II. ULUSLARARASI BOZOK SEMPOZYUMU

Yozgat'ın Turizm Potansiyelleri ve Sorunları

04 - 06 MAYIS 2017

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THE KERKENES ECO-CENTER AND ITS ECO-TOURISM POTENTIAL

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The Kerkenes Eco-Center Project, initiated in 2002, was devoted to research into and promotion of renewable energy and sustainable village life. Activities included schemes to promote the use of renewable energy and appropriate technologies against a background of climate change, socio-economic inequality and a migration of the rural population towards the urban centers. Experimenting with appropriate building materials and energy efficient designs, drip irrigation for organic gardens, solar energy, solar drying and cooking, recycling, stimulating and creating income generating activities for both men and women, the Kerkenes Eco-Center promotes environmental design for a sutainable future. One of its objectives is to encourage village development and income generating activities that might halt and even reverse migration from the village to the city. Bringing the city to the village rather than the villagers to the city could play a significant role in reducing the negative impact that the human race has on our planet. Amongst income generating activities is the potential to attract visitors, local, national and international. The village of Sahmuratlı which hosts the Eco-Center is overlooked by an Iron Age mountain-top city built on the Kerkenes Dağ. Research, educational activities and arousing public awareness has been central to the annual program of activities but the challenge remains to make those economically viable. Ongoing programs of Hands-on Courses as well as the annual campaign of archaeological reasearch contribute to the publicity needed within the borders of Turkey and abroad to keep the place on some tourist maps but fails to attract sufficient attention to become self sufficient. The project would not have been initiated without generous support from sponsors and local authorities and so far continues to depend on grants to continue to exist. Although acclaimed for its pioneering role in both the archeological research and environmentally friendly approach to ways of living, it has not yet secured a sustainable existence. How then can this situation be overturned and the Kerkenes Eco-Center be given a long lease of life?

Keywords: Kerkenes Eco-Center, Eco-tourism, Sustainable Rural Development, Appropriate Technology, Renewable Energy.

1. Introduction

The Kerkenes Eco-Center is located in the village of Şahmuratlı, a typical Turkish village on the Anatolian Plateau. Its situation within the Sorgun District of Yozgat Province makes it an ideal platform from which to promote renewable energy and sustainable rural development at both local and national scale. Şahmuratlı Village also possesses a world class cultural heritage site, an Iron Age mountain-top city, probably ancient Pteria, founded on the Kerkenes Dağ towards the end of the

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seventh century BCE. This combination of cultural heritage and a beautiful natural setting in a rural environment makes the place an attractive destination for casual visitors as well as for groups of tourists, whether they come from Turkey or beyond. The Kerkenes Eco-Center was initiated in 2002 to encourage village and local development alongside the research that started in 1993 at the nearby ancient city.

Figure 1. The Kerkenes Eco-Center provides facilities for students and visitors. The Iron Age capital on the Kerkenes Dağ forms a backdrop while at the Erdoğan Akdağ Center for Research and Education solar cookers and a bioclimatic straw bale greenhouse demonstrate how renewable energy can be used for sustainable rural development.

The Kerkenes Eco-Centre Project has piloted schemes for the promotion of renewable energy and appropriate technologies against a background of climate change, socio-economic inequality and rapid depopulation of rural areas in favor of urban growth. Development of sustainable local economies supported by renewable energy could provide a reduced rural population with acceptable levels of comfort, appropriate dwellings and economic security. Since 2002, the many-faceted Kerkenes Eco-Center Project has covered extensive grounds. Advocating an environmentally friendly approach to the development and improvement of rural settlements, the project worked with ŞAHDER (The Kerkenes and Şahmuratlı Village Association for Public Relations, Prosperity, Help and Support) and teams of researchers from METU (Middle East Technical University) in Ankara.

2. Mission

The purpose of the Kerkenes Eco-Center is to promote sustainability through environmental studies and experimental researches. It was established as a demonstration center with emphasis on education and public awareness through the following objectives:

- To advocate the use of renewable sources of energy;
- To act as a stimulus and a catalyst for environment-friendly building with appropriate materials and energy efficient designs;
- To act as a dynamic experimental base for testing designs, materials and activities suitable for viable and sustainable village life.
- To encourage village development and income generating activities that might halt and even reverse migration from rural areas to the cities.

Focusing on the promotion of renewable energy and low carbon footprint, the Eco-Center has implemented a variety of programs offering models for sustainable rural development initiatives thus providing a showcase for environmentally friendly and energy sensitive approaches for a sustainable future. Various annual programs have included experiments with appropriate building materials and energy efficient designs, drip irrigation for organic gardens, solar energy, solar drying and cooking, recycling, stimulating and creating income generating activities for both men and women. The Kerkenes Eco-Center team at METU, Ankara, has monitored the performance of the buildings with data loggers, using available climate data with modelling and simulation software to suggest modifications that will improve the energy efficiency of buildings or suggestions for future designs of buildings with better environmental performance. Several conference papers have been published on the results of this research.

