A project for the NZERO-Foundation in the south of Italy

Ali Sayigh *Editor*

Sustainable Energy for all

Selected Papers from the World Renewable Energy Congress WREC 2016

Springer

http://www.springer.com /978-3-319-77540-1

"Sustainable Energy for All"

" Selected Papers from the World Renewable Energy Congress WREC 2016"

Sayigh, Ali (Ed) 2018

ISBN is 978-3-319-77540-1.

Bibliographic Information

www.springer.com/us/book/9783319775401#aboutBook

Book Title
Sustainable Energy for All

Book Subtitle
Selected Papers from the World Renewable Energy Congress WREC 2016

Editors
Ali Sayigh

Series Title
» Innovative Renewable Energy

Copyright
2018

Publisher
Springer International Publishing

Copyright Holder
The Editor(s) (if applicable) and The Author(s)

eBook ISBN
978-3-319-77541-8

DOI
10.1007/978-3-319-77541-8

Hardcover ISBN
978-3-319-77540-1

Series ISSN
2522-8927

Edition Number
1

Number of Pages
X, 520

Number of Illustrations and Tables
50 b/w illustrations, 100 illustrations in colour

Topics
» Renewable and Green Energy

X, 520 p. 150 illus., 100 illus. in color.

Printed book

Hardcover

Ca. 149,99 € | Ca. £119.99 | Ca. $179.99
[1]Ca. 160,49 € (D) | Ca. 164,99 € (A) | Ca. CHF 165,00

eBook

Available from your library or springer.com/shop

MyCopy [3]

Printed eBook for just
€ | $ 24.99
springer.com/mycopy

Ali Sayigh (Ed.)

Sustainable Energy for All

Selected Papers from the World Renewable Energy Congress WREC 2016

Series: Innovative Renewable Energy

- Presents advances in research related to various renewable energy topics relating to energy efficiency and the development and application of technologies with energy saving capabilities in industrial, commercial, transportation and household sectors;
- Contains case studies and examples to enhance practical application of the technologies presented;
- Covers the most up-to-date research developments, government policies, business models, and best practices and innovations from countries all over the globe.

This book contains selected papers presented during technical and plenary sessions at the World Renewable Energy Congress, the world's premier conference on renewable energy and sustainable development. This biennial Congress provides an international forum that brings together top experts, policy makers and business practitioners to address the most strategic issues of sustainable energy development and innovation. The book highlights the most current research and technological breakthroughs in this rapidly growing field and contains the most up-to-date innovations and practical applications in renewable energy development, utilization and energy efficiency efforts.

List of Mediterranean Green Buildings and Renewable Energy Forum – 4

31 July –2 August 2017 – University of Florence, Department of Architecture, Florence, Italy

41- **Proposing a new method for fenestration shading design in prefabricated modular buildings**

Seyedehmamak Salavatian[1] salavatian@iaurasht.ac.ir

42- **EFFECTIVENESS OF OCCUPANT BEHAVIORAL VENTILATION STRATEGIES ON INDOOR THERMAL COMFORT IN HOT-ARID CLIMATE**

Ali Sedki[1], Neveen Hamza[2], Theo Zaffagnini

[1] *Beirut Arab University, Faculty of Architecture, Lebanon,* egylord@hotmail.com

[2] *Newcastle University, Department of Architecture, Newcastle, UK*

[3] *Ferrara University, Department of Architecture, Ferrara, Italy*

43- Effectiveness of materials, technologies and renewable energy in educational buildings through cluster analysis of energy retrofitting

Francesco Asdrubali*, Laura Calcagnini**, Luca Evangelisti*, Maria Claudia Guattari*, Paola Marrone**
*Roma Tre University, Department of Engineering, Via Vito Volterra 62, 00146 Rome, Italy
**Roma Tre University, Department of Architecture, Via della Madonna dei Monti 40, 00184 Rome, Italy
laura.calcagnini@uniroma3.it

44- Renewable Energy in Argentina (PDF)

Prof. Carlos Labriola
Faculty of Engineering - Universidad Nacional del Comahue – Buenos Aires 1400 (8300) Argentina
carloslabriola54@yahoo.com.ar

45- Wind energy potential research in a low building within an urban environment (PDF)

Jorge Lassig, Claudia Palese, Juan Valle Sosa, Ubaldo Jara y Carlos Labriola
Faculty of Engineering - Universidad Nacional del Comahue – Buenos Aires 1400 (8300) Argentina
lassig@uncoma.edu.ar - carloslabriola54@yahoo.com.ar-Te:54-299-4490322

46- The natural light in Architecture. The use inspired by the constructive tradition.

Fabio G.S. Giucastro
SDS of Architecture of Siracusa, University of Catania, Italy
fabiogiu@gmail.com

47- The cost of building to the near Zero Energy Building standard – a financial case study

Shane Colclough[1#], John Mernagh[2], Derek Sinnott[2], Neil J Hewitt[1], Philip Griffiths[1]
[1] Ulster University, Newtownabbey, Co Antrim, BT370QB, Northern Ireland
[2] Waterford Institute of Technology, Cork Road, Waterford, X91 K0EK, Republic of Ireland
[#]Corresponding author: Dr. Shane Colclough, S.Colclough@Ulster.ac.uk

48- POLICY OF INTENSIFICATION, DIVERSIFICATION, CONSERVATION, AND INDEXATION IN PURSUING THE SUSTAINABLE TRANSPORT

Koesmawan[1]
1).Prof.Dr.Koesmawan, DBA, Commissioner of Ffaireness Indonesia Daya (FID), former Rector andThe Head of Quality Assurance of Ahmad Dahlan School of Economics,
.mkoesmawanas@gmail.com

49- PROBLEM OF EDUCATION IN DEVELOPING RENEWABLE OF ENERGY

By: EllyaMarlianaYudapraja, B.Sc, Edu. M.M 1)
1). EllyaMarlianaYudapraja, Faculty of Teaching and Education Science
Pasundan University-Bandung Indonesia.
Ellya.Marliana2010@gmail.com

50- Winter performance of certified passive houses In a Temperate Maritime Climate – nZEB Compliant?

