers (Office, Hotel, Hot Floor, and Industry): this lack of automatic procedure is the biggest weakness of the chosen simulation process.

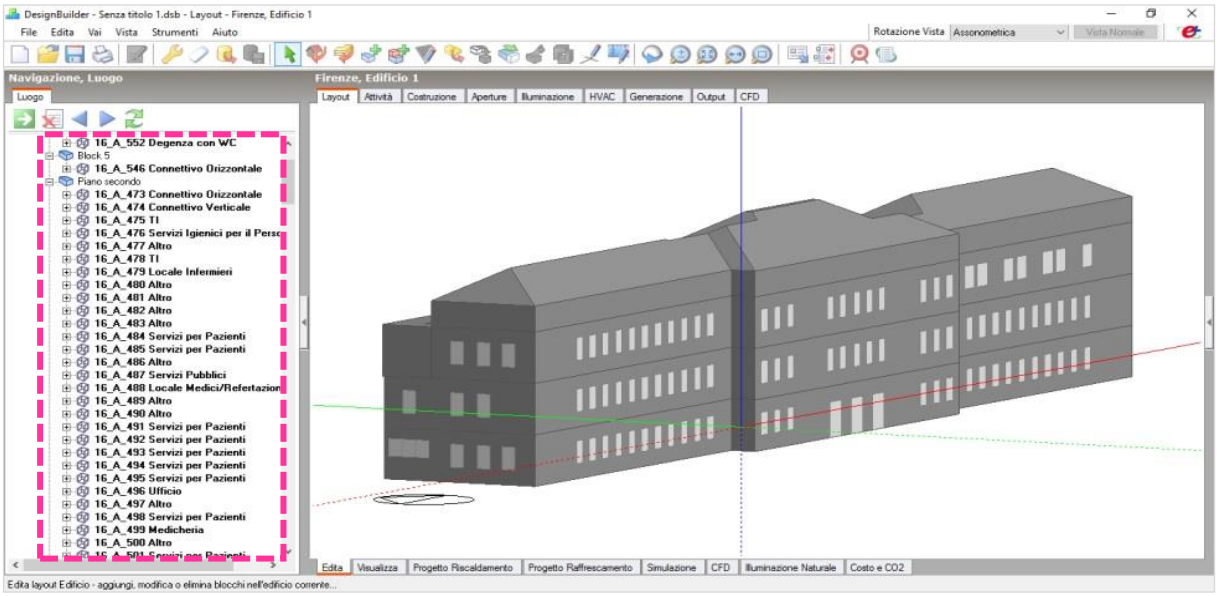


Fig. 15 – Importing the San Luca Vecchio model inside Design Builder.
The model contains the SACS© name and code of the rooms. The model is imported floor by floor.

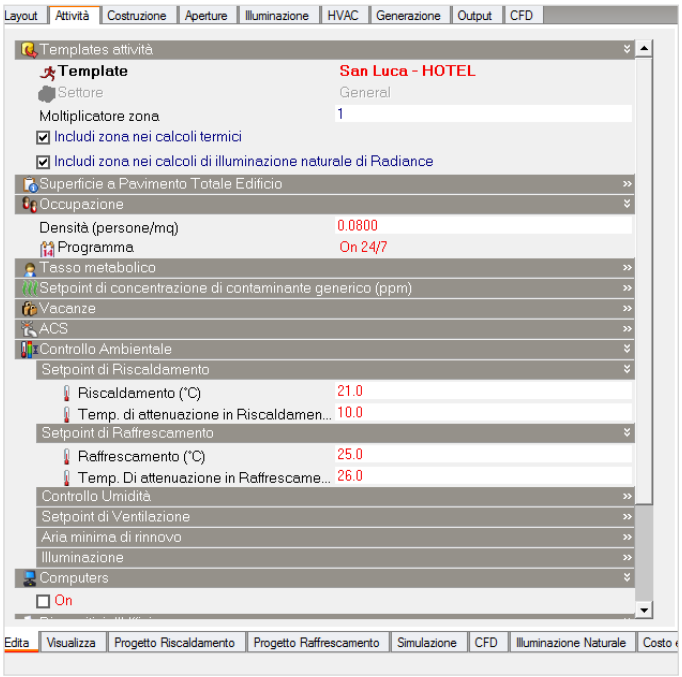


Fig. 16 – Building the models for occupancy, use and set point of temperature

One model with HVAC system with AHU (Air Handling Unit) and another model with radiators (heating system) and split (air conditioning) have been made in order to abridge the typology of existing MEP system.

Materials and components included in the model are those listed in Deliverable 7.5 and have been adjusted according to the planned retrofitting scenarios (fig. 17).

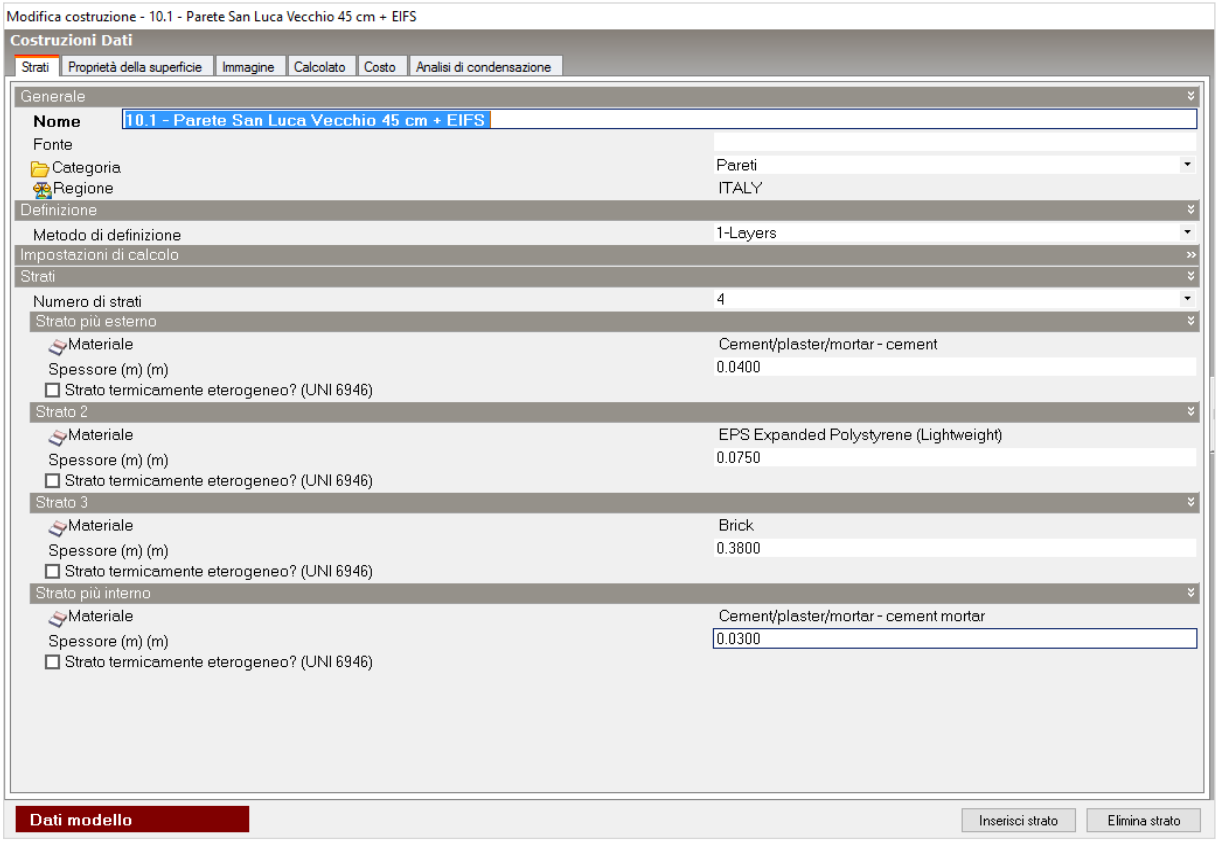


Fig. 17 – Example of model used for linking materials in Design Builder

The energy simulations aiming to validate the STREAMER process in the Italian case study have been done according to the following scenarios:

0. State of the art
0.1 State of the art with label values in each room
1. Changes on layout of the first floor
2. Changes on envelope
3. Changes on MEP system
4. Changes on layout of the first floor, envelope and MEP system
5. Changes on layout of the first floor and envelope
6. Changes on layout of the first floor and MEP system
7. Changes on envelope and MEP system

Design Builder provides also the calculation of two parameters processed by the Dashboard:

- the annual carbon emission (kWh/m^2/year);
- the thermal comfort (annual hours of deviations from comfort air temperature set point).

This data (see Appendix 1) has been included with SimpleBim or directly in the Dashboard.

2.4.8 Processing of the IFC file with SimpleBim

SimpleBim is software used to check the presence of information inside an IFC file. Meanwhile, it allows the enrichment of the IFC file with further data set: directly on the file by a graphical interface or applying models starting from an Excel file. In the process, the use of SimpleBim has been crucial due to various key functions:

1.

Control and check of the exported file, both from Revit and Archicad. There are many useless property sets, automatically exported, that make the file harder to be managed. This has been avoided using an Excel file (fig. 18) listing the following rules:

- **Model view**: it allows objects or properties to be included or excluded.
- **Validation**: it allows objects or properties to be set up (completeness test) and properties rules to be included (for example, the rule “the value must be > 0” can be related to the property set “Space”-“Area”).

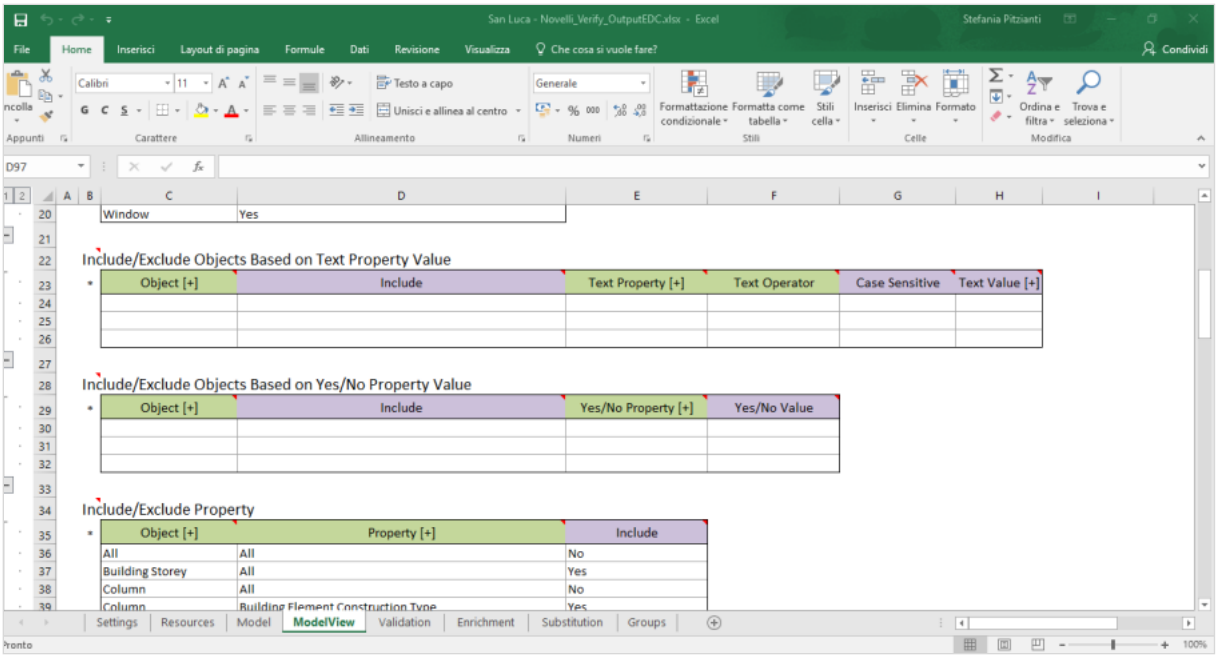


Fig. 18 – Excel file for SimpleBim validation

The worksheet has been then applied to the exported IFC file by using SimpleBim (fig. 19).

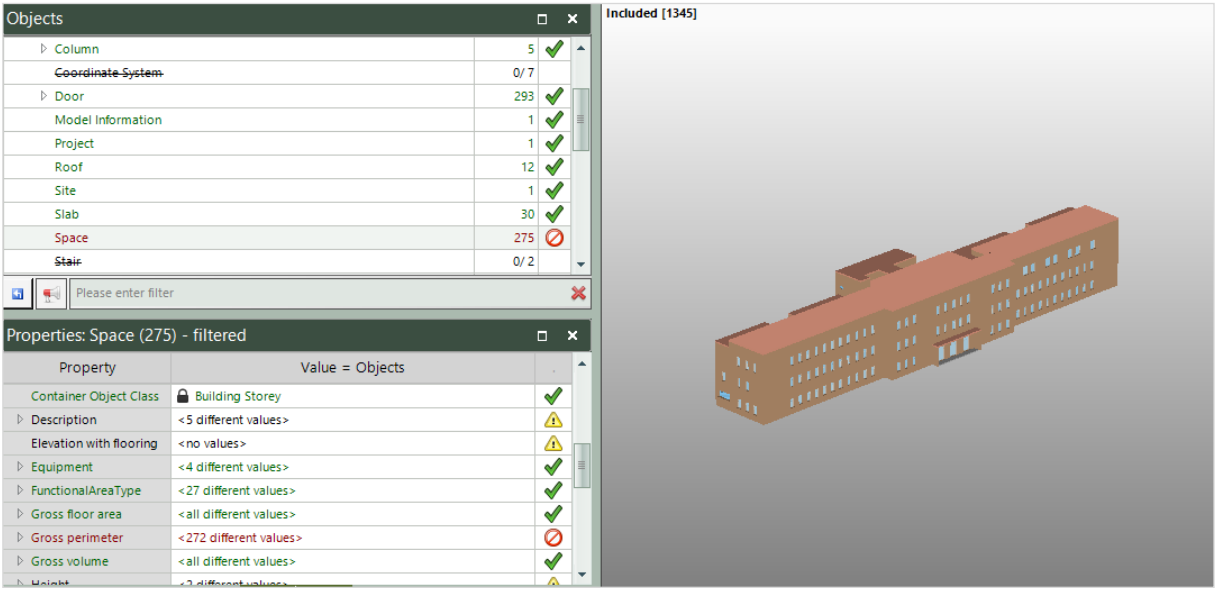


Fig. 19 – Validation rules applied to the San Luca Vecchio model

2.

Compatibility with the EDC output and link with PoR (labels added automatically). The software allows also the values to be changed/added in order to obtain an IFC file equal to the one exported from EDC.

The combined use of Excel worksheets and SimpleBim lets the label values to be automatically associated to every single room (fig. 20 and 21; see Appendix 2).

Identity Key	Name	PropertySet Name
BI:STREAMERPOR:RoomType	**RoomType**	STREAMER PoR
BI:STREAMERPOR:FunctionalAreaType	**FunctionalAreaType**	STREAMER PoR
BI:STREAMERPOR:Area	**Area**	STREAMER PoR
BI:STREAMERPOR:Amount	**Amount**	STREAMER PoR
BI:STREAMERROOM:Area	**Area**	STREAMER Room
BI:STREAMERLABELSPOR:AccessSecurity	**AccessSecurity**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:BowcollegeLayer	**BowcollegeLayer**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:HygienicClass	**HygienicClass**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:ComfortClass	**ComfortClass**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:Construction	**Construction**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:Equipment	**Equipment**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:UserProfile	**UserProfile**	STREAMER Labels PoR

Fig. 20 - Sample of worksheet for adding properties

Object Or Group [+]	Space						
Property Name or Key	Space Number	Room Type	FunctionalArea Type	Amount	Bouwcollege Layer	Hygienic Class	Access Security
Operator	Match = equals	Set	Set	Set	Set	Set	Set
	16_A_001	ConferenceRoom	ConferenceRoom	1	O	H2	A2
	16_A_001a	Corridor	Corridor	1	H	H1	A1
	16_A_001b	Toilet	Toilet	1	I	H4	A2
	16_A_001c	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2

Fig. 21 - Sample of worksheet for adding properties (room type and labels)

3.

Adding numerical values related to the labels.

The file resulting afterward the second step is a file including the geometry, the materials and the rooms drawn by Archicad but enriched with labels. The flexibility of the software has given the further opportunity of including numerical values correlated to labels: a second worksheet containing temperature set points, ventilations, occupancy, etc. has been imported in the model (fig. 22 and 23).

The IFC file obtained by this process can be easily imported in other energy simulation tools (Simergy or CEN).

Object Or Group [+]	Space				
Property Name or Key	Comfort class	Space Temperature Min	Space Temperature Max	LightingRequirement	Mechanical VentilationRate
Operator	Match = equals	Set	Set	Set	Set
	CT1	<no value>	<no value>	NOTDEFINED	<no value>
	CT2	<no value>	<no value>	DIRECT DAYLIGHT	<no value>
	CT3	20	<no value>	DIRECT DAYLIGHT	10
	CT4	20	24	DIRECT DAYLIGHT	10
	CT5	20	24	DIRECT DAYLIGHT	10
	CT6	18	24	NOTDEFINED	18
	CT7	18	24	NOTDEFINED	60
	CT8	<no value>	<no value>	NOTDEFINED	<no value>

Fig. 22 - Sample of worksheet for numerical values (temperature set points, etc.)

Object Or Group [+]	Space	
Property Name or Key	User Profile	OccupancyTimePerDay
Operator	Match = equals	Set
	U1	10
	U2	12
	U3	10
	U4	24

Fig. 23 - Sample of worksheet for numerical values (occupancy)

2.4.9 Using the Dashboard

The final step of the process has been the comparison among the solutions analysed with the Dashboard.

The Dashboard can upload IFC format models (currently belonging only to the STREAMER standard) and supplementary information (energy consumption values or further KPIs) aiming to a better assessment.

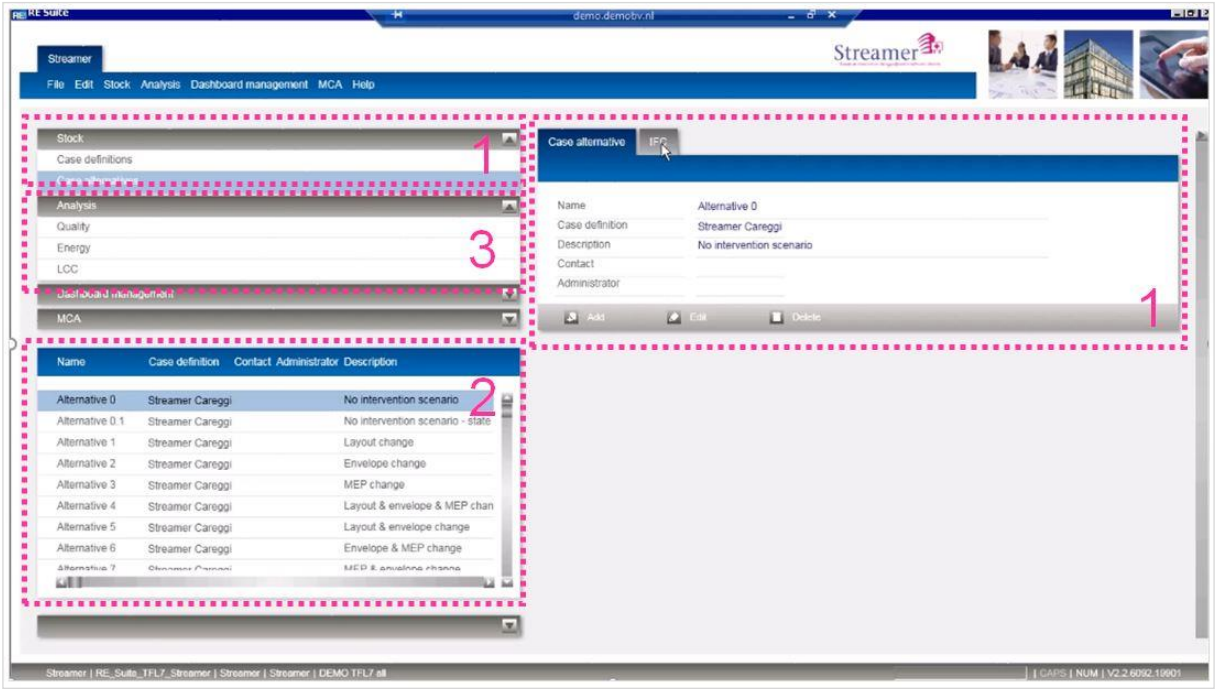
As previously listed, the solutions/scenarios considered for the San Luca Vecchio have been:

0. State of the art
0.1 State of the art with label values in each room
1. Changes on layout of the first floor
2. Changes on envelope
3. Changes on MEP system
4. Changes on layout of the first floor, envelope and MEP system
5. Changes on layout of the first floor and envelope
6. Changes on layout of the first floor and MEP system
7. Changes on envelope and MEP system

The set of KPIs chosen for evaluating the solutions has been:

a. **Thermal Comfort** (data obtained by the energy simulation) - Quality
b. **Energy consumption** (data obtained by the energy simulation)
c. **Carbon emission** (data obtained by the energy simulation)
d. **Life Cycle Cost** (data obtained with an internal tool of the Dashboard that correlates the cost to the surface and the labels of every single room. Currently the costs are referred to the Dutch Legislation but the improvement of the reference values concerning other European Countries is expected) (fig. 24 and 25).

Fig. 24 - Initial screen of the Dashboard



1. Identification of the case study
2. Scenarios analysed
3. KPIs used for the comparison

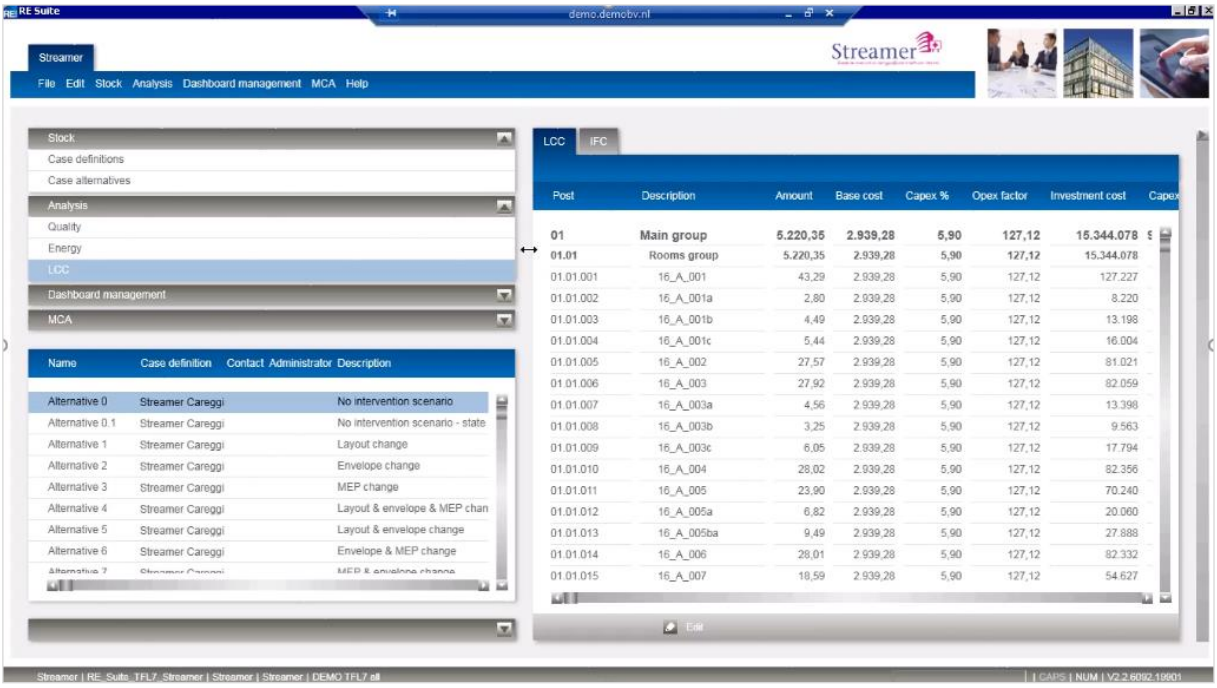


Fig. 25 - LCC calculation of the Dashboard

A rating scale has been given to each parameter. The analysis based on these KPIs can be visualized as well as related graphics (fig. 26).

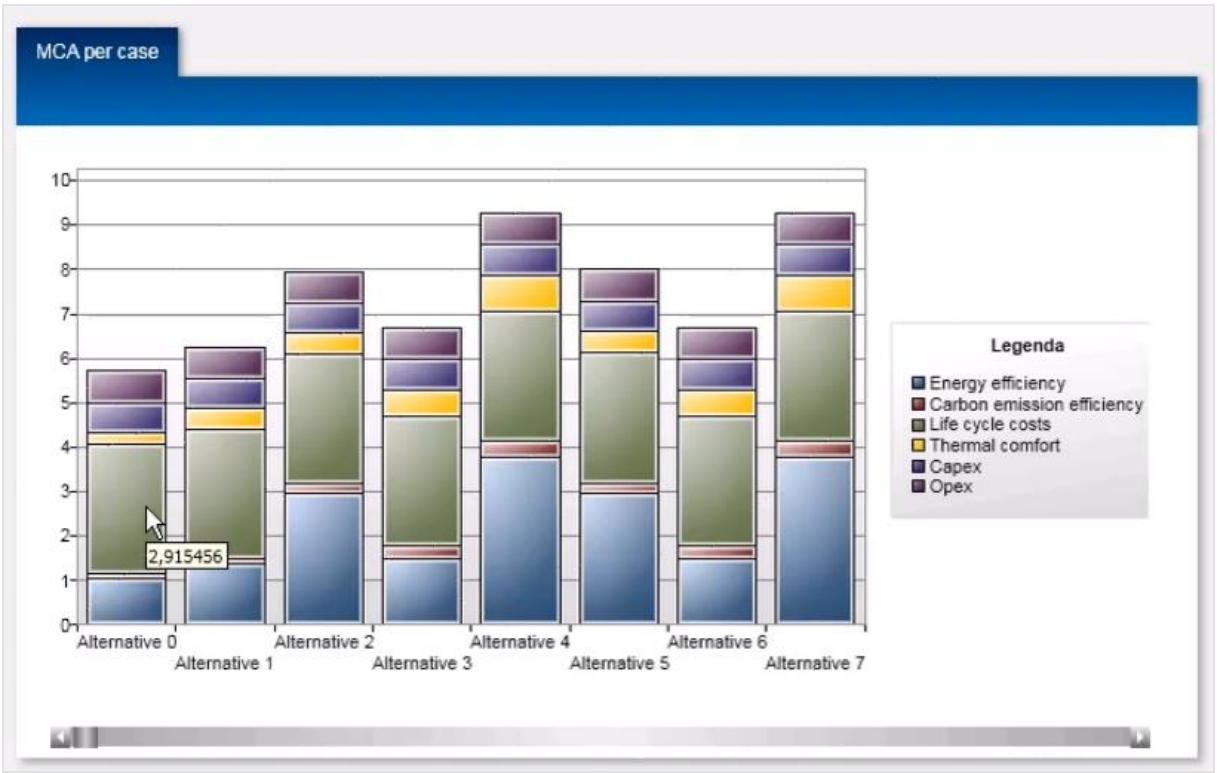


Fig. 26 - Graphical comparison among scenarios

2.5 SACS© System

The improvements done - and to be further increased – on the SACS© system concern the extension of its functionalities of including the assessment and management of energy efficiency and, potentially, some others management tools (for example a more effective management and control of the maintenance activities).

With this aim the work done so far has been focussed on the implementation of the BIM model, currently referred to one of the three buildings of the San Luca Complex, that is based on the data, information and CAD files available in the SACS© database.