3. Building Activities

Several buildings have been erected or renovated at the Kerkenes Eco-Center which became an experimental base for research into building materials and energy efficient design. Groups of students and researchers from the Middle East Technical University (METU), villagers, masters and workers, volunteers from ecological organizations have all been involved and wish to share and spread the knowledge and experience gained.

3.1. Environmental Performance of Building Study

A first study on the environmental performance of buildings was carried out by METU researchers and students in collaboration with a team from the Architectural Association in London and under a British Council Partnership scheme. A survey and analysis of the comfort of traditional

and modern houses in the village was presented at the 2003 PLEA conference, an international conference on Passive and Low Energy Architecture (Fig. 2). Results indicated that modern and expensive materials are not adapted to all climatic conditions. Nevertheless traditional indigenous building materials are being rapidly replaced by industrially produced bricks because they require far less maintenance than a mudbrick house with mud plastered walls.

3.2. Traditional Mudbrick Construction

In the light of the results of this study, the construction of a mudbrick building (Fig. 3a) was undertaken so as to provide an experimental building that could be monitored to further ongoing research. Collected temperature and humidity data showed how a material such as mud has thermal mass that regulates thermal comfort inside the building when extreme temperatures are reached outside.

In 2015, this same building had its mud roof replaced by Autoclaved Aerated Concrete (AAC) blocks, an innovative use of this industrially produced material (Fig. 3b). AAC has a good insulation value and is weather resistant but the roof construction does need suitable waterproofing.

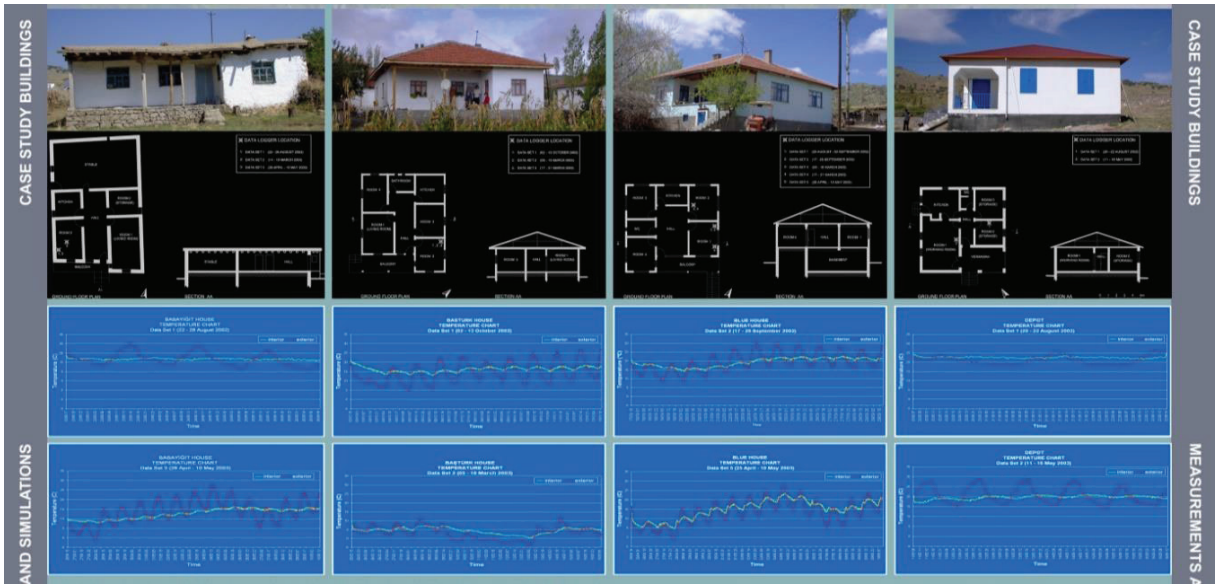

Figure 2. Design for energy efficient buildings (extract of a poster presented in 2003 for the PLEA conference)

(a) **(b)**

Figure 3. (a) The mudbrick building built in 2002; (b) the mud roof was replaced by AAC blocks during a Hands-on session with METU students in 2012.