Dr Shane Colclough[#], Prof Philip Griffiths, Prof Neil J Hewitt
Ulster University, Newtownabbey, Co Antrim, BT370QB, Northern Ireland
#- corresponding author: S.Colclough@Ulster.ac.uk

51- A parametric tool for assessing optimal location of buildings according to environmental Criteria (PDF)

Giacomo Chiesa*, Mario Grosso
Politecnico di Torino, Dipartimento di Architettura e Design, Viale Mattioli 39, 10125 Torino, Italy.
**Corresponding author: giacomo.chiesa@polito.it*
Forum topic: *sustainable architecture*
Keywords:*parametric morphology; site design; environmental design; bioclimatic architecture*

52- Methodology of Solar Project Managing
Through All Stages of Development

Andrejs Snegirjovs 1, Peteris Shipkovs 1, Kristina Lebedeva 1, Galina Kashkarova 1,

Dimitry Sergeev 2
1 Energy resources laboratory, Institute of Physical Energetics
Krivu Street 11, Riga, Latvia, LV-1006, shipkovs@edi.lv
2 PVStream, MZ Consulting
Lenka Street 9, Riga, Latvia, LV-1006, info@pvstream.com

53- Computational BIPV Design: An energy optimization tool for solar facades

Omid Bakhshaei, independent researcher and co-founder of Novin Tarh Studio, 2nd floor, 193, Molla Sadra Street, Tehran, Iran.
bakhshaei.omid@gmail.com
Giuseppe Ridolfi, professor at the Department of Architecture (DIDA), Università degli Studi di Firenze,
via della Mattonaia n.14, Florence, FI, Italy.
giuseppe.ridolfi@unifi.it
Arman Saberi, doctorate researcher at the Department of Architecture (DIDA), Università degli Studi di Firenze, via della Mattonaia n.14, Florence, FI, Italy.
arman.saberi@unifi.it

54- Feasibility Study of a Low Carbon House in the UK

Timothy Aird, Hossein Mirzaii
School of Aerospace & Aircraft Engineering, Kingston University London SW15 3DW, UK
H.Mirzaii@kingston.ac.uk

55- Why Do We Need To Reduce The Carbon Footprint In UAE?

Prof. Riadh AL-Dabbagh
University of Ajman, UAE, riadhdabbagh@yahoo.com

56- URBAN FARMING IN THE ERA OF CRISIS IN GREECE: THE CASE STUDY OF THE URBAN GARDEN OF AGIOI ANARGIROI –KAMATERO AND FILI

Konstadinos Abeliotis and Konstadinos Doudoumopoulos
Harokopio University, Department of Home Economics and Ecology, El. Venizelou 70, 17671 Athens, Greece. Tel +302109549363, email: kabeli@hua.gr

57- RESILIENT URBAN DESIGN. BEOGRAD AND FLORENCE: RECONNECT THE WATERS TO THE CITY

Prof.PhD Arch.Chiara Odolini
UNIFI-DIDA, Florence, Italy – chiara.odolini@gmail.com

58- Strategic Sustainable and Smart Development Based on User Behavior

Shahryar HABIBI* and Theo ZAFFAGNINI**
* *PhD, Department of Architecture, University of Ferrara, Italy*
email: shahryar_habibi@yahoo. com (corresponding author)
** *Associate Professor, PhD, Department of Architecture, University of Ferrara, Italy*
email: theo.zaffagnini@unife.it. ORCID: orcid.org/0000-0002- 9693-809X

59- High | Bombastic adaptive skin conceptual prototype for mediterranean climate (PDF)
Giuseppe Ridolfi
University of Florence
giuseppe.ridolfi@unifi.it

60- QUALITY OF HEALTHCARE: A REVIEW OF THE IMPACT OF HOSPITAL PHYSICAL ENVIRONEMNT ON IMPROVING QUALITY OF CARE (PDF)
Dr. Jazla Fadda
American University in the Emirates- Block 7- Dubai International Academic City- Dubai – United Arab Emirates- P.O.Box: 503000 |Email: Jazla.fadda@aue.ae

61- Enhancing Indoor Air Quality for Residential Building in Hot Arid Regions
Ghanim Kadhem Abdul Sada,[a] , Tawfeeq Wasmi M. Salih[b a] Mechanical Engineering Dept. / Al Mustansiriyah University, Baghdad Iraq, Email; ghanimkadhim@yahoo.com
**Materials Engineering Dept. / Al Mustansiriyah University, Baghdad Iraq
Email; tawfeeq1978@yahoo.com

62- Performance of Solar Window Film With Reference to Energy Rationalizing in Buildings
Dr .Kamil M .Yousif [1] **and**, **Alan Ibrahim Saeed** [2]
[1] Dept of Environmental Sciences, Zakho University, Zakho, Iraq.
Email: kamy22002@yahoo.co.uk
[2] Dept of Physics, Zakho University, Zakho, Iraq.

