SECTION 6

SUPPORTING MATERIAL

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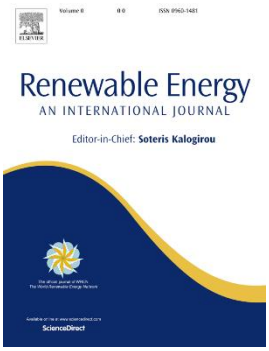
SUPPORTING MATERIAL

Laura Aelenei, Gilles Notton

This section gives background information about the journals that publish papers related to building integrated systems, a list of the relevant standards, research and testing of COST participants centres and infrastructures, international activity, networks and projects and a database of case studies examined in this COST Action.

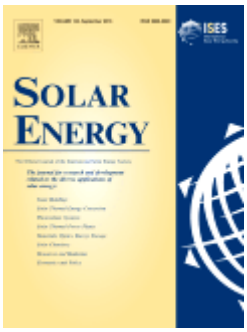
6.1 Scientific Journals



ISSN: 0960-1481

Renewable Energy

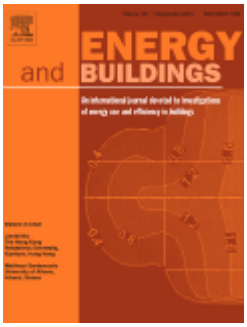
Website: http://www.journals.elsevier.com/renewable-energy



ISSN: 0038-092X

Solar Energy

Website: http://www.journals.elsevier.com/solar-energy/



ISSN: 0378-7788

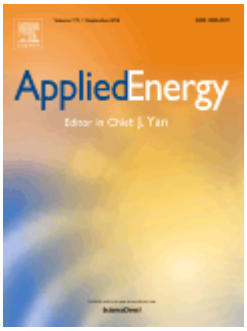
Energy and Buildings

Website: http://www.journals.elsevier.com/energy-and-buildings/

ISSN: 0360-5442

Energy

Website: http://www.journals.elsevier.com/energy



ISSN: 0306-2619

Applied Energy

Website: http://www.journals.elsevier.com/applied-energy/

6.2 Standards

ISO. ISO 13790:2008 - Energy performance of buildings -- Calculation of energy use for space heating and cooling. n.d.

EN 12975-1 Thermal solar systems and components - Solar collectors - Part 1: General Requirements

ASHRAE 93 Methods of Testing to Determine the Thermal Performance of Solar Collectors

EN ISO 9806 Solar Energy - Solar thermal collectors - Test methods

EN 12976-1 Thermal solar systems and components - Factory made systems - Part 1: General requirements

EN 12976-2 Thermal solar systems and components - Factory made systems - Part 2: Test methods

EN 12977-1 Thermal solar systems and components - Custom built systems - Part 1: General requirements for solar water heaters and combi-systems

EN 12977-2 Thermal solar systems and components - Custom built systems - Test methods for solar water heaters and combi-systems

EN 12977-3 Thermal solar systems and components - Custom built systems - Part 3: Performance test methods for solar water heater stores

EN 12977-4 Thermal solar systems and components - Custom built systems - Part 4: Performance test methods for solar combi-stores

EN 12977-5 Thermal solar systems and components - Custom built systems - Part 5: Performance test methods for control equipment

EN ISO 9488 Solar energy – Vocabulary

6.3 Research and testing participants centres and infrastructures

Partner	Information	
Cyprus University of Technology *Department of Mechanical Engineering and Materials Sciences and Engineering*	**Web site**	www.cut.ac.cy
	Address	Dorothea Building, 4th and 5th floor, 45 Kitiou Kyprianou Str., 3041 Limassol
	Contact	**Soteris Kalogirou** Soteris.Kalogirou@cut.ac.cy
	Short description	The Department of Mechanical Engineering and Materials Science and Engineering is one of the first Departments that started operating with the establishment of the University in 2004. The first undergraduate students have been accepted in September of 2007 while the Master program of the Department has commenced in September of 2012.
	Main infrastructures &equipment	Archimedes Solar Energy Laboratory (ASEL) dealing with all subjects related to solar and renewable energy systems. Main available facilities include solar collectors and systems characterization, indoor solar simulator 12 kW and popular energy performance analysis tools (TRNSYS, Energy+, etc.) and model based design platforms (MatLab, Simulink, and COMSOL).
University of Ulster Centre for Sustainable Technologies *School of the Built Environment, Faculty of Art & Design and the Built Environment*	**Web site**	https://www.ulster.ac.uk/research/institutes/built-environment/centres/sustainable-technologies
	Address	25-51 York St, Belfast BT15 1ED
	Contact	**Mervyn Smyth** m.smyth1@ulster.ac.uk **Aggelos Zacharopoulos** a.zacharopoulos@ulster.ac.uk
	Short description	The Centre for Sustainable Technologies undertakes multidisciplinary research to design, create, develop, improve, demonstrate and evaluate emerging, existing and alternative sustainable renewable energy, building design, construction materials, transport and environmental modification technologies.
Fraunhofer Institute for Solar Energy Systems *Division Solar Thermal and Optics*	**Web site**	https://www.ise.fraunhofer.de
	Address	Heidenhofstr. 2, 79110 Freiburg, Germany
	Contact	**Werner Platzer** werner.platzer@ise.fraunhofer.de **Christoph Maurer** christoph.maurer@ise.fraunhofer
	Short description	Founded in Freiburg, Germany, in 1981, the Fraunhofer Institute for Solar Energy Systems ISE is the largest solar energy research institute in Europe, with a staff off approx. 1100. It creates technological foundations for supplying energy efficiently and on an environmentally sound basis in industrialized, threshold and developing

