



# POLICY Brief

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## Why Tackling Indoor Air Pollution Makes Sense – A Study from Nepal

Indoor air pollution (IAP) is a major environmental health problem in Nepal. Most of the poor in the country cook in poorly ventilated kitchens using inefficient stoves that burn wood and other biomass fuels creating a dangerous cocktail of hundreds of pollutants. They, therefore, suffer from numerous respiratory health problems. In a recent study, Min Bikram Malla Thakuri looked at the costs and benefits of a particular indoor air pollution control initiative and found that it offers a viable and cost-effective way of dealing with IAP.

The study finds that a smoke hood and simple changes to stoves can reduce the consumption of fuel, improve air quality and reduce health costs borne by households. These 'anti-pollution interventions' can also help reduce emissions of green house gases. A cost-benefit analysis suggests that it makes economic sense for households (and society at large) to roll out the implementation of these interventions more widely. The study highlights what must be done to help make this happen.

### INDOOR AIR POLLUTION IN NEPAL

According to the World Health Organization, IAP from solid fuel burning is responsible for the deaths of around 7,500 people, 204,400 Disability-Adjusted Live Year (DALYs) and 2.7 percent of the national burden of diseases annually in Nepal. According to the Nepal Demographic and Health Survey, acute respiratory infection contributed to 23 percent of all deaths among Nepali children below five years of age in the year 2006. Acute lower respiratory infections, Chronic Obstructive Pulmonary Disease and Tuberculosis are among the top 10 causes of death in Nepal and there is strong evidence to suggest that IAP has a significant role in the occurrence of such illnesses. (For more on the impact of IAP in the developing world, see side bar, page 2).

A number of technological solutions are available to address the indoor air pollution problem. However, due to a lack of information on the costs and benefits of such technologies, their wide-scale adoption is not taking place at a rapid pace in Nepal. This study therefore aims to help fill this information gap and promote action to solve the country's IAP problem.

### THE STUDY AREA

The study is based on data from five Village Development Committees in Rasuwa district, which lies about 80 miles from Kathmandu. More than 90% of the households in the area are totally dependent on biomass fuel for cooking and room heating. While most households cook with inefficient traditional stoves in poorly ventilated kitchens, in recent years some households have installed smoke hoods and made changes or 'anti-pollution interventions' to their traditional stoves.

The new smoke hoods that are used in Rasuwa suck out smoke produced by the incomplete combustion of fuel wood while cooking. The hoods also radiate heat into the room, and allow people to cook in the way they want, using different types and sizes of pots. Many households have installed the hoods with the financial and technical support from an NGO, Practical Action Nepal. Loans were provided to households through local revolving fund groups to put in the smoke hoods.

## INDOOR AIR POLLUTION PROBLEM IN DEVELOPING COUNTRIES

According to the World Health Organisation more than three billion people worldwide depend on solid fuels, including biomass (wood, dung and agriculture residues) and coal, to meet their basic energy needs such as cooking, boiling water and heating. However, the inefficient burning of biomass fuel creates a dangerous cocktail of hundreds of pollutants in the air in people's homes. In general, people in developing countries use solid fuels because of their availability and affordability. Studies suggest that IAP is strongly associated with income level. It is the poor who rely on the lower grades of fuel and have the least access to cleaner technologies; it is therefore the people in the least developed areas that are most likely to experience the highest levels of indoor air pollution.

There is abundant evidence supporting the link between IAP and health problems such as acute respiratory infections, chronic obstructive pulmonary disease and lung cancer in women. Inhaling indoor smoke doubles the risk of pneumonia and other acute infections of the lower respiratory tract among children under five years of age. Women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary diseases, such as chronic bronchitis or emphysema, than women who cook with electricity, gas or other cleaner fuels. Moreover, some studies have linked exposure to indoor smoke to asthma, cataracts, tuberculosis, adverse pregnancy outcomes, heart and lung diseases and nasopharyngeal and laryngeal cancers. Globally, IAP is responsible for 1.6 million deaths annually and 2.7 percent of the global burden of disease.

Table 1: Summary of Cost and Benefits (in Rs.)

Headings	Perspectives	
	House hold (in Rs.)	Societal (in Rs.)
Costs	-	-
Cost of a smokehood	5000	(5000+150)x 640
Annual maintenance cost	100	100 x 640
Programme cost (excluding support for smokehoods)	-	2,850,870
Benefits		
- Treatment cost saving	987	(987+375)x 640
- Day loss due to illness saving		
- Annual fuel collection time saving (Rs/Year)	1900 (19 days)	950 x 640
- Annual cooking hour saving (Rs/Year)	4000 (40 days)	2000 x 640
- Carbon dioxide (CO <sub>2</sub> ) emission saving (Rs./Year)	1050 (10.5 days)	525 x 640
- Carbon dioxide (CO <sub>2</sub> ) emission saving (Rs./Year)	-	962 x 640