63- Visualizing the infrared response of an urban canyon throughout a sunny day
Benoit Beckers[1], José Pedro Aguerre[2], Gonzalo Besuievsky[3], Eduardo Fernández[2], Elena García Nevado[4], Christian Laborderie[1], Raphaël Nahon[5]
[1] Université de Pau et des Pays de l'Adour, Allée du Parc Montaury, 64600 Anglet (France) - benoit.beckers@univ-pau.fr
[2] Universidad de la Republica (Uruguay)
[3] Universidad de Gerona (Spain)
[4] Universidad Politécnica de Cataluña (Spain)
[5] Université de Lille 1 (France)

64- Ventilation effectiveness of residential ventilation systems and its energy saving potential
Mohammad Reza Adili[1*], Michael Schmidt [2]
[1, 2] University of Stuttgart, Institute for Building Energetics, Stuttgart, Germany
[*]*Corresponding email: reza.adili@ige.uni-stuttgart.de*

65- Meta-design approach to Environmental building programming for passive cooling of Buildings (PDF)
Giacomo Chiesa*, Mario Grosso
Politecnico di Torino, Dipartimento di Architettura e Design, Viale Mattioli 39, 10125 Torino, Italy.
** corresponding author - giacomo.chiesa@polito.it*
Forum topic: *sustainable architecture*
Keywords: *meta-design; environmental design; building programming; passive cooling*

66- Urban and Architectural Sustainability in Restoration of Iranian cities (Strategy and Challenges), Case study of Soltaniyeh

Arch. Nazila Khaghani, Ph.D University of Florence
nazilakhaghaniarchitect@gmail.com

67- INFLUENCE OF THE PARIOD OF MEASUREMENTS ON WIND POTENTIAL ASSESSMENT FOR A GIVEN SITE

H. Nfaoui* & A. Sayigh**
* Solar Energy & Environment Laboratory, Sciences Faculty, B.P.1014, Mohammed V University in Rabat, Morocco. Email: hassan.nfaoui@gmail.com
** Chairman of WREC & Director General WREN, Editor-in-chief Renewable Energy
P O Box 362, Brighton BN2 1YH, UK

68- Integration strategies of Luminescent Solar Concentrators panels: a case study in Florence - Italy

Lucia Ceccherini Nelli, Giada Gallo Afflitto
Department of Architecture DIDA – Centro ABITA, University of Florence, via San Niccolò 93 Firenze, Italy lucia.ceccherininelli@unifi.it, giadagallo@hotmail.it

69- Photovoltaic and Thermal solar concentrator integrated into a dynamic shading device

Giulia Chieli, Lucia Ceccherini Nelli
Department of Architecture DIDA – Centro ABITA, University of Florence, via San Niccolò 93 Firenze, Italy, lucia.ceccherininelli@unifi.it, chieli.g@gmail.com

70- A University Master Course and training program for energy managers and expert in environmental design in Italy

Marco Sala[1], Lucia Ceccherini Nelli[2], Alessandra Donato[2]
Department of Architecture DIDA – Centro ABITA, University of Florence, via San Niccolò 93 Firenze, Italy, marco.sala@unifi.it, lucia.ceccherininelli@unifi.it, alessandra.donato@unifi.it
[1] Ordinary professor, [2] PhD and contract professor

71- A project for the NZERO-Foundation in the south of Italy

Lucia Ceccherini Nelli[1], Vincenzo Donato[2], Danilo Rinaldi[1]
[1] Department of Architecture DIDA – Centro ABITA, University of Florence, via San Niccolò 93 Firenze, Italy lucia.ceccherininelli@unifi.it, arch.rinaldi@hotmail.com
[2] DISEG - Department of Structural, Geotechnical and Building Engineering, Corso Duca degli Abruzzi, 24 - 10129 Torino (TO), Italy – Vincenzo.donato@polito.it

72- Planning without waste. (PDF)

Adolfo F. L. Baratta*, Laura Calcagnini*, Fabrizio Finucci*, Antonio Magarò*
*Roma Tre University, Department of Architecture, Via della Madonna dei Monti 40, 00184 Rome, Italy
adolfo.baratta@uniroma3.it

73- Policy Of Intensification, Diversification, Conservation, And Indexation In Pursuing The Sustainable Transport(PDF)

Koesmawan1
1).Prof.Dr.Koesmawan, DBA, Commissioner of Ffaireness Indonesia Daya (FID), former Rector andThe Head of Quality Assurance of Ahmad Dahlan School of Economics, mkoesmawanas@gmail.com

74- Problem Of Education In Developing Renewable Of Energy(PDF)

By: EllyaMarlianaYudapraja, B.Sc, Edu. M.M 1)
1). EllyaMarlianaYudapraja, Faculty of Teaching and Education Science
Pasundan University-Bandung Indonesia.
Ellya.Marliana2010@gmail.com

75- Production of ZnO Cauliflowers Using the Spray Pyrolysis Method

Shadia J. Ikhmayies
Al Isra University, Faculty of Science, Department of Physics, Amman 11622, Jordan. E-mail: shadia_ikhmayies@yahoo..com

76- RESILIENT URBAN DESIGN. BEOGRAD AND FLORENCE: RECONNECT THE WATERS TO THE CITY (PDF)

Prof.PhD Arch.Chiara Odolini
UNIFI-DIDA, Florence, Italy – Chiara.odolini@gmail.com

77 - Adaptive skin conceptual prototype for Mediterranean climate.(PDF)

