Non-Refereed Papres, Symposium on Mosque Architecture, Vol. 10B, pp15-22, College of Architecture & Planning, King Saud University (1419H-1999)

The Solar Mosques Concept

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Abstract: Mosques historically hold a special position in the socio-cultural structure of islamic, communities. However, in rural areas, the lack of facilities reduces the services mosques can provide its attendance with, and lightens their function within rural populations.

Besides, photovoltaic electricity can contribute to the consolidation of the activities within and around mosques by defining a context in which it integrates. "The solar Mosques Concept" constitutes an auspicious framework for social and economic development at a local level. This will provide rural communities, on one hand with access to electricity, and on the other hand with the means to improve the quality of life of their populations and to develop.

The Comoros Islands Mosques Solar Electrification Project is a relevant example, which illustrates the viability of such kind of, projects, on condition that it is correctly planned and studied.

Introduction

A mosque is originally a place only reserved for public worship. Unlike big cities – where infrastructures for telecommunications, communication, education and social development are largely available – rural areas need socio-cultural centres. The mosque where people meet 5 times a day may be the ideal location to shelter these socio-cultural centres.

Electricity is the factor that will contribute to give to the mosques that supplementary dynamism.

Considering the transport costs and the distribution facilities, the photovoltaic solution seems to be the most suitable means of producing that electricity.

Photovoltaic Solar Energy

Characteristics

Photovoltaic solar energy uses the world's best distributed source of energy : sunlight. It is obtained by direct transformation of sunlight into electricity by means of solar cells. It draws upon a universally available source of energy to supply basic needs (such as lighting, pumping, cold chain for vaccine storage), and conveniences that only electricity can provide (such as communication and telecommunications).

Since it is extremely flexible, easy to install and requires minimal maintenance, photovoltaic electricity is a practical and cost-effective means of providing electricity in rural areas to where the national electricity grid is not extended.

The photovoltaic solution also contributes to social balance. By bringing progress and dynamism to remote areas, electric power can retain populations that would otherwise migrate to already overcrowded cities.

Direct transformation of light into electricity

The photovoltaic solution is not only suitable for locations that enjoy strong sunlight. Plants convert solar energy by the process of photosynthesis, and anywhere plants grow, photovoltaic systems can provide electricity.

The photovoltaic cell

The photovoltaic cell is an electronic component, a semiconductor, in which the absorption of photons, elemental light particles, releases electrons and "holes". These electric charges are separated by an internal electric field and collected by a grille in front and a contact behind. In this manner, the photovoltaic cell acts as an elementary electricity generator. This direct transformation of light into electricity is achieved without moving parts, without pressurised fluids circulating at high temperatures, without a rise in temperature, and without either pollution or waste.

The module

Several photovoltaic cells must be interconnected so as to supply sufficient tension and power to the outside load. These sets of cells are then encapsulated in modules, to project them from shock and damage.

The modules can be assembled in panels that are interconnected to form a photovoltaic array. A generating station consists of a number of photovoltaic arrays, together comprising a photovoltaic system.

Electricity storage

Very often, periods of sunshine and consumption do not coincide (for example, when supplying power for lighting). It is essential, therefore, to store the energy that is produced. Moreover, storage can deal with unexpected power demands, which go beyond that which the photovoltaic array can supply instantaneously.

The storage devices are usually batteries lead or, more rarely, of nickel-cadmium.

This storage capacity is 3 to 7 days without recharging, or as much as 10 days for systems where a safety margin is advisable.

Regulation of charge and discharge protects the batteries against overcharging and excessive discharging and lengthens their life, which can then exceed 5 to 7 years.

In addition, operating systems without storage can be designed. In this kind of system, the electricity produced is used immediately. This is the case for most photovoltaic pumps supplying water to villages; it is more economical to pump water when sunlight is available and store it in tanks, than to store electricity in batteries in order to maintain the pump in continuous operation.

Conditioning of electricity

If necessary, the direct current produced by the photovoltaic system is converted by an inverter into an alternating current adapted to manufacturing standards (single-phase or three-phase, 50 or 60 Hertz).