During the implementation of the BIM model it has been analysed the possibility to develop its configuration (i.e. structure, classification and level of details of the BIM data) according to the opportunity to increase and improve tools and functionalities of SACS©.

This work required - and it will require in the next months - the implementation of specific interfaces for the interoperability between the software and many of the tools currently used in SACS©, those ones developed in STREAMER and other specific existing software for energy simulation. Some of the existing features in SACS© could be exploited by using existing data (e.g. area, volume, height) for automated calculations in third party energy efficiency algorithms and software. These data are available for each and every room in the whole hospital (Fig. 27).

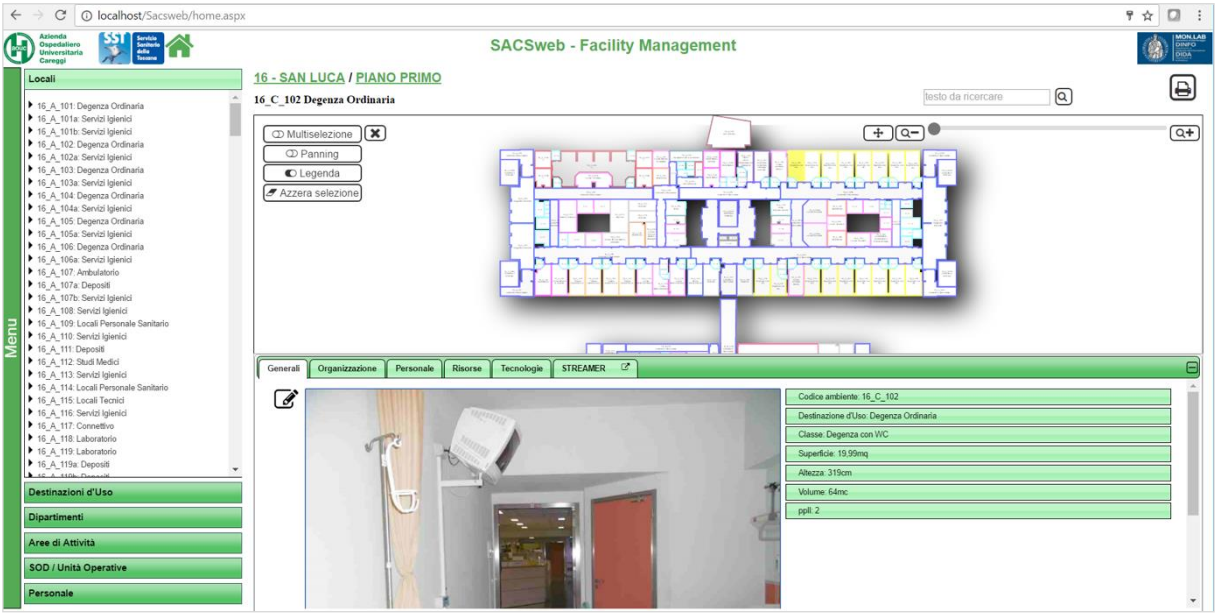


Fig. 27 - Screenshot of room details in SACS©

A dedicated Streamer section is visible in figures 28 and 29. It includes a navigable 3D BIM model of the whole building floor, as well as all the data pertinent to the Streamer classification.

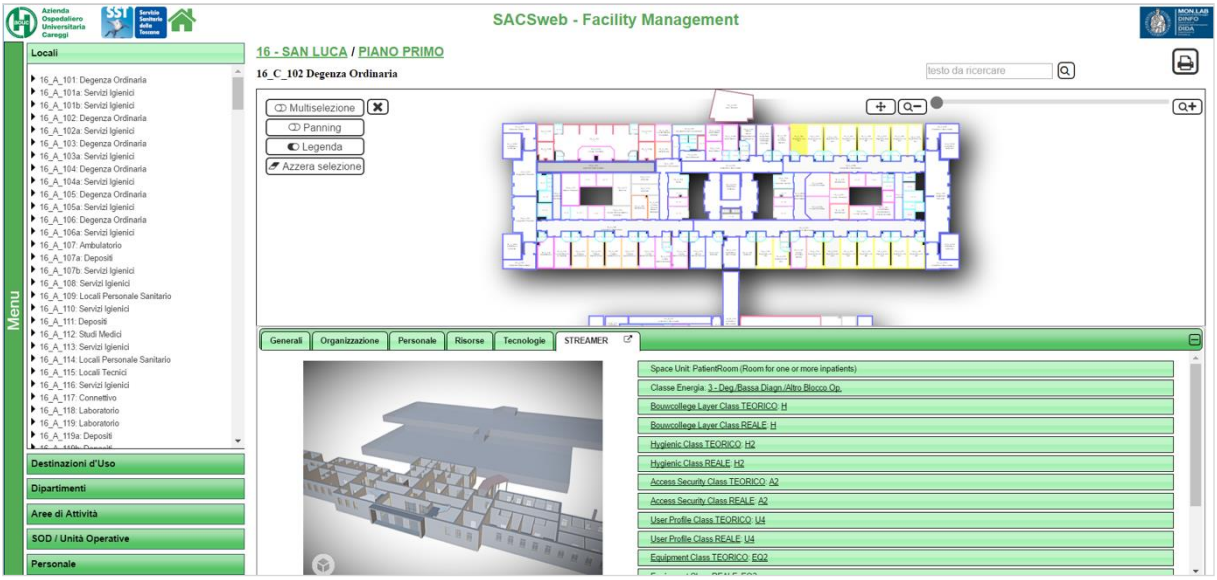


Fig. 28 - Streamer dedicated section in SACS©

Fig. 29 - 3D Navigable BIM model

All the voices listed in the abovementioned Streamer section can be clicked in order to get access to the deepest detail levels, mastering information about energy class, Bouwcollege layer class, hygienic class, access security class, user profile class, equipment class, etc. (see Fig. 30).

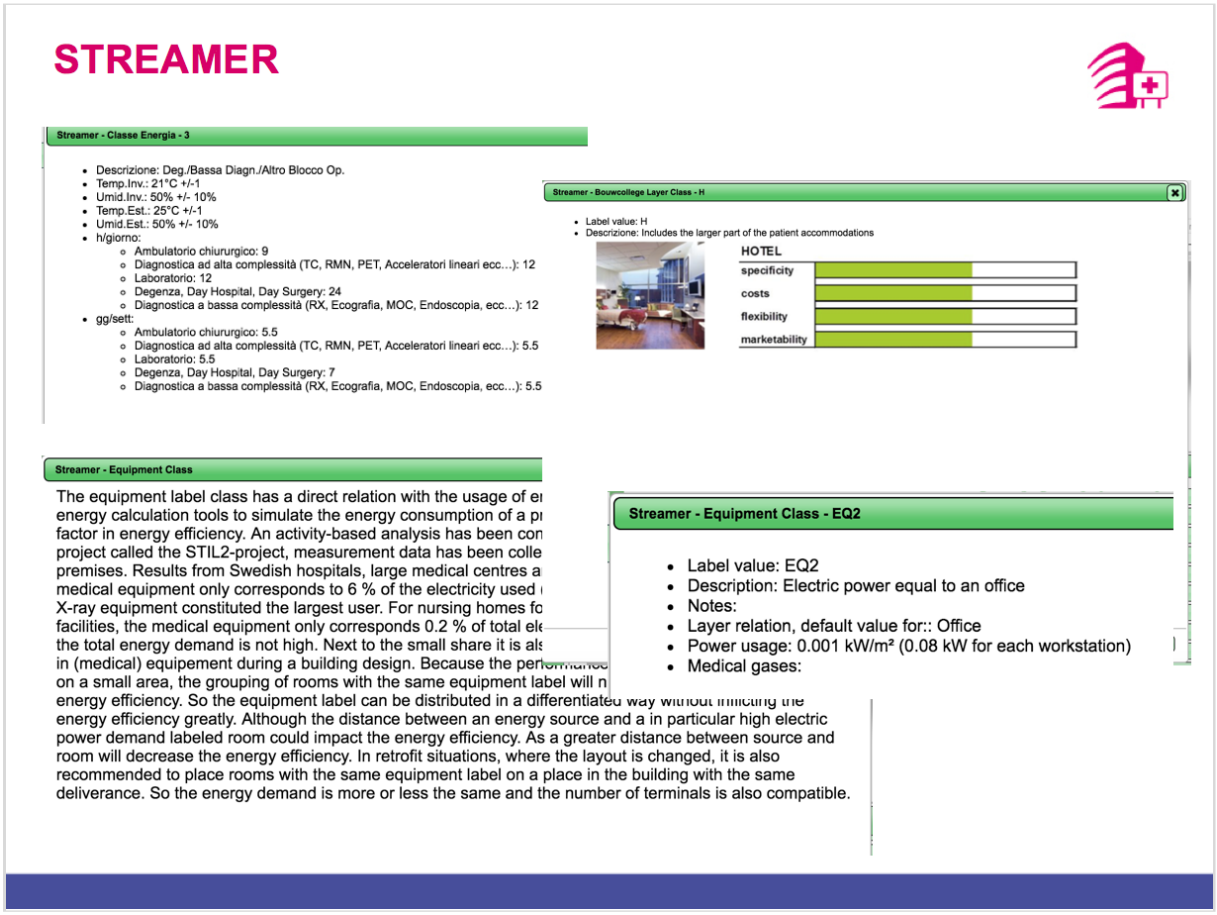


Fig. 30 - Details about Streamer classification and description of the rationale, for each room.

All such data may be conveniently pooled, in order to produce very complex and complete analyses including graphs, stats and numerical reports. The Eureka© search engine (included in SACS©) should also, advantageously, be made able to access all the Streamer data to perform complex queries like “show all the hospital rooms having Layer Class H and with a power usage higher than 0.002 kW/m^2”. Such a capability, properly provided with machine learning techniques, could be a tremendous added value at every stage of planning and management.

It is expected that the results achieved will be tested in the project for the refurbishment and retrofitting of the San Luca Complex using the extended version of SACS© for assessing, validating and managing the energy efficiency during the planning and design stage.

2.6 Conclusion

The outcomes of the strong, sometime frustrating, research activity just described are effective and promising. The last months of the research will be used to enhance the performance of the Dashboard in retrofitting cases, especially the working link with the CEN tool, and to implement the STREAMER tools into the SACS© Systems.

3. Outcome of the Italian workshop

3.1 Background

Due to organization and availability issues, the pre-workshop scheduled for November was cancelled. The goal of the pre-workshop was the planning of the two workshops to be held during the 2016. The planning was done informally among the Italian partners.

AOC also decided to match the two workshops in only one to be held in November the 28th: on March the demonstration could be only partial and the feedback to be achieved could be more productive and focused if related to final results. Moreover, due to the complicated procedure peculiar of a Public Body as AOC, it was preferable to organize one complete (technical and application) workshop instead of two.

However, on the 15th of March 2016, Luca Marzi, Sergio Leone and Thorsten Lang were carrying out a four-hour professional training course on BIM made for internal employees (technical managers and personnel). Two hours was spent to show the STREAMER research and the Italian case study. The feedback from the participants has been very useful for the work that was done during the following months.

3.2 Workshop themes

Presentation of the STREAMER project and the role of AOU Careggi: the perspective of the «STREAMER enhanced» BIM approach in the healthcare field.

Demonstration of new processes and new tools validated on the Careggi case study and development of the functionality of the SACS© system according to the STREAMER results: exchange of the knowledge between the Italian STREAMER partners and other Italian professionals and actors.

3.3 Targeted audience and actual attendees

Written invitations (fig. 31) were individually e-mailed to 85 persons (professionals, technicians, managers, etc.) members of 28 companies/institutions operating in the field of health, architecture and engineering.

46 of them participated to the workshop, as listed in table 1 (the names of the researchers directly involved in the project have been highlighted in bold). The signed list of the attendances is reported in Appendix 5.

Fig. 31 - Invitation

Table 1

GUEST LIST
STREAMER Italian partners
AOUC Careggi (Academic Hospital)
√ **Arch. Filippo Terzaghi**
√ **Eng. Andrea Giuntini**
√ Arch. Giano Ardinghi
√ Eng. Andrea Belardinelli
Eng. Maria Giuliana Bonaviri
√ Arch. Antonella Gesualdi
√ Mr. Massimo Mocali
Eng. Daniele Novelli
Arch. Massimo Novelli
Arch. Giuseppe Petti
Eng. Agnese Pieracci
Eng. Francesco Tinti
University of Florence (Third part)
√ **PhD. Beatrice Turillazzi**
√ **PhD. Luca Marzi**
√ **PhD. Ernesto Iadanza**
Prof. Roberto Bologna

GUEST LIST

√ Eng. Alessio Luschi
Arch. Francesco Napolitano
Arch. Daniele Donatini
√ Arch. Leone Pierangioli

Ipostudio architetti

√ **Prof. Roberto Di Giulio**
√ **Prof. Carlo Terpolilli**
√ **Arch. Lucia Celle**
√ **PhD Luca Belatti**
√ **Arch. Panfilo Cionci**
√ **Arch. Ilaria Brogi**
√ **Arch. Agnese Cacciamani**
√ **Arch. Thorsten Lang**
√ **Arch. Sergio Leone**
√ **Arch. Barbara Vanni**
√ Arch. Elisabetta Zanasi Gabrielli
√ PhD Mariagiulia Bennicelli Pasqualis
√ PhD Luigi Vessella

Becquerel Electric

√ **Prof. Giacomo Bizzarri**
√ **Arch. Stefania Pitzianti**

PUBLIC HEALTHCARE SERVICES

Tuscany Regional Healthcare Service

√ Mr. Luca Radicati

AO Siena (Hospital)

Arch. Silvio Marsicano

AO Pisa

Eng. Rinaldo Giambastiani

AOU Meyer (Pediatric Academic Hospital)

Eng. Giovanni Grazi

USL Centro (Mid-Tuscany Healthcare service)

√ Eng. Niccolò Bellandi
Eng. Manuele Dell'Olmo
Eng. Luca Meucci
√ Eng. Andrea Rossi

USL SudEst (South-East Tuscany Healthcare service)

√ Eng. Gilberto Cristofoletti
Eng. Daniele Giorni
Arch. Alessandro Lenzi
√ Arch. Sabrina Palleggi
Eng. Giuliano Stecchi

USL NordOvest (North-West Tuscany Healthcare service)

Eng. Stefano Maestrelli

GUEST LIST

CONTRACTORS

GESIN (Facility Management Services)

√ Mr. Alessio Fabbri

√ Mr. Enrico Buracchi

SENECA (Energy distribution)

√ Dott. Massimiliano Magherini

√ Eng. Carlo Mattarocci

√ Eng. Roberto Sodini

CET (Energy distribution)

Eng. Luca Perni

INSO (Construction Company)

Arch. Raffaele Di Marco

Eng. Fabrizio Pucciarelli

CMB Carpi (Construction Company)

Eng. Giovanni Gallo

Arch. Ruben Saetti

ARCHITECTS, ENGINEERS AND ADVISORS

Florence Board of Architects

√ Arch. Mario Perini

CSPE Firenze

Prof. Romano Del Nord

Prof. Paolo Felli

√ Arch. David Matteoli

Binini partners Reggio Emilia

Arch. Tiziano Binini

Studio Altieri Thiene

√ Arch. Alberto Altieri

MoMa studio Firenze

Arch. Massimo Moglia

Consilium ingegneria Firenze

Eng. Paolo Pietro Bresci

Eng. Leopoldo D'Inzeo

Ael progetti Firenze

Eng. Niccolò De Robertis

Politecnica Ingegneria Modena

Eng. Barbara Frascari

Arch. Claudia Romero

SOFTWARE HOUSES

Modula Informatica (Autodesk)

Mr. Antonio Miele

EXPERTS

SIAIS (Italian Society for Healthcare Engineering and Architecture)

Eng. Daniela Pedrini

TESIS Systems and Technologies for Healthcare and Social Facilities

PhD Maria Grazia Giardinelli

GUEST LIST	
	PhD Valentina Santi
STUDENTS	
Department of Architecture of the University of Florence	
	Mrs Paola Baldassari
	Mr. Mirco Castellani
√	Mrs. Flaminia D'Aria
	Mr. Niccolò Giannini
√	Mrs. Natasha Giardino
√	Mr. Franco Lombardi Romero
√	Mrs. Eleonora Macconi
	Mrs. Ilaria Marchione
√	Mr. Nicola Materazzi
√	Mrs. Carolina Nassi
√	Mr. Marco Sabatino

3.4 Workshop organisation / Agenda

AOC organized the workshop and was supported by IAA and BEQ. Lecturers and chairmen were personnel and researchers from AOC, IAA and BEQ. The seminar was in Italian language.

3.4.1 Date and location

Monday 28th of November 2016

09:00-12:30

Room 8

NIC Nuovo Ingresso Careggi

Largo Brambilla 3 Firenze

3.4.2 Agenda

WELCOME				
F. Terzaghi		10'	09:20	09:30
PRESENTATION OF THE STREAMER PROJECT				
Aims | Consortium | Description of Work Packages	R. Di Giulio	10'	09:30	10:35
STRATEGIES OF ENERGY EFFICIENCY IN THE HEALTHCARE DISTRICTS				
Energy efficiency in the Healthcare Districts	G. Bizzarri	15'		
RESULTS OF THE STREAMER PROJECT				
Labeling system | PoR | EDC | KPIs | Dashboard	R. Di Giulio	30'		
ROLE OF CAREGGI IN THE RESEARCH PROJECT				
Role | Energy policy | Chosen case study and SACS© system	R. Di Giulio	10'		
Coffee Break		15'	10:35	10:50

PRESENTATION AND DEMONSTRATION OF THE ITALIAN CASE STUDY

BIM-GIS Modelling of the District and the San Luca Buildings | PoR	L. Marzi	15'	10:50	12:00
Procedures of importation of the model	T. Lang	10'		
Energy simulation and use of the Dashboard	S. Pitzianti	25'		
SACS© system enhanced with STREAMER	E. Iadanza	20'		

DISCUSSION AND CONCLUSION

F. Terzaghi, R. Di Giulio and G. Bizzarri	30'	12:00	12:30

3.5 Minutes

The agenda of the meeting was carefully followed in contents and timing. During the **first part** (see Appendix 3 and figures from 32 to 34), after the welcome of Filippo Terzaghi and the Head of the Hospital staff, Andrea Belardinelli, the Italian partners presented an overview of the STREAMER research project - its consortium, aim, description of work and results achieved so far - together with a short communication about the strategies of energy efficiency in the healthcare field. The role of Careggi inside the project and the case study were shortly shown to introduce the subject of the second part after the coffee break.

During the **second part** of the meeting (see Appendix 4 and figures from 35 to 38), the Italian partners described the technical work done on the case study, more thoroughly regarding the use of the Dashboard (shown via video) and the SACS© system enhanced with STREAMER (shown via live demonstration). Even if the workshop was not interactive as the Dutch one - it has been traditional with some time for the audience questions - the attendees were very interested and receptive. Finally, AOC "twittered" the event on its Twitter social profile @AOU Careggi (figures from 40 to 44).

3.6 Feedback

The time for the questions of the attendees was short but they were fitting and productive for the work still to be performed during the last months of the research project; the following are the main issues that the questions and remarks have been related to:

- the way the STREAMER tools will be managing dynamic input (changing requirements, etc.);
- the way the STREAMER standard (vocabulary, labelling system, etc.) will be able to be valid, effective, among the different European Countries;
- the possibility of extending the compatibility of the STREMER tools with the mostly used energy calculation software;
- the way the STREAMER tools and procedures would be applied in the advanced and detailed design stages.

Special interest was shown by the Manager of the Tuscany Regional Healthcare Service, which is the person in charge for the coordination and management of the entire Regional Healthcare real estate. The Italian partners are in contact with him to involve the Service as part of the national Implementers Community.

3.7 Conclusions

The workshop organised as part of the Italian demonstration case confirmed the interest regarding the STREAMER project and its methodology for professionals.

The opportunity to improve and enhance the SACS© system applying methodology and tools implemented in STREAMER, has been particularly emphasized during the discussion had after the presentations.

Considering the interest of the AOC board to investigate in this direction, the next actions implemented on the demonstration project will be focused on the compatibility and interoperability of the SACS© and the STREAMER tools. In particular, the possibility to transfer information and advices provided by the dashboard about energy efficiency and costs into the SACS© system will be analyzed.

According to the interest shown by the attendees and based on the achievement of further results, Italian partners will be evaluating the opportunity to hold another workshop at the end of the research.

Fig. 32 to 39 – Pictures of the event

Fig. 40 to 44 - Twitter screenshots related to the event

4. References

Streamer Deliverables: 1.4 - 4.2 - 7.5

R. Di Giulio, S. De Hoogh, B. Turillazzi, C. Quentin and R. Sebastian, “Hospital campus design related with EeB challenges”, in “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, Editors: Ardeshir Mahdavi, Bob Martens and Raimar Scherer, Publisher: CRC Press/Balkema - Taylor & Francis Group, London, UK, 2015, pp. 907–915.

E. Iadanza, B. Turillazzi, F. Terzaghi, L. Marzi, A. Giuntini, R. Sebastian, “The STREAMER European project. Case study: Careggi hospital in Florence”, in “6th European Conference of the International Federation for Medical and Biological Engineering - IFMBE Proceedings 45 - MBEC 2014, 7-11 September 2014, Dubrovnik, Croatia”, Editors: Igor Lacković and Darko Vasic, Publisher: Springer International Publishing, Switzerland, 2015). pp. 649-652.

A. Luschi, L. Marzi, R. Miniati, E. Iadanza, “A custom decision-support information system for structural and technological analysis in healthcare”, IFMBE Proceedings of XIII Mediterranean Conference on Medical and Biological Engineering and Computing, Seville, 2013, vol. 41, pp. 1350–1353.

R. Miniati, F. Dori, E. Iadanza, M. Fregonara, G. Biffi Gentili, “Health technology management: A database analysis as support of technology managers in hospitals”, Technology and Health Care, 2011, vol. 19, no. 6, pp. 445-454.

APPENDIX 1 – Summary of Design Builder energy simulations

San Luca Vecchio - Energy Simulations								
Alternative:	0		0.1		1		2	
Date:	gen-17		gen-17		gen-17		gen-17	
Energy calculation tool:	Design Builder + Energy Plus		Design Builder + Energy Plus		Design Builder + Energy Plus		Design Builder + Energy Plus	
Climate file:	Energy Plus - FIRENZE PERETOLA		Energy Plus - FIRENZE PERETOLA		Energy Plus - FIRENZE PERETOLA		Energy Plus - FIRENZE PERETOLA	
Changes to simulation 0:	[redacted]		Setpoint room = Streamer labels		Layout change (First floor only)		Envelope change	
Energy demand for heating ($Q_{H;nd\_1}$)	249868,9	kWh/year	277746,69	kWh/year	163510,34	kWh/year	312283,40	kWh/year
Energy demand for cooling ($Q_{C;nd\_1}$)	255866,6	kWh/year	477102,71	kWh/year	440772,11	kWh/year	426746,61	kWh/year
Internal load + solar load:								
General lighting	80,06	kWh/year	160,11	kWh/year	154,57	kWh/year	160,11	kWh/year
Equipment	7,44	kWh/year	20,66	kWh/year	14,54	kWh/year	13,15	kWh/year
Occupation	41,27	kWh/year	24,96	kWh/year	23,69	kWh/year	25,48	kWh/year
Solar loads through internal windows	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year
Solar loads through internal windows	15,30	kWh/year	27,19	kWh/year	29,24	kWh/year	27,19	kWh/year
Sensitive heating of zone	27,89	kWh/year	53,05	kWh/year	33,19	kWh/year	59,68	kWh/year
Sensitive cooling of zone	-87,68	kWh/year	-72,83	kWh/year	-74,95	kWh/year	-64,44	kWh/year
Envelope + ventilation								
Windows	-15,31	kWh/year	-17,21	kWh/year	-16,16	kWh/year	-16,85	kWh/year
Walls	-133,45	kWh/year	-56,54	kWh/year	-53,57	kWh/year	-54,85	kWh/year
Floors	-37,80	kWh/year	-46,21	kWh/year	-40,99	kWh/year	45,71	kWh/year
Partitions	0,00	kWh/year	0,00	kWh/year	-11,13	kWh/year	0,00	kWh/year
Roofs	-40,76	kWh/year	-6,30	kWh/year	-5,74	kWh/year	-6,04	kWh/year
Floors	-0,82	kWh/year	-0,11	kWh/year	-0,72	kWh/year	-0,1	kWh/year
Infiltration	-29,26	kWh/year	-26,05	kWh/year	-24,17	kWh/year	-25,45	kWh/year
Mechanical ventilation + Natural ventilation + infiltration	0,21	Vol/h	1,43	Vol/h	1,02	Vol/h	1,42	Vol/h
Separated energy consumption								
Room electricity	7,44	kWh/year	33,81	kWh/year	14,54	kWh/year	13,15	kWh/year
Lighting	86,55	kWh/year	160,11	kWh/year	154,57	kWh/year	160,11	kWh/year
Heating (other source)	43,81	kWh/year	62,29	kWh/year	38,92	kWh/year	69,92	kWh/year
Heating (electricity)	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year
Cooling (electricity)	19,85	kWh/year	61,04	kWh/year	105,25	kWh/year	38,93	kWh/year
HWS (other source)	187,94	kWh/year	147,52	kWh/year	12,15	kWh/year	12,41	kWh/year
Total energy consumption								
Electricity	83,67	kWh/year	260,88	kWh/year	298,75	kWh/year	235,08	kWh/year
Other source	335,34	kWh/year	270,84	kWh/year	51,07	kWh/year	137,57	kWh/year
Carbon emission	65745,0	kg/mq year	158096,8	kg/mq year	181070	kg/mq year	142,48	kg/mq year
Thermal Comfort (n° hour)								
CEN 15251 - Cat. 1	2244	n° hours	2114	n° hours	1733	n° hours	2118	n° hours
CEN 15251 - Cat. 2	580	n° hours	1400	n° hours	1052	n° hours	1331	n° hours
CEN 15251 - Cat. 3	227	n° hours	981	n° hours	679	n° hours	889	n° hours
Average numbers of temperature deviation	1017	n° hours	1498	n° hours	1155	n° hours	1446	n° hours