Omid Bakhshaei, independent researcher and co-founder of Novin Tarh Studio, 2nd floor, 193, Molla Sadra street Tehran, Iran. Bakhshaei.omid@gmail.com
Giuseppe Ridolfi, professor at the Department of Architecture (DIDA), Università degli Studi di Firenze,
via della Mattonaia n.14, Florence, FI, Italy. giuseppe.ridolfi@unifi.it
Arman Saberi, doctorate researcher at the Department of Architecture (DIDA), Università degli Studi di Firenze, via della Mattonaia n.14, Florence, FI, Italy. arman.saberi@unifi.it

78- EVALUATING DEEP RETROFIT STRATEGIES FOR BUILDINGS IN URBAN WATERFRONTS

Nicola Strazza[1]*, Piero Sdrigotti[1], Carlo Antonio Stival[2], Raul Berto[1]
1: Department of Engineering and Architecture
University of Trieste 34127 via A. Valerio, 6/1, Trieste (IT)
e-mail: {nicola.strazza@phd.units.it ; piero.sdrigotti@gmail.com; rberto@units.it},
2: Department of Civil, Environmental and Architectural Engineering
University of Padova
35151 via F. Marzolo, 9, Padova (IT)
e-mail: carloantonio.stival@dicea.unipd.it, web: http://www.dicea.unipd.it

79- Enhancing the Thermo-physical Properties of Rammed Earth by Stabilizing with Corn Husk Ash (PDF)

Batagarawa Amina L., Abodunrin Joshua A., Sagada Musa L.
Department of Architecture, Ahmadu Bello University, Zaria, Kaduna, Nigeria.
Aminab_@hotmail.com

80- THERMAL MONITORING OF LOW INCOME HOUSINGS BUILT WITH AUTOCLAVEDAERATED CONCRETE IN A HOT-DRY CLIMATE

Ramona Romero-Moreno, Gonzalo Bojórquez-Morales, Aníbal Luna-León, César Hernández
Facultad de Arquitectura y Diseño, Universidad Autónoma de Baja California,
México. Z.C. 21800. Tel. 52 (686) 566-4250.
ramonaromero@uabc.edu.mx, gonzalobojorquez@uabc.edu.mx, anibal@uabc.edu.mx

81- RENEWABLES ARE COMMERCIALLY JUSTIFIED TO SAVE FUEL AND NOT FOR STORAGE

Donald Swift-Hook,
Secretary, WREN and Visiting Prof, Kingston University,
Woking, Surrey GU21 4XX
United Kingdom
email: donald@swift.hook.com

82- Developing Sustainable Energy and Climate Action for Local Governments: Baseline Emission Inventory - Case studies of City of Luxor and City of Hurghada, Egypt

Mohsen Aboulnag1, Bruno Rebelle2, Emilie Essono3, Naguib Amin4 and Sara Ali5
1 Professor of Sustainable Built Environments Cairo University & CES-MED - SECAP Senior Expert for Egypt 2 Managing Director, Transitions, France, CES-MED - SECAP Consultant, 3 Energies Demain, France, BEI Energy Analysist, 4 Team Leader, CES-MED Project, Beirut & Morocco, 5 Junior Research Assistant, mohsen_aboulnaga@yahoo.com
(Full Paper WILL BE RECEIVED LATER)

83- Climate Change Assessment, Simulation and Adaptation for Hot-Arid Urban Settlements: The Case Study of Asmara Project, Cairo, Egypt

Dr. Mohsen Aboulnaga1, Dr. Amr Alwan2, Mohamed Elsharouny3
1 Professor of Sustainable Built Environment, Dept. of Architecture, Faculty of Engineering, Cairo University, Giza, Egypt
2 Associate Professor, Dept. of Architecture, Faculty of Engineering, Military Technical Collage, Cairo, Egypt
3 Researcher, Master Program in Environmental Design & Energy Efficiency, Dept. of Architecture, Cairo University, Giza, Egypt. mohsen_aboulnaga@yahoo.com
(Full Paper WILL BE RECEIVED LATER)

A project for the NZERO-Foundation in the south of Italy

Lucia Ceccherini Nelli[1], Vincenzo Donato[2], Danilo Rinaldi[1]

[1] Department of Architecture DIDA – Centro ABITA, University of Florence, via San Niccolò 93 Firenze, Italy
lucia.ceccherininelli@unifi.it, arch.rinaldi@hotmail.com

[2] DISEG - Department of Structural, Geotechnical and Building Engineering, Corso Duca degli Abruzzi, 24 - 10129 Torino (TO), Italy - vincenzo.donato@polito.it

Forum topic:
Sustainable architecture

Keyword:
BIM, nZEB, green building, tools, wind control, dynamic envelope, sun shading, buffer spaces, roof garden, efficient heating

---

Abstract:

NZero-foundation is a complex future oriented student housing.
It has been designed thinking about the characteristics of the place that surrounds it, the specific climatic properties of the Mediterranean region, and the needs and the behavior of the final users.
The model of the building has been completely created using a BIM software, which permitted to simulate the performances of the envelope, annual energy consumption, lifecycle cost, daylight and shading of the facades, and most important, it permitted to use a unique tool for the different phases of the design management.
The nZero-foundation is a green building, the energy consumptions are near to zero, maintaining reasonable realization costs. To reach the target it adopts different strategies to reduce heat losses during winter (buffer spaces, roof gardens, low transmittance glasses and walls, led lights) and during summer (brise-soleil, natural shading, natural daylighting, high-efficiency mechanical ventilation systems). The complex collects rainwater, coming from roofs and non-permeable soils, for domestic and watering uses, recover heat from geothermal and produce energy from photovoltaic on the rooftop obtaining a balanced system between energy performances and an affordable realization cost.