Photovoltaic systems and applications

A photovoltaic system consists of a photovoltaic electricity source and its accompanying loads. These systems can be of the stand-alone type, or combined with an auxiliary generator, or else connected to the grid (photovoltaic plants and roofs).

The philosophy when designing a photovoltaic system is to conceive a consistent system dedicated to its specific application. Systems design is all but the assembling of the best performing standard components.

An autonomous, reliable and modular solution

With a storage device, a photovoltaic system can provide an uninterrupted supply of electricity. Thanks to its simple design, upkeep and servicing require little attention.

Among every producing systems, only the photovoltaic solution hardly ever requires a break in the production of power, for maintenance. This unique feature has proved particularly attractive for applications such as telecommunications, security installations, water supply and refrigeration.

Whatever its power capacity, the design of a photovoltaic system always follows the same principles. Design studies, installation, training and maintenance are the same for any size of system, thus facilitating technology transfer. Moreover, a photovoltaic system can always grow by adding modules and batteries to keep pace with developing needs.

Photovoltaic systems are supplied ready to operate with all their auxiliary equipment. Assembly is quick and easy. Thy are light and convenient and they can be easily integrated into most sites and type of architecture. They never need substantial civil engineering installations.

Unlike every other system of electricity generation, a non-specialist can undertake basic on-site maintenance of a photovoltaic system after only a few hours of training.

This maintenance consists of simple but necessary operations such as cleaning of the units and checking the electrical connections and battery electrolyte levels. Apart from this, one or two checks a year from a maintenance officer, who can be trained in a matter of days, should be enough to ensure that the system runs correctly and durably.

Photovoltaic Electricity and remote sites

Solar solutions are already viable as a rational alternative energy solution for providing electricity to remote areas: for domestic use (basic kits, home generators, etc.); for collective use (clinics, schools, village centres, hydraulic pumps, etc.); or communal services (telecom, measuring systems, alarms, etc.)

More closely related to the subject of this paper, an electrification programme for mosques was initiated in Comoros Islands. The programme embraced two major services for mosques: sound amplification and lighting. It involved about 30 mosques out of 200 initially identified.

The Solar Mosques Concept

Conceptual basis

The research that has been conducted for several years by international organisations such as UNESCO shows from demographic data and development needs in terms of health and education, that the energy demand issue in those regions needs to be addressed differently, with a more realistic approach, adapted to the economical and financial situation of the populations concerned.

Considering the huge capitalisation required by conventional electricity production and distribution systems in areas which are isolated or thinly populated, alternative energy sources constitute answer which can prevent from precariousness and exclusion.

The extension of the conventional electricity grid to the rural areas is complex. That's the reason why other models of electrification – such as solar energy – should replace conventional electrification.

The technology of photovoltaic systems is well known and mature with a continuously decreasing cost. Moreover, it assures the protection of the environment and the preservation of natural resources.

The idea of using the mosque as a socio-cultural zone corresponds to the original role of mosques in the Islamic Civilisation. That will help the elementary development in traditional and isolated social structures through education, improvement in services and sanitary conditions for rural clinics, telecommunications. This will, as well, characterise the will of a Nation to restructure its rural and traditional society harmlessly by giving it an answer to fatalism. It thereby brings hope for the formulation of a new type of relationships between individuals within the same community and between that community and the whole Nation.

Description of the solar mosque

The analysis of the role of mosques in Rural Islamic Areas led to the idea of widening the range of activities and services people may enjoy beyond prayers. This includes 5 buildings broke up as follow, with the description of their usage and functions, and the equipment installed:

1. The central building which constitutes the mosque
   - Function/Activity
     - building used for public worship
   - Equipment

- lighting for the building
- sound amplification system
- electric vacuum cleaner
- fans

2. School/Library/Computer Lab

- Function/Activity
  - Education of children, teenagers and adults
  - Location for teleconference, debates, regional discussions or other cultural ceremonies
  - Initiation to information science
- Equipment
  - School material (books, maps, etc.)
  - Tele audio video system
  - Television, VCR
  - Computers

3. Medical centre

- Function/Activity
  - To provide the inhabitants with health services
  - To manage the inhabitants' medical files
  - To conserve the medicines and vaccines
  - To set better conditions up for pregnant women
- Equipment
  - lighting for the building
  - shelves
  - refrigerators
  - medical equipment
  - fans

4. Bathroom

- Function/Activity
  - Preparation for prayers
  - Lavatory
- Equipment
  - lighting for the building
  - Water pumping device
  - Storage tanks

- Water treatment and recycling

5. Telecommunication centre

- Function/Activity
  - To permit communication with the rest of the world (telephone, internet, fax, etc.)
- Equipment
  - lighting for the building
  - telephones
  - other communication machines

In addition to all this, the irrigation of a small field can be considered, with the water used in the bathroom in prayers preparation.

