

## Alternative building design and significant electricity savings on Lotan Eco-Campus

Electricity consumption and climatic behavior of ten housing units with extra thick insulation in Kibbutz Lotan's eco-campus were monitored for a year. The housing units were specifically designed to be energy efficient. In controlled, unoccupied conditions they used 50% less energy for cooling than conventional buildings in the Southern Arava (Golding, J., 2010). The purpose of the monitoring program was to evaluate their energy consumption while occupied for an entire year.

The insulation material of the units was 50 centimeters of straw, a renewable, natural resource. The units were dome shaped, formed on a geodesic structural framework. The floor area of each dome was 20m<sup>2</sup>. The domes were occupied by one to three ecological volunteers. Electricity consumption of the auxiliary buildings and services in the eco-campus was also monitored.

Electricity production of nearby 0.68 kWp photovoltaic solar panel array was monitored concurrently in order to determine the size of photovoltaic system required to make the eco-campus energy neutral and/or energy independent.

Electricity consumption of the entire eco-campus, domes and auxiliary buildings, was compared to that of six conventionally built concrete housing units (Ravakiot, see graph below). Each concrete unit had a similar floor area and was occupied by two kibbutz volunteers. The occupants used air conditioners for heating and cooling throughout the year as needed. The eco-volunteers utilized air conditioners only for cooling in the summer. The insulated units were heated by direct solar gain in the winter. Electric water heaters supplied hot water for the standard units all year. Eco-campus hot water was supplied by solar absorbers and supplemented by an auxiliary electric boiler for two months in the winter.

The main findings were:

- The average electricity consumption per inhabitant in the eco-campus was 1.02 kWh/day versus 5.2 kWh/day in the concrete units.
- The yearly electricity consumption in the insulated eco-campus housing units was 29 kWh/m<sup>2</sup> compared to 167 kWh/m<sup>2</sup> in the concrete units.

- In summer months the average consumption of electricity in the insulated eco-campus housing units was 2.8 kWh/day compared to 5.2 kWh/day in the concrete units.
- In January, when external temperatures were as low as 8°C, temperatures in the passive solar heated insulated eco-campus units stayed above 18°C. The temperature range within the dome was only 3°C.
- Correlation between eco-campus' electricity consumption and production of the nearby PV system showed that a solar panel array of 3.5 kWp would suffice to make the eco-campus net energy neutral. A solar array of 6.8 kWp would be necessary to meet the peak demand of all ten insulated, air conditioned housing units and would ostensibly allow the entire eco-campus to be energy independent.

The significantly low electricity consumption of the eco-campus was the result of two factors. Firstly, the eco-campus dome housing units had energy efficient, climate specific designs. Secondly, the motivation of the eco-volunteers to properly operate their housing units in order to reduce electricity consumption was influential.

## צריכת חשמל לקירור וחימום - יחידות דיור באקו-קמפוס ודירות סטנדרטיים

### Electricity Consumption for Heating and Cooling per EcoCampus Unit and Standard Unit (kWh/day)

