

Indoor Air Pollution and Appropriate Cooking and Light Solutions for the Poorest Mountain Communities in the Nepal Himalayas

Presented by:

Alex Zahnd
Kathmandu University, School of Mech. Engineering
P.O. Box 6250 Kathmandu
NEPAL

Email: azahnd@wlink.com.np

For a Workshop at the:

Indoor Air Pollution, Health and Household Energy

South Asia Regional Workshop

in Kathmandu, Nepal

27th – 28th February 2006



Abstract

100 years after Edison's life changing discovery, still 1.6 – 2 billion people on the globe live in dark and smoke filled homes. The families in the upper Humla district of Nepal belong also to the 2.4 billion people who still depend on the use of traditional biomass for their daily energy services such as cooking, heating and light. These activities on open fireplaces have a direct chronic impact on the health and extremely low life expectancy of the women and children along with devastating deforestation. Further, with no pit latrines and polluted drinking water, their hygienic conditions are very poor.

Some of the children are not given a name till they are five, because they have lost the battle for survival before that age. Four month per year the labor from their own fields just barely brings forth the crop to feed the own family's hungry mouths, if nature has been favorable that year. Life expectancy at birth is in the 40's, the average years of schooling 0.88 years, and women's literacy rate 4.8%¹. These are the living conditions in the remote and impoverished Himalayan villages of upper Humla, in the north western part of the Karnali zone, some 16 days walk away from the next road head in Surkhet.

Conditions in Nepal confirm IEA's (International Energy Agency) statement that lack of electricity and heavy reliance on traditional biomass are hallmarks of poverty in developing countries², as families in the remote Himalayan areas use precious trees for firewood on open fire places for cooking, room heating and light. The cooking with firewood on an open fire, takes place either on three stones, or a three-legged metal piece, called "odhan" (see pictures 1 & 2).

Traditionally in the high altitude homes in Humla, in order to provide light in the otherwise-dark homes (as most have only very small unglazed windows which are mostly closed due to the cold), people burn the traditional "jharro", a stick of resin soaked pine wood (see picture 1). Needless to say that the open fireplace and the "jharro" burned all evening long create very unhealthy living health conditions.

These activities consume daily 20 kg – 40 kg firewood a day³, with direct chronic impact on the health of women and children in particular, due to the enormous indoor smoke pollution⁴, suffering from respiratory diseases, asthma, blindness and heart disease⁵, resulting in the extremely low life expectancy for women and the high death rate of children under 5 years of age⁶.



¹ Karnali Rural Development & Research Center. Governance in the Karnali, an Exploratory Study. Jumla 2002, page 5

² IEA, *World Energy Outlook 2002*, chap. 13, page 365, 366, 371, 373, 387, 389

³ Alex Zahnd, "Firewood consumption survey on 16 villages in the Jumla district", unpublished report 1999;

⁴ Open fire use create the PM₁₀ levels $\geq 20,000\mu\text{g}/\text{m}^3$. US-EPA 24 hrs average not exceed $150\mu\text{g}/\text{m}^3$ more than 3 times a year. Annual average not exceeding $50\mu\text{g}/\text{m}^3$, *Smoke, Health and Household Energy*, ITDG, September 2002

⁵ IEA, *World Energy Outlook 2002*, chap. 13, page 367-8

⁶ More details in *Smoke-the Killer in the Kitchen*, Hugh Warwick et al, ITDG Publishing 2004, ISBN 1 85339 5889; IEA, *World Energy Outlook 2002*, chap. 13, page 367, 368

Picture 1: Open fire place cooking and "jharro" burning. The traditional way of having a small dim light inside the home is the "jharro" (resin soaked pine wood stick burning to the left, with a one evening ration ready to be burned at the bottom left). While burning "jharro", thick black smoke is developed, adding to the already health hazardous condition of open fireplace cooking

Picture 2: Open fire place cooking
Cooking on open fires is the traditional and common way to cook the daily food. The mother, and often the children, sit around the smoky fire as the meals are prepared. Women and children are most likely to suffer from exposure to the indoor smoke pollution⁷, causing health hazards such as respiratory diseases, asthma, blindness and heart disease⁸.

According to the Nepal Water and Energy Commission Secretariat (WECS), about 30%, or 42,240 km² of Nepal's total landmass of 140,800 km² is covered with forest. About 11% is covered with shrubs and bushes. Monitored data shows that the forest areas are annually reduced by 1.7%⁹, which can be considered as too high for such a fragile hill ecosystem.