San Luca Vecchio - Energy Simulations										
Alternative:	3		4		5		6		7	
Date:	gen-17		gen-17		gen-17		gen-17		gen-17	
Energy calculation tool:	Design Builder + Energy Plus		Design Builder + Energy Plus		Design Builder + Energy Plus		Design Builder + Energy Plus		Design Builder + Energy Plus	
Climate file:	Energy Plus - FIRENZE		Energy Plus - FIRENZE PERETOLA		Energy Plus - FIRENZE PERETOLA		Energy Plus - FIRENZE PERETOLA		Energy Plus - FIRENZE PERETOLA	
Changes to simulation 0:	MEP System change		Layout (first floor only) + Envelope + MEP change		Layout (first floor) + envelope change		Envelope + MEP change		Layout (first floor only) + MEP change	
Energy demand for heating ($Q_{H;nd\_1}$)	312283,40	kWh/year	177623,17	kWh/year	312283,40	kWh/year	208069,04	kWh/year	312283,40	kWh/year
Energy demand for cooling ($Q_{C;nd\_1}$)	426746,61	kWh/year	266251,21	kwh/year	426746,61	kwh/year	479931,98	kwh/year	426746,61	kwh/year
Internal load + solar load:										
General lighting	154,75	kWh/year	77,17	kWh/year	160,11	kWh/year	160,11	kWh/year	154,75	kWh/year
Equipment	14,46	kWh/year	14,51	kWh/year	13,15	kWh/year	13,15	kWh/year	14,46	kWh/year
Occupation	24,99	kWh/year	24,79	kWh/year	25,48	kWh/year	25,14	kWh/year	24,99	kWh/year
Solar loads through internal windows	0,00	kWh/year	8,27	kWh/year	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year
Solar loads through internal windows	14,24	kWh/year	25,27	kWh/year	27,19	kWh/year	23,95	kWh/year	14,24	kWh/year
Sensitive heating of zone	8,06	kWh/year	36,52	kWh/year	59,68	kWh/year	39,12	kWh/year	8,06	kWh/year
Sensitive cooling of zone	-111,53	kWh/year	-43,90	kWh/year	-64,44	kWh/year	-74,25	kWh/year	-111,53	kWh/year
Envelope + ventilation										
Windows	-14,8	kWh/year	-10,95	kWh/year	-16,85	kWh/year	-12,24	kWh/year	-14,8	kWh/year
Walls	-51,23	kWh/year	-18,84	kWh/year	-54,85	kWh/year	-22,35	kWh/year	-51,23	kWh/year
Floors	-39,08	kWh/year	30,03	kWh/year	45,71	kWh/year	-43,30	kWh/year	-39,08	kWh/year
Partitions	39,02	kWh/year	-7,25	kWh/year	0,00	kWh/year	0,00	kWh/year	39,02	kWh/year
Roofs	-5,69	kWh/year	-5,5	kWh/year	-6,04	kWh/year	-7,08	kWh/year	-5,69	kWh/year
Floors	-0,08	kWh/year	-0,07	kWh/year	-0,1	kWh/year	-0,11	kWh/year	-0,08	kWh/year
Infiltration	-23,51	kWh/year	-22,88	kWh/year	-25,45	kWh/year	-26,41	kWh/year	-23,51	kWh/year
Mechanical ventilation + Natural ventilation + infiltration	1,46	Vol/h	1,02	Vol/h	1,42	Vol/h	1,43	Vol/h	1,46	Vol/h
Separated energy consumption										
Room electricity	14,46	kWh/year	14,51	kWh/year	13,15	kWh/year	13,15	kWh/year	14,46	kWh/year
Lighting	154,75	kWh/year	77,17	kWh/year	160,11	kWh/year	160,11	kWh/year	154,75	kWh/year
Heating (other source)	14,53	kWh/year	42,67	kWh/year	69,92	kWh/year	24,88	kWh/year	14,53	kWh/year
Heating (electricity)	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year	0,00	kWh/year
Cooling (electricity)	33,59	kWh/year	35,13	kWh/year	38,93	kWh/year	41,40	kWh/year	33,59	kWh/year
HWS (other source)	262,7	kWh/year	12,12	kWh/year	12,41	kWh/year	147,52	kWh/year	262,7	kWh/year
Total energy consumption										
Electricity	190,21	kWh/year	151,12	kWh/year	235,08	kWh/year	239,54	kWh/year	190,21	kWh/year
Other source	289,83	kWh/year	54,79	kWh/year	137,57	kWh/year	227,26	kWh/year	289,83	kWh/year
Carbon emission	115270	kg/mq year	91610	kg/mq year	142,48	kg/mq year	145,16	kg/mq year	115270	kg/mq
Thermal Comfort (n° hour)										
CEN 15251 - Cat. 1	1906	n° hours	1631	n° hours	2118	n° hours	1980	n° hours	1906	n° hours
CEN 15251 - Cat. 2	1167	n° hours	870	n° hours	1331	n° hours	1246	n° hours	1167	n° hours
CEN 15251 - Cat. 3	716	n° hours	510	n° hours	889	n° hours	823	n° hours	716	n° hours
Average numbers of temperature deviation	1263	n° hours	1004	n° hours	1446	n° hours	1350	n° hours	1263	n° hours

APPENDIX 2 – Sample file for adding data on the BIM model with SimpleBIM

Template version 5.0

Add Identity Source

* Identity Source Key	Variate	Level	Reference (URL)	Reference Base (URL)
BI	Becapred - poStudio			

Add Identity

* Identity Source Key	Identity Key	Name	Description	Reference	Metadata# - (optional)	Metadata#2 (optional)	Metadata#3 (optional)
BI							
	BI	Ipo Studio					

Add Identity (for IFC PropertySet)

* Identity Source Key	Identity Key	Name	Description	Reference	PropertySet Name	Property Name	Property Type
BI	BI:STREAMER:POR:RoomType	RoomType			STREAMER Pset	RoomType	IfcLabel
BI	BI:STREAMER:POR:FunctionalAreaType	FunctionalAreaType			STREAMER Pset	FunctionalAreaType	IfcLabel
BI	BI:STREAMER:POR:Area	Area			STREAMER Pset	Area	IfcReal
BI	BI:STREAMER:POR:Amount	Amount			STREAMER Pset	Amount	IfcReal
BI	BI:STREAMER:ROOM:Area	Area			STREAMER Room	Area	IfcReal
BI	BI:STREAMER:LABELSPOR:AccessSecurity	AccessSecurity			STREAMER Labels Pset	AccessSecurity	IfcLabel
BI	BI:STREAMER:LABELSPOR:BowcellegeLayer	BowcellegeLayer			STREAMER Labels Pset	BowcellegeLayer	IfcLabel
BI	BI:STREAMER:LABELSPOR:HygienicClass	HygienicClass			STREAMER Labels Pset	HygienicClass	IfcLabel
BI	BI:STREAMER:LABELSPOR:ComfortClass	ComfortClass			STREAMER Labels Pset	ComfortClass	IfcLabel
BI	BI:STREAMER:LABELSPOR:Construction	Construction			STREAMER Labels Pset	Construction	IfcLabel
BI	BI:STREAMER:LABELSPOR:Environment	Environment			STREAMER Labels Pset	Environment	IfcLabel
BI	BI:STREAMER:LABELSPOR:UserProfile	UserProfile			STREAMER Labels Pset	UserProfile	IfcLabel

Add Identity (for IFC Element Quantity)

* Identity Source Key	Identity Key	Name	Description	Reference	QuantitySet Name	Quantity Name	Quantity Type

Add Identity Metadata

Template version 5.2

Object Or Group [+]	Space																							
Property Name or Key	Space Number	RoomType		FunctionalAreaType		Amount		BowcalleLayer		HygienicClass		AccessSecurity		UserProfile		Equipment		Construction		ComfortClass		Area		Area	
Operator	Match = equals	Set		Set		Set		Set		Set		Set		Set		Set		Set		Set		Set		Set	
	1b A 001	ConferenceRoom		ConferenceRoom		1		0		H2		A2		U1		HU1		C1		C3		45.28451421		45.28451
	1b_A_001a	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		2.796375		2.796538
	1b_A_001b	Toilet		Toilet		1		I		I14		A2		U4		CQ1		C1		C6		4.490300309		4.490300
	1b_A_001c	ToiletDisabledPeople		ToiletDisabledPeople		1		I		H4		A2		U4		EQ1		C1		C6		5.444825		5.444813
	1b_A_002	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		27.56453067		27.5645
	1b_A_003	Reception		Reception		1		O		H4		A1		U2		EQ1		C1		C3		27.91757517		27.91758
	1b_A_003a	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		4.538120258		4.53812
	1b_A_003b	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		3.233466064		3.233461
	1b_A_003c	ToiletDisabledPeople		ToiletDisabledPeople		1		I		H4		A2		U4		EQ1		C1		C6		6.053843876		6.053904
	1b_A_004	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		28.0159583		28.0194
	1b_A_005	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		23.83725243		23.89725
	1b_A_005a	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		6.824742479		6.82474
	1b_A_005b	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		9.48793125		9.487951
	1b_A_006	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		28.01129098		28.01120
	1b_A_007	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		18.58534		18.58534
	1b_A_008	AreaRoom		AreaRoom		1		H		H1		A2		U4		FQ1		C1		C4		3.649755175		3.649755
	1b_A_008a	Toilet		Toilet		1		I		H4		A2		U4		HU1		C1		C6		1.95941738		1.95941
	1b_A_008b	StoreRoom		StoreRoom		1		I		H2		A5		U1		EQ1		C1		C6		1.5326625		1.532663
	1b_A_008c	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		3.907467437		3.907467
	1b_A_009	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		11.7655		11.7855
	1b_A_013	ChangingRoomPersonnel		ChangingRoomPersonnel		1		I		H1		A5		U3		EQ6		C1		C6		7.9785		7.9785
	1b_A_011	ChangingRoomPersonnel		ChangingRoomPersonnel		1		I		H1		A5		U4		EQ1		C1		C6		8.591		8.591
	1b_A_012	ChangingRoomPersonnel		ChangingRoomPersonnel		1		I		H1		A5		U4		EQ1		C1		C6		13.8621375		13.86214
	1b_A_013	ChangingRoomPersonnel		ChangingRoomPersonnel		1		I		H1		A5		U4		EQ1		C1		C6		36.79664196		36.79664
	1b_A_013a	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		6.780885862		6.780987
	1b_A_013b	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		6.731415562		6.731417
	1b_A_014	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		14.6434213		14.6434
	1b A 015	Laboratory		Laboratory		1		I		H5		A5		U3		EQ6		C2		C6		12.654929		12.65499
	1b_A_016	Laboratory		Laboratory		1		I		H5		A5		U3		EQ6		C2		C6		20.20180939		20.20181
	1b_A_016a	Laboratory		Laboratory		1		I		H5		A5		U3		EQ6		C2		C6		3.762550125		3.76259
	1b_A_017	TechnicalRoom		TechnicalRoom		1		I		H1		A5		U3		EQ1		C2		C6		2.343125		2.343125
	1b_A_018a	TechnicalRoom		TechnicalRoom		1		I		H1		A5		U3		EQ1		C2		C6		3.192105		3.192105
	1b_A_019	NursingStation		NursingStation		1		H		H2		A5		U4		EQ1		C1		C4		18.85603239		18.85605
	1b_A_019a	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		5.141509625		5.141506
	1b_A_020	TechnicalRoom		TechnicalRoom		1		I		H1		A5		U3		EQ1		C2		C6		18.90053844		18.90054
	1b_A_021	TechnicalRoom		TechnicalRoom		1		I		H1		A5		U3		EQ1		C2		C6		16.30251		16.30351
	1b_A_021a	TechnicalRoom		TechnicalRoom		1		I		H1		A5		U3		EQ1		C2		C6		34.57365156		34.57365
	1b_A_022	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		217.6334219		217.6334
	1b_A_023	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		6.878311814		6.878316
	1b_A_029b	Stairs		Stairs		1		H		H1		A1		U4		EQ1		C1		C2		122.9208685		122.9209
	1b_A_030	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		32.20193885		32.20104
	1b_A_031	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		10.31933698		10.31986
	1b_A_032	Office		Office		1		O		H2		A4		U1		FQ1		C1		C3		10.66099998		10.66393
	1b A 033	Office		Office		1		O		H2		A4		U1		HQ1		C1		C3		18.44367099		18.44387
	1b_A_034	Reception		Reception		1		O		H4		A1		U2		EQ1		C1		C3		18.94199923		18.942
	1b_A_035	Archives		Archives		1		O		H1		A5		U1		EQ1		C1		C3		13.991008		13.99101
	1b_A_036	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		13.977566		13.97757
	1b_A_037	NursingStation		NursingStation		1		H		H2		A5		U4		EQ1		C1		C4		8.78787		8.78787
	1b_A_038	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		10.759		10.759
	1b_A_038a	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		3.7947225		3.794723
	1b_A_039	StoreRoom		StoreRoom		1		I		H2		A5		U1		EQ1		C1		C6		6.2524		6.2524
	1b_A_039a	Anteroom		Anteroom		1		H		H1		A2		U4		EQ1		C1		C4		1.957767438		1.957767
	1b_A_039b	Toilet		Toilet		1		I		H4		A2		U4		EQ1		C1		C6		1.5556625		1.555963
	1b_A_039c	StoreRoom		StoreRoom		1		I		H2		A5		U1		EQ1		C1		C6		1.978735063		1.978735
	1b A 039d	ToiletDisabledPeople		ToiletDisabledPeople		1		I		H4		A2		U4		HU1		C1		C6		5.09869775		5.098678
	1b_A_040	Kitchenette		Kitchenette		1		I		H2		A4		U1		EQ3		C1		C6		7.376825		7.376828
	1b_A_041	Office		Office		1		O		H2		A4		U4		EQ1		C1		C3		14.7202		14.7202
	1b_A_042	NursingStation		NursingStation		1		H		H2		A5		U4		EQ1		C1		C4		19.46241625		19.46275
	1b_A_043	ConferenceRoom		ConferenceRoom		1		O		H2		A2		U1		FQ1		C1		C3		44.78975		44.78975
	1b A 044	Office		Office		1		O		H2		A4		U1		HQ1		C1		C3		20.44825125		20.44851
	1b_A_045	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		15.3957		15.3957
	1b_A_046	Office		Office		1		O		H2		A4		U1		EQ1		C1		C3		15.70325625		15.70326
	1b_A_047	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		4.507925		4.507938
	1b_A_047a	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		22.14125		22.14613
	1b_A_047b	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		13.9725		13.9725
	1b_A_048	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		5.159687		5.159688
	1b_A_048a	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		12.727125		12.72713
	1b_A_048b	ConsultationExaminationRoom		ConsultationExaminationRoom		1		O		H3		A2		U1		EQ1		C1		C3		23.2565		23.2865
	1b_A_049	WaitingRoom		WaitingRoom		1		O		H1		A2		U1		EQ1		C1		C3		26.23163134		26.23163
	1b_A_057	Corridor		Corridor		1		H		H1		A1		U4		FQ1		C1		C2		68.83105387		68.83306
	1b A 052b	Corridor		Corridor		1		H		H1		A1		U4		HU1		C1		C2		11.10313722		11.10314
	1b_A_053	Corridor		Corridor		1		H		H1		A1		U4		EQ1		C1		C2		11.17167606		11.17168
	1b_A_055	Corridor		Corridor		1		H		I11		A1		U4		CQ1		C1		C2		41.40875		41.40887

16_A_056	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	41.07780125	41.0778
16_A_101	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	29.85834339	29.85834
16_A_101a	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	4.825487557	4.825488
16_A_101b	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	8.59920094	8.599201
16_A_102	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	25.0551928	25.05519
16_A_102a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	9.548172563	9.548173
16_A_103	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	30.03428386	30.03428
16_A_103a	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	5.69434706	5.694347
16_A_104	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	27.96491423	27.96491
16_A_104a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	10.7718411	10.77184
16_A_105	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	25.7055457	25.70555
16_A_105a	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	6.32795447	6.327954
16_A_106	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	33.65734065	33.65734
16_A_106a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	6.283914261	6.283914
16_A_106b	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	4.382713791	4.382714
16_A_107	Treatment room	Treatment room	1	HF	H4	A3	U4	EQ6	C1	CT4	26.56413715	26.56414
16_A_107a	SterileStore	SterileStore	1	I	H3	A5	U3	EQ1	C1	CT6	8.253403473	8.253403
16_A_107b	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.244120848	3.244121
16_A_108	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.078632671	3.078633
16_A_109	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	12.32459821	12.3246
16_A_110	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.940227687	2.940228
16_A_111	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	4.26524046	4.26524
16_A_112	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	19.76399999	19.764
16_A_113	UtilityRoom	UtilityRoom	1	I	H4	A5	U4	EQ3	C1	CT3	8.990999998	8.991
16_A_114	Kitchenette	Kitchenette	1	I	H2	A4	U1	EQ3	C1	CT6	13.86210398	13.8621
16_A_115	TechnicalRoom	TechnicalRoom	1	I	H1	A5	U3	EQ1	C4	CT6	8.816418216	8.816418
16_A_116	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.532113214	2.532113
16_A_117	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	1.781670092	1.78167
16_A_118	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	5.854630698	5.854631
16_A_119	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	33.97424586	33.97425
16_A_119a	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	3.915222191	3.915222
16_A_119b	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	4.215311648	4.215312
16_A_119c	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	4.628763612	4.628764
16_A_120	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	19.2035144	19.20351
16_A_120a	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	11.76090324	11.7609
16_A_122	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	11.58466631	11.58467
16_A_122a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.211278459	3.211278
16_A_123	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	10.53392738	10.53393
16_A_123a	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	3.122008687	3.122009
16_A_124	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	10.33157513	10.33158
16_A_124a	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	3.150106312	3.150106
16_A_125	Kitchenette	Kitchenette	1	I	H2	A4	U1	EQ3	C1	CT6	11.66925619	11.66926
16_A_125a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.211278459	3.211278
16_A_126	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	10.14358633	10.14359
16_A_126a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.560837501	3.560838
16_A_127	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	5.534688253	5.534688
16_A_128	ChangingRoomPersonnel	ChangingRoomPersonnel	1	I	H1	A5	U4	EQ1	C1	CT6	5.969785179	5.969785
16_A_129	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	10.21450032	10.2145
16_A_130	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	4.031841384	4.031841
16_A_131	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	10.15369554	10.1537
16_A_132	GroupRoom	GroupRoom	1	O	H2	A2	U1	EQ1	C1	CT3	24.40733097	24.40733
16_A_133	Kitchenette	Kitchenette	1	I	H2	A4	U1	EQ3	C1	CT6	13.979595	13.9796
16_A_134	UtilityRoom	UtilityRoom	1	I	H4	A5	U4	EQ3	C1	CT3	8.78584	8.78584
16_A_135	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	4.7769405	4.776941
16_A_136	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	14.8734595	14.87346
16_A_137	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	4.698432375	4.698432
16_A_138	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.132965063	3.132965
16_A_139	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	12.5087275	12.50873
16_A_140	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.060386375	3.060386
16_A_140a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	3.2249805	3.22498
16_A_141	Treatment room	Treatment room	1	HF	H4	A3	U4	EQ6	C1	CT4	26.108765	26.10877
16_A_141a	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	8.851392188	8.851392
16_A_142	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	33.797925	33.79793
16_A_142a	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	4.36419375	4.364194
16_A_142b	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	6.03238125	6.032381
16_A_143	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	27.22412645	27.22413
16_A_143a	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	6.605515848	6.605516
16_A_144	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	27.93057611	27.93058
16_A_144a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	9.218625	9.218625
16_A_145	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	29.67274392	29.67274
16_A_145a	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	5.387941997	5.387942
16_A_146	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	25.49017325	25.49017
16_A_146a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	9.735546698	9.735547
16_A_147	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	28.4726375	28.47264
16_A_147a	AnteRoom	AnteRoom	1	H	H1	A2	U4	EQ1	C1	CT4	8.340391585	8.340392
16_A_147b	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	4.373183967	4.373184
16_A_149	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	18.110325	18.11033
16_A_149a	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	3.152175	3.152175
16_A_150	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	12.2	12.2
16_A_151	ConferenceRoom	ConferenceRoom	1	O	H2	A2	U1	EQ1	C1	CT3	21.4125	21.4125

16_A_153	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	73.46961646	73.46962
16_A_154	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	30.7717243	30.77172
16_A_156	Stairs	Stairs	1	H	H1	A1	U4	EQ1	C1	CT2	33.375	33.375
16_A_157	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	84.0204944	84.02049
16_A_158	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	14.60007719	14.60008
16_A_160	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	5.618019185	5.618019
16_A_161	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	5.20557	5.20557
16_A_162	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	27.8020581	27.80206
16_A_162a	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	5.581365985	5.581366
16_A_163	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	3.839894347	3.839894
16_A_164	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	2.749379017	2.749379
16_A_165	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	3.412258306	3.412258
16_A_165a	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	3.341074932	3.341075
16_A_166	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	33.79931669	33.79932
16_A_167	Stairs	Stairs	1	H	H1	A1	U4	EQ1	C1	CT2	58.9025	58.9025
16_A_169	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	75.53278767	75.53279
16_A_170	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	3.913167563	3.913168
16_A_172	WaitingRoom	WaitingRoom	1	O	H1	A2	U1	EQ1	C1	CT3	24.00245333	24.00245
16_A_201	RestingRoomPersonnel	RestingRoomPersonnel	1	O	H2	A4	U4	EQ1	C1	CT3	29.37155772	29.37155
16_A_201a	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	4.7955025	4.795503
16_A_202	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	4.236876449	4.236876
16_A_202a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	4.10395	4.10395
16_A_203	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	4.326232374	4.326232
16_A_203a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	4.1905025	4.190503
16_A_204	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	32.55605288	32.55605
16_A_205	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	31.85733524	31.85734
16_A_206	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	3.909354621	3.909355
16_A_206a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	4.093845692	4.093846
16_A_207	UtilityRoom	UtilityRoom	1	I	H4	A5	U4	EQ3	C1	CT3	4.120764064	4.120764
16_A_208	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	35.31141745	35.31142
16_A_208a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	4.315232014	4.315232
16_A_208b	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	5.326854438	5.326854
16_A_209	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	27.53353392	27.53353
16_A_209a	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	10.30392689	10.30393
16_A_210	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	7.470151617	7.470152
16_A_210a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.981301444	2.981301
16_A_211	Kitchenette	Kitchenette	1	I	H2	A4	U1	EQ3	C1	CT6	7.235151854	7.235152
16_A_211a	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	2.397897017	2.397897
16_A_212	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	12.50195025	12.50195
16_A_213	Treatment room	Treatment room	1	HF	H4	A3	U4	EQ6	C1	CT4	10.09034768	10.09035
16_A_214	PatientRoom	PatientRoom	1	H	H2	A2	U4	EQ2	C1	CT4	57.68067766	57.68068
16_A_217	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	13.39932678	13.39933
16_A_218	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	4.939736923	4.939737
16_A_218a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	4.697576374	4.697576
16_A_219	Laboratory	Laboratory	1	I	H5	A5	U3	EQ6	C4	CT6	10.55515221	10.55515
16_A_220	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	5.514093477	5.514093
16_A_220a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.872654499	2.872654
16_A_220b	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	16.72619709	16.7262
16_A_221	Corridor	Corridor	1	H	H1	A1	U4	EQ1	C1	CT2	4.966854552	4.966855
16_A_221a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.587563222	2.587563
16_A_221b	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	17.16155114	17.16155
16_A_222	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	5.520690621	5.520691
16_A_223	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	16.87017686	16.87018
16_A_223a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	5.51753941	5.517539
16_A_224	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	6.306481062	6.306481
16_A_226	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	5.1382625	5.138263
16_A_226a	ChangingRoomPersonnel	ChangingRoomPersonnel	1	I	H1	A5	U4	EQ1	C1	CT6	5.176506312	5.176506
16_A_227	Kitchenette	Kitchenette	1	I	H2	A4	U1	EQ3	C1	CT6	14.036435	14.03644
16_A_228	StoreRoom	StoreRoom	1	I	H2	A5	U1	EQ1	C1	CT6	9.0538	9.0538
16_A_229	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	19.691	19.691
16_A_230	Treatment room	Treatment room	1	HF	H4	A3	U4	EQ6	C1	CT4	11.379165	11.37917
16_A_231	NursingStation	NursingStation	1	H	H2	A5	U4	EQ1	C1	CT4	13.06419138	13.06419
16_A_232	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	7.8361115	7.836111
16_A_232a	UtilityRoom	UtilityRoom	1	I	H4	A5	U4	EQ3	C1	CT3	3.699967375	3.699967
16_A_233	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	19.19196781	19.19197
16_A_233a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.9904385	2.990438
16_A_233b	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	4.36829	4.36829
16_A_234	Office	Office	1	O	H2	A4	U1	EQ1	C1	CT3	10.78783223	10.78783
16_A_235	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	17.9808825	17.98088
16_A_235a	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2	U4	EQ1	C1	CT6	5.03654	5.03654
16_A_235b	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	4.635627598	4.635628
16_A_236	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	15.18272656	15.18273
16_A_236a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.590848299	2.590848
16_A_236b	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	4.514400309	4.5144
16_A_237	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	17.52928713	17.52929
16_A_237a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.738924068	2.738924
16_A_237b	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	5.464473551	5.464474
16_A_238	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	13.82623288	13.82623
16_A_238a	Toilet	Toilet	1	I	H4	A2	U4	EQ1	C1	CT6	2.810573634	2.810574
16_A_238b	PatientRoomIntensiveCare	PatientRoomIntensiveCare	1	H	H2	A2	U4	EQ6	C1	CT4	3.659859821	3.65986

16_A_239	PatientRoomIntensiveCare	1	H	H2	A2	U4	E06	C1	C74	13.4373289	13.43733
16_A_239a	Toilet	1	I	I14	A2	U4	E01	C1	C76	2.738924068	2.738924
16_A_239b	PatientRoomIntensiveCare	1	H	H2	A2	U4	E06	C1	C74	3.595609177	3.595609
16_A_240	PatientRoomIntensiveCare	1	H	H2	A2	U4	F06	C1	C74	14.0349786	14.03498
16_A_240a	Toilet	1	I	H4	A2	U4	E01	C1	C76	2.85425725	2.854257
16_A_240b	PatientRoomIntensiveCare	1	H	H2	A2	U4	E06	C1	C74	3.773084O9	3.773084
16_A_241	PatientRoomIntensiveCare	1	H	I12	A2	U4	E06	C1	C74	13.44G03713	13.44624
16_A_241a	Toilet	1	I	H4	A2	U4	E01	C1	C76	2.762712875	2.762713
16_A_241b	PatientRoomIntensiveCare	1	H	H2	A2	U4	E06	C1	C74	3.584685	3.584685
16_A_242	PatientRoomIntensiveCare	1	H	H2	A2	U4	E06	C1	C74	13.56085443	13.56085
16_A_242a	Toilet	1	I	H4	A2	U4	E01	C1	C76	2.893760875	2.893766
16_A_242b	PatientRoomIntensiveCare	1	H	H2	A2	U4	E06	C1	C74	3.507595	3.507595
16_A_243	PatientRoomIntensiveCare	1	H	H2	A2	U4	E06	C1	C74	14.00650094	14.00650
16_A_243a	Toilet	1	I	H4	A2	U4	E01	C1	C76	2.72320425	2.723201
16_A_243b	PatientRoomIntensiveCare	1	H	H2	A2	U4	F06	C1	C74	3.97821713	3.978217
16_A_245	Laboratory	1	I	H5	A5	U3	E06	C6	C76	34.67086866	34.67087
16_A_246	Laboratory	1	I	H5	A5	U3	E06	C6	C76	20.98875	20.98875
16_A_247	Laboratory	1	I	I15	A5	U3	E06	C6	C76	11.65	11.65
16_A_248	Laboratory	1	I	H5	A5	U3	E06	C6	C76	22.23625	22.23625
16_A_250	ChangingRoomPersonnel	1	I	H1	A5	U4	E01	C1	C76	22.20481822	22.20482
16_A_251	Corridor	1	H	H1	A1	U4	E01	C1	C72	96.60358017	96.60358
16_A_253	Corridor	1	H	H1	A1	U4	E01	C1	C72	33.67985359	33.67985
16_A_254	Corridor	1	H	H1	A1	U4	E01	C1	C72	84.09577665	84.09578
16_A_255	Corridor	1	H	H1	A1	U4	E01	C1	C72	32.17231024	32.17231
16_A_256	Stairs	1	H	H1	A1	U4	E01	C1	C72	24.23166194	24.23163
16_A_257	Corridor	1	H	H1	A1	U4	F01	C1	C72	94.57966664	94.5797
16_A_259	Stairs	1	H	H1	A1	U4	E01	C1	C72	35.575	35.575
16_A_260	Corridor	1	H	H1	A1	U4	E01	C1	C72	2.085285	2.085285
16_A_ASC001	Lift	1	I	I11	A1	U4	E01	C2	C72	7.842169466	7.842169
16_A_ASC002	Lift	1	H	H1	A1	U4	E01	C2	C72	8.816179195	8.816179
16_A_ASC007	Lift	1	H	H1	A1	U4	F01	C2	C72	8.676641936	8.676564
16_A_ASC101	Lift	1	H	H1	A1	U4	E01	C2	C72	7.841962793	7.841963
16_A_ASC107	Lift	1	H	H1	A1	U4	E01	C2	C72	8.676660963	8.676661
16_A_ASC201	Lift	1	I	I11	A1	U4	E01	C2	C72	7.84217574	7.842176
16_A_ASC207	Lift	1	H	H1	A1	U4	E01	C2	C72	10.17452022	10.17452
16_A_S00	TechnicalRoom	1	I	H1	A5	U3	E01	C2	C76	1018.980158	1018.98