1. Introduction

The concept of green architecture, also known as sustainable architecture, is the philosophy, science of buildings designed and constructed in accordance with environmentally friendly principles.

The purpose of the study is to manage the entire design process through a single software, from the preliminary conceptual phase until the energy simulation phase, allowing the designer to correct in real time the strategic decisions and avoiding multiple software problems.

The use of a holistic BIM methodology, permit to create a visual high detailed model, useful to chose the shapes of the architectural object and, at the same time, to calculate the performance of the system, wich is essential for a responsible shared strategy. The difficulty of the study is to manage a very great volume in this calculation, keeping in mind that the project refers to a social housing district, and that passive strategy can't be easily computed in a conceptual energy building model.

2. Project objectives

The target is to demonstrate with a conceptual model, that even a very large scale building, mostly reserved for public use, can reach Nearly Zero Energy Building standards (NZEB). NZEB building is defined in Article 2 of the EPBD Directive 2010/31/EU as " building that has a very high energy performance. The nearly zero amount of energy required should be covered to a very significant extent by energy from renewable sources, produced onsite or nearby2. In our case the transmittance requirements, that are specific for different climatic zone in the south of Italy (south area is mostly assigned to B and C) refer to D.M. 26/06/2015, that defines the limits of the opaque (U= 0.38 W/mq+K) or transparent envelope (U= 2.40 W/mq*K) in addition to roof and floor transmittances (U= 0.36 W/mq*K). The metric that is used to compare the energy consumption for different buildings by accounting conditioned floor area is EUI, Energy Use Intensity, that is defined as annual energy consumption divided by conditioned floor area and is expressed in the units of kBtu/sf/yr or kWh/sm/yr. Our specific objective is to reach at least 16 kBtu/sf/yr = 52 kWh/sm/yr, which is a good goal for a social housing complex that can accommodate over 2600 students and contain many services for the entire community in 89.000 square meters of conditioned floor area.

In addition to the technical requirements, the very important target is the implementation of a passive strategy which contributes to maintain high level of comfort using basic knowledge of bio-climatic architecture, essential creating a healthy green design with a limited budget.

A rendered view created with internal program engine

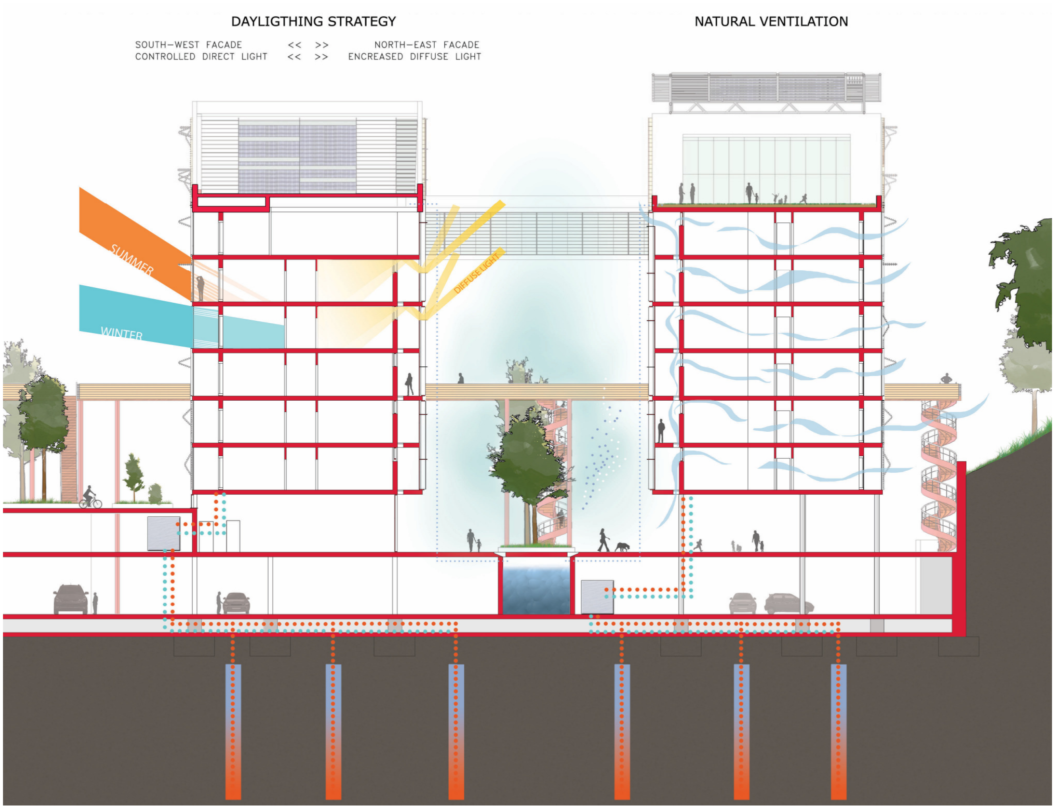
3. Methodology

In order to achieve the stipulated aim, the study presented in this paper traces the following steps:

1. Describing the benefits of applying adopted passive strategies that depend from site climatic considerations;
2. Exposing the technical properties of the building;
3. Defining the criteria assumptions for the creation of a simplified conceptual model;
4. Describing the results of the simulation in order to validate the strategic assumptions.

