Project / Program title

Green Energy Laboratory – GEL at the Shanghai Jiao Tong University

Purpose

The Green Energy Laboratory (GEL) is a platform for the testing and dissemination of energy efficient and "low-carbon" technologies in the building and housing sectors. GEL has been jointly envisioned and supported by the Italian Ministry for the Environment Land and Sea (IMELS) and the Shanghai JiaoTong University (SJTU), since 2007. it is another "landmark" in the Sino-Italian Cooperation Programme in the field of sustainable urban development and architecture.

Designed by Italian experts together with the Dept. of Mechanical and Electrotecnical Engineering of the Shanghai University, GEL is located in the Minhang campus of the JiaoTong University and was created as research centre and laboratory for the analysis and diffusion of low carbon emission technologies in the construction and housing sector.

Recipient Country	Sector	Total funding	Years in operation
Italy-China	Sustainable Architecture	2 M Euro	36 months – completed in 2012

Description

The building sector in China has been estimated to be responsible for more than 30% of the energy consumption, it is therefore an important sector for GHG emission reduction, in which IMELS has been promoting good practices in eco-architecture, energy-efficient technologies and research and development of construction materials.

The 1500 m2 Green Energy Laboratory is conceived as a compact body surrounding a central court, covered by a large skylight, that can be opened or closed depending on the season, a solution chosen due to its functional characteristics in terms of distribution and energetic optimization. The space, surrounded by access balconies, is configured as a void that optimizes energy consumption. During the sunny winter days, it functions as an accumulator of heat, while during the summer days, it acts as a chimney, aspirating the hot air produced in the interior.
The building has three floors with a total surface area of 1500 square metres above ground, and a maximum height of 20 m. The first two floors host laboratories, meeting rooms, a control room, classrooms for the students and an exhibition space; every interior has windows on two sides, to the exterior and the inner court. The third floor hosts two sample apartments, the simulation of a two-room flat and a three-room flat covered by a pitched roof with photovoltaic panels, realized as platform for tests on residential types of spaces, to experiment with energy-efficient systems and buildings.
The orientation of the building and its rectangular shape, along with the façade and the glazed interior court, are conceived to maximize the natural ventilation and to control exposure to the sun, in order to obtain an ideal interior climate with a minimum expenditure of energy. The façade, the distinctive feature of the exterior volume, consists of a double skin: an internal layer in glazed cells that provide waterproofing and insulation and an external one consisting of earthenware shutters that serve as sunscreens, to shade and regulate the illumination in the working spaces inside. The HVAC system has been designed on the basis of a main system (CHPC/WHP) combined with other, dedicated ones of smaller dimensions that are interchangeable according to the tests and research work done in the different laboratories.

Indicate factors which led to project's success:

GEL obtained the Gold level LEED Green Building Certification and is regarded as one of the most advanced green building research platforms in the world.

Technology transferred

GEL integrates nearly 20 advanced technologies in terms of renewable energy, air conditioning, building automatic control and green buildings. Different types of solar collectors with corresponding solar air conditioning systems (solar adsorption chiller, solar absorption system, solar desiccant cooling system and solar ice-making system) operate inside GEL. The cooling and heating power is provided by different heat pump technologies. The building is also equipped with many other advanced facilities, including a highly efficient, independent temperature and humidity control system, a floor heating terminal, a cold radiant ceiling terminal, a fan coil terminal with minor temperature difference, a total heat exchanger, a combined cooling, heating and power system, a heat storage system (phase change material, thermo-chemical heat storage), biogas power, a hybrid PV/wind system, a smart grid, a building energy management system, a zero energy apartment and a smart apartment, etc.

Impact on greenhouse gas emission/sinks (optional):

The orientation of the building, its shape, along with the façade and the interior space have been designed to optimize energy consumption. The construction materials and the advanced technologies in terms of renewable energy, air conditioning, building automatic control contribute to GHG reduction, high energy efficiency and very low environmental impact.