Applied Research Partnerships with Developing and Transition Countries

Swiss Universities of Applied Sciences and Universities of Teacher Education

Photo: Daniel Pittet

Project title

Assessing the environmental impact of building technologies in Kutch District, Gujarat, India. A training-cum research project.

Thematic focus

Building technologies, environmental impact

Year

2010

Project location

Kutch District, Gujarat State, India

Swiss Institution

University of Applied Sciences of Southern Switzerland
World Habitat Research Centre, www.worldhabitat.supsi.ch
Eng. Daniel Pittet, daniel.pittet@supsi.ch

Partner Institution

Hunnarshala, www.hunnar.org, eng. Tejas Kotak.
CEPT University, Ahmadabad, www.cept.ac.in.
Prof. Neelkant Chhaya

Description

The housing sector is generating worldwide substantial environmental impacts. It contributes to about half of the total energy consumption of high income countries and is responsible of a major share of greenhouse gas emissions also in development and transition (D&T) nations. Scientific data on environmental impacts of building technologies in D&T countries are rather limited and it is difficult to make informed choices aiming at reducing such impacts. The study aims at filling a gap in the assessment and of such impacts in India and in D&T countries in general. It is based on a detailed analysis of various walling technologies (traditional, modern and alternative).

The impacts have been assessed including the production chain of materials, their transportation on site, all construction procedures as well as the maintenance activities over fifty years, whereas the impacts due to demolition of the structures at the end of their life cycle have been evaluated through qualitative analysis. Environmental impacts are represented through indicators such as the total energy consumption, the share of non renewable energies (NRE), the amount of CO_2 emissions and water consumption. Various phases of production processes are represented separately in order to inform on their respective quantitative relevance.

Development relevance

This project is particularly relevant in terms of environmental sustainability because the housing sector contributes highly to environemental damages and knowledge on alternative technologies is essential for reducing such impacts. The project has also a strong partnership component in research implementation as well as in educational activities. Besides, theoretical training is completed by the involvement of students in research activities and participate directly to improve the education level and research capacity in both countries. Indirectly, since the results demonstrate that traditional technologies present lower environemental impacts, a major use of those would increase local people's role in housing sector and participate to reduce poverty.

Local production of bricks

Construction of a house

KFH
Rektorenkonferenz der Fachhochschulen der Schweiz
Conférence des Recteurs des Hautes Ecoles Spécialisées Suisses
Conferenza dei Rettori delle Scuole Universitarie Professionali Svizzere
Rectors' Conference of the Swiss Universities of Applied Sciences

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

Main features of the project

This research has demonstrated that there are considerable variations of energy and water consumption as well as CO2 emissions between different walling technologies. In order to reduce substantially the energy consumption and related CO2 emissions, technologies such as adobe, cob walls, wattle and daub and stone walls making limited use of cement or lime mortar and plaster should be encouraged. Rammed earth, cement and fly ash blocks as well as stabilized earth technologies represent possible alternatives, in particular if they make limited use of cement/lime mortar and plaster. In this case, proper constructive and maintenance measures must be observed in order to preserve the durability of the structures. When such technologies are applied in combination with significant amounts of cement/lime mortar and plaster, their environmental impacts increase substantially. Burnt clay bricks, in particular those coming from industrial processes, as well as RCC walls present from far the biggest impacts in terms of energy consumption and CO2 emissions. Because of the characteristics of the cement production processes in India (energy mix and efficiency), the CO2 emissions of RCC are exacerbated compare to the energy consumption.
Water consumption is presenting totally different figures, in the sense that the technologies that are performing better in terms of energy consumption, CO2 emissions and demolition phase (adobe, cob walls, wattle and daub) are those consuming drastically higher amounts of water, especially during the maintenance phase. However, the relevance of this issue could be lowered when maintenance activities that need big amounts of water are planned according to seasonal variations taking advantage of the abundance of water during the rainy season. If the conditions and the maintenance requirements allow such strategy, then the issue of water consumption for maintenance might become less problematical and relevant.
The results of this study are valid only in the context of Kutch and, to a certain extent, in other Indian regions because they are directly influenced by various local factors such as the characteristics of energy sources and the specific uses made of such sources for the various production processes. In particular, the composition of the electricity mix (shares of thermal, nuclear, hydro or other renewable sources for producing electricity) have a drastic influence on CO2 emissions. Similarly, the fact that the production of a material can be done using different energy sources according to the region (i.e. using coal instead of wood for firing bricks) will influence seriously the impacts on the environment, like the energy efficiency of production processes. The impacts due to transportation of materials are also variables according to the distances and the means utilized. The contextualization of environmental impact assessment is consequently of primary importance in the search for representative results

House owner explaining how he built his house

Local partners and students that collaborated to the field survey