APPENDIX 3 – PPT presentation (1st part)

IL PROGETTO EUROPEO **STREAMER**

STRUMENTI E METODI PER IL MIGLIORAMENTO DELL'EFFICIENZA ENERGETICA DEI DISTRETTI OSPEDALIERI

SISTEMI INTEGRATI BIM-GIS NELLA PROGETTAZIONE DI INTERVENTI DI EDILIZIA SANITARIA

Azienda Ospedaliero Universitaria Careggi ipostudio architetti srl beog

WORKSHOP 28.11.2016 FIRENZE

Streamer
European research on energy-efficient healthcare districts

arch. Filippo Terzaghi

APERTURA DEI LAVORI

Streamer
European research on energy-efficient healthcare districts

AGENDA

APERTURA DEI LAVORI	arch. Filippo Terzaghi
PRESENTAZIONE DEL PROGETTO	
Obbiettivi | Consorzio | Descrizione delle fasi di progetto	prof. Roberto Di Giulio
ASPETTI ENERGETICI NELL'EDILIZIA OSPEDALIERA	
Strategie di efficienza energetica nei distretti ospedalieri	prof. Giacomo Bizzarri
I RISULTATI DEL PROGETTO	
Labeling system | PoR | EDC | KPIs e Dashboard	prof. Roberto Di Giulio
IL RUOLO DELL'AOU CAREGGI NEL PROGETTO	
Caso studio individuato | SACS	prof. Roberto Di Giulio
DIMOSTRAZIONE DEL CASO STUDIO ITALIANO	
Modellazione BIM-GIS del distretto e del caso studio e programma funzionale	arch. Luca Marzi
Procedure di importazione del modello	arch. Thorsten Lang
Simulazione energetica del caso studio e uso della dashboard	arch. Stefania Pitzianti
Il sistema SACS potenziato con Streamer	ing. Ernesto Iadanza
DISCUSSIONE E CONCLUSIONI	arch. Filippo Terzaghi prof. Roberto Di Giulio prof. Giacomo Bizzarri

prof. Roberto Di Giulio

PRESENTAZIONE DEL PROGETTO

Streamer
European research on energy-efficient healthcare districts

Streamer
European research on energy-efficient healthcare districts

Semantic-driven Design through Geo and Building Information Modeling for Energy-Efficient Buildings Integrated in Mixed-use Healthcare Districts

Progetto finanziato nel 7° Programma Quadro

1 settembre 2013 – 31 agosto 2017

Area Tematica EeB

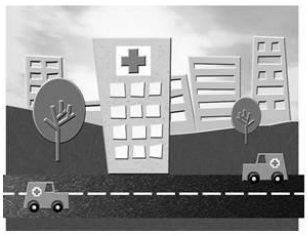
«Optimised design methodologies for energy-efficient buildings integrated in the neighbourhood energy systems»

IL CONTESTO DELL'ESPERIENZA

European Commission

OBIETTIVO	EFFICIENZA ENERGETICA DEGLI EDIFICI	
EFFICACIA DEI RISULTATI	INTERVENTI ALLA SCALA URBANA	
STRATEGIA	AZIONI IN FASE DI PROGETTAZIONE	
FOCUS	DISTRETTI OSPEDALIERI	

OSPEDALI IN EUROPA



- gli ospedali e tutti gli edifici inseriti all'interno di un distretto sanitario sono strutture tra le più «energivore» e più «inquinanti»
- un ospedale consuma in media 2,5 volte più di un edificio destinato a uffici

- in Europa sono presenti circa 15.000 ospedali che sono responsabili di almeno il 5% dell'emissione annuale europea di anidride carbonica (pari a 250 milioni di tonnellate)
- la sanità genera circa il 10% del PIL ed un sistema sanitario può arrivare a pesare fino al 60% sulla spesa di un Paese

EFFICIENZA ENERGETICA NEI DISTRETTI SANITARI

L'interoperabilità degli strumenti di gestione e controllo del processo di progettazione è una delle tematiche sulle quali si concentrano la ricerca e le innovazioni nel campo dei sistemi di modellazione BIM (Building Information Modelling).

Su tale principio si basa la capacità di gestire, su piattaforme di scambio e condivisione di dati complessi e conoscenze pluridisciplinari, le attività e i ruoli dei diversi operatori che intervengono nel processo di programmazione, progettazione e gestione degli interventi.

Nell'ambito di interventi di nuova costruzione o di retrofitting all'interno dei grandi distretti ospedalieri, la possibilità di sviluppare modelli progettuali capaci di simulare condizioni alternative e di misurarne gli effetti garantendo un feedback condiviso è una condizione essenziale per ottimizzare l'attività di gestione durante l'intero ciclo di vita degli edifici.

FINE E STRUMENTI DI STREAMER

OBIETTIVO STRATEGICO

RIDUZIONE DEL 50% DEL CONSUMO ENERGETICO E DELLE EMISSIONI DI ANIDRIDE CARBONICA NEI NUOVI PROGETTI O NEL RETROFITTING DI EDIFICI NEI GRANDI DISTRETTI SANITARI

MEZZI

STRUMENTI PROGETTUALI AVANZATI COME IL BIM E IL GIS.

Tali strumenti sono in grado di indirizzare le scelte di coloro che si occupano del progetto e della gestione dei grandi complessi ospedalieri verso l'efficienza energetica.

In tal modo è possibile indagare e ottimizzare
- l'involucro,
- l'organizzazione (tipologica, spaziale e funzionale) degli edifici,
- il sistema degli impianti e delle apparecchiature medicali e
- il sistema di infrastrutture a rete dell'intero distretto sanitario e del suo intorno.

IL CONSORZIO

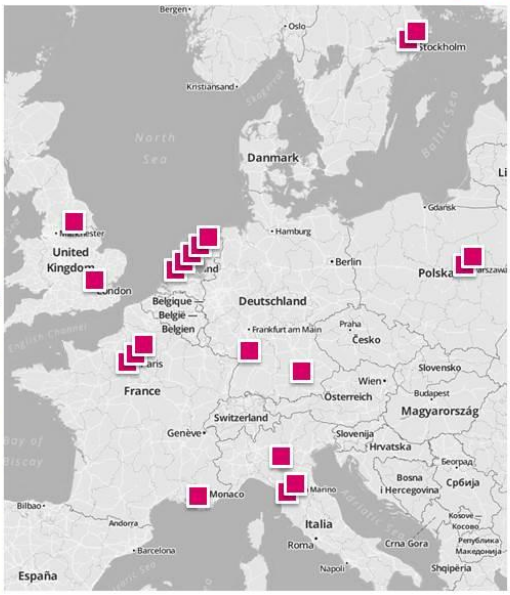
19 PARTNERS afferenti a 9 PAESI UE

8 piccole/medie imprese

4 ospedali

3 imprese di costruzioni

4 enti di ricerca



GLI OSPEDALI IN STREAMER

I quattro distretti ospedalieri sono coinvolti quali casi studio per la verifica dei risultati attesi

NHS di Rotherham (Gran Bretagna)

NHS Rotherham

Rijnstate Ziekenhuis di Arnhem (Olanda)

Rijnstate

AP-HP di Parigi (Francia)

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

AOU di Careggi (Italia)

Azienda Ospedaliero Universitaria Careggi

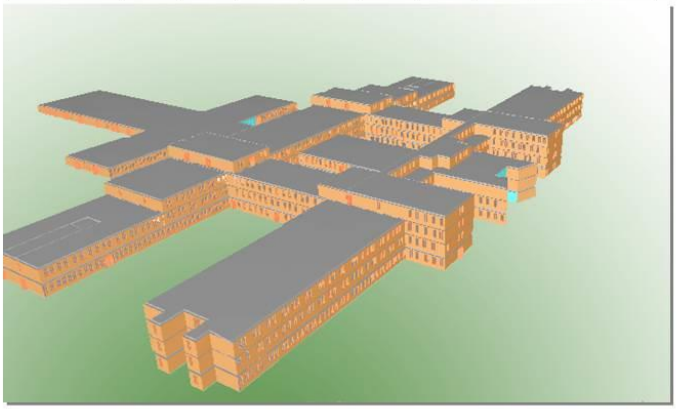
prof. Giacomo Bizzarri

ASPETTI ENERGETICI NELL'EDILIZIA OSPEDALIERA

Streamer
European research on energy-efficient healthcare districts

OSPEDALI – STRUTTURE TRA LE PIU' ENERGIVORE

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Q_E [MWhe]	476	476	505	481	537	669	690	711	496	518	493	488
Q_H [MWht]	1715	1449	1270	894	460	232	134	139	233	637	1167	1600
Q_C [MWht]	-	-	-	-	154	322	533	468	292	-	-	-

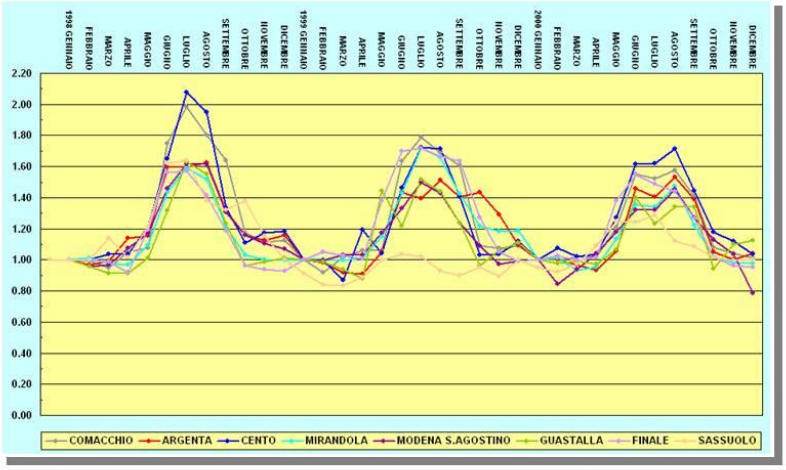


G. Bizzarri
2003 BIM model
ospedale
Lagosanto
(Ferrara)

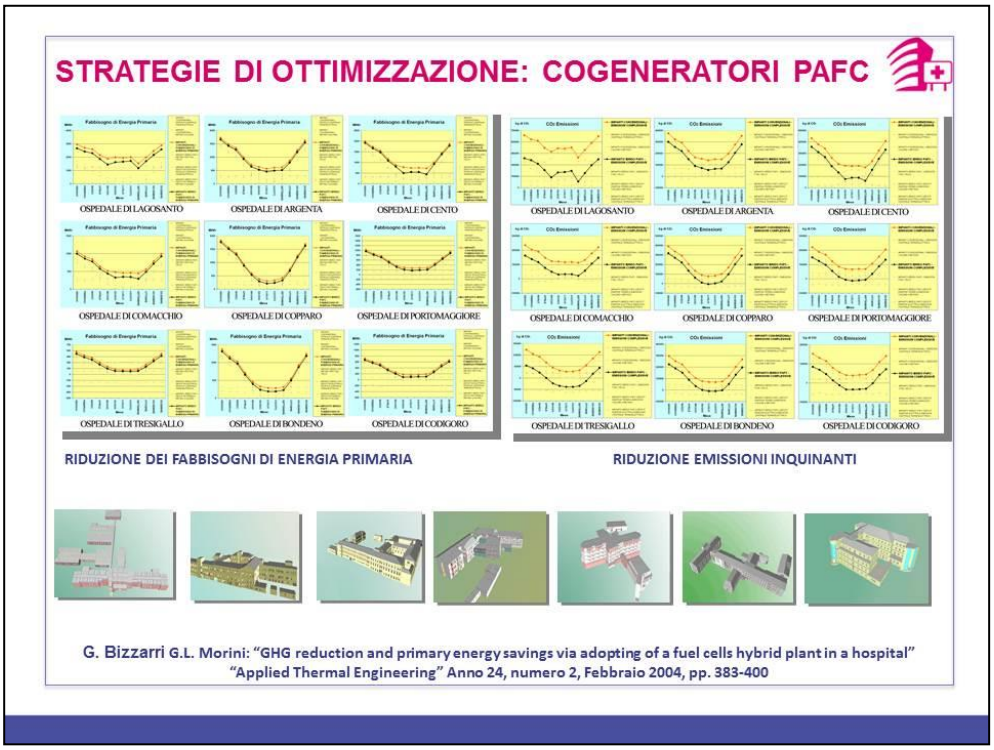
G. Bizzarri G.L. Morini: "New technologies for an effective energy retrofit of hospitals" "Applied Thermal Engineering" Anno 26, numero 2-3, Febbraio 2006, pp. 161-169

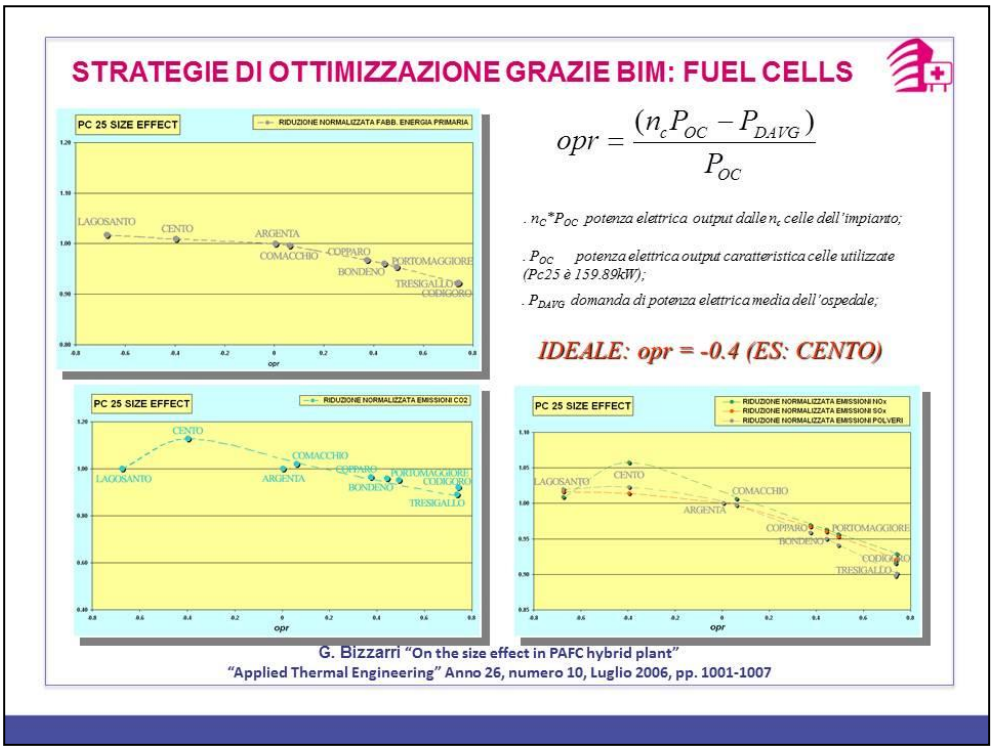
PATTERNS RICORRENTI NELLA DOMANDA

24 OSPEDALI RIPARTIBILI IN TRE CATEGORIE DI UTENZE



G. Bizzarri "On energy requirements and potential energy savings in Italian hospital buildings" 4th Int. Conf. on Urban Regeneration and Sustainability "The sustainable city", Tallin, Estonia, 17-19 July 2006»


STRATEGIE DI OTTIMIZZAZIONE: COGENERATORI PAFC
OSPEDALE DI LAGOSANTO
OSPEDALE DI ARGENTA
OSPEDALE DI CENTO
OSPEDALE DI COMACCHIO
OSPEDALE DI COPPARO
OSPEDALE DI PORTOMAGGIORE
OSPEDALE DI TRESIGALLO
OSPEDALE DI BONDENO
OSPEDALE DI CODIGORO
RIDUZIONE DEI FABBISOGNI DI ENERGIA PRIMARIA
RIDUZIONE EMISSIONI INQUINANTI
G. Bizzarri G.L. Morini: "GHG reduction and primary energy savings via adopting of a fuel cells hybrid plant in a hospital"
"Applied Thermal Engineering" Anno 24, numero 2, Febbraio 2004, pp. 383-400


STRATEGIE DI OTTIMIZZAZIONE GRAZIE BIM: FUEL CELLS
PC 25 SIZE EFFECT
RIDUZIONE NORMALIZZATA FABB. ENERGIA PRIMARIA
LAGOSANTO
CENTO
ARGENTA
COMACCHIO
COPPARO
PORTOMAGGIORE
BONDENO
TRESIGALLO
CODIGORO
opr
$opr = \frac{(n_c P_{OC} - P_{DAVG})}{P_{OC}}$
. $n_c * P_{OC}$ potenza elettrica output dalle n_c celle dell'impianto;
. P_{OC} potenza elettrica output caratteristica celle utilizzate (Pc25 è 159.89kW);
. P_{DAVG} domanda di potenza elettrica media dell'ospedale;
IDEALE: opr = -0.4 (ES: CENTO)
PC 25 SIZE EFFECT
RIDUZIONE NORMALIZZATA EMISSIONI CO2
PC 25 SIZE EFFECT
RIDUZIONE NORMALIZZATA EMISSIONI NOx
RIDUZIONE NORMALIZZATA EMISSIONI SOx
RIDUZIONE NORMALIZZATA EMISSIONI POLVERI
G. Bizzarri "On the size effect in PAFC hybrid plant"
"Applied Thermal Engineering" Anno 26, numero 10, Luglio 2006, pp. 1001-1007

DOMANDA ENERGIA TERMICA OSPEDALE CAREGGI

PATTERN CARATTERISTICO GRANDI STRUTTURE OSPEDALIERE:

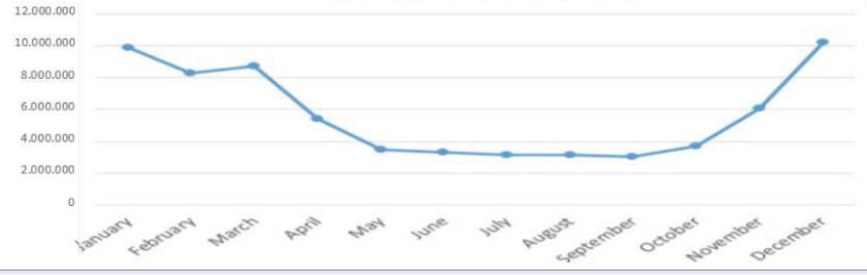
_ PICCHI DOMANDA INVERNALI
_ BASE LOAD ESTIVO PER ACS E BATTERIE UTA

RETROFIT IDEALE:

COGENERAZIONE/TRIGENERAZIONE OTTIMIZZATA SU DOMANDA REPARTI (BIM)

	2008	2009	2010	2011	2012	2013	2014	Average Year
Period	kWhp	kWhp	kWhp	kWhp	kWhp	kWhp	kWhp	kWht
January	11.069.189	9.395.704	10.386.547	9.930.650	9.298.742	9.133.493	9.791.000	9.869.054
February	7.566.165	8.931.804	7.585.814	6.553.469	10.116.312	9.068.161	8.215.600	8.303.621
March	11.002.819	7.340.649	9.739.848	9.342.850	5.833.866	9.085.476	7.948.710	8.724.251
April	6.965.714	4.397.044	5.250.631	4.857.398	5.093.040	6.000.028	8.189.130	5.427.309
May	3.846.261	3.473.056	3.696.870	3.266.297	2.617.656	3.977.728	4.860.850	3.479.645
June	3.566.145	2.610.143	4.166.667	3.525.527	2.652.098	3.474.331	4.802.550	3.332.485
July	4.020.617	3.006.317	3.168.532	2.263.578	2.915.687	3.595.870	5.264.200	3.161.767
August	3.668.003	2.355.831	3.601.114	2.932.057	3.116.254	3.198.580	5.408.540	3.145.307
September	3.934.136	2.209.965	3.344.768	1.809.613	3.350.608	3.531.420		3.030.085
October	3.437.293	4.335.433	3.851.665	3.738.116	2.995.563	3.690.840		3.674.818
November	4.218.320	6.106.649	8.071.301	5.166.916	6.148.734	6.817.020		6.088.157
December	13.359.677	12.671.518	9.124.117	6.232.408	10.532.280	9.487.010		10.234.502
Year	76.654.338	66.834.112	71.987.875	59.618.880	64.670.839	71.059.957	54.480.580	68.471.000

Note: requirements associated to heating thermal end uses are expressed in terms of primary energy - fuels: natural gas and fuel oil BTZ – considering the correspondent lower calorific value



DOMANDA ENERGIA FRIGORIFERA OSPEDALE CAREGGI

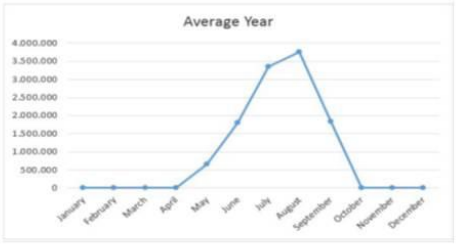
PATTERN CARATTERISTICO GRANDI STRUTTURE OSPEDALIERE IN CLIMI TEMPERATI:

_ PICCHI DOMANDA CONCENTRATI IN ESTATE PER RAFFRESCAMENTO REPARTI CLIMATIZZATI

RETROFIT IDEALE:

TRIGENERAZIONE UTILIZZO ABSORPTION CHILLERS OTTIMIZZATA SU DOMANDA REPARTI (BIM)

	Average Year	2009	Average Year
Period	kWhp	kWhp	kWht
January	3.259.597		
February	3.031.612		
March	3.170.937		
April	3.224.004		
May	3.442.715	218.711	656.133
June	3.824.657	600.653	1.801.958
July	4.341.036	1.117.032	3.351.097
August	4.476.205	1.252.201	3.756.603
September	3.839.833	615.829	1.847.488
October	3.572.768		
November	3.325.207		
December	3.439.186		
Year	42.947.757	3.804.426	11.413.277



DOMANDA ENERGIA ELETTRICA OSPEDALE CAREGGI

PATTERN CARATTERISTICO GRANDI COMPLESSI SANITARI:

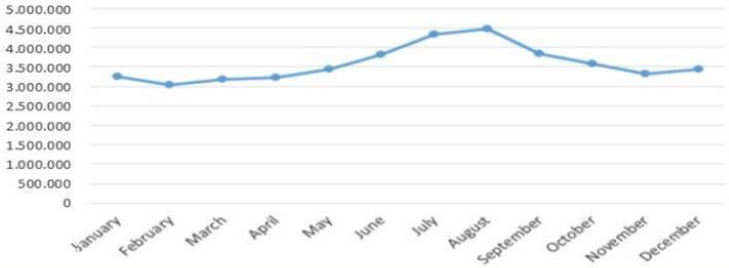
_ PRESENTE PICCO ESTIVO DOVUTO ALL'ALIMENTAZIONE ELETTRICA DEI SISTEMI DI RAFFRESCAMENTO
_ PICCO RIDOTTO RISPETTO A GRANDI OSPEDALI PER PRESENZA DI UN ABBONDANTE BASE LOAD TUTTO L'ANNO

RETROFIT IDEALE:

TRIGENERAZIONE OTTIMIZZATA SU DOMANDA REPARTI (BIM)

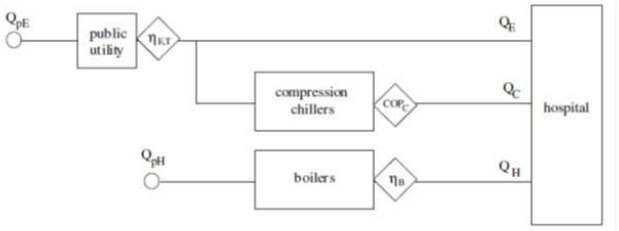
	2008	2009	2010	2011	2012	2013	2014	Average Year
Period	kWhe	kWhe	kWhe	kWhe	kWhe	kWhe	kWhe	kWhe
January	2.951.955	3.040.250	3.105.891	3.194.713	3.316.818	3.947.957	3.917.917	3.259.597
February	2.852.238	2.706.694	2.916.768	2.890.506	3.267.810	3.555.658	3.454.760	3.031.612
March	3.012.124	2.926.049	2.844.068	3.199.379	3.233.590	3.810.409	3.962.730	3.170.937
April	2.948.133	2.990.375	3.250.397	3.141.229	3.270.857	3.743.033	3.832.920	3.224.004
May	3.228.576	3.396.697	3.202.701	3.387.232	3.419.507	4.021.576	3.976.770	3.442.715
June	3.536.258	3.522.558	3.740.135	3.826.515	4.154.243	4.168.230	4.251.970	3.824.657
July	4.083.685	4.188.630	3.229.272	4.216.089	5.206.054	5.122.488	4.769.250	4.341.036
August	4.029.727	4.312.974	3.229.272	4.224.866	4.990.265	6.070.125	4.598.850	4.476.205
September	3.498.256	3.677.080	3.125.103	4.059.551	4.282.886	4.396.123		3.839.833
October	3.335.720	3.236.785	3.229.272	3.498.940	4.095.971	4.039.920		3.572.768
November	3.041.968	3.000.158	3.125.103	3.143.522	3.803.330	3.837.158		3.325.207
December	3.006.124	3.128.378	3.250.005	3.324.941	3.951.082	3.974.588		3.439.186
Year	39.524.764	40.126.628	38.247.987	42.107.483	46.992.413	50.687.265	32.765.167	42.947.757

Table 03 Historical Careggi electric energy requirements (kWhe)



