Brazilian electricity, and the increment of population purchasing power leads to an increase in energy consumption by this sector. This highlights the need to adopt energy efficiency measures and alternative and renewable energy sources, so that people can have access to consumer goods and improve their quality of life in an efficient way.

The Brazilian energy matrix is considered clean. In the National Interconnected System (SIN), 67% of energy comes from hydropower. Nevertheless, increasing concern with environmental and social impacts of the construction of new plants has been noticed. On the other hand, studies show the enormous potential for the exploitation of solar energy in the country, due to favorable levels of solar radiation throughout the year and photovoltaic systems for distributed generation are approaching an economic feasibility (EPE 2012). Therefore, it is argued that solar energy has demonstrated potential to contribute to supply this growing demand.

Given this scenario, this study aims to determine the contribution of a Zero Energy Solar-House (ZESH) to the sustainable development through energy efficiency and the use of solar energy, allowing the reduction of GHG emissions associated to energy consumption by residential sector in Brazil. To verify the potential of these actions on a larger scale, is taken as geographical boundaries the Southeastern Brazil, considering the replacement of a percentage of single-family houses by units (or systems) in the lines of the CSZE. Methodologically this study adopts a solar-house prototype, the "Ekó House", that verifies the ZESH. Thus, it is possible to predict the effective reduction of GHG emissions associated with energy use by Brazilian residential sector.

The Ekó House prototype was developed by Team Brazil, a partnership between São Paulo University and Federal University of Santa Catarina to participate on Solar Decathlon Europe in 2012. This prototype is adopted because it meets the requirements of a ZESH and simulation data regarding its energy and environmental performance are available.

GUIDELINES FOR A ZERO ENERGY SOLAR HOUSE

This study takes as dwelling unit reference a house that generates locally its own energy from PV modules. The ZESH also uses sun energy in architectural design for passive conditioning of indoor environment, reducing energy consumption. In this sense, geometries that result in elongated facades facing north and south orientation obtain a better use of the sun throughout the year. In summer, when the sun is more directly overhead, radiation is less intense on north oriented facades than is east and west oriented facades (Southern Hemisphere). In winter the sun is lower, and radiation is more intense in north oriented facades than in east and west oriented facades, as shown in **Figure 1**.

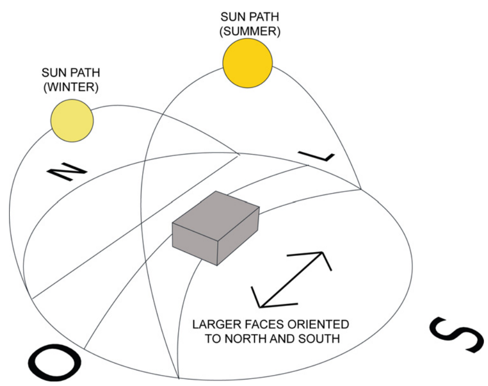

Figure 1 Solar trajectory and geometry.

The envelope elements of a CSZE have appropriate thermal performance, based on climate conditions of the implantation site, through strategies such as insulation, the use of thermal mass and/or natural ventilation. The reference prototype has high thermal insulation levels and windows properly dimensioned and positioned, ensuring natural lighting and ventilation. This results in good comfort conditions with low energy consumption by integrating passive and active strategies. Simulation models

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