Tropical Zero Energy Office Building: PTM in Malaysia

The new headquarter for Pusat Tenaga Malaysia is designed to be a Zero Emission Office Building (ZEO). A full range of passive and active energy efficiency measures are implemented such that the building will need no more electricity than what can be produced via its own Building Integrated PV system. The overall objective of the project is to achieve zero energy consumption at lowest possible initial investments. The ZEO Building shows implementation of integrated design concepts, where active and passive energy systems are interwoven into the building itself, and where several building elements also serve as energy systems. This helps in bringing the extra costs of the building down, and the economic feasibility of the ZEO building concept is improved. Advanced computer design tools have been used throughout the design process. The passive design features include orientation of the building, so that windows are only towards the north and south, in order to reduce the solar heat gains. In order to reduce the loss of cooling through the building envelope, the walls and the roofs are heavily insulated, and the windows have double low energy glazing. The building will be lit primarily by daylight, supplemented by electric lighting during very dark and overcast periods. Extensive active energy efficiency measures are implemented in the building in order to reduce the need for electricity to an absolute minimum, without compromising the request for comfortable temperatures and adequate lighting. These measures include the use of high efficient lighting controlled according to demand, high efficiency pumps and fans, a high efficiency chiller, and use of energy efficient office equipment. The buildings PV system is connected to the grid. Solar electricity is exported to the grid during daytime, when there is maximum draw of electricity from the grid. During nighttime at off peak hours, the electricity is bought back and used to run the chiller. Cooling will be stored in the concrete floor slabs and in a chilled water tank. During daytime, cooling will be provided to the building passively from the chilled floors and ceilings. A downsized ventilation system connected to the chilled water tank provides fresh and dehumidified air into the building. Finally, the active ventilation system will balance the passive cooling emission from the floor slabs, such that a comfort temperature of 24 – 26 oC can be maintained throughout the office hours. The PV roof of the building serves multiple purposes. During daytime, the roof becomes the powerplant of the building, and during nighttime, the PV roof becomes the “cooling tower” for the chiller. The roof will be covered by a thin water film, which will emit heat from the chiller to the sky and to the cool night air.

General information
Publication status: Published
Organisations: Department of Civil Engineering, IEN Consultants Sdn. Bhd.
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Publication date: 2006

Host publication information
Title of host publication: ACEEE : Summer Study on Energy Efficiency in Buildings
Publisher: ACEEE (American Council for an Energy Efficient Economy
URLs:
http://aceee.org
Source: orbit
Source-ID: 185297
Research output: Chapter in Book/Report/Conference proceeding › Article in proceedings – Annual report year: 2006 › Research › peer-review