		countries. With its research focusing on energy conversion, energy efficiency, energy distribution and energy storage, it contributes to broad application of new technology.
	Main infrastructures &equipment	TestLab Solar Thermal Systems, TestLab Solar Façades, TestLab PV Modules, TestLab Power Electronics and the Calibration Laboratory with the Units CalLab PV Cells and CalLab PV Modules.
LNEG-National Energy and Geology Laboratory *Energy Efficiency Unit*	**Web site**	www.lneg.pt/
	Address	Estrada do Paço do Lumiar, 22, 1649-038 Lisbon, Portugal
	Contact	**Laura Aelenei** laura.aelenei@lneg.pt
	Short description	The Portuguese National Laboratory of Energy and Geology (LNEG) is a State laboratory of the Ministry of Economy that makes R&D oriented to the needs of society and enterprises. Investing in a sustainable research, along with the international best practices, ensures that its areas of expertise allow an adequate response to the needs of the business sector. Energy Laboratory integrates different departments of the Renewable Energy research and testing as: Buildings Energy Efficiency, Solar Energy, Wind energy and electric grids, Bioenergy and Energy Conversion
	Main infrastructures &equipment	SOLARXXI building, NZEB living lab (office building), Solar Energy testing laboratory Laboratory of Materials and Coatings Laboratory of Biofules and environment.
University of Belgrade *Faculty of Architecture*	**Web site**	www.arh.bg.ac.rs
	Address	73 Bulevar kralja Aleksandra, Belgrade
	Contact	**Aleksandra Krstic-Furundzic** akrstic@arh.bg.ac.rs
	Short description	The first elements of higher education in the field of architecture in Serbia are mentioned in the 1844. when by moving Lyceum to Belgrade, was reformed its teaching, in which, at the Department of Philosophy introduced the subject of civil architecture. The first elements of higher education in the field of architecture in Serbia are mentioned in the 1844. when by moving Lyceum to Belgrade, was reformed its teaching, in which, at the Department of Philosophy introduced the subject of civil architecture.
University of Lleida *Applied physics section Environmental Science Department*	**Web site**	http://www.deptetsea.udl.cat/dept/macs/eng/
	Address	Dpt. Medi Ambient i Ciències del Sòl (Campus ETSEA, Edifici 3), Av. Rovira Roure, 191, 25198 LLeida
	Contact	**Daniel Chemisana** daniel.chemisana@macs.udl.cat