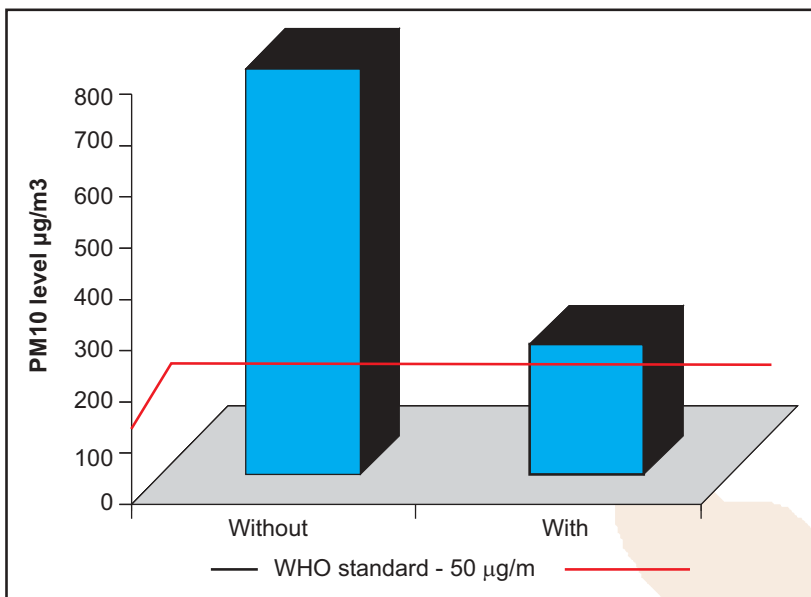
## ASSESSING INDOOR AIR POLLUTION

The information for this study was collected through household surveys and indoor air quality monitoring. 400 households (80 of which had implemented anti-pollution interventions) were surveyed and data collected on household resources, skills, energy use, income and health status. The main cook in each household was asked whether they or the household's children suffered from any of the adverse health symptoms that are associated with IAP. These include coughing, wheezing and eye irritation. Information was also gathered annual treatment costs for respiratory problems.



Researcher Min Malla conducting the household survey

Figure 1: PM10 level in the kitchens (with and without interventions)



Indoor air quality was monitored to gauge the level of IAP in each household. Carbon Monoxide and particulates (PM<sub>10</sub>), two key emissions that are harmful to health, were measured. In 60 households (30 of which used interventions and 30 that did not) PM<sub>10</sub> was monitored using Buck S.S. pumps. Carbon monoxide was monitored in 203 households (123 that did not use interventions and 80 that did) using the Industrial Scientific ISC T82 real-time single gas monitor.

A cost-benefit analysis was carried out to see whether it makes economic sense for people to install smoke hoods and carry out other anti-pollution interventions. To do this analysis, four benefits of implementing the interventions were highlighted and their economic values calculated. These benefits were: (i) health benefits; (ii) fuel savings; (iii) cooking time savings; and (iv) global environmental benefits due to greenhouse gas reductions.

Figure 2: Particles deposited in smoke monitoring filters in with and without intervention households



## THE ECONOMIC BENEFITS OF INTERVENTION

The levels of IAP in the kitchens in the households in the survey area were very high (see Figure 1). The 24 hour average PM<sub>10</sub> level was 763 µg/m<sup>3</sup> in households that did not use anti-pollution interventions. This is about 15 times higher than the WHO-recommended safe level of 50µg/m<sup>3</sup>. In households that did use interventions, the 24 hour average PM<sub>10</sub> level was 255µg/m<sup>3</sup>; this is still significantly higher than WHO guideline levels, but is 66% less than the levels in households that had done nothing to reduce IAP levels. This shows that the interventions used in the study area are effective at significantly reducing the level of indoor air pollution.

Not surprisingly, the occurrence of respiratory illnesses (e.g., cough, phlegm, and wheezing symptoms) was significantly lower amongst the cooks and children of the households that used anti-pollution interventions. The interventions reduced the number of sick days that householders had to take by approximately 19 Fig. 2: Particles deposited in smoke monitoring filters in with and without intervention households days per year per household. Economically, the interventions contributed to a reduction in treatment costs of Rs. 987 per year to each household.

The interventions also resulted in a reduction in firewood consumption and saved each household about 40 working days, since they did not have to collect as much firewood. In addition, improved stove efficiency and changes in cooking practices led to a reduction in approximately 84 hours per year per household. In monetary terms, households with interventions saved Rs. 5050 per household per year because of



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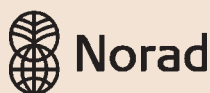
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*Women cooking - after the intervention*

a reduction in fuelwood collection and cooking time. Adding up these various household level benefits, the study estimates that interventions amounted to a savings of Rs. 7937 of annual income per year.

## DO INTERVENTIONS MAKE ECONOMIC SENSE?

To look at the financial viability of the anti-pollution interventions, their costs were compared with their benefits. The initial investment cost for the interventions per household was approximately Rs.5000, plus a maintenance requirement of Rs.100 per year. Added to this are the costs of implementing the program by Practical Action.

The cost-benefit analysis shows that the anti-pollution interventions will save households and the wider community money. For households, the estimated financial net present value from these interventions is Rs. 39,281. A sensitivity analysis shows that the investment in smoke hoods is economically viable even if there is an increase in product costs of 20 percent or a decrease in associated benefits of 20 percent. Investing in increasing the adoption of anti-pollution interventions is economically viable for society as a whole as well.

## CHALLENGES AHEAD

While it makes sense to invest in anti-pollution interventions, currently adoption of these interventions is rather limited. There are several reasons why widespread adoption is not happening. The three most obvious ones are: i) an information gap – households are not aware of the benefits the interventions can provide; ii) a lack of credit facilities to help households offset initial investment costs; and iii) no regular supply of the necessary technology, because there is no established market for it.

Policy makers need to address these challenges as part of an overall programme to help people reduce the IAP in the homes. Such a programme could be based around using smoke hoods, stove improvement and other anti-pollution interventions and would bring health and economic benefits to households and to society at large.

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