Energy retrofit trigenerazione

STATO DI FATTO



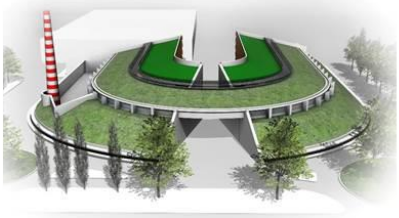
ENERGY RETROFIT: TRIGENERAZIONE A GAS NATURALE

Electric Nominal Power 10,5 MW_e

Recovered Heat (heating) 17,3 MW_t

3 back up gas-fired boilers11 MW_t

Absorption chillers cooling power 6,3 MWf

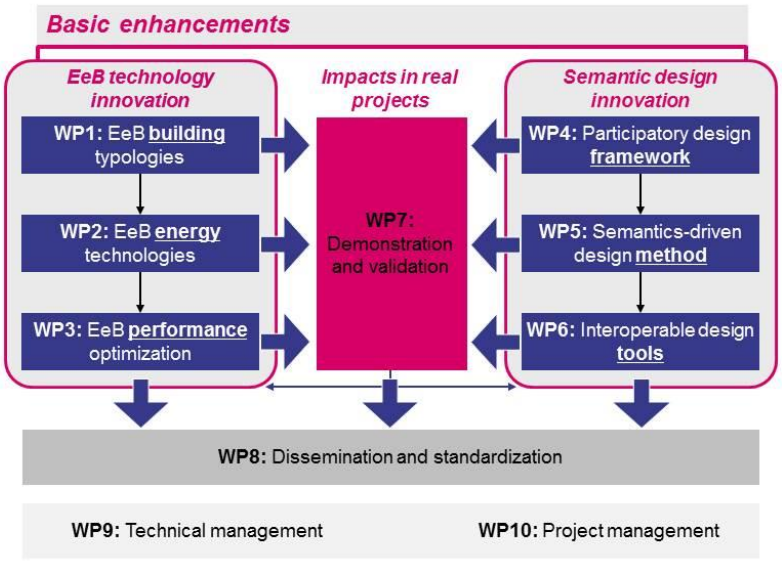


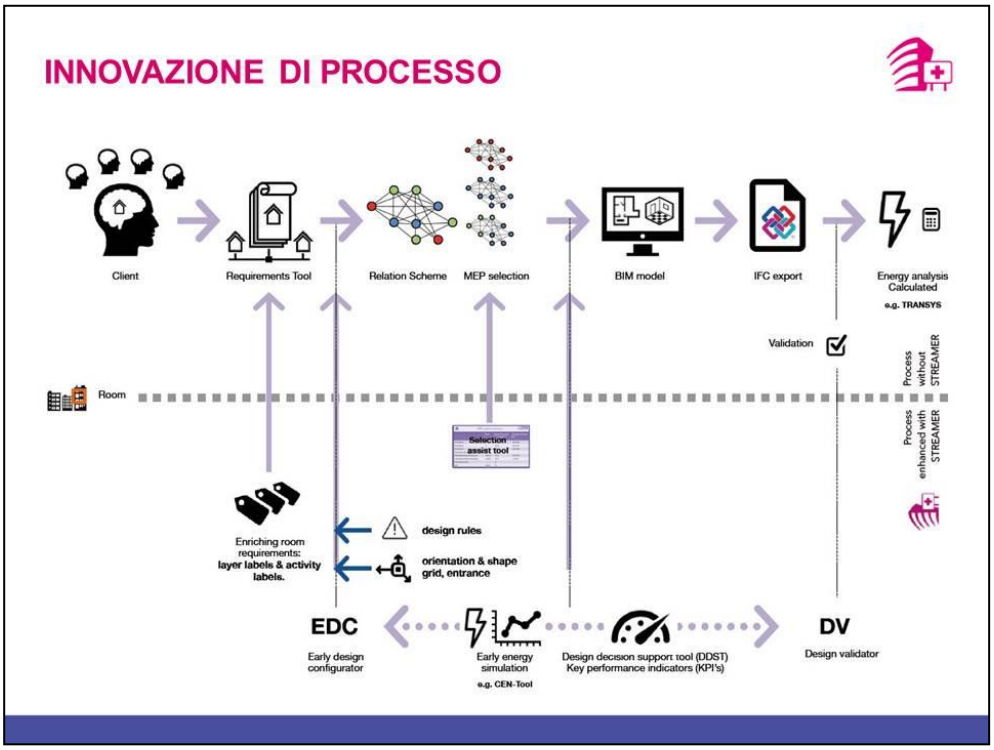
prof. Roberto Di Giulio

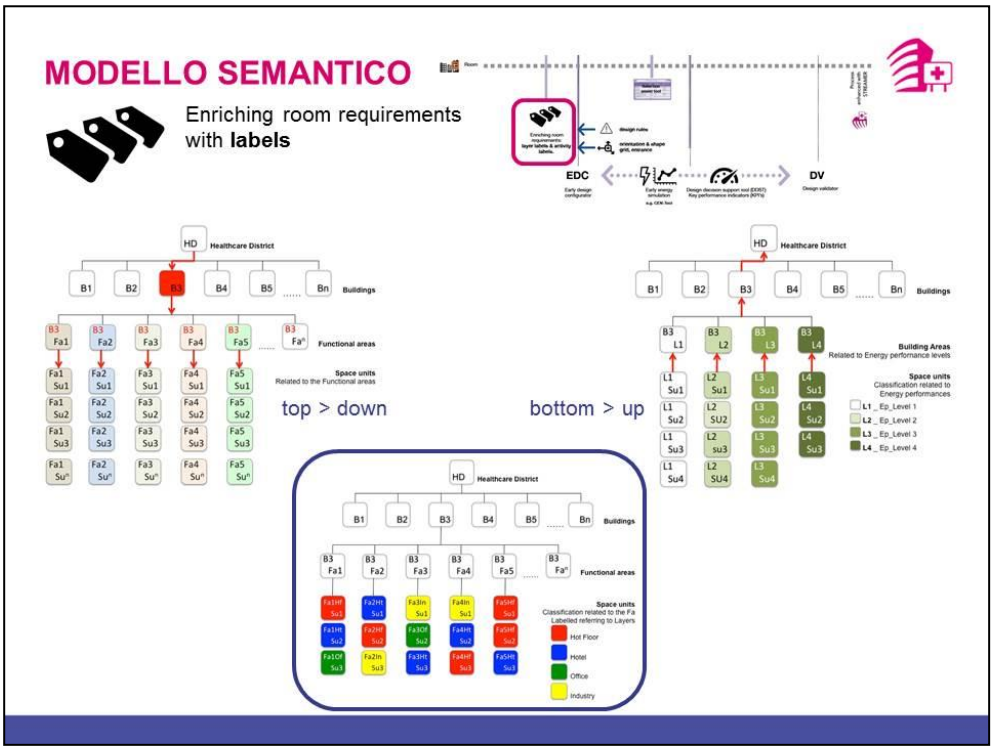
I RISULTATI DEL PROGETTO

Streamer
European research on energy-efficient healthcare districts

PROGRAMMA DI RICERCA



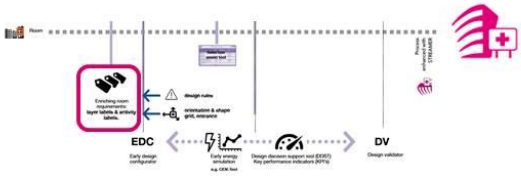

INNOVAZIONE DI PROCESSO
Client
Requirements Tool
Relation Scheme
MEP selection
BIM model
IFC export
Energy analysis Calculated
e.g. TRANSYS
Validation
Process without STREAMER
Process enhanced with STREAMER
Room
Selection assist tool
Enriching room requirements: layer labels & activity labels.
design rules
orientation & shape grid, entrance
EDC
Early design configurator
Early energy simulation
e.g. CEN-Tool
Design decision support tool (DDST) Key performance indicators (KPI's)
DV
Design validator


MODELLO SEMANTICO
Enriching room requirements with labels
HD
Healthcare District
B1
B2
B3
B4
B5
Bn
Buildings
Functional areas
Space units
Related to the Functional areas
top > down
bottom > up
Building Areas
Related to Energy performance levels
Space units
Classification related to Energy performances
L1 _ Ep_Level 1
L2 _ Ep_Level 2
L3 _ Ep_Level 3
L4 _ Ep_Level 4
Space units
Classification related to the Fa
Labelled referring to Layers
Hot Floor
Hotel
Office
Industry

MODELLO SEMANTICO

il Bouwcollege approach

4 layers con caratteristiche omogenee

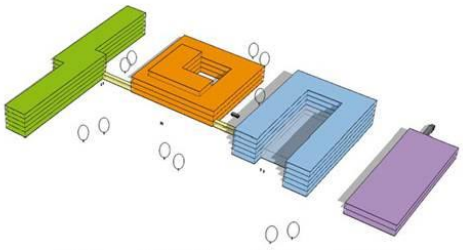


HOTEL
specificity
costs
flexibility
marketability

HOT FLOOR
specificity
costs
flexibility
marketability

OFFICE
specificity
costs
flexibility
marketability

INDUSTRY
specificity
costs
flexibility
marketability



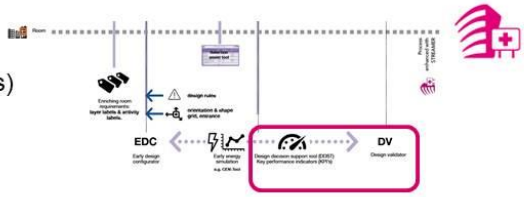
MODELLO SEMANTICO

Il **Labelling system** di Streamer

H Hygienic classes (has a relation with amount of ventilation, air tightness, cleaning, materials)	H1	(corridor, reception, toilette, , etc.)
	H2	(office, bathroom, etc.)
	H3	(patient room, examination room, treatment room, etc.)
	H4	(operating room, insulation room, etc.)
	H5	(laboratory, production pharmacy, etc.)
A Accessibility (has a relation with the position in the hospital, safety/protective/security device)	A1	(Public)
	A2	(Patients, visitors and staff)
	A3	(Patients and staff
	A4	(All staff members)
	A5	(Specific staff members)
U User profile (has a relation with the type of use)	U1	(Monday to Friday from 8:00 – 18:00)
	U2	(U1 with emergency function outside this timeslot)
	U3	(24*7)
	U4	(U1 extended till 20:00)
EQ Equipment (has a relation with the type of function, high electric power needed, medical gasses, ICT data points)	EQ1	(No additional electric power is needed)
	EQ2	(Electric power equal to an office)
	EQ3	(Electric power equal to an office combined with emergency power supply)
	EQ4	(Electric power higher (1.6 times) than an office)
	EQ5	(High electric power demand (1.5 kW/m2))
	EQ6	(Special equipment and requirements regarding safety)
C Construction (has a relation with floor strength, shielding against radiation, floor height, air tightness)	C1	(Office level)
	C2	(Office level with extra floor strength)
	C3	(Office level with extra floor height)
	C4	(C2 and C3)
	C5	(Accessible from the outside with heave load)
	C6	(Shielding against radiation)
CT Comfort (has a relation to requirements on day light, view to the outside, air flow, design temperature, lighting, indoor noise and control of lighting)	CT1	(e.g. archive room)
	CT2	(e.g. corridor)
	CT3	(e.g. office)
	CT4	(e.g. patient room with direct daylight)
	CT5	(in)direct daylight
	CT6	(e.g. laboratory)
	CT7	(e.g. operating room)
	CT8	special

INDICATORI QUALITÀ

KPIs (Key Performance Indicators)



ENERGY PERFORMANCE

Energy efficiency
Carbon emission efficiency

FINANCIAL PERFORMANCE

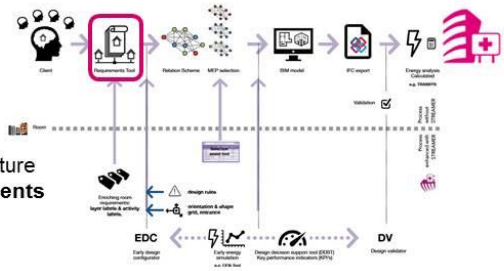
Life cycle costs

QUALITY PERFORMANCE

Patient satisfaction
Overall quality
Thermal comfort
Operational efficiency (building efficiency and travel time efficiency)

NUOVI STRUMENTI: POR

Requirements Tool, to capture
Programme of Requirements

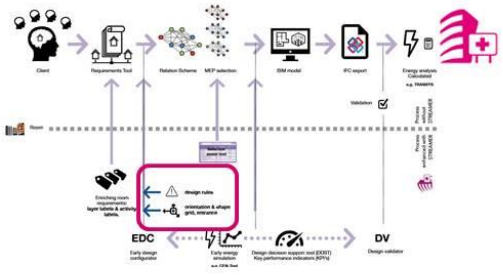


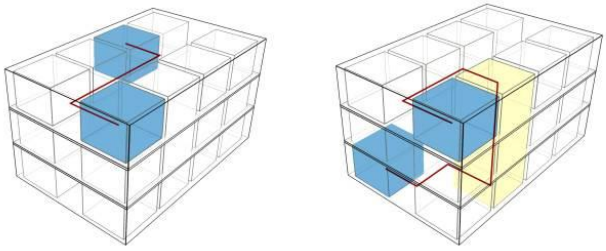
Category	STREAMER Spatial Unit Identifier	Spatial Units	Description
SPACE	Corridor	Corridor	/
SPACE	Lift	Lift	Vertical connection by elevator
SPACE	Stairs	Stairs	/
SPACE	InternalFireEscapeStairs	Internal fire escape stairs	Vertical connection
ROOM	AirLock	Air lock	Traffic support equipment space with at least two doors that can be crossed without more than one door to be
ROOM	AmbulanceHall	Ambulance hall	Space for loading and unloading of patients to / from the ambulance
ROOM	AnalysisRoom	Analysis room	Space designated for basic analysis of blood and urine samples
ROOM	AnteRoom	Ante-room	Traffic support equipment space with at least two doors that can be passed with several doors open at once. L
ROOM	Archives	Archives	Room designated for storage of documents
ROOM	BabyChangingRoom	Baby-changing room	/
ROOM	Basement	Basement	Technical space underneath the hospital

STREAMER SPACE UNITS	Bouwcollege layer class	Hygiene class	AccessSecurity class	UserProfile class	Equipment class	Construction class	Comfort class
AirLock	I	H3	A5	U4	EQ1	C1	CT6

NUOVI STRUMENTI: DR

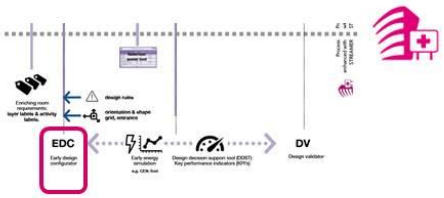
Design Rules

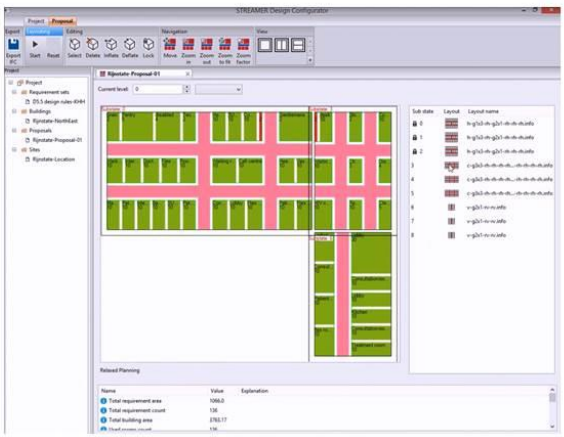




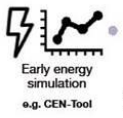
NUOVI STRUMENTI: EDC

Early Design Configurator

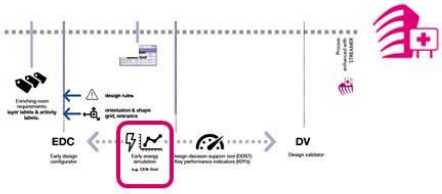




NUOVI STRUMENTI: CEN



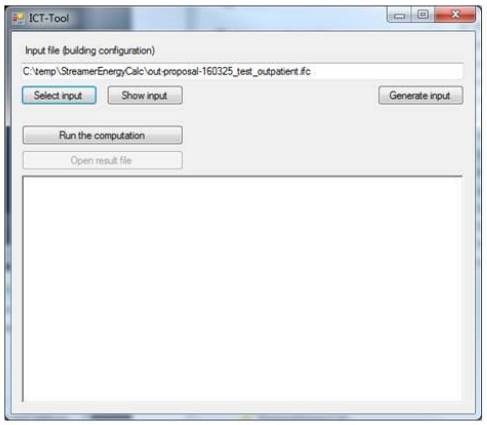
Early Energy Simulation



- "Select input" button
  To browse the file system for the ifc-file to be used as input.
- "Run the computation" button
  Starts the calculation and creates output files.

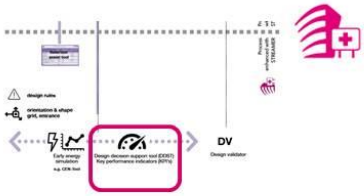
Ifc output is saved in the same location as the used input ifc-file.

Other outputs are saved in the applications folder.

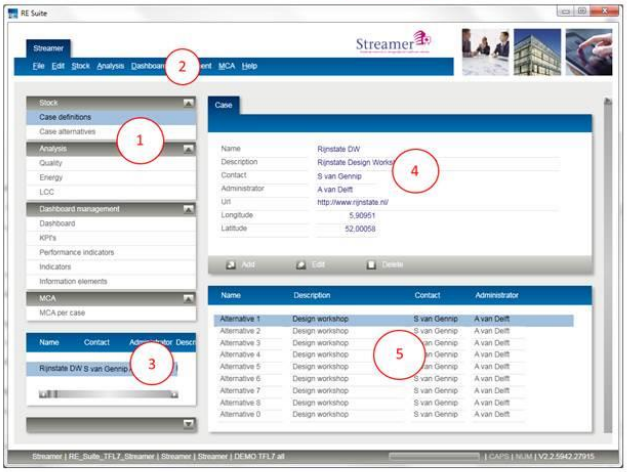


NUOVI STRUMENTI: DASHBOARD

Design decision support tool (**DDST**)

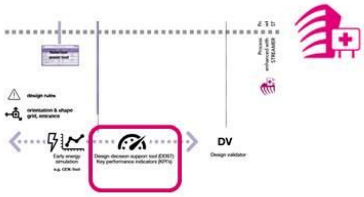


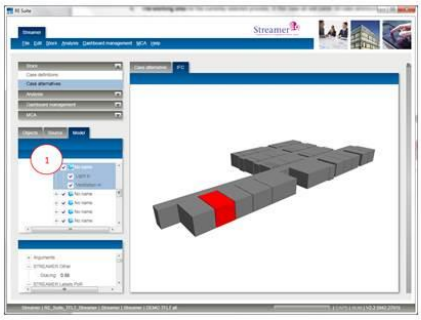
1 | The process navigator
2 | The menu bar
3 | The object navigator
4 | The working area
5 | The list of items contained within the currently selected object



NUOVI STRUMENTI: DASHBOARD

Design decision support tool (**DDST**)





prof. Roberto Di Giulio

IL RUOLO DELL' AOU CAREGGI NEL PROGETTO

Streamer
European research on energy-efficient healthcare districts

AOU CAREGGI

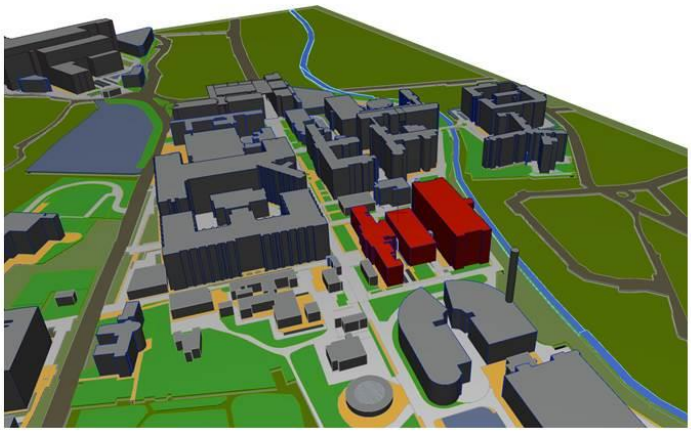
L'AOU Careggi ha strategicamente deciso di avvalersi dell'Università di Firenze come terza parte, utilizzando, ai fini della ricerca, il sistema informatizzato e geo-referenziato "**SACS®** - Sistema per l'Analisi delle Consistenze Strutturali".

Data base in uso ed in continuo aggiornamento
Attualmente risultano mappati più di 16.000 ambienti in 52 edifici.

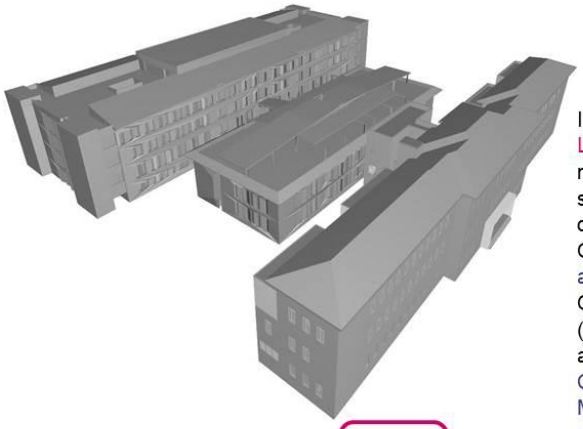
L'obiettivo dell'Azienda è di:
implementare questo sistema con i risultati della ricerca "Streamer" per utilizzarlo quale supporto in tutte le fasi decisionali riguardanti il proprio patrimonio immobiliare in un'ottica di contenimento energetico ed efficienza funzionale.

IL CASO STUDIO

Considerando la programmazione dei futuri interventi sul patrimonio strutturale, l'AOU di Careggi ha scelto di utilizzare il polo oncologico "San Luca" quale oggetto della validazione dei risultati della ricerca.
Il polo si articola in un complesso di tre edifici posto nel cuore del distretto, in adiacenza alla nuova centrale di trigenerazione.



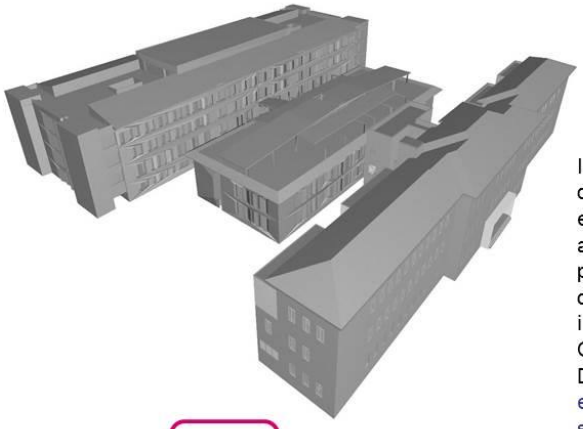
IL CASO STUDIO



San Luca Nuovo | San Luca Volano | **San Luca Vecchio**

Il primo dei tre edifici, il "San Luca vecchio", è stato costruito negli anni '60 e presenta uno schema planimetrico a "triplo distributivo" su tre livelli.
Ospita, oltre ai locali destinati all'accoglienza, le Strutture Ospedaliere Dipartimentali (SOD) afferenti ai Dipartimenti ad Attività Integrata (DAI) del Cuore e del Vasi, del DEA e Medicina e Chirurgia Generale e di Urgenza, e di Biomedicina.
Conta 282 ambienti distribuiti in 3.646 m2 e ospita 60 posti letto.

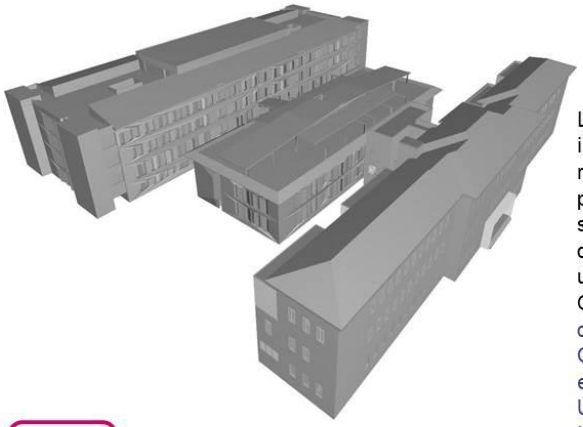
IL CASO STUDIO



San Luca Nuovo | **San Luca Volano** | San Luca Vecchio

Il secondo, il cosiddetto "Volano", di collegamento tra gli altri due edifici, è stato inaugurato da due anni e presenta uno schema planimetrico a "quintuplo distributivo" su 4 livelli (di cui uno interrato).
Ospita, oltre ai locali tecnici, i DAI di Diagnostica per immagini e di Oncologia. 7 sono le nuove sale operatorie al piano terra.
Conta 242 ambienti distribuiti su 4.662 m2.

IL CASO STUDIO



San Luca Nuovo | San Luca Volano | San Luca Vecchio

La costruzione del terzo edificio, infine, il «San Luca Nuovo», risale a 15 anni fa. La struttura presenta, come il "volano", uno schema planimetrico a "quintuplo distributivo" ma su 6 livelli (di cui uno interrato).
Ospita i DAI del Cuore e dei vasi, delle Specialità Medico-Chirurgiche, del DEA e Medicina e Chirurgia Generale e di Urgenza, di Diagnostica per Immagini e di Oncologia.
Conta 817 ambienti distribuiti su 13.784 m2 e ospita 219 posti letto.

IL CASO STUDIO

La Direzione dell'Azienda, considerata la vetustà e l'inefficienza – funzionale e prestazionale - del primo edificio (San Luca Vecchio), si è posta il problema del tipo di intervento da intraprendere, cioè se effettuare una demolizione e ricostruzione oppure una ristrutturazione profonda.
"STREAMER" DIVENTA QUINDI LO STRUMENTO STRATEGICO PER EFFETTUARE QUESTA SCELTA SECONDO CRITERI DI EFFICIENZA ENERGETICA.