		Luisa F. Cabeza lcabeza@diei.udl.cat **Chrysovalantou Lamnatou** lamnatou@macs.udl.cat
	Short description	Research group on : Dynamic Systems Applied Solar Energy (SDAE) Solar generation systems: Development of photovoltaic, thermal and hybrid innovative systems. Numerical simulation of thermal collectors (CFD) and photovoltaic collectors (SPICE). Experimental characterization of thermal and photovoltaic systems. Building integration of solar thermal and photovoltaic collectors. Photovoltaic green-roofs. Solar concentration: Development of optical elements to increase the conversion efficiency. Development of optical systems to facilitate the building integration of solar systems. Numerical and experimental characterization of optical elements. Energy efficiency: Analysis and building energy refurbishment. Energy optimization and parametric analysis based on statistical algorithms. Development and application of stochastic inverse models for optimizing solar hybrid systems. Service models for energy savings in buildings based on ICTs and low cost measures.
University of Patras *Department of Physics*	**Web site**	http://www.physics.upatras.gr/index.php?lang=en
	Address	Department Of Physics, Panepistimioupoli Patron 265 04, Greece
	Contact	**Yiannis Tripanagnostopoulos** yiantrip@physics.upatras.gr
	Short description	The Physics Department of the University of Patras was founded in 1964 and is among the oldest Departments of our University; in 2014 we will celebrate its fifty years of fruitful activities. It is located at the University of Patras campus, about 8 km north of downtown Patras. Currently it is divided in four Sections, namely: Applied Physics, Condensed Matter Physics, Electronics and Computers, Theoretical & Mathematical Physics, Astronomy & Astrophysics.
	Main infrastructures &equipment	Laboratories of the Applied Physics Division: Atmospheric Physics Laboratory, Solar Energy Laboratory, Renewable Energy and Environment Laboratory, Laser, Nonlinear and Quantum Optics. Solar Energy Laboratory: There are available two horizontal roofs on Physics Dept building for solar energy system testing, where solar thermal collectors, photovoltaic panels and PV/T systems can be tested in outdoors conditions.

Dublin Institute of Technology	**Web site**	www.dit.ie
	Address	Aungier St, Dublin 2, Irlanda
	Contact	**Brian Norton** president@dit.ie **David Kennedy** david.kennedy@dit.ie
	Short description	Over 125 years, Dublin Institute of Technology pioneered technological higher education: the Institute's alumni play important roles in technical and scientific innovation, economic and social development and culture and education both in Ireland and internationally.
	Main infrastructures &equipment	Dublin Energy Lab (DEL) is a leader in science and engineering energy research in Ireland with an associated staff of fourteen academics, four full time researchers, fifteen full and part time PhD researchers and three MPhil researchers. DEL conducts research across a range of disciplines with key efforts organised into themes of: electrical, power, energy policy, solar energy, zero emissions buildings, lighting, energy demand analysis and forecasting, life cycle assessment.
University of Corsica Pasquale Paoli *Laboratory Sciences For Environment – UMR CNRS 6134*	**Web site**	http://spe.univ-corse.fr/
	Address	Centre de Recherches Georges Peri – Route des Sanguinaires – F20000 AJACCIO
	Contact	**Gilles Notton** gilles.notton@univ-corse.fr **Christian Cristofari** cristofari@univ-corse.fr
	Short description	This laboratory depends on the University of Corsica and National Center for Scientific Research (CNRS). Concerning researches in Renewable energies, the main topics are : - Prediction and estimation of the renewable energy resources; - Problematic of intermittence in island network; - Energy storage and energy management - Smart grid; - Integration of renewable energy systems in buildings.
	Main infrastructures &equipment	Two R&D platforms: - Myrte : Coupling between PV plant (550 kWp) and hydrogen storage (50 kW electrolyzer/100 kW fuel cell) - Paglia Orba : Coupling between renewable energy means and energy storages in connected or islanding mode. Meteorological stations, thermal solar collector experimentations.
Kaunas University of Technology *Institute of Architecture*	**Web site**	http://ktu.edu/en/institute-architecture-and-construction
	Address	Tunelio St. 60,

and Construction		Kaunas, Lithuania phone: +370 (37) 451 351 fax: 8 (37) 451 355 email: asi@ktu.lt
	Contact	Manager– Researcher, **Dr. Karolis Banionis** phone. 8 (37) 350 799 e-mail. karolis.banionis@ktu.lt
	Short description	**Institute of Architecture and Construction** was established in 1956. Institute's mission is a high-level architecture, landscaping and civil engineering research and experimental development, participation in the study process, helping to ensure the needs of society and the state's sustainable science, economics and culture.
	Main infrastructures &equipment	**Building Physics Laboratory and Composite and Finishing Materials Laboratory** Research fields: building energy performance of buildings and heat transfer studies, studies of renewable energy usage in buildings, feasibility studies of solar and wind energy, made in building or its surrounding, usage for effective building energy performances, efficiency researches of energy- efficient buildings tightness and heating-ventilation systems.
University of Malta *Department of Environmental Design*	**Web site**	http://www.um.edu.mt/ben/envdesign
	Address	Department of Environmental Design, Faculty for the Built environment, University of Malta, Msida MSD2080.
	Contact	Prof. Vincent Buhagiar
	Short description	Research in Design towards energy efficiency in buildings and lowering the carbon footprint
	Main infrastructures &equipment	Environmental Laboratory Field equipment Software licenses
Warsaw University of Technology *Institute of Heat Engineering* *Faculty of Power and Aeronautical Engineering*	**Web site**	www.eng.itc.pw.edu.pl/
	Address	Nowowiejska 21/25, room 105 00-665 Warsaw, Poland
	Contact	**Dorota Chwieduk** dorota.chwieduk@itc.pw.edu.pl
	Short description	The Institute of Heat Engineering was established in 1961. With its staff comprising of 87 persons (50 of them are the research staff) and in the view of 17 professors and associated professors employed, the Institute can be regarded as one of the institutes at Warsaw University of Technology having the greatest scientific capacity. Nowadays, the institute comprises of the following divisions: Division of Thermodynamics, Division of Refrigeration and Process Equipment, Division of Aeroengines, Division of Power Engineering and Division of Pumps, Drives and Plants and three special

