

Zero Energy House

(Construction Experience of Nepal)

Sukunt Lal Hirachan
President,
Federation of Contractors Association of Nepal

Background

The sun is the ultimate and continuous source of Energy, which provides 16000 times more energy than they are currently consumed. It is an important source of energy and is cheap, clean and abundantly available. Solar energy is the right supplement for other energy sources that are exhaustible. This shows that maximum use of solar energy has not only become a challenge for the country like ours but also a need of the time.

Nepal is a small landlocked country situated between India and China. The geographical setting of the country is highly favorable for the utilization of solar energy. Out of 365 days in a year, it is estimated that about 300 days, Nepal gets sunny days and most of the parts of the country can exploit the solar energy. Pulimarang Solar Project managed by Centre for Renewable Energy (CRE) can be taken as an example.

In order to develop human resources and to work for the utilization of solar energy, the oldest engineering institute of the country, Institute of Engineering (IOE) has established Centre for Energy Studies (CES). The CES has constructed Zero Energy House (ZEH) in the premises of IOE, which is the first project of its kind in Nepal. This paper briefly discusses the construction experiences of ZEH.

Zero Energy House

The building, ZEH a three storied building having total area of 2000 sq.m. The major stakeholders of the project are as follows.

Client: Institute of Engineering.

Consultant: Institute of Engineering

Research Training and Consultancy Services Unit (RTCSU)

Chief Architect: Mr. Suman Vaidya

Contractor: United Builders & engineers Pvt. Ltd.

The ZEH will utilize both energy production and saving approaches and will efficiently use active and passive solar energy for heating and cooking purposes also.

The ZEH has been designed to meet the following requirements:

- i. Average energy production equals the total energy consumption.
- ii. Optimum use of environmental friendly materials, and
- iii. Aesthetically acceptable design.

The ZEH is raised in RCC frame structure with all the filler walls with double leaves. Open gaps between the ceilings and walls can be used in creating air space to maintain comfortable indoor temperature by heating or cooling. To maintain this, the floor isolation will also be provided.

Electricity required for the building will be generated through photovoltaic cells (solar panels) kept on the roof of the porch and faced southward with 30° inclinations. The porch for solar panels has been designed in such a way that optimum utilization of the solar energy would become possible. The vertical south façade is optimum for collection of sparse winter sun and therefore the entire south façade including porch can be utilized as active solar energy collectors, passive air collectors and windows for day light. The solar panel attached on the porch whose area is 56 sq. m is expected to generate around 6 KWH energy and this amount of energy is considered as sufficient to use low energy appliances for household uses.

It is assumed that below 5.75 m Ground Level in Kathmandu, Nepal has Constant temperature throughout the year, which is proved by the experiment. An underground tunneling of 20m lengths is provided which is 5.75 m below the existing ground level. The surrounding air enters the tunnel and passes upto 20m distance to enter the ZEH. During the period of traveling a 20 m distance, the surrounding air temperature becomes equal with the underground temperature and is circulated in the rooms in the ZEH. It will operate as natural air conditioning system in the house throughout the year and help maintaining comfortable room temperature.

As an alternative source of energy, windmill facility will also be incorporated in the ZEH. A big concave reflector has been fixed in north-south direction to concentrate the reflected rays on the solar stove. A solar kitchen will be built in the students' mess to utilize solar energy for cooking purpose. Similarly, to demonstrate that by using solar energy, boats can be operated, a boating pond having approximate area of 256 sq. m has been already constructed in the ZEH premises. If this becomes successful, such scheme can be used commercially for marine transportation purposes also.

Conclusion

Every aspect of human activities requires energy and use of cheap, renewable and environment friendly energy has become a challenge. In this regard, successful construction and use of ZEH in Nepal will demonstrate advance energy production, conservation and control and also expected that this will encourage for development, construction and use of energy saving affordable and environment friendly residential houses in future.