PAUSA

Streamer
European research on energy-efficient healthcare districts

Colophon

PowerPoint: Italian Workshop
Issue Date: 28th November 2016
Author: Beatrice Turillazzi (AOC-UNIFI), Roberto Di Giulio (IAA) and Giacomo Bizzarri (BEQ)
Version: 1.0

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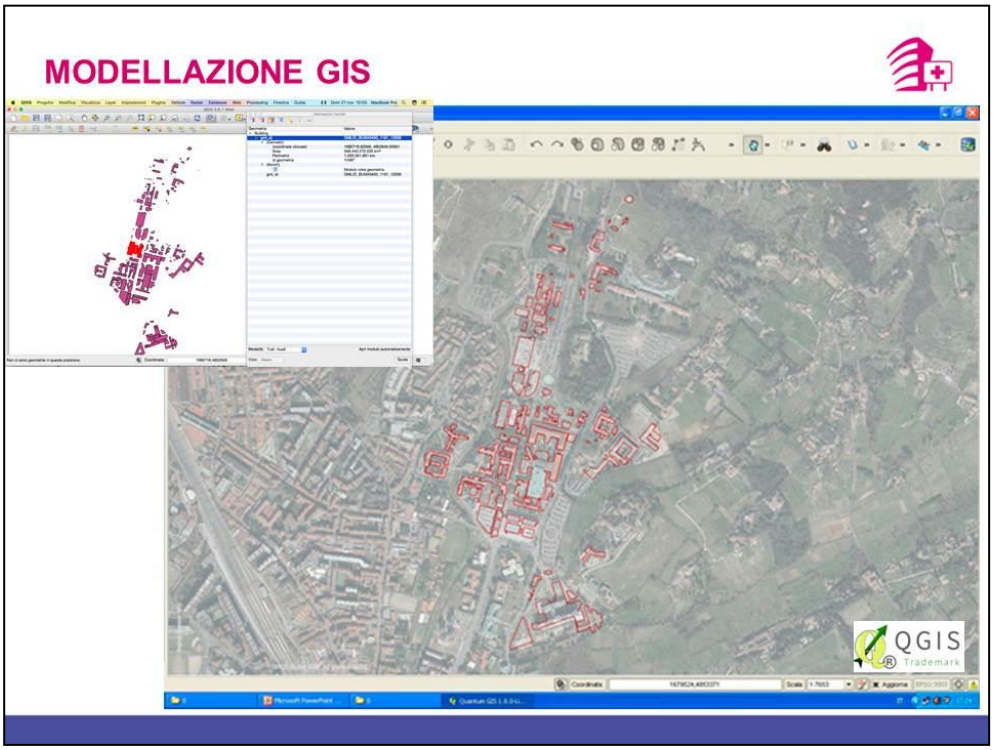
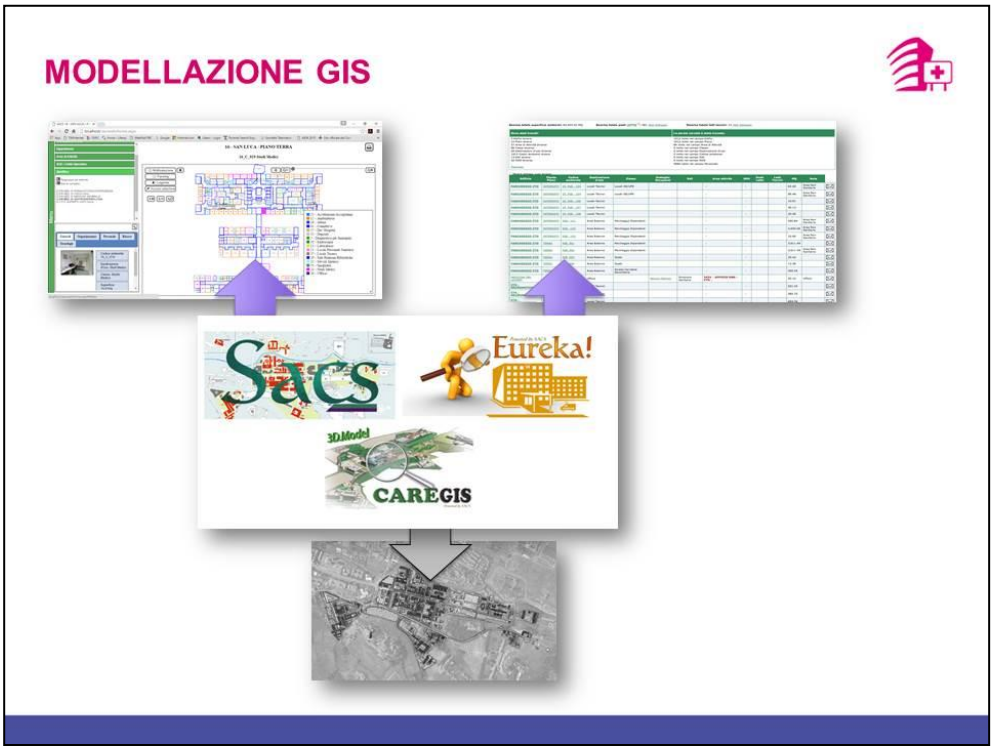
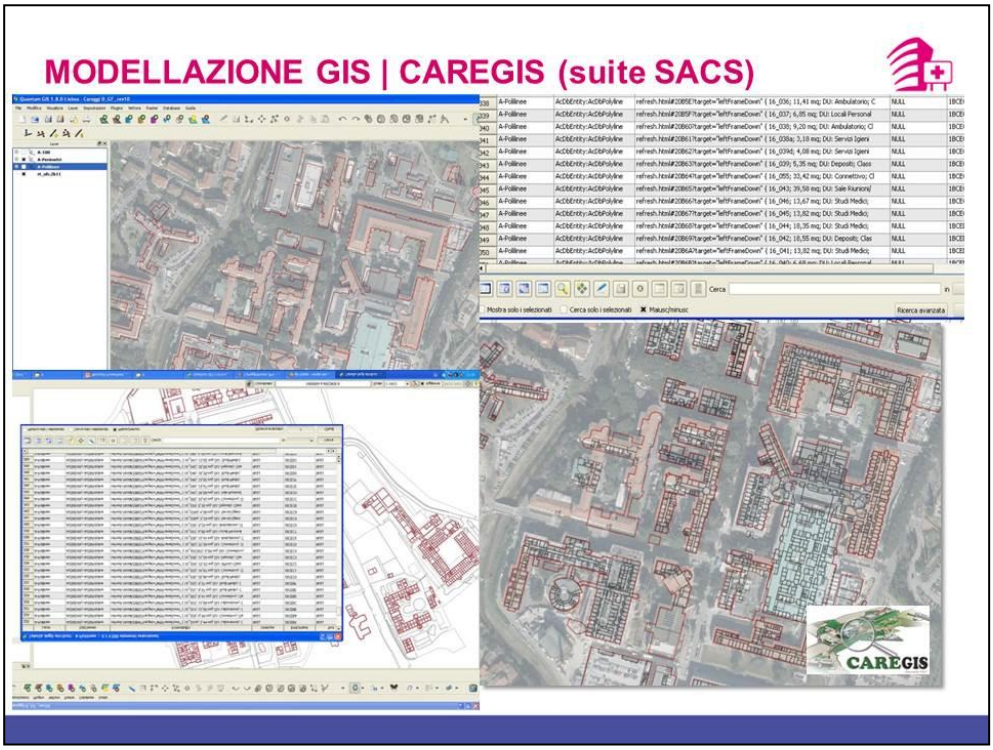
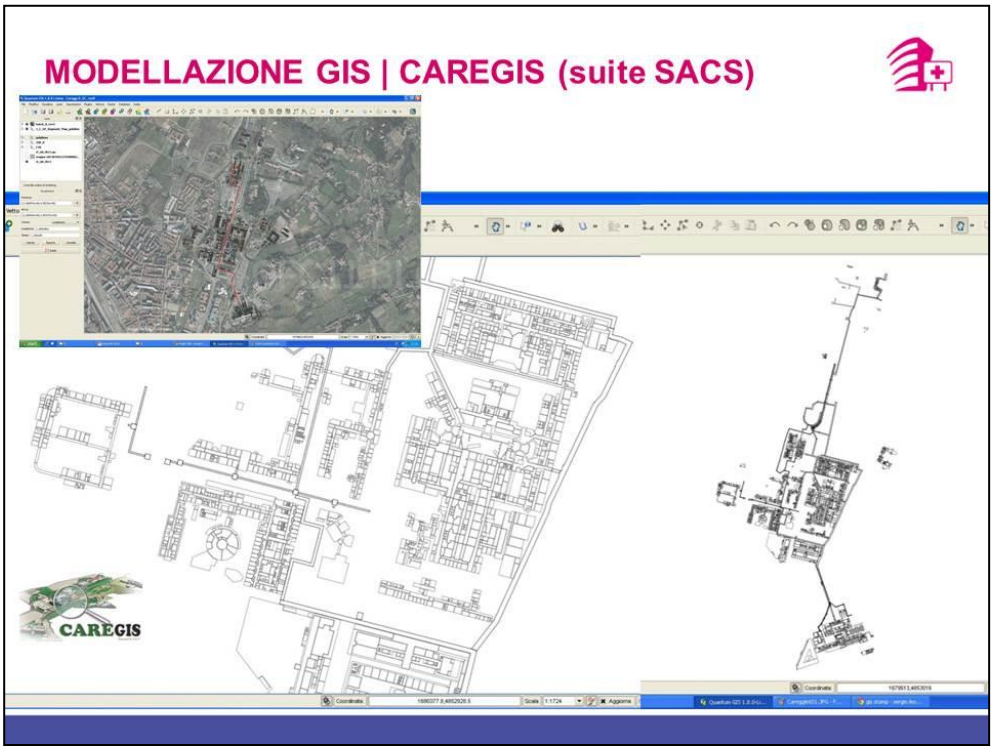
Streamer
European research on energy-efficient healthcare districts

APPENDIX 4 – PPT presentation (2nd part)

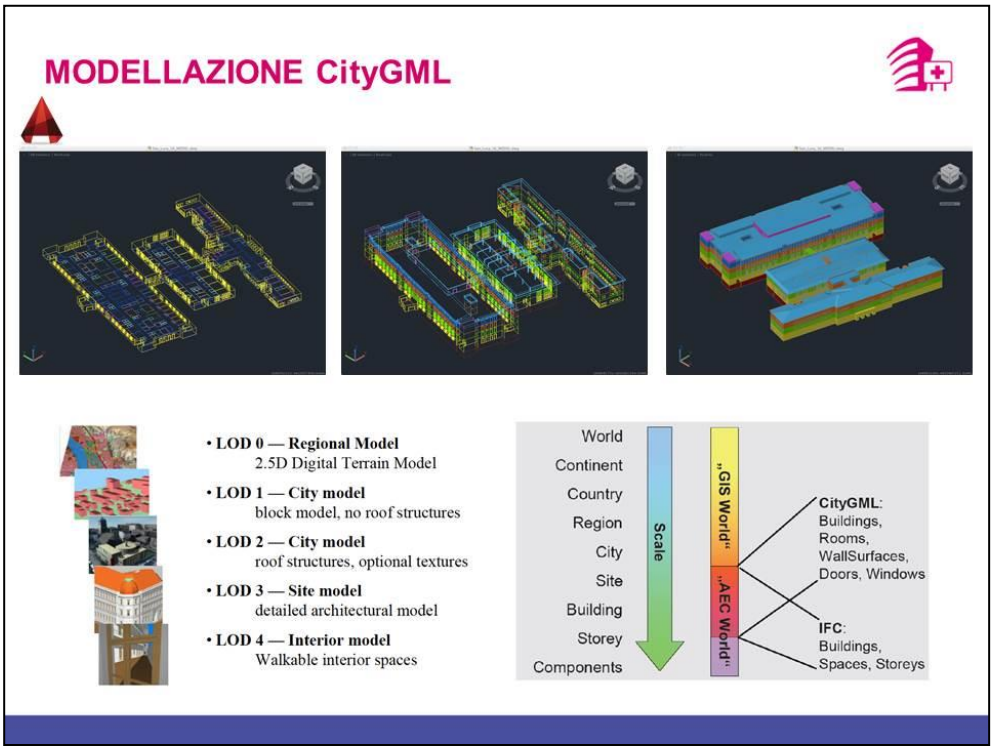



MODELLAZIONE GIS
SACS
Eureka!
CAREGIS


MODELLAZIONE GIS | CAREGIS (suite SACS)
CAREGIS

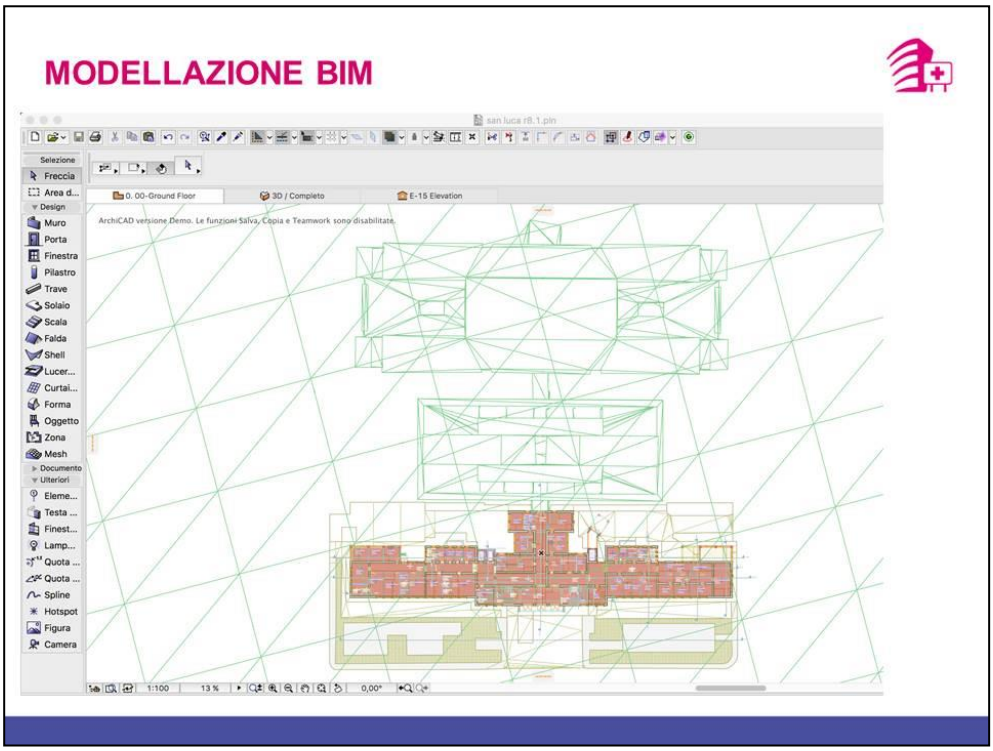

MODELLAZIONE GIS | CAREGIS (suite SACS)
CAREGIS

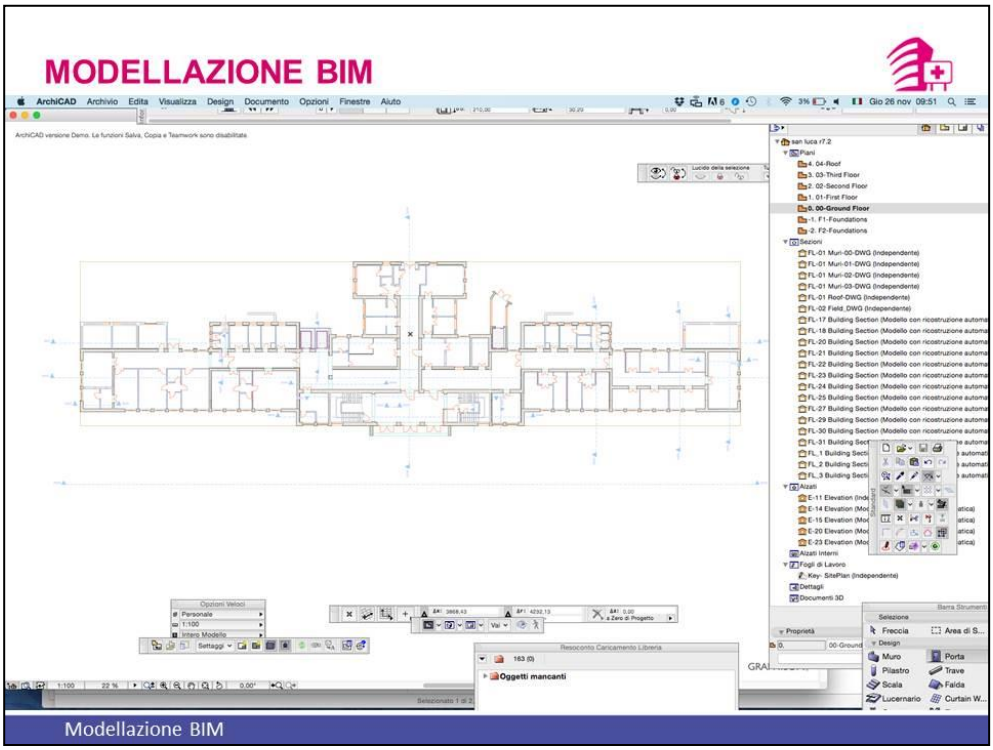

MODELLAZIONE GIS | C.GML
Google Earth

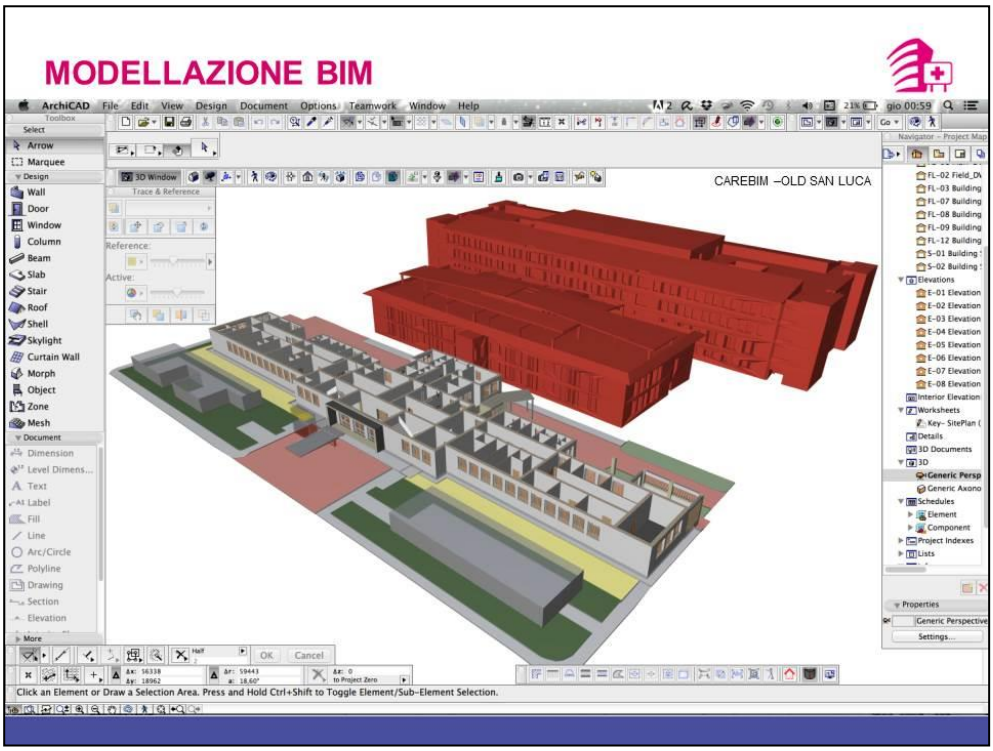

MODELLAZIONE CityGML
• LOD 0 — Regional Model
2.5D Digital Terrain Model
• LOD 1 — City model
block model, no roof structures
• LOD 2 — City model
roof structures, optional textures
• LOD 3 — Site model
detailed architectural model
• LOD 4 — Interior model
Walkable interior spaces
World
Continent
Country
Region
City
Site
Building
Storey
Components
Scale
„GIS World"
„AEC World"
CityGML:
Buildings,
Rooms,
WallSurfaces,
Doors, Windows
IFC:
Buildings,
Spaces, Storeys

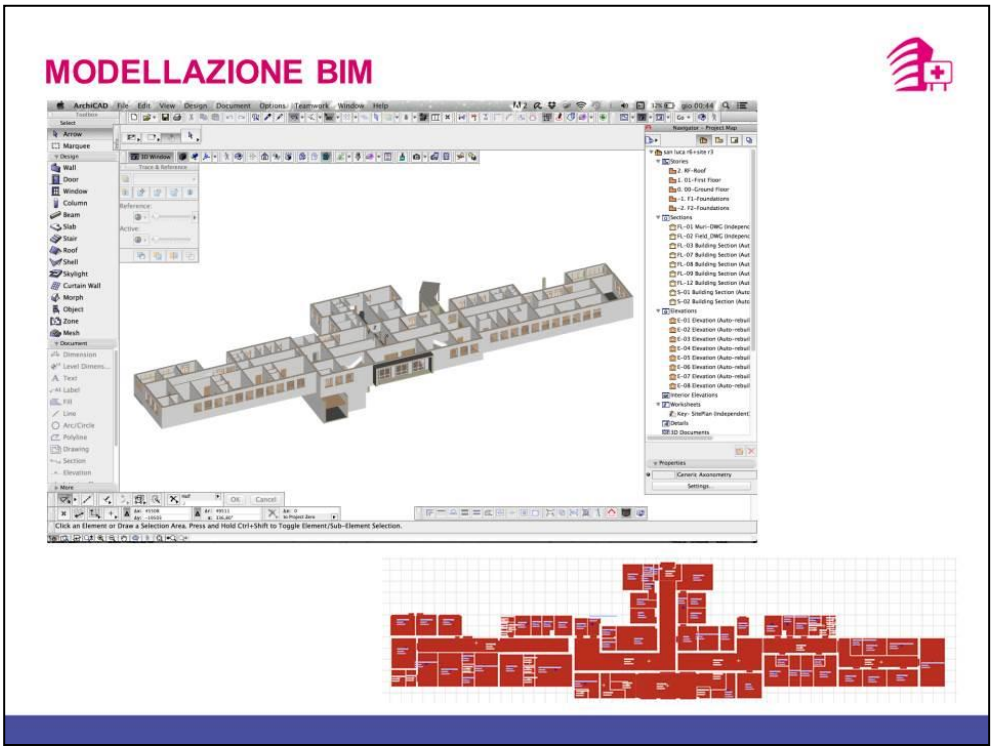

MODELLAZIONE CityGML

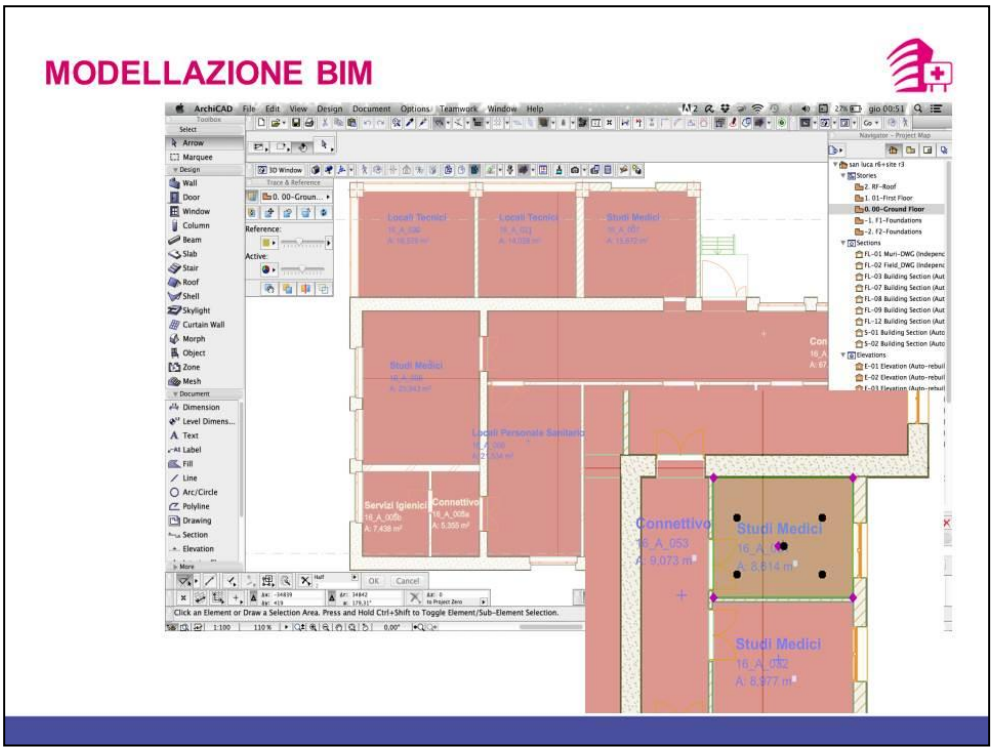

MODELLAZIONE GIS-CityGML-BIM

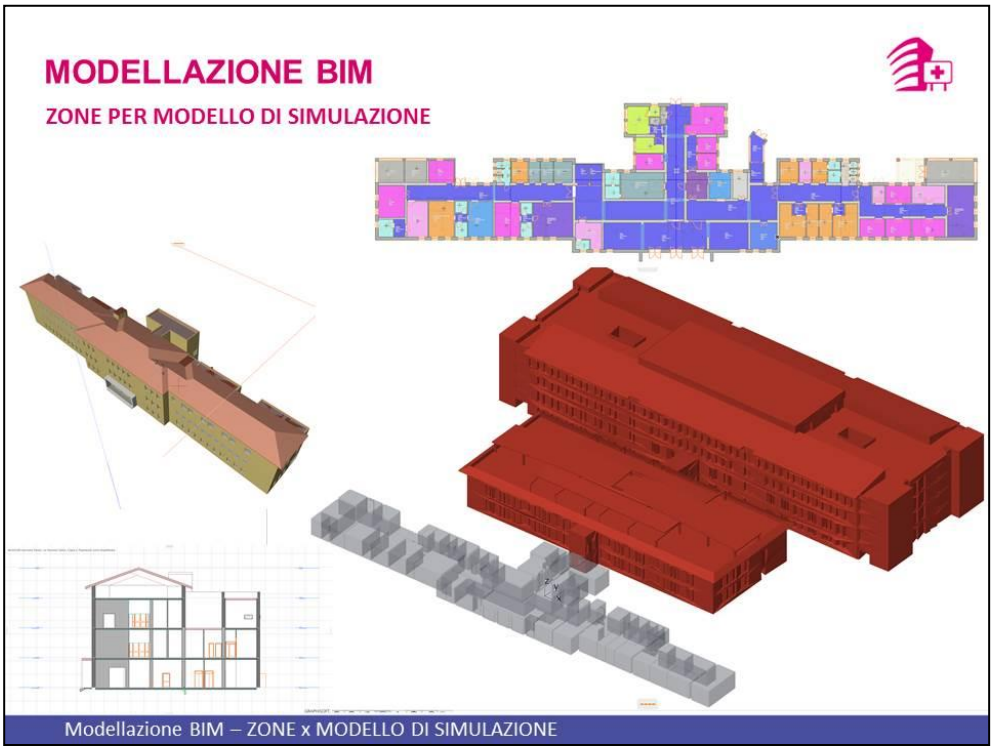

MODELLAZIONE BIM
Selezione
Freccia
Area d...
Design
Muro
Porta
Finestra
Pilastro
Trave
Solaio
Scala
Falda
Shell
Lucer...
Curtai...
Forma
Oggetto
Zona
Mesh
Documento
Ulteriori
Eleme...
Testa ...
Finest...
Lamp...
Quota ...
Quota ...
Spline
Hotspot
Figura
Camera
0. 00-Ground Floor
3D / Completo
E-15 Elevation
ArchiCAD versione Demo. Le funzioni Salva, Copia e Teamwork sono disabilitate.


MODELLAZIONE BIM
Modellazione BIM


MODELLAZIONE BIM
CAREBIM –OLD SAN LUCA
Click an Element or Draw a Selection Area. Press and Hold Ctrl+Shift to Toggle Element/Sub-Element Selection.