		laboratories for Computer Sciences, Thermovision Services and Combustion Laboratory of Aeroengines Division. Most of the researchers working for the institute are well known specialists, recognised as prominent experts.
	Main infrastructures &equipment	Computer Sciences Laboratory, Thermovision Services Laboratory. Heat Engineering Labs
University of Minho *Department of Civil Engineering, School of Engineering*	**Web site**	https://www.uminho.pt/EN/uminho/Units/schools-and-institutes/Pages/school-of-Engineering.aspx
	Address	Campus de Azurém, 4800-058 Guimarães
	Contact	**Manuela Almeida** malmeida@civil.uminho.pt **Sandra Monteiro da Silva** sms@civil.uminho.pt **Ricardo Mateus** ricardomateus@civil.uminho.pt
	Short description	With origins going back to the birth of the University of Minho, the School of Engineering focus its activities on the traditional areas of Engineering, as well as on emerging and unique areas with a strong research component. It also focuses, at a national level, on the excellence of its teaching, internationalization and social interaction projects. This is a School for the Community and the relevance of its work is evident through numerous partnerships with the economic fabric of national and international business.
	Main infrastructures &equipment	Laboratory of Structures Building Physics Laboratory Geotechnical Laboratory Hydraulic Laboratory Building Materials Laboratory Geographic Information Systems Laboratory Transport Laboratory
University of Kragujevac *Faculty of Engineering*	**Web site**	www.mfkg.rs/eng/
	Address	6, Sestre Janjic Str. 34000 Kragujevac, Serbia
	Contact	**Ivan Miletic** imiletic@kg.ac.rs **Danijela Nikolic** danijelan@kg.ac.rs **Jasna Radulovic** jasna@kg.ac.rs

	Short description	The Faculty of Engineering belongs to a group of the most distinguished and most prestigious scientific-educational institutions from the area of technical sciences. Today, it is a modern scientific-educational institution with clearly defined mission, vision, objectives and program orientation. Education at the Faculty of Engineering includes a whole spectrum of development of modern and contemporary technology, in accordance with the European trends, ideally placed for practical profession, but also as a basis for efficient creative work.
University of Naples Federico II *DII – Department of Industrial Engineering*	**Web site**	http://www.dii.unina.it/
	Address	P.le V. Tecchio 80, 80125 Naples, Italy
	Contact	**Adolfo Palombo** adolfo.palombo@unina.it **Annamaria Buonomano** annamaria@buonomano@unina.it
	Short description	The University of Naples Federico II was established in 1224 through an Imperial Charter of the Holy Roman Emperor Frederick II Hohenstaufen. It was the first publicly funded university in Europe. It is one of the world's oldest state university and academic institution. The Department of Industrial Engineering consists of more than 100 Professors and Researchers involved also on skills as *energy, heat transfer, thermo-fluidynamics, HVAC systems*. Particular attention is paid on research topics regarding *renewable energy systems* (solar, geothermal, etc.) and *high energy efficiency building technologies* (building integrated solar thermal systems, innovative HVAC systems, solar heating and cooling systems, innovative heat pumps, nearly/net-zero energy buildings, innovative adaptive and predictive control strategies for systems, etc.). The researchers involved in these fields developed a significant skill in buildings solar systems analysis and related advanced control schemes by also using some popular energy performance analysis tools (TRNSYS, Energy+, etc.) and model based design platforms (MatLab, Simulink, etc.).
	Main infrastructures &equipment	Laboratories of the Department of Industrial Engineering – Laboratory of Applied Thermodynamics.
Szent Istvan University Department of Physics and Process Control *Institute for*	**Web site**	http://www.fft.szie.hu/
	Address	Gödöllő, Páter K. u. 1., H-2100 Hungary
	Contact	**Istvan Farkas** Farkas.Istvan@gek.szie.hu