3.1. Passive strategies:

The passive bioclimatic strategies are the following, and allow to reduce the Energy requirements of the entire system without requiring additional costs:



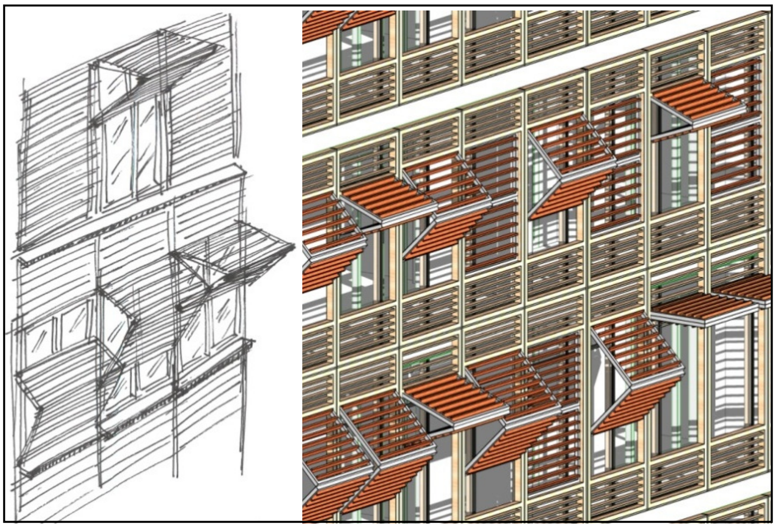
Illustrated south-west section

- *Wind control:*
  Take advantage of fresh winds during late hours of summer to increase cross ventilation and reduce mechanical intervention as much as possible;
- *Environment:*
  Benefit from existing vegetation buffers to reduce noise and cold winds;
  create gardens at different levels to multiply green socialization spaces and increase healthy places;

recover rainwater for domestic use;

- *Sun shading:*

  A double skinned wall surrounds the building, reduces sun penetration during summer months and lets the light and heat in during winter months.

  
  From the sketch to the "parametric family"

  In particular, a "parametric family" has been expressly created to speed up the creation process of the shading facade, which allows to regulate the right angle of the brise-soleil fixture according to the final user needs.

- *Buffer spaces:*

  Passive solar design pre-heat air entering from adjacent rooms and help maintain thermal comfort indoor;

  Adjustable windows permit the users to control natural ventilation according to their own needs;

  Intermediate space permits a flexible use, ideal for drain clothing, summer lecture room or outdoor dog house.

- *Distribution balcony:*

  Facing the internal court makes it possible to create two-sided overlooking apartments, and generates vertical stack effect through ventilation grids;

- *Roof garden:*

  Create high insulated rooftops;

  Generate exclusive shared spaces ideal for socialization and with high solar exposition.

- *Efficient heating:*

  Mechanical air systems with heat recovery reduce heat losses;

  The vertical geothermal system linked with heat pumps permits high efficient heating system.

- *Envelope:*

  Low u-value (transmittance) walls and windows reduce heat losses during cold season and minimise mechanical intervention during summer.

3.2. Project assumptions

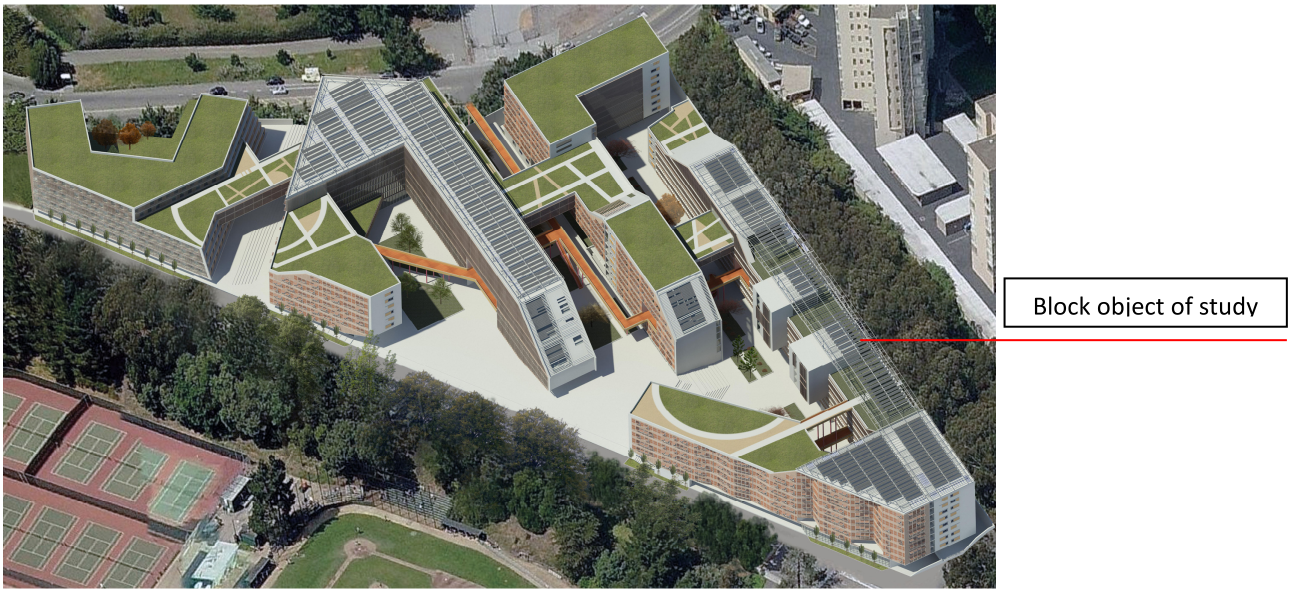
The site is characterized by high level of relative humidity, influenced by the sea breeze, and the diurnal average temperature have a range between 9℃ and 25℃.