MODELLAZIONE BIM


MODELLAZIONE BIM
Locali Tecnici
Locali Tecnici
Studi Medici
Studi Medici
Locali Personale Sanitario
Servizi Igienici
Connettivo
Connettivo
Studi Medici
Studi Medici



SACS | DESTINAZIONI D'USO

Operating Room (beds)	01_00	General OR; Specialist OR; Hybrid OR; Orthopedics OR; Pre-Operation (Patient) /Awakening; Pre-Operation (Staff);	Intensive Care Unit (beds)	02_00	IC Box; NCC; Filter; Washing; Other	Sub-Intensive CareUnit (beds)	03_00	
Radiotherapy	04_00	Radiotherapeutic Applications; Thomotherapy; Gamma-Knife; CT Simulator; Control Room	Diagnostic	05_00	Control Room; CT; MRI; Uninterventionist Angiography; Radiography; COM; RIS-PACS;	Nuclear Imaging	06_00	Medicine Preparation; Diagnostic; Gamma Camera; Other
A&E	07_00	Examination Box; Discharge Room; Isolation; Triage; Shock-room; Short Observance; Intensive Observance; Other	Day Surgery	08_00		Delivery Room (beds)	09_00	Delivery Room; Labour Room; Pre-Operation (Staff); Substerilization; Filter; Other
Endoscopy	10_00	Bronchoscopy; Digestive Endoscopy; Urologic Endoscopy; Disinfection; Pre-operation (Patient); Control Room; Other	Frigoemoteca	11_00		Ambulatory	12_00	Echocardiography; Ergometry; Dynamic Electrocardiography; Surgery Ambulatory (local anaestethic); Surgey Ambulatory
Laboratory	13_00	BLS 1; BLS 2; BLS 3; BLS 4; Biobank; Cold Cell; Cold Store; Filter; Other	Mental Health Unit	14_00	Therapeutic & Rehabilitative Assistance; Socio-Rehabilitative Assistance; Minor Intensity Therapeutic & Rehabilitative	Pharmacy	15_00	Medicine Store; Fridge; Medicine Collecting; Antiblastic Medicine Unit; Medicine Preparation; Other
Rehabilitation	16_00	Gym; Swimming Pool; Physical Therapy & Rehabilitation	Day Hospital	17_00		Ward (beds)	18_00	Ward with Toilet; Ward without Toilet; Crèche; Other
Specialist Ward (beds)	19_00	Psychiatric Ward with Toilet; Hematologic Ward with Toilet; Isolation Ward with Toilet; Pediatric Ward with	Dyalisis (beds)	20_00		Staff Room	21_00	Nursing Coordinator; Reporting; On-Call-Doctor Room; Tisanery; Nurse Room; Relaxation Area; Other
Toilet	22_00	Public Toilet, Staff Toilet, Patient Toilet (for Invalids), Public Toilet (for Invalids), Staff Toilet (for Invalids), Bedpan	Medical Office	23_00	Office; Talk Room; Other	Sport Medicine	24_00	1st Level; 2nd Level
Acceptance	25_00	Acceptance; Information; CUP; Administration; Porter's Lodge	Waiting Room	26_00	Waiting Room for Relatives; Waiting Room for Patients; Game Space; Living Room; Other	Public Service	27_00	Commercial; Chapel; Showroom; Game Room; Other
Morgue	28_00	Autopsy; Corpse Waiting; Corpse Exposoure; Cold Store; Other	Meeting Room Library	29_00	Meeting Room; Reading Room; Library; Other	Office	30_00	Office; Administration; Direction; Other
Outer Area	31_00	Footpath; Parking; Other	Unclassified	32_00		Warehouse	33_00	Surgery Instruments; Medicine; Cleaning; Dirty Stuff; Clean Stuff; Archive; Other
Lavandry	34_00		Locker Room	35_00	Staff Locker Room; Patient Locker Room	Kitchen Work Canteen	36_00	Cooking; Work Canteen; Larder; Cold Store; Diet Kitchen; Meat Treathment; Washing; Warehouse; Other
Technical Room	37_00	Vertical Atrium; Server; Sound & Data; Lift House; Boiler House; Electric Panel; EG / UPS; Other	Medical-Aid Fecundation	38_00	Level 1; Level 2; Level 3A; Level 3B	Sterilization Disinfection	39_00	
Didactics	40_00	Administration; Office; Classroom; Auditorium; Conference Room; Simulator; Other	Connective	41_00	Horizontal Connective; Verical, Connective/Stairs; Litter Lift; Lift; Elevator; Service Lift; Stairlift; Backstairs;	Hemoteca	42_00	

ETICHETTATURA STREAMER IN SACS

STREAMER: 89 unità spaziali

ROOM	
Air lock	Traffic support equipment space with at least two doors that can be crossed without more than one door to be opened simultaneously.
Ambulance hall	Space for loading and unloading of patients to / from the ambulance
Analysis room	Space designated for basic analysis of blood and urine samples
Ante-room	Traffic support equipment space with at least two doors that can be passed with several doors open at once. Located in the wards.
Archives	Room designated for storage of documents
Baby-changing room	/
Basement	Technical space underneath the hospital
Breast feeding room	/
Canteen	Space where food is served
Central hall	Entrance hall to the hospital
Changing room (personnel)	/
Conference room	Room for groups (for teaching , conversation , etc.)
Conservation room	Room in which the deceased are kept in a conditioned space
Consultation + examination room	Room with an area for examination of patients and area for conversation
Darkroom	/

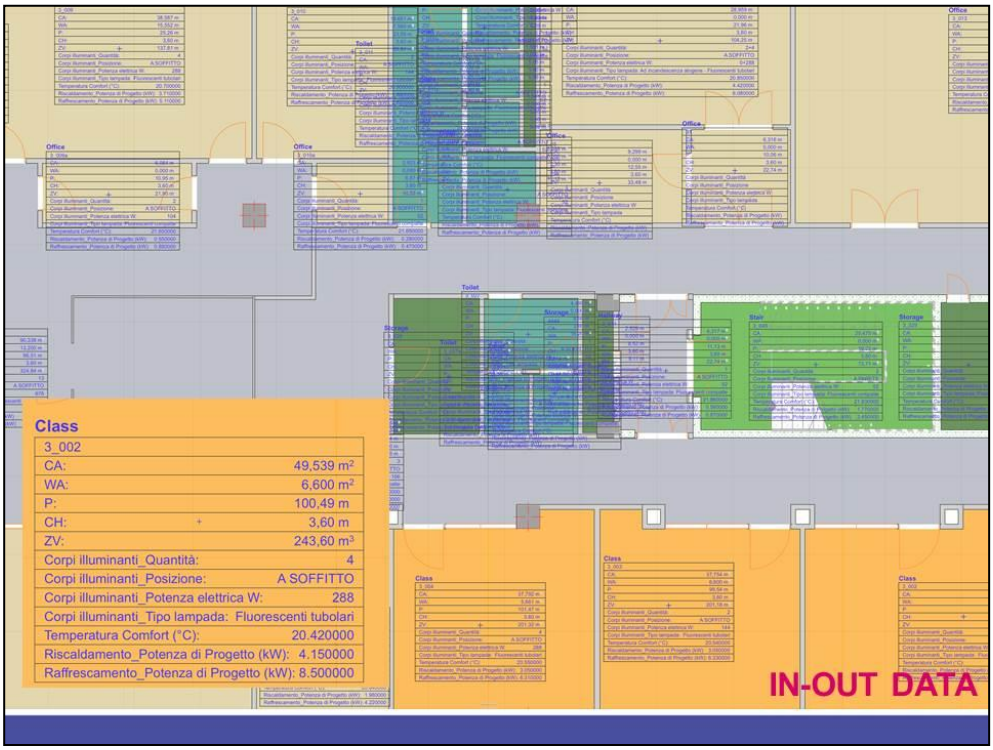
	A	B	C	D	E	F	G	H
	STREAMER Spatial Units Identifier	Description	Bouwcollege layer class	Hygiene class	AccessSecurity class	UserProfile class	Equipment class	Construction class
	AirLock	Traffic support equipment space with at least two doors that can be crossed without more than one door to be opened simultaneously.	I	H5	A5	U4	EQ1	C1
	AmbulanceHall	Space for loading and unloading of patients to / from the ambulance	I	H1	A3	U4	EQ1	C4
	AnalysisRoom	Space designated for basic analysis of blood and urine samples	I	H5	A5	U3	EQ4	C1
	AnteRoom	Traffic support equipment space with at least two doors that can be passed with several doors open at once. Located in the wards.	H	H1	A2	U4	EQ1	C1
	Archives	Room designated for storage of documents	O	H1	A5	U1	EQ1	C2
	BabyChangingRoom	/	O	H1	A2	U4	EQ1	C1
	Basement	Technical space underneath the hospital	I	H1	A4	U4	EQ1	C2
	BreastFeedingRoom	/	O	H1	A2	U4	EQ1	C1
	Canteen	Space where food is served	H	H1	A2	U2	EQ1	C3
	CentralHall	Entrance hall to the hospital	O	H1	A1	U4	EQ1	C4
	ChangingRoomPersonnel	/	I	H1	A5	U4	EQ1	C1
	ConferenceRoom	Room for groups (for teaching , conversation , etc.)	O	H2	A2	U1	EQ2	C1
	ConservationRoom	Room in which the deceased are kept in a conditioned space	I	H2	A5	U1	EQ3	C1
	ConsultationExaminationRoom	Room with an area for examination of patients and area for conversation	O	H3	A2	U1	EQ2	C1
	Darkroom	/	O	H2	A5	U1	EQ2	C1
	DayRoom	Room set up for relaxing and socializing between patients and visitors within the wards	H	H2	A2	U4	EQ1	C1
	DeliveryRoom	Room for giving birth	HF	H3	A3	U4	EQ4	C1
	DisinfectionRoom	Room designated for cleaning and disinfection of medical equipment	I	H4	A5	U4	EQ6	C1

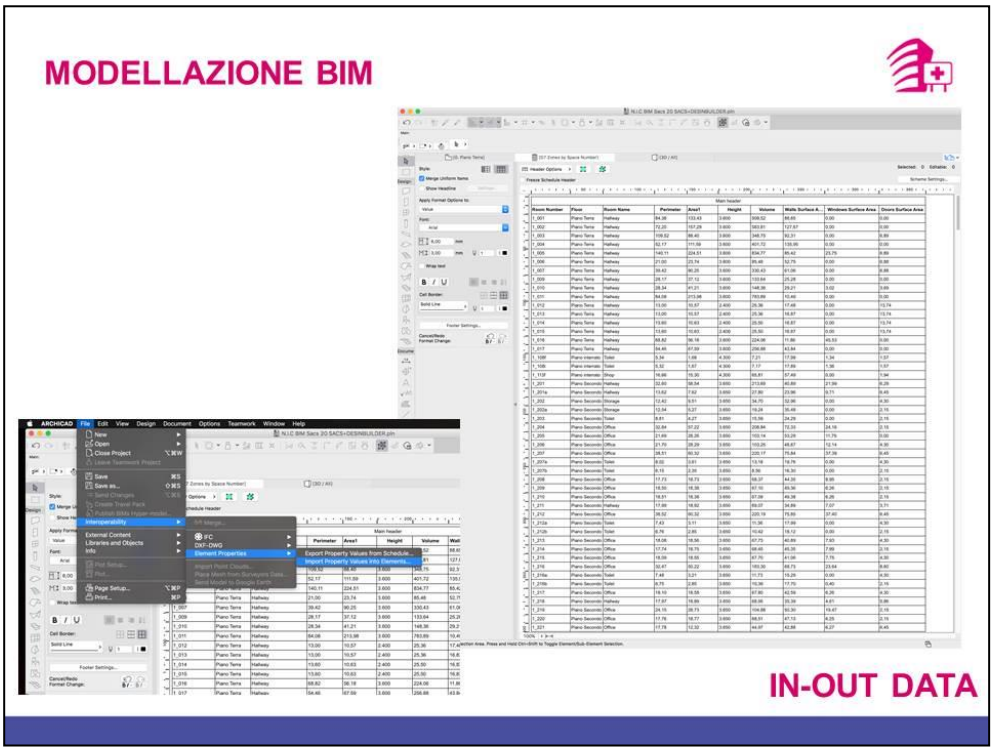
7 Label per ogni unità spaziale

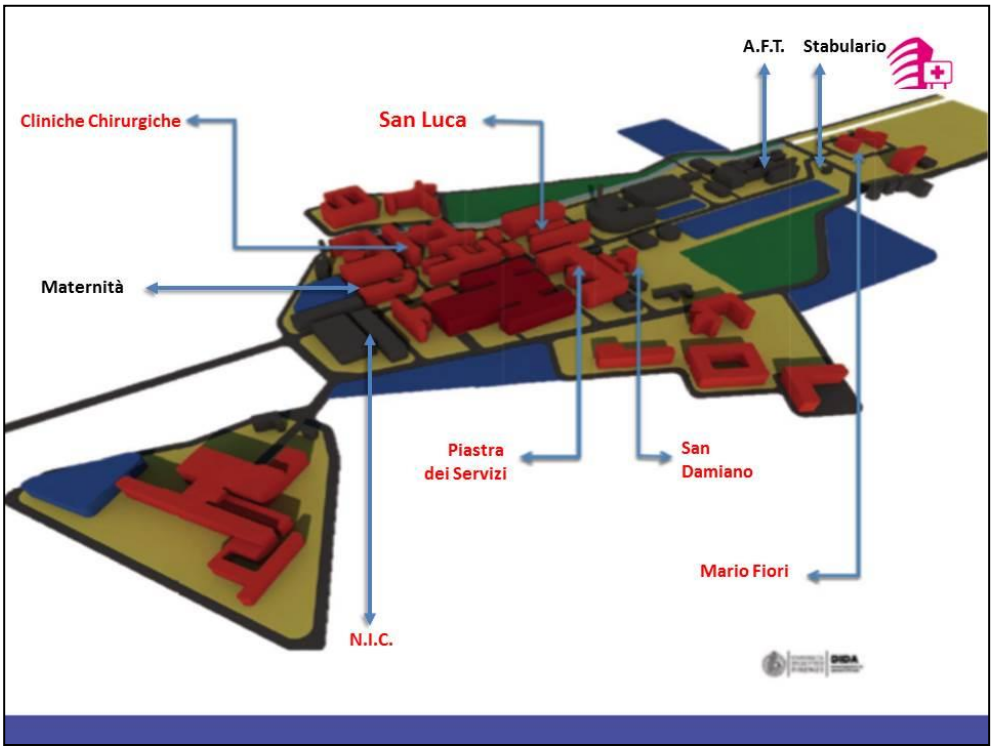
ETICHETTATURA STREAMER IN SACS

CLASSE SACS	COD CLASSE SACS	STREAMER SPACE UNITS	Bouwcollege layer class	Hygiene class	AccessSecurity class	UserProfile class	Equipment class	Construction class	Comfort class
SO Chirurgia Generale	01_01	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
SO Chirurgia Specialistica	01_02	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
SO Ibrida	01_03	OperationTheatreHybrid	HF	H2	A3	U3	EQ6	C6	CT7
SO Chirurgia Ortopedica/Traumatologica	01_04	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
Preparazione Paziente/Risveglio	01_05	Holding	HF	H4	A4	U3	EQ5	C1	CT7
Preparazione Paziente/Risveglio	01_05	RecoveryRoom	HF	H4	A3	U3	EQ5	C1	CT7
Lavaggio e Preparazione Staff Chirurghi	01_06	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
Lavaggio Strumentario/Sbsterilizzazione	01_07	PreparationRoom	HF	H3	A5	U3	EQ1	C1	CT7
Filtro	01_08	AirLock	I	H3	A5	U4	EQ1	C1	CT6
Angiografia	01_09	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
Emodinamica	01_10	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
SO Sperimentale	01_11	OperationTheatreHybrid	HF	H2	A3	U3	EQ6	C6	CT7
Zona Relax Chirurghi	01_12	RestingRoomPersonnel	O	H2	A4	U4	EQ1	C1	CT3
Altro	01_99	OperationTheatre	HF	H4	A3	U3	EQ7	C7	CT7
T.I.	02_01	PatientRoomIntensiveCare	H	H2	A2	U4	EQ6	C1	CT4
Filtro	02_02	AirLock	I	H3	A5	U4	EQ1	C1	CT6
Lavaggio	02_03	PreparationRoom	HF	H3	A5	U3	EQ1	C1	CT7
T.I.N.	02_04	ResuscitationChildren	HF	H4	A3	U4	EQ6	C1	CT7
Altro	02_99	PatientRoomIntensiveCare	H	H2	A2	U4	EQ6	C1	CT4
Altro	03_99	PatientRoomIntensiveCare	H	H2	A2	U4	EQ6	C1	CT4
Applicazioni Radioterapiche	04_01	Radiotherapy	HF	H4	A3	U1	EQ6	C6	CT3
Thomotherapy	04_02	Radiotherapy	HF	H4	A3	U1	EQ6	C6	CT3
Gamma-Knife	04_03	Radiotherapy	HF	H4	A3	U1	EQ6	C6	CT3
TAC Simulatore	04_04	Radiotherapy	HF	H4	A3	U1	EQ6	C6	CT3
Sala comandi/Controllo	04_05	Radiotherapy	HF	H4	A3	U1	EQ6	C6	CT3
Altro	04_99	Radiotherapy	HF	H4	A3	U1	EQ6	C6	CT3
Preparazione Paziente	05_01	Holding	HF	H4	A4	U3	EQ5	C1	CT7
Sala Comando/Controllo	05_02	Office	O	H2	A4	U1	EQ1	C1	CT3
TAC	05_03	ExaminationRoomCT	HF	H2	A3	U3	EQ7	C4	CT7
RM	05_04	ExaminationRoomMR	HF	H2	A3	U3	EQ7	C4	CT7
Angiografia (non interventistica)	05_05	ExaminationRoomXRay	O	H2	A4	U3	EQ7	C4	CT3
Radiografia	05_06	ExaminationRoomXRay	O	H2	A4	U3	EQ7	C4	CT3
MOC	05_07	ExaminationRoomXRay	O	H2	A4	U3	EQ7	C4	CT3
RIS-PACS	05_08	Office	O	H2	A4	U1	EQ1	C1	CT3
Refertazione	05_09	Office	O	H2	A4	U1	EQ1	C1	CT3
Mammografia	05_10	ExaminationRoomXRay	O	H2	A4	U3	EQ7	C4	CT3
Lavaggio	05_11	PreparationRoom	HF	H3	A5	U3	EQ1	C1	CT7
Altro	05_99	ExaminationRoomXRay	O	H2	A4	U3	EQ7	C4	CT3

AD OGNI UNITÀ SPAZIALE (CLASSE) DEL SACS SONO ASSOCIATI I LABELS DI STREAMER


Class
3_002
CA: 49,539 m²
WA: 6,600 m²
P: 100,49 m
CH: 3,60 m
ZV: 243,60 m³
Corpi illuminanti_Quantità: 4
Corpi illuminanti_Posizione: A SOFFITTO
Corpi illuminanti_Potenza elettrica W: 288
Corpi illuminanti_Tipo lampada: Fluorescenti tubolari
Temperatura Comfort (°C): 20.420000
Riscaldamento_Potenza di Progetto (kW): 4.150000
Raffrescamento_Potenza di Progetto (kW): 8.500000
IN-OUT DATA


MODELLAZIONE BIM
IN-OUT DATA


A.F.T.
Stabulario
Cliniche Chirurgiche
San Luca
Maternità
Piastra
dei Servizi
San
Damiano
Mario Fiori
N.I.C.


arch. Thorsten Lang
PROCEDURE DI IMPORTAZIONE DEL MODELLO
Streamer
European research on energy-efficient healthcare districts

IFC FORMATO DI INTERSCAMBIO MODELLI E DATI

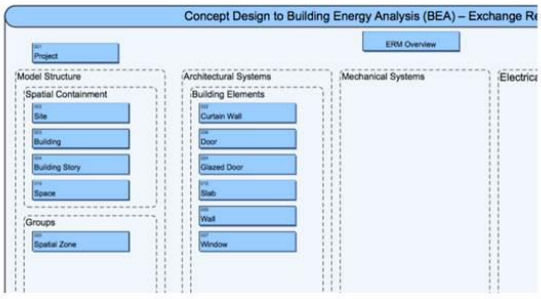
- Standard aperto ISO di iniziativa industria
- Basato su classi di oggetti predefiniti (solaio, muro,..)
- Gerarchico, ad esempio: Un muro sta su un livello all'interno di un edificio, che sta sul un sito,...
- Espandibile: si possono aggiungere proprietà al di fuori dello standard

La predefinizione degli oggetti secondo gli schemi e l'uniformità del significato permette di **definire delle regole semantiche**

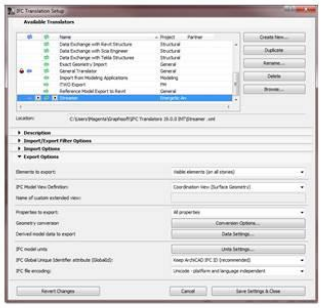
DEFINIRE CONTENUTI DI INTERSCAMBIO

Serve definire l'intento del modello da interscambiare, stabilendo le **esigenze del interscambio** *(Exchange requirements)*.

Questi vengono salvati in una tabella che definisce l'esportazione.

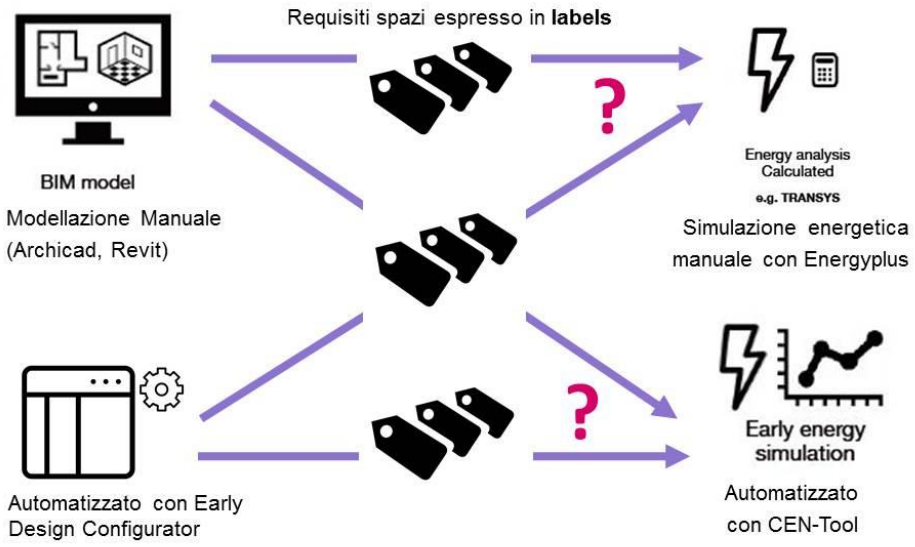


Overview of exchange requirements for Concept Design to Building Energy Analysis
Source: GSA/ Statsbygg/ Senate Properties/ OGC/ AECOO Testbed Sponsors/ Digital Alchemy



Archicad export settings contained in Xml file

VERIFICA MODELLO ED INFORMAZIONE PER PERCORSI MODELLO



QUALE INFORMAZIONE SERVE ALLA SIMULAZIONE ENERGETICA?

COERENZA MODELLO

Il modello deve avere un sito?
L'involucro è chiuso?
Ad ogni muro è assegnato un tipo?
…

COMPLETEZZA DATI

Per ogni spazio; sono presente tutti label?
I valori degli label sono tra quelli ammessi?
…

SE MANCANO DATI AL MODELLO (es. CORRIDOIO)

Aggiungere in base alle informazioni presenti;
Aggiungere valore di default;
…

QUALE INFORMAZIONE SERVE ALLA SIMULAZIONE ENERGETICA?

COERENZA MODELLO

- Il modello deve avere un sito?
- L'involucro è chiuso?
- Ad ogni muro è assegnato un tipo?
- ...

COMPLETEZZA DATI

- Per ogni spazio; sono presente tutti label?
- I valori degli label sono tra quelli ammessi?
- ...

Early energy simulation

SE MANCANO DATI AL MODELLO (es. CORRIDOIO)

- Aggiungere in base alle informazioni presenti; codice locale
- Aggiungere valore di default; CEN Tool
- Agguingere manualmente da esperto; Simulazione Designbuilder

Energy analysis Calculated

arch. Stefania Pitzianti

SIMULAZIONE ENERGETICA DEL CASO STUDIO E USO DELLA DASHBOARD

Streamer
European research on energy-efficient healthcare districts

SIMULAZIONE ENERGETICA DEL CASO STUDIO

Archicad: Modellazione BIM – Assegnazione PoR ad ogni singola zona

IFC – Modello geometrico

Revit: per esportazione IFC con i confini di zona di II livello corretti/ esportazione gbXml

IFC

SimpleBim:
Verifica completezza informazioni IFC
Aggiunta automatica valori Labels alle stanze
Aggiunta valori numerici Labels

IFC (validato) + Labels

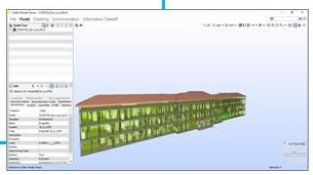
DST - Dashboard Valutazione delle alternative di progetto:
- **0. Stato di fatto – utilizzo reale**
- **0.1 Stato di fatto – valori labels**
- **1. Modifica layout**
- **2. Modifica involucro**
- **3. Modifica MEP system**
- **4. Modifica Layout + involucro + MEP system**
- **5. Modifica Layout + involucro**
- **6. Modifica Layout + MEP system**
- **7. Modifica MEP system + involucro**

Secondo i parametri:
- **Life Cicle Cost** (Dashboard)
- **Consumo energetico**
- **Emissione di anidride carbonica**
- **Comfort termico**

GbXml – superfici analitiche

Design Builder: simulazione energetica

CSV – risultati simulazione + KPIs Emissione CO2 e Comfort termico



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SIMULAZIONE ENERGETICA DEL CASO STUDIO

Simergy

✓ Consente importazione IFC con proprietà

× Difficoltà importazione geometria IFC – Complessità simulazione

EQUA IDA ICE

✓ Consente importazione IFC

× IFC solo geometrico

× Utilizzo di un motore di simulazione interno (non Energy Plus)

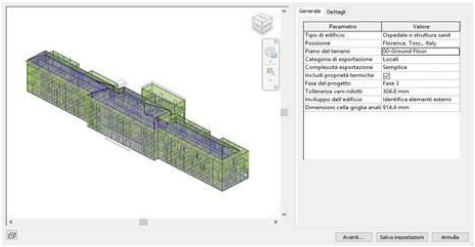
DesignBuilder SOFTWARE

× Non consente importazione IFC

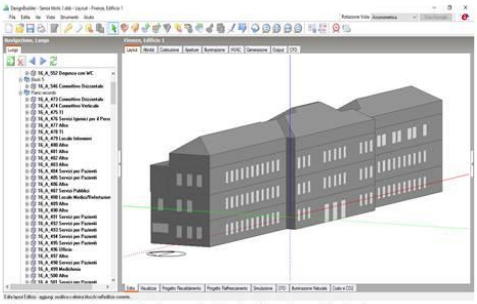
✓ Simulazione corretta

30

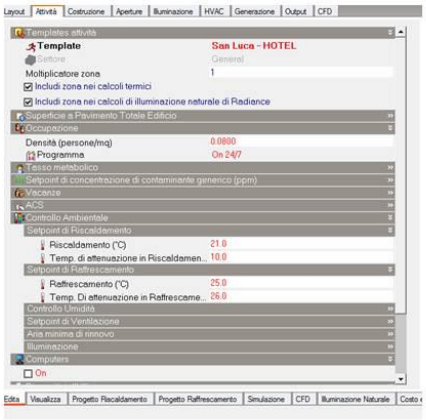
SIMULAZIONE ENERGETICA DEL CASO STUDIO



Esportazione modello GbXml per simulazione energetica



Importazione del modello in Design Builder



Template per la simulazione energetica

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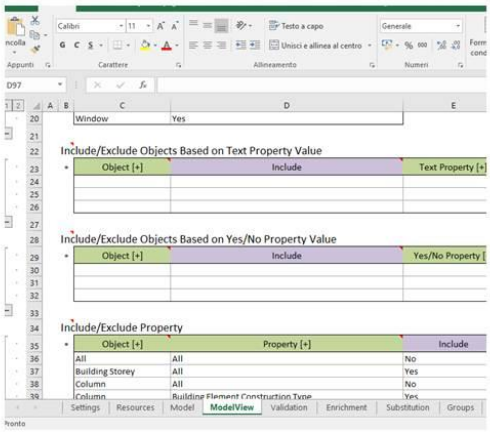
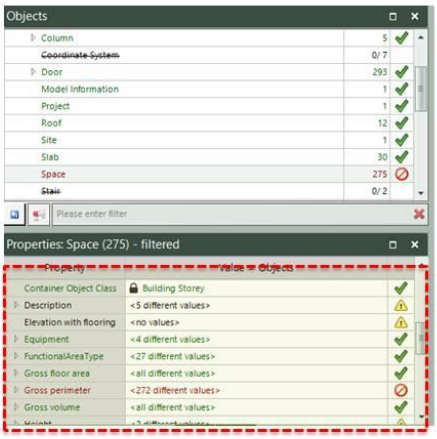
USO DELLA DASHBOARD

Gestione del file in formato IFC per la corretta importazione: Verifica





Applicazione delle regole di completezza e validazione al modello del San Luca Vecchio

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USO DELLA DASHBOARD

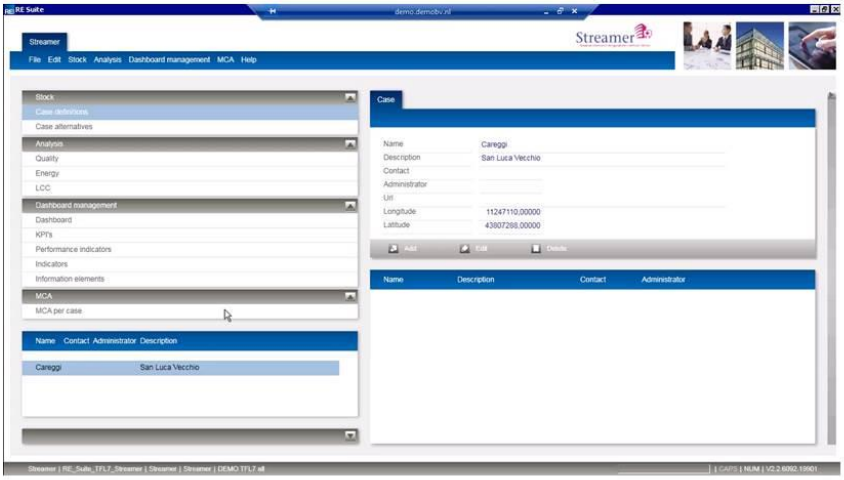
Gestione del file in formato IFC per la corretta importazione: Arricchimento