Environmental Engineering Systems	**Short description**	The Department of Physics and Process Control Department is working in the auspice of the Institute for Environmental Engineering Systems, Faculty of Mechanical Enegineering, Szent Istvan University, Gödöllő, Hungary. The main research activity of the Department relates to the solar energy applications including both solar thermal and photovoltaic fields. Specific topics are building integrated tile collectors, spectral sensitivity of PV modules, solar drying, solar heated greenhouses, transparent insulation of buildings.
		Solar energy/technology system. Modular solar dryer. Solar heated greenhouse. Transparent insulation wall. Solar heated swimming pool. 10 kW grid connected PV system.
Transilvania University of Brasov *RESREC, Renewable Energy Systems and Recycling*	**Web site**	http://www.unitbv.ro/Default.aspx?alias=www.unitbv.ro/resrecen&
	Address	R&D Institute of the Transilvania University of Brasov, Laboratory L7 Institutului 10, Brasov
	Contact	Prof. dr. eng. Ion Visa, RESREC Coordinator visaion@unitbv.ro
	Short description	The Renewable Energy Systems and Recycling Centre was founded in 2002 and currently gathers 20 staff members, Ph.D. and M.Sc students from the Faculty of Product Design and Environment. The main focus of the centre is to develop complex, integrated solutions for the sustainable built environment, by developing renewable energy systems for energy efficient buildings, covering the concept “from material to prototype”. Renewable-based conversion systems are developed, adapted to the implementation location for covering the thermal and electric energy needs in a building, along with novel solutions for wastewater treatment aiming at water re-use, and for using wastes as second raw materials for novel products development.
	Main infrastructures &equipment	The Solar House, used as onsite laboratory Equipment to assess the renewable energy potential Renewable-based energy mixes for thermal energy production Solar photovoltaic systems Small wind farms
University POLITEHNICA of Bucharest *The Faculty of Mechanical Engineering*	**Web site**	www.upb.ro/en/about-us.html
	Address	Splaiul Independentei nr. 313, sector 6, Bucuresti, ROMANIA, Postal cod: RO-060042
	Contact	**Professor Viorel Badescu,** badescu@theta.termo.pub.ro

and Mechatronics **Romania**	**Short description**	The University POLITEHNICA of Bucharest is the oldest and most prestigious engineering school in Romania, with a tradition of more than 190 years made possible by the efforts of some of the greatest Romanian professors. Its specificity relies in creating knowledge through research and technological innovation, as well as through its implementation by means of education and professional training at a European level. At present the University POLITEHNICA of Bucharest is formed by 15 different faculties. Consequently, classrooms and laboratories are located in several places: the historical Polizu building, as well as the modern university campuses located in 313 Splaiul Independentei, and in 1-3 Iuliu Maniu Blvd., both in sector 6.
National Technical University of Athens *Unit of Environmental Science and Technology* *School of Chemical Engineering*	**Web site**	https://www.uest.gr/
	Address	9, Iroon Polytechneiou St., Zographou Campus Athens 157 73 Greece Athens 157 73 Greece
	Contact	**Christophis Koroneos** koroneos@chemeng.ntua.gr
	Short description Main infrastructures &equipment	The Unit of Environmental Science and Technology (UEST) is an educational and research unit at the School of Chemical Engineering of the National Technical University of Athens. The unit works in collaboration with other Universities, research institutes, public and local authorities and with the private sector with the aim of enhancing education, research, technology and innovation. UEST works in close cooperation with competent Ministries and other Governmental agencies, as well as various European and International organizations, providing environmental management inputs for the development and implementation of national strategies and action plans. UEST has been the National Reference Center of Greece representing the country at the European Topic Center on Waste and Material Flows (ETC/WMF) of the European Environment Agency (EEA).

6.4 International activities, networks and projects

IEA. Task 41 Solar Energy and Architecture, http://task41.iea-shc.org/

IEA. Task 40 Net Zero Solar Energy Buildings, http://task40.iea-shc.org/

The Solar Keymark. http://www.estif.org/solarkeymarknew/contacts/centc-312 n.d.

