

## Traditional architecture – a premise for intelligent energy use, Punakha Hospital

Bhutan (1993 – 1997, 1999 and 2002 – 2003)

### Technology:

Improved traditional building practices for natural ventilation and shading, low embodied energy, local materials, renewable energy (hydropower, wood stoves, a little solar water heating).

### Performance:

- About 40% energy saving compared to conventional building methods and material, 50% less wood used in modern roof construction compared to traditional methods, 250 000 Rupees saved by using locally produced roof tiles instead of imported galvanised iron sheets.

### Description:

This project highlights the issue of cultural sustainability. Sensitivity to local tradition is integrated in an efficient

and extremely economical project. It has become a model for subsequent hospitals in Bhutan – a sure mark of appropriate design. It was described by international health



experts as the most successful in the country, and received a commendation in the international Ralph Erskine awards in 2000. The traditional decoration was emphasised as it has both religious and cultural significance. The project aimed to sustain and strengthen indigenous architecture. Not by imitation or pastiche – but real understanding of and careful improvements to the traditional architecture. It was essential for the project that the architect worked with the craftsmen.

The aim was a low-cost hospital to meet the medical needs of village people. The hospital has an inpatient capacity of 25-30 beds, and a full range of outpatient services including laboratory, pharmacy, X-ray, clinic, and sections for indigenous medicines, hostel and administration, as well as staff housing. Total 4000 m<sup>2</sup>.

The project uses a maximum of local materials, reducing transport and embodied energy. Heating and power are electric since Bhutan produces hydropower. Some cooking is with wood, an abundant resource in Bhutan. There is an emergency diesel backup for the hospital since power supplies are not reliable. A small amount of solar water heating is used. However, the main energy strategy was to reduce the demand side, by careful planning, climatic adaptation and appropriate construction. The hospital thus needs no air conditioning, has good day lighting using natural light, simple ceiling fans, and probably uses about 60% of the energy in comparable buildings.

### Adaptation to local conditions:

Punakha has a hot climate but it was also important to protect against winter winds. The buildings are oriented east-west to minimise solar gain. Large roof overhangs, verandas and trees increase shade. A fountain in a flower garden provides coolness. The main building has a three-storey high stair-well for natural ventilation. All rooms and corridors have cross ventilation and heavy building materials to keep the building cool. The roof is an open ventilated space following traditional solutions.

Paints are traditional earth- and plant-based pigments. Synthetic materials were avoided, reducing climate emissions and increasing use of local, natural resources. Locally produced roof tiles and use of modern trusses reduced cost of roof construction.

### Lessons learned and recommendations:

This approach of bioclimatic or passive design, which reduces energy demand and all technology, is especially relevant in developing countries, where supply-side options and energy technologies may be inefficient and unreliable. Also, in developing countries there is often little money for maintenance so that energy technologies may quickly stop functioning. And good, energy-efficient design is free. It should always be the first priority.

Ecology, economy and community are the three pillars of sustainability. Whilst this project has many interesting ecological features, it is one of the few which puts great emphasis on the cultural and community part of sustainability – a reminder to energy and other specialists that all three aspects are equally important.

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Comment:

- I find it difficult to read this, quality of print is very low. But the topic is interesting so would be good to include sth. What I don't really like is that he talks about 'project' all the time. To me that sounds as if it is really driven by a donor, not locally (but maybe that's just me);
- And would be good to have update. Developments since 2003, a lot of replication?
- Style seems a bit dry;

14 June 09: Dear Chris,

Here is the feedback for Bhutan. Pls find in the document. I am very sorry but I cannot find the text we used for the booklet on energy efficiency as I have changed jobs a few times since ForUM. Do you have text available? And do you have a chance to update in accordance with the comments of my colleague in Paris? I will get back to you with comments on the other case study as soon as I can.

Kind regards,

Anne



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