

INTRODUCTION

With the ever increasing need in Malaysia to use air conditioning to make homes more comfortable, the necessity to consider energy efficiency together with renewable sources for electricity generation must be paramount and somewhat overdue.

Building COOLTEK has shown that well designed energy efficient buildings in the tropics can produce less pollution and consume far less energy, enhanced further when obtaining much energy from the sun.

1. ENERGY EFFICIENCY

The Energy Efficiency aspects are more easily achievable and at a lower cost, than the introduction of expensive renewable energy equipment. Therefore they should be the first priority.

- ✓ Reducing energy consumption by the use of low energy light bulbs and appliances is now available to all households.
- ✓ The latest energy efficient air conditioning equipment is widely available.
- ✓ Orientation of the structure to avoid direct sunlight passing through windows can be designed into most new buildings and new housing area roads.
- ✓ Using shading from trees or overhanging roofing can reduce the heat build-up in buildings.
- ✓ Introduction of insulation for walls, ceiling and especially floors will reduce cooling energy consumption.
- ✓ Energy efficient building materials and methods can easily replace present ones.
- ✓ New standards for sealed homes with simple underground 'earth-cooled' ventilation could be encouraged.
- ✓ Energy efficient fixed double glazed windows can be used for all air conditioned homes.

Some of the above methods may need government incentives or even legislation to promote their adoption up to a respectable level.

Cost effectiveness

As some of the energy efficient aspects of the building, such as orientation and shading from trees, may involve no additional cost, their application to new buildings is desirable. The replacement of old, worn-out or broken equipment with energy efficient appliances, lighting and air conditioning will require little extra cost but could bring immediate savings.

The substitution of energy efficient building materials may carry a small additional cost, but their payback is rapid as the cost of running air conditioning is high and increasing.

The use of insulation and double glazing in buildings gives maintenance free savings that will quickly pay back this small extra investment.

Altogether, the energy efficient house, COOLTEK, disregarding the electricity generated from the photovoltaic installation, uses around 19% of the electricity of a conventionally built Malaysian house (see Appendix I). Based on the year 2008 and with the electricity tariffs current at that time, this translates to a return of RM12,268 per annum from building energy efficiency alone.

2. SOLAR ELECTRICITY GENERATION

With the installation of photovoltaic panels on the roof of an already energy efficient designed and built house, COOLTEK has shown that the percentage saving is considerably higher than for a standard Malaysian house (see section Appendix I below).

Where a typical household using air conditioning is examined, it accounts for a large percentage of electricity consumed. Even in COOLTEK, it accounts for 56% of all electricity consumed. Fortunately, most solar electricity is generated during the hottest time of the day exactly when required for air conditioning thereby saving transmission losses at exactly the right moment.

The photovoltaic installation cannot be long term cost effective at this time of current non-premium tariff for renewable generated, and was undertaken by the owners as a pioneering project to help pave the way for the wider introduction and development of solar electricity generation in Malaysia. The owners also believed the present zero premium tariff was only temporary.

Emissions avoided and resource saving

For the year 2008, a total of **5,793 kWh** of renewable electricity was generated, with a direct saving of **3.5¹ metric tonnes** of carbon dioxide, which then increases to **3.73 metric tonnes** per year when the avoidance of distribution losses are included². The production of **5,793kWh** of green solar electricity in the year 2008, has saved the consumption of almost **20 million BTU's** of the limited national resource of natural gas.

Note 1: Most Malaysian electricity is generated using natural gas, so a conservative figure of 600grammes of CO₂ per kilowatt hour has been used.

Note 2: A figure of 7.3% for distribution losses has been used, which is given as the percentage distribution loss in the UK.

Current credit for green solar electricity generated as given by the Malaysian utility company, Tenaga Nasional Berhad are based on a **net kilowatt-hour** calculation, where each month the number of kilowatt-hours generated are subtracted from the total kilowatt-hours consumed during the month, before the applicable domestic tariff is applied. **No premium feed-in tariff is paid in Malaysia making it out of line with other countries and quite some distance from common sense.**

Cost effectiveness

On this basis, the average credit for the year 2008 was RM 0.312 per kWh or RM1,807 for the year. With this rate of return, the payback period on just the RM55,000 paid by the owners is almost thirty-one years and for the full cost of the installation of RM125,000, the payback period would be almost seventy years. If loss of interest on capital employed was included the payback period is infinite. These calculations allow nothing for breakdown and maintenance.

As can be seen from above, at the moment this project is financially sick and does little to encourage participation by the general population. Development of more efficient equipment at lower unit cost, better funding options and the realisation of its need, are the only hopes for the future widespread use of photovoltaic technology for generating electricity in exceptionally sunny Malaysia. With a **premium feed-in tariff, of say RM2 per kWh for solar electricity generated**, the payback periods could be reduced to a more acceptable five years for the RM55,000 paid by the owners and less than eleven years for the total true cost of the installation.

COOLTEK as an example of energy efficiency has been widely reported in the Malaysian press since its completion in October 2005. The addition of a renewable energy generating system has only added to its efficiency and profile.

Many hundreds of Malaysians and those from other nations have visited the building for many different reasons, be they government officers, architects, builders, teachers, students or homeowners. It has shown that homes in the tropics can be more comfortable without increasing the use of precious fossil fuels or increasing the pollution of the atmosphere.

As British individuals, we are also happy to support the work of the Ministry of Tourism in promoting the MALAYSIA MY SECOND HOME programme, and to successfully represent Malaysia in the 2009 ASEAN ENERGY AWARDS.

APPENDIX I COMPARITIVE ENERGY INDEX FOR THE YEAR 2008

For comparison purposes a standard built Malaysian house was used, which had no insulation or other energy efficiency features. It was occupied by a European family, who used the air conditioning for twenty-hours each day, as is the case in COOLTEK.

Based on the ground floor area of 232 sq m and a yearly occupation of 350 days with the air conditioning running continuously for twenty hours, the electricity consumed by Cooltek in 2008 was a total of 8,636 kWh, giving an energy index of just **37.2 kWh/m²/yr (due to energy efficiency)**, and **an amazing 12.3 kWh/m²/yr (with renewable energy included)** with a mere net consumption of 2,843kWh from fossil fuel generated electricity.

The first comparison below is with the total energy consumed by COOLTEK, which takes into account only its Energy Efficiency features. The Energy Index shows that it uses around **81%** less electricity than the comparison house.

In the second comparison, which includes the renewable solar electricity generated on site, the Energy Index shows that COOLTEK uses just over **6%** that of a standard house, a total saving of non-renewable energy of **94%**. Put another way; 16 homes for the energy cost of only one.

| | Comparative house | 1. COOLTEK (gross kWh) | 2. COOLTEK (net kWh) |
|---------------------------------------|-------------------|------------------------|----------------------|
| Daily consumption (kWh) | 280 | 25 | 8 |
| No of days | 350 | 350 | 350 |
| Annual consumption (kWh) | 97,920 | 8,636 | 2,843 |
| Ground Floor Area m ² | 500 | 232 | 232 |
| Energy index (kWh/m ² /yr) | 195.8 | 37.2 | 12.3 |
| Comparison result | | 19% | 6.3% |

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