6.5 Data base of Case studies

Some examples of BISTS realization and adapted material for solar thermal collector integration:

- Japan´s large natural gas company, Tokyo Gas, started producing a collector panel that can be integrated into balconies.
  Website: www.solarthermalworld.org/content/tokyo-gas-launches-balcony-integrated-collector

- The glazed flat plates collectors is well integrated with as the double facade for building and solar thermal element in the Social housing building hosts in Paris which designed by Architect Philippon.
  Website: www.igreenspot.com/philippon-kalt-designed-the-first-social-housing-with-solar-panels-in-paris/ http://abdulqadirbayz.blogspot.fr/2012/12/rewable-energy-categories.html

- Vacuum solar collector in the loggia. Laureate of the Solar Price 2012, Minergie P, house with three apartments in Ponti/Zurich-Höngg.
  Website: kaempfen.com

- The Evacuated tubes of the Apartment house Sunny Woods building have second function as balcony fence.
  Website: kaempfen.com

- A solar collector integrated in a balcony.
  Website: blueclean.en.made-in-china.com/product/rXpxVohbgzWR/China-Balcony-Wall-Mounted-Solar-Water-Heater.html

- Architectural Integration Quality: SOLABS – Development of unglazed solar absorbers: Survey results - Maria-Cristina Munari Probst. European Survey: Questionnaire results on Architectural integration quality for 10 existing buildings.
  Website: leso.epfl.ch/page-37324-en.html

- Solar thermal collectors can be integrated into balcony balustrades on higher density projects – freeing up roof space for green roofs or PV.
  The U pipe collector is a type of Solar Thermal which is comprised of a manifold and many vacuum tubes each containing one U-shaped copper pipe. Sunlight is captured by the coated vacuum tubes which absorb the radiation as heat and conduct it through

aluminum fins to the U pipes. A manifold on the top of the solar collector allows the working fluid (typically anti-freeze) to be pumped through all of the U pipes in parallel, and then through an external heat exchanger which transfers the heat to water in a pressurized storage tank.
Web site: www.zedfactory.com/#!zedrenewable/uyw05

- Prototypes of different innovative BIST technologies.
  Website: www.omicsonline.com/articles-images/2090-4541-5-182-t002.html

- Solar thermal collectors as architectural elements. Website: www.renewableenergyworld.com/articles/print/volume-10/issue-2/solar-energy/built-for-the-sun-solar-thermal-collectors-as-architectural-elements-51551.html

- Examples of BIST in Europa.
  Website: www.aee-intec.at/0uploads/dateien354.pdf

- Home for disabled people in Salzburg, Austria, 67 kWth façade collector + 2.5 kWp PV on roof.
  Website: www.arching.at/brandmueller www.aks-doma.com

- 18 terraced houses and two storey residential buildings in Hamburg Bramfeld, Germany, 2.1 MWth (4500 m^3 storage tank).
  Website: www.wagner-solartechnik.de.

- Eleven storey multi-family residencial buildings in Leipzig, Germany, 207 kWth.
  Website: www.denk-ai.de www.schusco.de

- A building for seasonal workers in the sports resort Val Thorens in France, 44 kWth integrated in roof.
  Website: www.clipsol.com

- Terraced houses with solar hot water preparation and space heating in Oslo, Norway, 65 kWth.
  Website: www.dbark.no www.solarnor.no

- Solar tiles: THERMOSLATE® solar thermal collectors installed with nails are fully integrated into the rest of the slate roof. This makes them perfect for any project that aims to develop a more sustainable, ecological architecture, also maintaining the inimitable appearance and texture of our natural slate.
  Website: www.cupapizarras.com/fr/thermoslate

- The design of Solar Roofing by Solex Energy follows the ICAX philosophy of providing a second function to existing building fabric. In this case the second function of solar thermal collection has been added to the primary function of a pitched roof covering – to ensure a waterproof seal.
  Website: www.icax.co.uk/Solar_Roofing.html

- BISTS in façade developed by IMS (Ingenieurleistungen Manfred Starlinger).
  Website: ims-plan.com/building-integrated-solar-thermal-bist.html

- PV/Th integrated solar collector: A house in suburban Sydney, Australia has installed the world's first building integrated solar system that generates electricity and heat. The rooftop array combines thin-film solar PV panels with a solar thermal duct system that warms and cools the air. The top layer produces electricity from the sun just as a normal PV panel would, while heat is trapped between the layers and distributed to the home.
  Website: inhabitat.com/worlds-first-integrated-solar-system-generates-electricity-and-heat/ www.bluescopesteel.com.au/

- An innovative aluminium-based façade with an integrated solar energy solution. Hydro Building Systems helped develop a building façade with solar functions integrated in the solution.
  Website: www.hydro.com/en/Press-room/News/Archive/2010/Solar-award-for-Hydro-unit-/

- A Bi-PV/W experimental rig.
  Website:
  www6.cityu.edu.hk/bst/BEET/project_page/research%20projects/hybrid%20photovoltaic%20thermal%20technology/hybrid%20photovoltaic%20thermal%20technology.htm