3.3. Straw Bale as a Building Material

In 2004 and 2005, with generous funding from sponsors, [5] the Kerkenes Eco-Center completed its first straw bale building, the Kerkenes Strawbale House and the Pilot Greenhouse (Figs 4 and 5). Temperature and humidity readings taken from both buildings throughout the different seasons confirmed that they are very energy efficient in winter and minimize the amount of heating necessary to keep a comfortable temperature inside. It was demonstrated that temperature inside a straw bale greenhouse would remain several degrees above freezing outside temperatures when the nights become very cold, thus extending the growing period of seasonal vegetables.

Figure 4. Construction of the Kerkenes Pilot Greenhouse in 2004.

Figure 5. The construction of the Kerkenes Strawbale House was started in 2004 and completed in 2005.

[5] Sponsors were the Canada Fund and additional funds from the Tyche/ArcheoCommunity Foundation (USA), Burdens Charitable Foundation (UK), New Holland Trakmak (Turkey), MESA, AKG and Mr Erdogan Akdağ as well as help in kind from the Yozgat Governorate, The Directorate of Rural Services and the Municipality of Sorgun.

3.4. The Erdogan Akdağ Center

In 2005, to host a growing number of visitors, village activities, regional events and dynamic displays on the archaeological and ecological activities of the Kerkenes Project, the Erdogan Mustafa Akdağ Foundation sponsored a center for Research and Education (Fig. 6). The building comprised a concrete frame infilled with aerated concrete blocks provided by AKG and roofing material by Onduline. It was monitored and the data collected was analyzed. It was found to be energy efficient and to provide thermal comfort in winter with relatively less heating than would a building with standard extruded bricks.

3.5. The Kerkenes Stone Conservation Building

The hybrid construction technique combining AAC blocks and straw bales was used for the Kerkenes Stone Conservation Building needed by the archeologists (Fig. 7). The structure consisted of load-bearing piers made from AAC blocks and tied together by concrete beams. Straw bales were used as infill with 5cm thick AAC blocks externally so as to provide a better weather proofing and thus less maintenance. Gravels were used under the straw bales to prevent rising damp. The roof structure was made of reused timbers and covered with corrugated bitumen roofing sheets. A large covered balcony provides a well ventilated and shaded area for hot summer days. As the land slopes, the front of the building has additional basement space for storage. Occupants have confirmed that the building provides pleasant working space in the summer.

3.6. The Kerkenes Solar House

A landmark at the Kerkenes Eco-Center is the Kerkenes Solar House built in 2006 (Fig. 8). Walls were of mudbrick partly stabilized by timber posts and beams. A south facing solar space provide a heat trap when the sun was shining thus raising temperatures inside the building. This building played a significant role in establishing an economically viable production of ecologically processed food products using solar energy. Drying racks were built inside the solar space to dry tomatoes, onions, mushrooms and other seasonal vegetables. The main room has a traditional oven or *tandır* where village ladies can prepare village bread for groups of visitors.

The mud roof of the solar house was replaced in 2011 by AAC blocks. Unfortunately, however, due to poor workmanship and harsh winter the roof had to be repaired again in 2015. Major repairs included a new rubber sheet and the replacement of interior beams and rafters damaged by water infiltration. This innovative use of AAC blocks improves the energy efficiency of the building.

Figure 6. The Erdoğan Akdağ Center was built with a concrete frame and AAC blocks infill.

Figure 7. A hybrid construction technique of AAC blocks and straw bales was used for the Kerkenes Stone Conservation Building.

Figure 8. In 2006 the Kerkenes Solar House was built with a south facing solar space.

3.7. Experiments and Research on Building Materials and Techniques

Experimental activities have been made with different materials including reused aluminum cans and glass bottles, mud, straw, pine-needle, lime, paper, AAC, car tires, etc. Research projects include academic research on building materials and their properties. Among research topics are the study of mud bricks, pressed mud bricks and their additives (Fig. 9), lightweight loam and pine-needles as a building material and different mud plasters on straw bale walls (Fig. 10).

Figure 9. Traditional sun dried mudbricks (left) and pressed bricks (right) were produced at Kerkenes and used for small projects designed by students.

Figure 10. Academic research and experiments on building materials and their properties include the study of lightweight loam and pine-needles (left) and applying different types of mud plaster on straw bale walls to assess their durability (right).

3.8. Hands-on Building Courses at the Kerkenes Eco-Center

METU hands-on building course, held regularly each year, have provided students with valuable experience and the opportunity to explore freely ideas and designs (Fig. 11). Students together with villagers, masons and workers, have taken part in building activities to improve facilities at the Kerkenes Eco-Center (Fig. 12). Students design and build their projects in small groups.

(a) **(b)**

Figure 11. (a) A small Nubian vault built with AAC blocks and (b) construction of a geodesic dome during Hands-on course at Kerkenes.