Identity Key	Name	PropertySet Name
BI:STREAMERPOR:RoomType	**RoomType**	STREAMER PoR
BI:STREAMERPOR:FunctionalAreaType	**FunctionalAreaType**	STREAMER PoR
BI:STREAMERPOR:Area	**Area**	STREAMER PoR
BI:STREAMERPOR:Amount	**Amount**	STREAMER PoR
BI:STREAMERROOM:Area	**Area**	STREAMER Room
BI:STREAMERLABELSPOR:AccessSecurity	**AccessSecurity**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:BowcollegeLayer	**BowcollegeLayer**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:HygienicClass	**HygienicClass**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:ComfortClass	**ComfortClass**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:Construction	**Construction**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:Equipment	**Equipment**	STREAMER Labels PoR
BI:STREAMERLABELSPOR:UserProfile	**UserProfile**	STREAMER Labels PoR

Object Or Group [+]	**Space**						
Property Name or Key	**Space Number**	**RoomType**	**FunctionalArea Type**	**Amount**	**Bowcollege Layer**	**Hygienic Class**	**AccessSecurity**
Operator	Match = equals	Set	Set	Set	Set	Set	Set
	16_A_001	ConferenceRoom	ConferenceRoom	1	O	H2	A2
	16_A_001a	Corridor	Corridor	1	H	H1	A1
	16_A_001b	Toilet	Toilet	1	I	H4	A2
	16_A_001c	ToiletDisabledPeople	ToiletDisabledPeople	1	I	H4	A2

33

USO DELLA DASHBOARD



34

ing. Ernesto Iadanza

IL SISTEMA SACS POTENZIATO CON STREAMER

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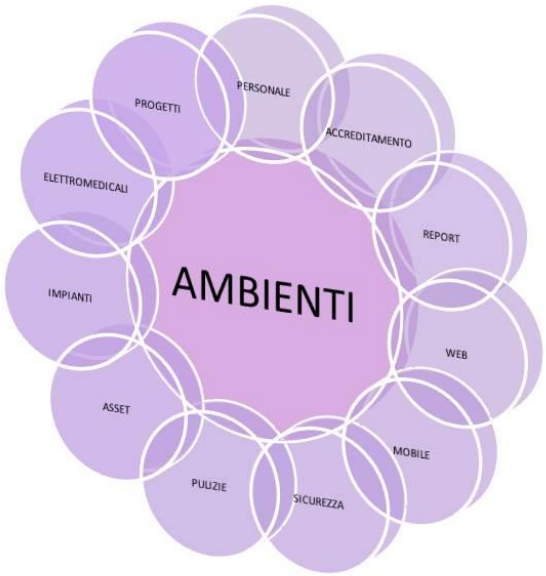
SACS:
SISTEMA ANALISI CONSISTENZE STRUTTURALI

SPAZI
- ANALISI DEGLI SPAZI
- SEGNALETICA
- WAYFINDING
- GESTIONE PULIZIE

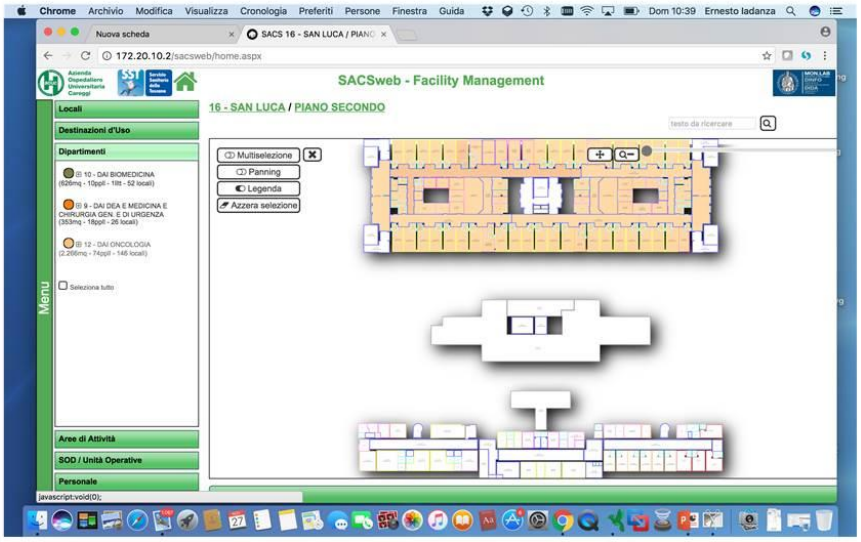
PERSONE
- GESTIONE PERSONALE
- ELENCO TELEFONICO
- EMAIL

TECNOLOGIA
- IMPIANTI
- ASSET
- ELETTROMEDICALI

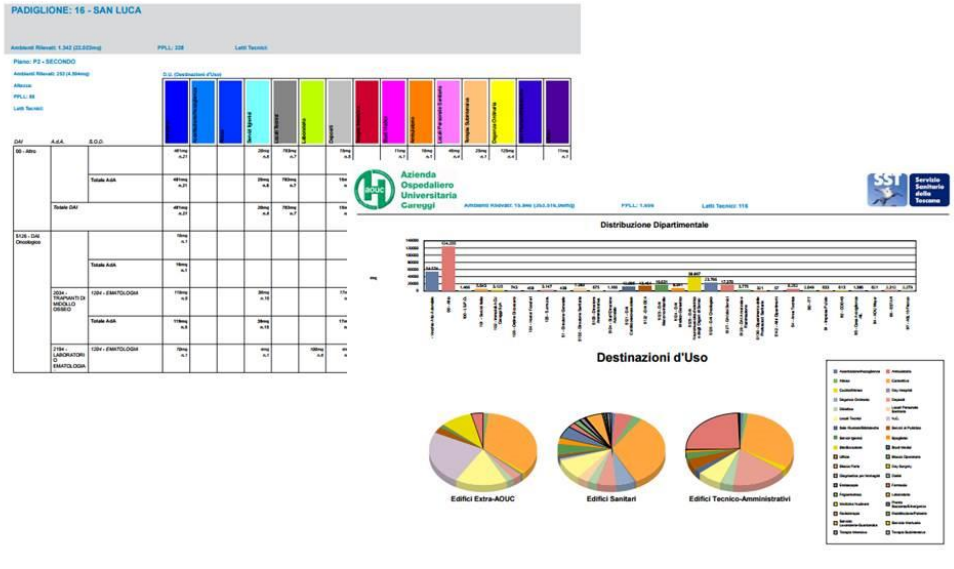
PROCESSI
- MODULISTICA
- REPORT
- ACCREDITAMENTO
- ENERGIA



ANALISI DEGLI SPAZI



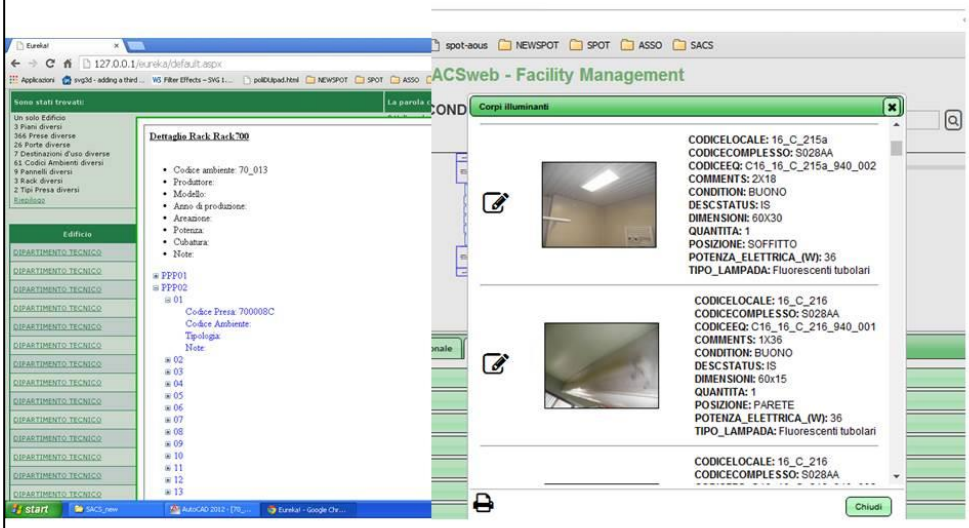
ANALISI DEGLI SPAZI



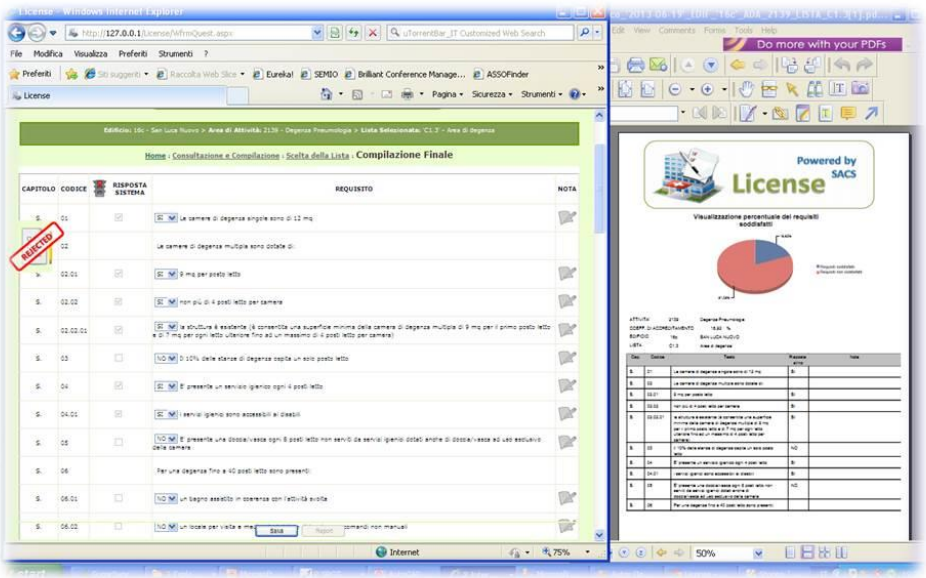
QUERY COMPLESSE CON EUREKA!

SEGNALETICA E WAYFINDING

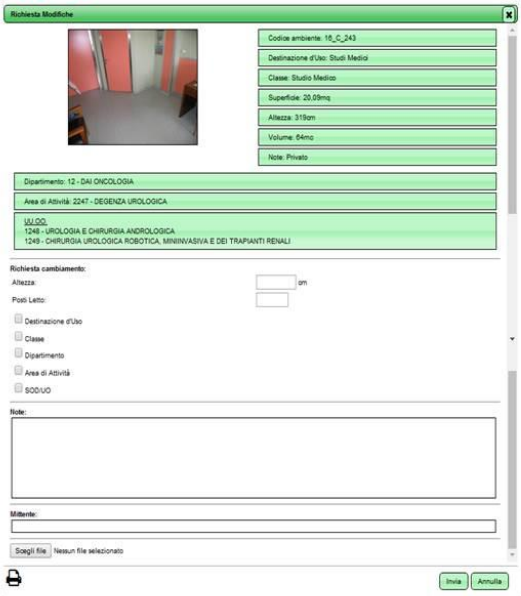
IMPIANTI, ASSET ED ELETTROMEDICALI



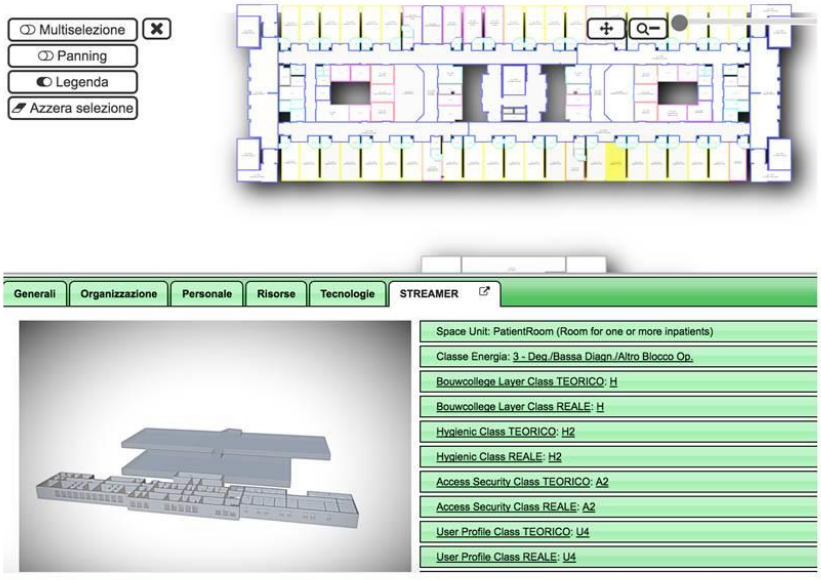
ACCREDITAMENTO

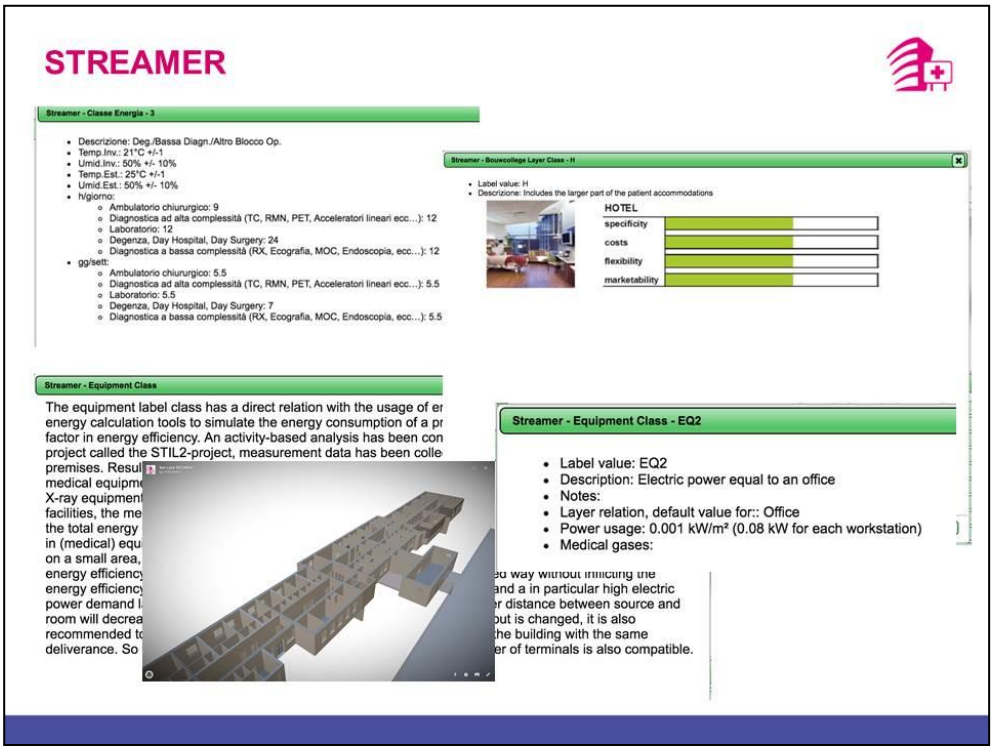


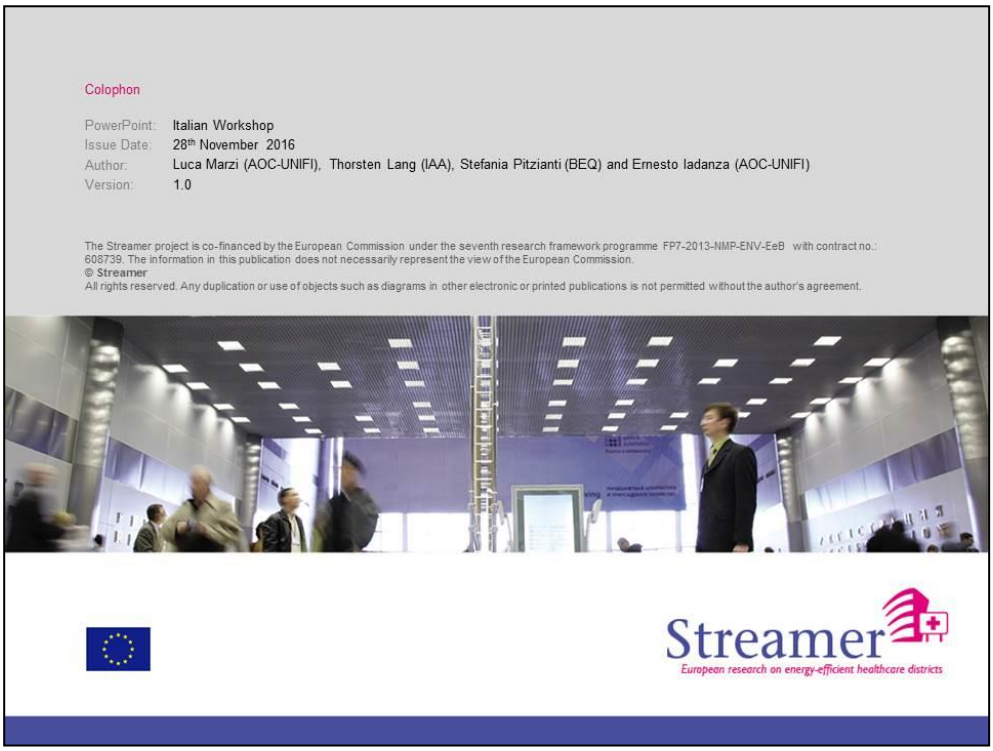
MODULISTICA WEB



STREAMER




STREAMER
Streamer - Classe Energia - 3
Descrizione: Deg./Bassa Diagn./Altro Blocco Op.
Temp.Inv.: 21°C +/-1
Umid.Inv.: 50% +/- 10%
Temp.Est.: 25°C +/-1
Umid.Est.: 50% +/- 10%
h/giorno:
Ambulatorio chiururgico: 9
Diagnostica ad alta complessità (TC, RMN, PET, Acceleratori lineari ecc...): 12
Laboratorio: 12
Degenza, Day Hospital, Day Surgery: 24
Diagnostica a bassa complessità (RX, Ecografia, MOC, Endoscopia, ecc...): 12
gg/sett:
Ambulatorio chiururgico: 5.5
Diagnostica ad alta complessità (TC, RMN, PET, Acceleratori lineari ecc...): 5.5
Laboratorio: 5.5
Degenza, Day Hospital, Day Surgery: 7
Diagnostica a bassa complessità (RX, Ecografia, MOC, Endoscopia, ecc...): 5.5
Streamer - Bouwcollege Layer Class - H
Label value: H
Descrizione: Includes the larger part of the patient accommodations
HOTEL
specificity
costs
flexibility
marketability
Streamer - Equipment Class
The equipment label class has a direct relation with the usage of er
energy calculation tools to simulate the energy consumption of a pr
factor in energy efficiency. An activity-based analysis has been con
project called the STIL2-project, measurement data has been colle
premises. Resul
medical equipm
X-ray equipment
facilities, the me
the total energy
in (medical) equ
on a small area,
energy efficiency
energy efficiency
power demand l
room will decrea
recommended t
deliverance. So
Streamer - Equipment Class - EQ2
Label value: EQ2
Description: Electric power equal to an office
Notes:
Layer relation, default value for:: Office
Power usage: 0.001 kW/m² (0.08 kW for each workstation)
Medical gases:
and a in particular high electric
r distance between source and
ut is changed, it is also
he building with the same
er of terminals is also compatible.


Colophon
PowerPoint: Italian Workshop
Issue Date: 28th November 2016
Author: Luca Marzi (AOC-UNIFI), Thorsten Lang (IAA), Stefania Pitzianti (BEQ) and Ernesto Iadanza (AOC-UNIFI)
Version: 1.0
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APPENDIX 5 – List of attendees

THE STREAMER PROJECT
TOOLS AND METHODOLOGIES FOR THE IMPLEMENTATION OF THE ENERGY EFFICIENCY IN THE HEALTHCARE DISTRICTS: BIM-GIS MODELS DURING THE EARLY DESIGN PHASE

Monday 28th November (09:00-12:30)
Room 8 | Pavillion 3 | New entrance building Careggi | Florence

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GUEST LIST	signature
STREAMER Italian partners	
AOUC Careggi (Academic Hospital)	
Arch. Filippo Terzaghi	
Eng. Andrea Giuntini	
Arch. Giano Ardinghi	
Eng. Andrea Belardinelli	
Eng. Maria Giuliana Bonaviri	
Arch. Antonella Gesualdi	
Mr. Massimo Mocali	
Eng. Daniele Novelli	
Arch. Massimo Novelli	
Arch. Giuseppe Petti	
Eng. Agnese Pieracci	
Eng. Francesco Tinti	
University of Florence (Third part)	
PhD. Beatrice Turillazzi	
PhD. Luca Marzi	
PhD. Ernesto Iadanza	
Prof. Roberto Bologna	
Eng. Alessio Luschi	
Arch. Francesco Napolitano	
Arch. Daniele Donatini	
Arch. LEONE PIERANGELI	

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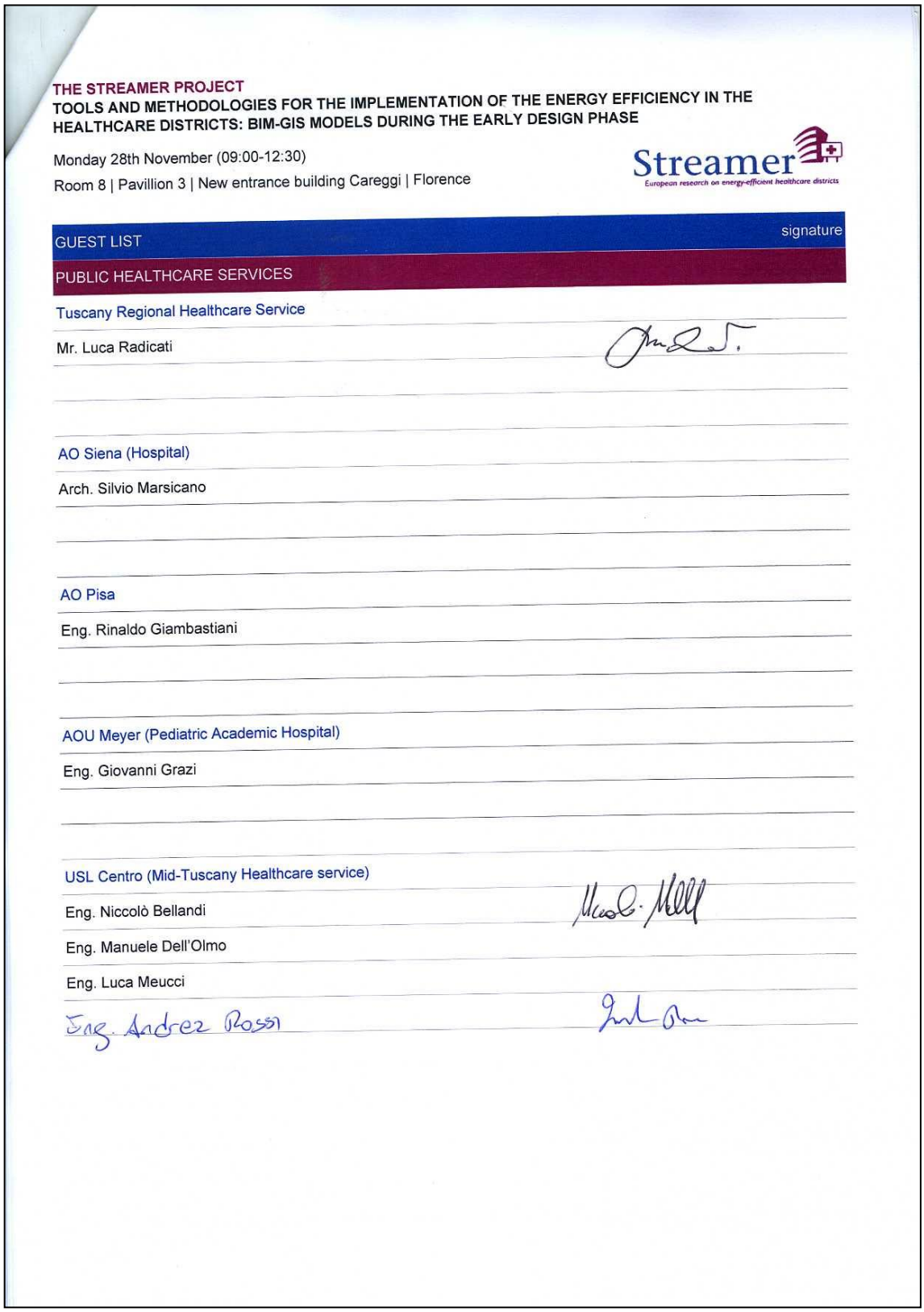
Ipostudio architetti	
Prof. Roberto Di Giulio	
Prof. Carlo Terpolilli	
Arch. Lucia Celle	
PhD Luca Belatti	
Arch. Panfilo Cionci	
Arch. Ilaria Brogi	
Arch. Agnese Cacciamani	
Arch. Thorsten Lang	
Arch. Sergio Leone	
Arch. Barbara Vanni	
Arch. Elisabetta Zanasi Gabrielli	
PhD Mariagiulia Bennicelli Pasqualis	
PhD Luigi Vessella	
Becquerel Electric	
Prof. Giacomo Bizzarri	
Arch. Stefania Pitzianti	



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PUBLIC HEALTHCARE SERVICES	
Tuscany Regional Healthcare Service	
Mr. Luca Radicati	
AO Siena (Hospital)	
Arch. Silvio Marsicano	
AO Pisa	
Eng. Rinaldo Giambastiani	
AOU Meyer (Pediatric Academic Hospital)	
Eng. Giovanni Grazi	
USL Centro (Mid-Tuscany Healthcare service)	
Eng. Niccolò Bellandi	
Eng. Manuele Dell'Olmo	
Eng. Luca Meucci	
Eng. Andrea Rossi	

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Eng. Gilberto Cristofoletti	
Eng. Daniele Giorni	
Arch. Alessandro Lenzi	
Arch. Sabrina Palleggi	
Eng. Giuliano Stecchi	
USL NordOvest (North-West Tuscany Healthcare service)	
Eng. Stefano Maestrelli	

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Mr. Enrico Buracchi	
SENECA (Energy distribution)	
Dott. Massimiliano Magherini	
Eng. Carlo Mattarocci	
Eng. Roberto Sodini	
CET (Energy distribution)	
Eng. Luca Perni	
INSO (Construction Company)	
Arch. Raffaele Di Marco	
Eng. Fabrizio Pucciarelli	
CMB Carpi (Construction Company)	
Eng. Giovanni Gallo	
Arch. Ruben Saetti	

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ARCHITECTS, ENGINEERS AND ADVISORS	
Florence Board of Architects	
Arch. Mario Perini	
CSPE Firenze	
Prof. Romano Del Nord	
Prof. Paolo Felli	
Arch. David Matteoli	
Binini partners Reggio Emilia	
Arch. Tiziano Binini	
Studio Altieri Thiene	
Arch. Alberto Altieri	

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MoMa studio Firenze	
Arch. Massimo Moglia	
Consilium ingegneria Firenze	
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Eng. Leopoldo D'Inzeo	
Ael progetti Firenze	
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Modula Informatica (Autodesk)	
Mr. Antonio Miele	

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GUEST LIST	signature
EXPERTS	
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PhD Maria Grazia Giardinelli	
PhD Valentina Santi	
STUDENTS	
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Mrs Paola Baldassari	
Mr. Mirco Castellani	
Mrs. Flaminia D'Aria	D'Aria Flaminia
Mr. Niccolò Giannini	
Mrs. Natasha Giardino	Giardino Natasha
Mr. Franco Lombardi Romero	
Mrs. Eleonora Macconi	
Mrs. Ilaria Marchione	
Mr. Nicola Materazzi	
Mrs. Carolina Nassi	
Mr. Marco Sabatino	