WECS states that about 15 million metric (MT) tons of air-dry fuel wood were consumed to provide the annual energy services in the year 1999. 98% of that total fuel wood consumption is used in private households, the rest in the industry and other commercial establishments. But considering that only about half, or 21,120 km², of the total forest area is accessible for fuel wood collection, the sustainable growth and availability of annual fuel wood is limited to about 7 million MT¹⁰. Not surprising, deforestation is widespread and the once picturesque, bio-diversity rich forests and valleys are stripped of their resources in unsustainable ways.

One of the first questions to ask the local people is how they themselves would define their most urgent needs. Again and again they answer:

"We need light inside the home and a smokeless stove, to get rid of the terrible smoke inside the home".

Thus it is clear that in order to get rid of the health threatening indoor pollution not only a stove is needed, but also appropriate light services, as otherwise people use again the smoky pine wood "jharro" to have the minimum light services during the evenings and early mornings.

In order to be able to design a suitable smokeless stove, appropriate for the rural high altitude areas, it is important to understand what the people's stable food is and how they like to have it cooked. During the workshop an appropriate, in Nepal designed and manufactured, and now over 9 years tested and in 2,800 households in the high altitude areas of Jumla, Mugu and Humla installed smokeless metal stove, will demonstrated and discussed (see pictures 3 -5). It has been designed according to the local communities' needs, available food, and the way they like the food being cooked.

Further there is a strong relationship between poverty and access to electricity, with increasing poverty levels the more remote and difficult to access the communities live. 85% of Nepal's 27.5 million people live in the rural areas, with about half so remote that neither a road nor the national grid will reach them, for generations to come. Nepal has no fossil fuel resources, but what Nepal is rich in are renewable energy resources such as hydro power and solar energy. These abundant local available renewable energy resources can be tapped into with approved and local developed

⁷ Open fires create PM₁₀ levels $\geq 20,000\mu\text{g}/\text{m}^3$. US-EPA 24 hrs average is not to exceed $150\mu\text{g}/\text{m}^3$ more than 3 times a year. Annual average not exceeding $50\mu\text{g}/\text{m}^3$, *Smoke, Health and Household Energy*, ITDG, September 2002

⁸ IEA, *World Energy Outlook 2002*, chap. 13, page 367-8

⁹ Biomass energy uses: an experience and application of alternative energy technologies in Nepal
Bishwa S. Koirala Environment Advisor, Rural Energy Development Program, UNDP, Nepal,
<http://bioproducts-bioenergy.gov/pdfs/bcota/abstracts/30/z324.pdf>

¹⁰ Renewable Energy in South Asia, *Country Reports Nepal*, chapter 2, http://www.worldenergy.org/wec-eis/publications/reports/renewable/country_reports/chap_2_5.asp

technologies. Generating and storing energy through the rich solar energy resource, powering appropriate and sustainable lights, brings potential health, education, social and economic benefits to the people who lived previously in homes with excessive indoor air pollution. In order to come up with a sustainable lighting solution one has again first to understand how the local people till now have fulfilled their need for light. During the workshop an appropriate and now in many households in the remote Karnali zone already successfully implemented elementary rural village electrification solution for indoor lighting purpose, is presented and discussed. Through solar PV technology with WLED white light emitting diode lamps (see pictures 6-8), or called WLED lamps, hundreds of people in upper Humla enjoy now daily some minimal lighting services. Most of the equipment are developed and manufactured in Nepal, creating valuable jobs and income, and teaching local people new skills. Some recently implemented projects in Humla are highlighted and can build the basis of further discussions.



Picture 3: A smokeless metal stove installed, providing good warmth during the cold seasons.



Picture 4: The high altitude smokeless metal stove allows to cook the traditional “dhal bhat” all at one time, saving up to 50% fire wood. It cooks easily for up to 12 people.



Picture 5: One project staff is teaching a family how to use the new smokeless metal stove. It has also a stainless steel water tank for 9 liter drinking water, ideal also for washing and clean the kids.



Picture 6: A new life experience, light inside the home with no smoke.



Picture 7: Now the families can grow up with clean indoor air and enable their kids to study in the evening with light.



Picture 8: A central village solar PV system with 300 W_R for 63 homes and a total of 189 WLEDs for each 5 hours light in each home. That is the Chauganphaya village’s lighting option now since January 2004.