(b) **(b)**

Figure 12. (a) Students taking part in the construction of the solar space of the refurbished Şamuratlı, School; (b) the completed solar space adds to the facilities available to host groups of students for Hands-on courses.

4. Water Management Programs

Water management is crucial in dry summer season. Insufficient water is pumped from wells to satisfy the needs of the villagers, including irrigation of vegetable gardens. Drip irrigation was introduced in 2006 with financial assistance for a few families willing to invest in a drip irrigation scheme (Fig. 12). Today many families have large gardens employing drip irrigation.

Figure 12. In 2006 villagers were encouraged to take part in the drip irrigation project.

5. The Promotion of Solar Energy

The Kerkenes Eco-Center Team in collaboration with ŞAHDER, supported by the UNDP Small Grant Program, conducted a project for the promotion of solar energy between 2006 and 2008. Gűner Mutaf from METU Industrial Design Department was a key figure in the development of new designs for solar cookers (Fig. 13) and dryers. One objective was to encourage the production of solar processed food in the village so as to create income generating activities. Villagers were involved in those projects through ŞAHDER and some international grants. Solar cookers were distributed and free access to the facilities of the Eco-Center was granted to the villagers to produce solar processed products (Fig. 14).

The difficulty of marketing such products on a commercial basis has prevented the realization of these goals but the project remains nevertheless an instrument to increase consciousness of the importance of supporting a low carbon economy as a major component in sustainable rural development. Public outreach was extended through the distribution of posters, leaflets and reports together with the updating of the Kerkenes Eco-Centre web page.

Figure 13. Parabolic solar cookers used to make jam.

Figure 14. Drying racks in the solar space.

6. The Eco-Tourism Potential at the Kerkenes Eco-Center

The potential for Eco-Tourism at the Kerkenes Eco-Center exists, but the difficulty is to make it sustainable. Visitors, whether they are groups of international tourists or visitors from Turkey, have all praised the work achieved but few have offered a solution to its economic viability. A day program usually combines a visit to the archeological site with lunch and some activities at the Eco-Center in the village. Lunch when provided is cooked on the solar cookers with organic garden produce from the village. Bread is prepared in the traditional way and guests usually invited to join in if they wish to. Day trips have also been organized for groups of school children from the region (Fig.15).

Several Kerkenes Festivals have been organized and the first one was in 1999 on the occasion of the solar eclipse. In 2006 the total eclipse of the sun over Kerkenes was a memorable moment witnessed by a large crowd gathered on the top of the mountain. In 2008 another Kerkenes Festival was hugely successful with three ambassadors and several dignitaries attending.

Figure 15. Local school students visiting Kerkenes Eco-Center (left) and making pressed mudbricks (right).

Figure 16. In 2008 the Kerkenes Festival gathered a large crowd and among the visitors were several ambassadors and dignitaries.

Future Perspectives

Perhaps the most successful type of activities has been the regular sessions of Hands-on activities where students come to Kerkenes for a few days as part of a university course. Since it was initiated in 2002, the Kerkenes Eco-Center has played a major role in promoting rural development and arousing awareness on the importance of an environmental approach in everyday life for a sustainable future. The project could not have existed without friends, volunteers and sponsors and yet its role is of utmost importance in securing a sustainable future for our planet. It has been a model for others to initiate such ventures in the region, in Turkey and even beyond the borders of Turkey. The aim is to reach all sectors of our society and to make everyone conscious that as individuals we have a role to play and for the sake of our children and grandchildren we need to take things in hand. It remains here to ask those who have supported the Kerkenes Eco-Center Project and those who may consider to do so in the future, to help us develop further this ambitious project and support both research, educational and promotional activities.

7. Acknowledgments

Sustained private sector interest in Kerkenes and small-scale energy projects has been demonstrated by the willingness of several companies to sponsor the Kerkenes Eco-Center and related activities. Since 1999, the Kerkenes Project has received generous help in kind as well as grants channeled through the METU Development Foundation (ODTÜ Geliştirme Vakfı). Amongst these are AKG Gazbeton, Erdogan Akdag Foundation, MESA Housing, Votorantim Cimento (previously a Lafarge-Yibitaş joint venture and then Cimpor-Yibitaş), Torreador and Yenigün. The project was awarded grants from several international institutions, embassies and some foreign organizations as can be seen on the Kerkenes Eco-Center web page:

http://kerkenes.metu.edu.tr/keco/02spons/index.html

Since 2012, several METU students enrolled in the Master or PhD program have received a monthly allowance that provided essential financial assistance during their studies. Students receiving this scholarship help with both the educational and research activities at the Kerkenes Eco-Center and METU. Local authorities have also been most supportive to both the archeological research and the Eco-Center and provided help in kind as well as funding for building repair and maintenance.

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