Potential benefits

Photovoltaic electricity can be a strong encouragement to economic and social development at a local level, on condition that it is correctly integrated just like with this "Solar Mosques Concept."

By facilitating the creation or protection of activities in areas remote from the main electricity grids, solar power brings economic and social benefits on a local level, both directly and indirectly.

The mosques, which, by definition, are socio-cultural locations, will at a greater level contribute to the development of the local community by providing it with the basic levels of comfort and of collective services (lighting, radio, television, schools, libraries, public halls, and buildings, telephones, pumping centres, etc.). That will definitely contribute greatly to maintaining rural communities.

In addition, that will create jobs related to the presence of a school, a library, a pumping centre (management of resources) and the photovoltaic system itself. This will be increasingly so, with the progressive transfer of technology and know-how.

The Comoros Islands Mosques

The Comoros Islands is an Islamic Federal Republic, which joined the Arab League in 1995. It is located at the front of the Mozambique Canal. It is composed by 3 overpopulated islands which are Anjouan, Main Comoros (or Ngazidjia) and Moheli. Mayotte, which is the fourth island of the archipel decided to remain, french after the independence of the country. Comoros is one of the less advanced countries in the world with a GNP of 470 US $/capita, a growth rate fluctuating around 2%, and an inflation rate of 5%. Agriculture is the unique resource if the country.

In this islamic country, mosques should play an important role in society. Pointing out the poor contribution of mosques in the social life of rural communities, due to lack of facilities; the electrification issue was a raise for the mosques located in rural areas. In fact, a modest effort was made to install lighting, sound amplification systems and vacuum cleaners inside mosques.

200 mosques were identified in rural areas, mainly in the Main Comoros and Anjouan islands.

The project

For this project, about 30 mosques were electrified with photovoltaic systems in the rural areas of the Main Comoros Island, remote from the main electricity grid. In some locations, these systems appeared in replacement of Diesel generators, which, among other drawbacks, had high operating costs.

Benefits

- service improvement (systems with a higher reliability, no noise)
- lower operating costs (maintenance, transport and supply of fuel)
- initiation of the local populations to the use of solar energy
- consolidation of the social role held by mosques in islamic communities

Concluding Remarks

The project has integrally reached the objectives after 18 months of operation:

- no breakdown
- equipment in perfect operating conditions
- population very satisfied
- headmasters convinced

Now the project is a complete success, the population expresses many requests for extension to other services. The requested extension includes water pumping, water treatment, and domestic usage (lighting).

مفهوم المساجد التي تعمل بالطاقة الشمسية

بسام عويضة، شريف سي، فيليب فيان

ترانسانرجي

اكولي، فرنسا

الملخص: تحظى المساجد منذ القدم بوضع خاص في التركيبة الثقافية و الاجتماعية لجماعة المسلمين. ولكن المساجد تواجه، خصوصا في المناطق الريفية، نقصا في الطاقة يحول دون أدائها للدور الذي اسست من اجله. و لذلك يكون مفهوم المساجد التي تعمل بالطاقة الشمسية ضروريا حتى تضطلع هذه المساجد بدورها الذي من اجله صممت. و يساعد ذلك تلك المناطق الريفية في الحصول على الطاقة الكهربائية. ومن جهة اخرى فان وجود الطاقة يحسن من الوضع المعيشي للسكان و يساعد على تنمية تلك المناطق. و خير دليل على ذلك هو مساجد جزر القمر حيث هنالك مشاريع الكهرباء المولدة من الطاقة الشمسية و التي تبرهن عن امكانيات مثل هكذا مشاريع اذا توفرت الدراسة و التخطيط السليمين.