- Facade Integrated Flat Plate Solar Thermal System.
  Website: www.sunmaxxsolar.com/

- Solar Tomorrow Inc. specializes in the design and delivery of solar thermal systems for use in hot water production, space heating, and space cooling. Based on this micro-channel absorber Solar Tomorrow developed a group of novel solar thermal collectors specially designed for architectural and building integration. The collectors can be used as a wall cladding in curtain-wall facades or as a roof covering elements.
  Website: www.solartomorrow.com

- IEA Solar Heating and Cooling Programme, Task 39. Architectural integration of solar thermal energy systems. 38 case studies are presented in this website.
  Website: projects.iea-shc.org/task39/projects/default.aspx

- Lightfarm: Hybrid Solar-Thermal Facade (Linear concentration). Lightfarm is a new method for utilizing building facade and rooftop in order to collect and concentrate light rays which then is used for heating and power generation by CPV photovoltaic cells. In this project, instead of using conventional photovoltaic of 12% to 19% efficiency, the sunlight would be concentrated by building façade using the thin plastic Fresnel lenses, and then an small surface of LCPV would generate electricity for the household with high conversion rate of 25 %. While PV cells would provide electricity with an efficiency of 25%, 75% waste of energy is transmitted to heat-sinks for water and space heating purposes.
  Websites: www.mohsen-saleh.com/2012/02/hybrid-solar-thermal-facade-linear.html#!/2012/02/hybrid-solar-thermal-facade-linear.html, www.mohsen-saleh.com/2011/10/light-farm.html#!/2011/10/light-farm.html

- MatrixAir Building-integrated solar air heating system.
  Website: www.matrixairheating.com

- Solar thermal glass façades with adjustable transparency: FLUIDGLASS unites four key functionalities in one integrated system: it acts as a fully transparent solar thermal collector, which enables harvesting of solar energy even in buildings with large glass share. It secondly acts as transparent insulation layer and thirdly controls the solar radiation transmission and inner glass surface temperature thus increasing the thermal user comfort and reducing the demand for heating, cooling and lighting. At the same time it substitutes conventional HVAC components such as cooling and heating panels.
  Website: www.fluidglass.eu

- A facade system which combines several functions: integrated evacuated tube collectors generate solar heat at a high temperature level, and provide even, semi-transparent light and protection against the sun for indoor areas without impairing the view. The system is particularly suitable for offices and other functional buildings with a large number of windows. It can also be used as an architectural design element for facades. Universität Stuttgart.
  Websites: www.bine.info/en/topics/renewable-energy-sources/solar-heat/publikation/fassadenkollektoren-mit-durchblick/?type=333, www.frener-reifer.com

- Termocoppo® is a totally new concept of solar collector entirely made in Italy, innovative, modern and functional. It can also be applied on the roofs to replace the tiles. It is a modular system consisting of individual elements lighter than tiles, easily transportable, carried by hand. They require no equipment or particular devices to be installed. The length of the module can be selected from different sizes (1500, 2000 and 3000 mm): this allows you to customize the solar system on the basis of the measures of the roof. It is thus possible to achieve continuous surfaces also of large dimensions.
  Website: www.krasno.it

- Architect Kate Johnson of Norfolk, Connecticut employed value engineering techniques to define savings in planning her home. She was able to afford a Solar Sandwich," an integrated solar standing seam metal roof system that supported a solar photovoltaic laminate system on the roof for electricity and a solar thermal system under the roof for hot water and heating.
  Website: www.englertinc.com

- SolarWall® technology is a solar air heating system that heats building ventilation air and improves indoor air quality.
  Website: solarwall.com

- SolarWall® 2-Stage - High Performance Solar Air Heating. It delivers a higher temperature rise - up to 36-100 °F (20-55 °C) above ambient temperature. It is more suited to solar space heating applications. SolarWall® PV/T^{TM} cogeneration system produces both heated air & electricity.
  Website: solarwall.com

- Double glass with partial transparency and krypton fill. The solar radiation is absorbed by a copper serpentine situated between the two glasses. Reflective tapes on the interior glass allow to control the solar flux.
  Website: www.robinsun.com

- 19 case studies of BISTS analyzed in the IEA SHC task 41: Solar Energy and Architecture: Collection of Case Studies.
  Website: task41.iea-shc.org/casestudies/