The "block" object of study, that is reduced compared to the total project area, has a floor area of 23.000 square meters, for an estimated number of 970 people. It was necessary to isolate a single block since every block is independent of each other.

The building envelope is crucial for high performance, and has very low-transmittance properties:

Wall R-Value: made in R-20 wood frame wall, equivalent to U = 0.28 Watt/mq*K

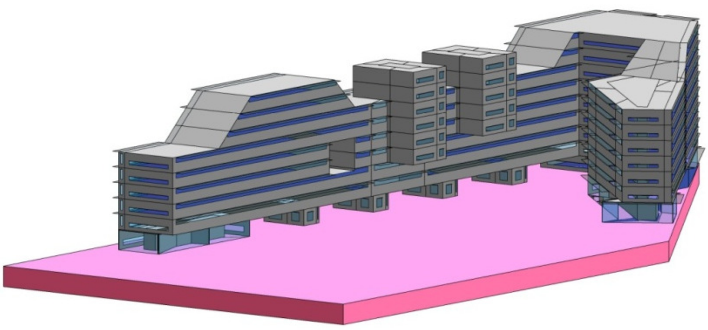
Roof R-Value: R-30 wood frame floor with overlying garden roof, equivalent to U = 0.18 Watt/mq*K
Windows U-Value: triple low emission glass, equivalent to U = 1.45 Watt/mq*K
Window to wall ratio: 28%
The heating and cooling system and the water system are based on ground source heat pumps having 4.2 COP of efficiency and the ventilation strategy is based on natural ventilation and supply fan flow. LED lighting has an average power density of 0.28 W/sf, controlled by photosensors.
Renewable consist in 90 meters depth geothermal for heat recovery, polycrystalline and thin-film photovoltaic for the production of about 600 kWatt/h/yr over a surface of 2200 square meters.



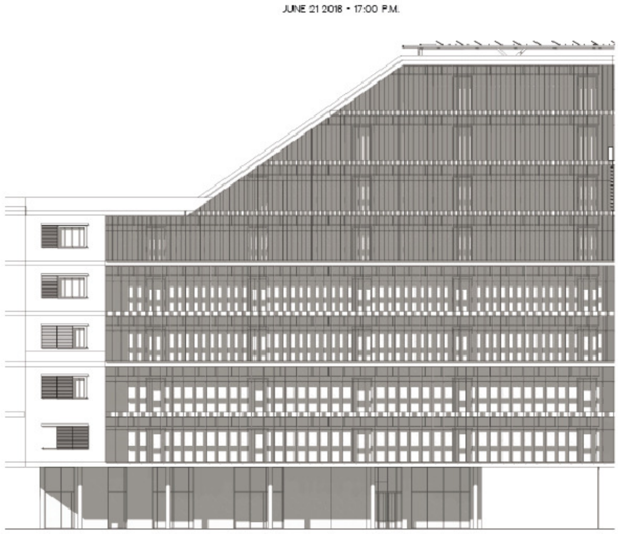
Photorealistic simulation

3.3. Energy model

Because of the complexity of the architectural shapes, it was necessary to create a conceptual massing elements model, easily manageable even if less accurate for the calculation.
This step, as the ideation one, has been performed with a single software, Revit Architecture, just to maintain the initial purpose of the study: manage the entire process adopting only one tool, from the design to the energy calculation.



Conceptual model created to calculate Energy performance of the block



Solar simulation during summer solstice – west –south/west elevation

3.4. Environmental Impact and results

After the modeling step, next one is to direct the information, contained inside the conceptual model, to the cloud tool GBS by Autodesk.

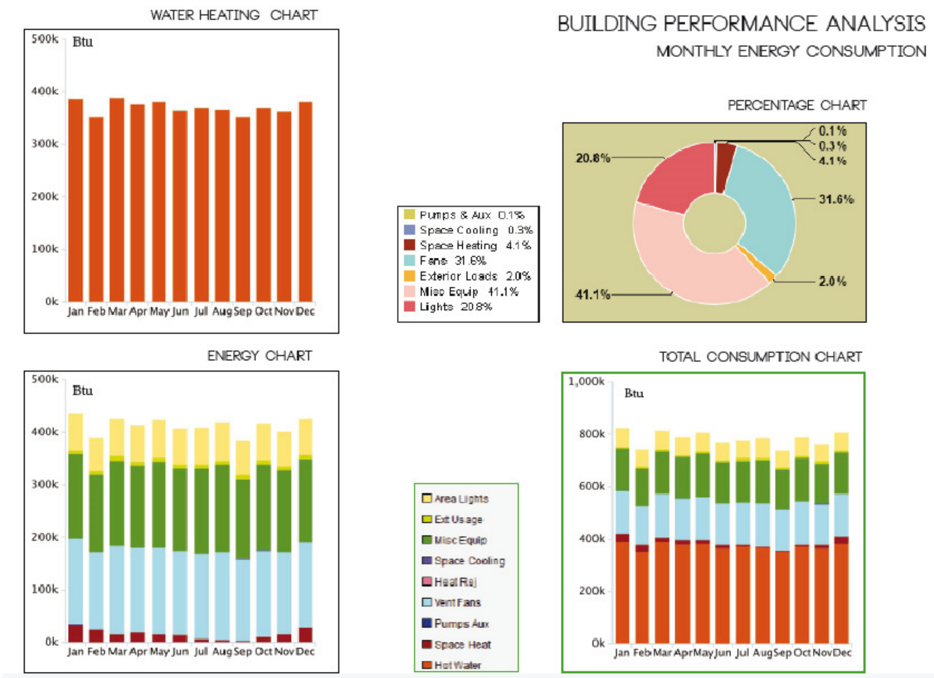
Green Building Studio is a cloud-based service that allows you to run building performance simulations to optimize energy efficiency and to work toward carbon neutrality earlier in the design process.