- Solar XXI – BIPV/T-PCM Systems. Prototype constructed within FRAME project. Solar Building XXI, built in 2006 at LNEG Campus in Lisbon is an example of a low energy building using passive systems both for heating and cooling (ground cooling) towards a Net Zero-Energy Building (NZEB). The main façade has a PV system with heat recovery which assists the heating in winter time. In summer a ground cooling system (earth tubes) is used to cool the building, together with night cooling strategies. Website: www.lneg.pt, www.rehva.eu/publications-and-resources/hvac-journal/2012/032012/solar-xxi-a-portuguese-office-building-towards-net-zero-energy-building

- The BISTS is a collector fields of CS 300M modules from Citrin Solar GmbH, Moosburg/Germany. The aim is to provide solar energy for the 3000m² floor heating of the building. The energy comes from the facades and additional collector of 66.5 m² on the roof is stored in a 17000 L tank. The vertical position of the collector maximizes the thermal energy in winter and avoid overheating in summer. Auxiliary heat is provided by a 200 kW wood chip boiler. The installation delivers heat to adjacent building.
  Website: www.solcess.com

- Balcony-mounted System: The system comprises of flat panel solar collectors, glass-lined storage tank with intelligent controller and mini circulating pump. It comprises of flat panel collector, a water tank, a heat exchanger, a controller and pumps. Balcony-mounted Solar Water Heating system is special designed for high-rise buildings.
  Website: www.ecvv.com

- Refurbishment: The essential improvement of the thermal envelope with prefabricated façade modules. The integration of a series of components into the prefabricated façade module system like windows, ventilation devices and solar thermal collectors. The implementation of a new and innovative solar-active energy concept
  Website:
  www.nachhaltigwirtschaften.at/resources/iea_pdf/iea_ecbcs_annex_50_anhang7b-demonstration_dieselweg_3-19.pdf

- Refurbishment: The residential area Dieselweg comprises five single buildings and one long building row. The innovative energy concept is the integration of solar thermal collectors in all south and southwest façade, the roof of carport was also covered with collectors and additional collectors were installed on the roofs of the five single buildings. The total area of collectors provides 3 m² of collectors per apartment. Website: www.iee-

square.eu/InformationPublications/Brochures/SQUARE_Short_info_Pilot_project_Austria_EN.pdf

- The Eko-Nok is an integral roof mounted ICS solar water heater available in connected modules. Each module has a water content of 26L, is 1.5 m long with a diameter of 270 mm and module width of 322 mm.
  Website: www.ares-rtb.nl/ares-rtb-home.asp

- GLE Solar Energy is a Michigan-based company that provides a solar water heating product. We have designed a unique collector specifically for the North American market: the only solar technology that makes best use of solar radiation when it is mounted vertically. The GLE evacuated tubes are much larger than traditional ones and create a much larger unit. The framing for the tubes is designed to integrate into fences, handrail and balustrade.
  Website: www.glesolar.com

- Some solar houses realizations of Jenni enterprise.
  Website: www.jenni.ch

- The Solar Thermal Collectors are installed on the roof and on the South, East and West facades. In the facades the STC are also used as the cladding of a ventilated wall. The roof has 144 solar collectors, with a 7º angle towards the South (this angle was due to architectural restrictions), with an area of approximately 400 m2. The south facade has 100 solar thermal collectors with an area of approximately 200 m2. In the East and West facades 48 solar thermal collectors are installed, with an approximate area of 96 m^2 (in each façade).
  Website: jlcg.pt

- SolTech Sigma solar tiles.
  Website: www.soltechenergy.com/

- Built in 2010 not far from Vienna, the Sunlighthouse was Austria's first carbon-neutral single-family home. The winning design, by Juri Troy of Hein-Troy Architekten, was a direct response to the home's surroundings.
  Website: www.velux.com/solutions/demo-buildings/sunlighthouse

- The home design strategy was guided by the culture and well-established architectural standards of the Old Webster district, a St. Louis suburb where historic buildings, beautiful surroundings and a strong community create an attractive environment for families. The project team transformed a traditional home design into an Active House, creating a structure that would fit its surroundings – yet significantly outperform neighboring buildings over its lifecycle with its minimal operation, energy, and maintenance costs.
  Website: www.velux.com/solutions/demo-buildings/smith-residence

- Façades solaires individuelles Winkler Solar.
  Website: www.winklersolar.com

- Clearline Vetro Solar Thermal Glazing Cassette: The Clearline Vetro family of solar heating panels install directly into vertical and sloping glazing systems as easily as a sheet of glass to produce an integrated aesthetic that matches adjacent glazed panels. This toilet block in Frinton on Sea benefits from a boost to hot water from Clearline Vetro solar panels integrated into a run of patent glazing.
  Website: www.viridiansolar.co.uk