The results of the calculation, having acceptable approximation because of the simplicity of the model, are the following:

The Energy Use Intensity (EUI) is about 24 kBtu/sf/yr, from wich we can subtract the photovoltaic production value of about 8.1 kBtu/sf/yr, that brings the final value to 15.9 kBtu/sf/yr, equivalent to about 51 kWh/sm/yr.

The estimated annual CO2 emissions are 494 tons for electric and 258 for onsite fuel.

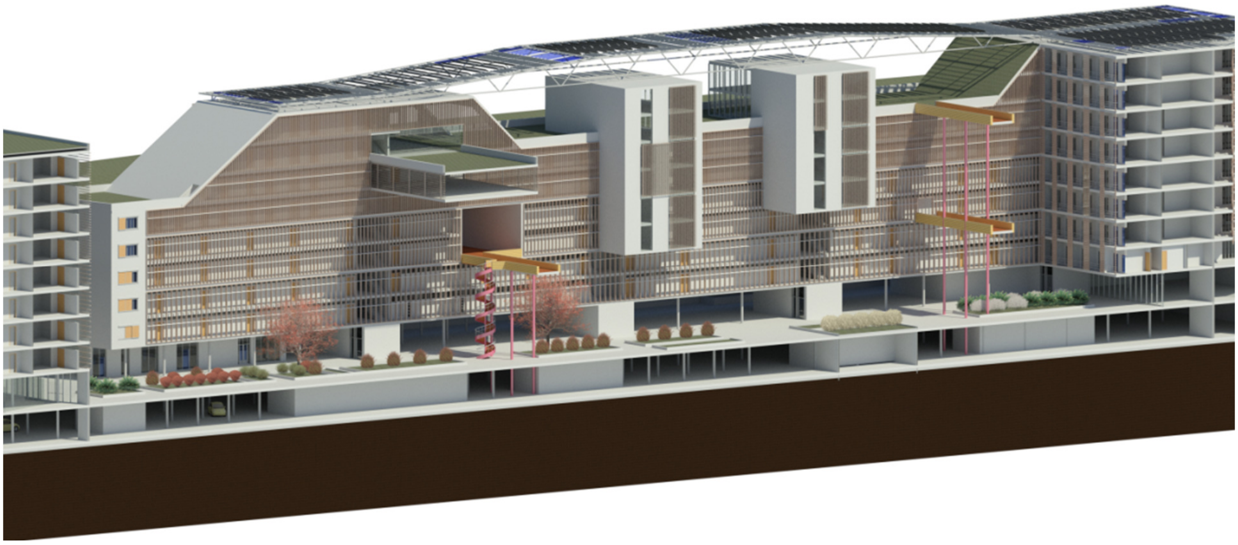
The estimated lifecycle energy demand is about 43.540.000 kW for electric and 1.335.000 therms for fuel.



4. Conclusions

Green architecture produces environmental, economic and social benefits. Environmentally, green architecture helps reduce pollution, conserve natural resources and prevent environmental degradation. Economically, it reduces the amount of money that the building's operators have to spend on water and energy and improves the productivity of those using the facility. Socially, green buildings are meant to serve the population by inserting beautiful artificial objects within the context, both natural and anthropic. To achieves this aims, the designer needs specific tools and preparation, essential to face the unforeseen and propose the solution. A holistic Bim oriented method, helps the operator make decisions in relatively short time, almost in real time, witch allows generating a better architecture without neglecting aesthetics neither functionality.

[4] Tools for the energy analysis are used by architects and engineers to design energy-efficient buildings. Energy was chosen. The energy consumption analysis should be defined at the conceptual design stage, this very could be very helpful for designers when makes decisions related to the selection of the most suitable design alternative that will lead to an energy-efficient building. Building Information Modeling (BIM) has the capability to help users assess different design alternatives and select vital energy strategies and systems at the conceptual design stage of proposed projects. Furthermore, by using BIM tools, designers are able to select the right type of materials early during the design stage and to make energy-related decisions that have a great impact on the whole building life cycle.



References

[1] Piano R, Piano C, AA VV (2012) Almanacco dell'Architetto, Costruire L'architettura, Bologna, Proctor Edizioni Spa, 2012

[2] Ceccherini Nelli L (2012) European project for training on renewable energy solutions and energy efficiency in retrofitting (REE_TROFIT). In: 2nd World Sustainability Forum, Web, 2012

[3] Ecofys. Towards nearly zero-energy buildings. Definition of common principles under the EPBD. Final report for Europen Commission; February 2013.

[4] Jalaei, Farzad & Jrade, Ahmad. (2014). Integrating BIM with Green Building Certification System, Energy Analysis, and Cost Estimating Tools to Conceptually Design Sustainable Buildings. Journal of Information Technology in Construction. 19. 140-149. 10.1061/9780784413517.015.

[5] Antonella Trombadore, Mediterranean smart cities, Collana MED Smart Cities, Firenze, Altralinea Edizioni s.r.l., 2015.