

POLICY RESEARCH ON  
HOUSEHOLD ENERGY AND  
INDOOR AIR POLLUTION IN  
SOUTH ASIA

Dr. Shailendra Sigdel  
Policy Research Coordinator  
Practical Action Nepal

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## EXECUTIVE SUMMARY

More than three billion people still burn wood, dung, coal and other traditional fuels inside their homes. The resulting indoor air pollution is responsible for more than 1.5 million deaths a year mostly of young children and their mothers. On current trends an extra 200 million people worldwide will rely on biomass for their cooking and heating needs by 2030, according to the International Energy Agency.

In spite of critical consequences on poverty, Indoor Air Pollution has not received serious attention among policy makers in national as well as international level until recently. There is a strong evidence linking indoor air pollution with acute lower respiratory infections such as pneumonia, and with chronic lung diseases such as chronic bronchitis and lung cancer.

In the last few decades, several successful technologies/products for alleviating the indoor smoke have been developed but scaling up such technology to reach the poor pose a formidable barrier. Experience has clearly shown that these small scale interventions cannot be replicable without appropriate policies by the government. The purpose of this research is to assess existing policies regarding household energy, health and Indoor Air Pollutions in South Asia and offer policy recommendations to reduce the negative impact of indoor air pollution.

### Key Findings

- Indoor air pollution has been given the lowest priority in reducing/minimizing air pollution because of lack of awareness of role of IAP in health and other developmental activities. The key information regarding negative impact of indoor air pollution is also missing. This lack of information on pollution data and health effects directly affects the policy making decision even though indoor air pollution is much higher than the out door air pollution.
- There is an absence of policy in South Asia (national and sub national) that acknowledges the contributions of a range of actors (government, business, NGOs, and so on) and sectors (energy, health, environment, finance, and so on) and that result in coordinated action. However, the issue has slowly started gaining some mentions in existing policies like national policies on environment, renewable energy, women development, health, etc.
- There exists little coordination among several agencies. Disconnected programs are implemented in rural communities by several agencies. Although NGOs are running some successful programs but it also lacks coordinated approach with relevant stakeholders.
- Lack of clear cut role and responsibilities of different stakeholders (including government, local government, private sector, academic institutions, NGOs, community groups, INGOs, donor agencies) contributes to duplication, confusion, and waste of resources.
- Switching to clean fuel will definitely contribute to reduce the impact of indoor air pollution but switching requires more investment on the part of poor which is only possible through raising standard of living which falls under the domain of various agencies.
- There exists lack of sufficient demands for intervention by the poor. Demand creation is one of the critical policy issues where several actors could play an important role. Once the demand is created, sustainable adoption should also be promoted through greater availability of a choice

of appropriately priced interventions through local commercial outlets (artisans, shops, markets).

### Recommendations:

- Effective strategies to reduce the burden of indoor air pollution require commitments from different sectors. Though different ministries aim to address the issue, their efforts stand isolated. Policy needs to be formulated to incorporate environment and health concerns for strategies on energy supply, conversion and use. There is a need for integrated approach and policy to manage this issue in South Asia.
- Regulatory frameworks are required to provide a supportive policy environment for private sector investment in energy infrastructure that is targeted at cooking and heating needs in both urban and rural areas.
- A broad based research not merely into the policies but also into the government and non-government programs with a view to identify the cross linkages, gaps and options are required in each country.
- To deal with the information gap, large-scale awareness raising campaigns, educational activities involving relevant sectors, and through the integration of the topic into formal school as well as other relevant professional curricula. International organizations and NGOs should support these efforts as much as possible.
- Non government organizations should be brought to scene when it comes to devising and influencing policies. The culture of influencing policies through communities should be promoted. Involving and engaging those living in poverty, particularly women, and responding to their needs and aspirations, will be critical in identifying and implementing successful solutions.
- Establishing the role of different actors are essential. The government in South Asia should create an enabling environment whereas Non-Government and Academia should involve in awareness raising, monitoring, ensuring accountability and feedback. Providing products and services are key responsibility of private sector but this requires sound policy framework on the part of the government. Communities can be important actors by raising their voices, finding appropriate forums, linkages with various tiers of government and non-government actors through their representative groups
- Considering the rural demography, improved cooking stoves with improved combustion characteristics, and biogas should be widely promoted to reduce harmful emissions. The important role of biomass should be recognized in the national policies in various social and economic sectors; e.g. in rural development and health sectors.
- There is a need for a national level institution to provide quality standard of different equipment for reducing indoor air pollution. Similarly, this institute should also involve in Research and Development to recommend several technological and policy measures to reduce the negative impact of IAP in future.
- Given the fact that kerosene subsidy is not reaching the targeted end users and diverted towards adulteration, government in South Asia should consider elimination of kerosene

subsidy with other policies to support lighting needs of poor. Provision of subsidy for solar lantern as short term policy and on the long term expansion of rural electrification net work will help in meeting this goal.

- There is a need for innovative approach to promote the use of better energy-using devices such as improved stoves, biogas plants, etc. The government should consider setting technical standards (promote stoves which has high combustion efficiency) and provide credit facilities and encourage promotional support to stove manufacturers.

## CHAPTER I: INTRODUCTION

### 1.1 Introduction to Study

This summary report assesses the policy gaps in household energy and health in relation to indoor air pollution in South Asia. Chapter one outlines objectives and context of the research. This chapter also provides an overview of household energy situation and its impact on health situations in South Asia. Chapter two provides framework for policy assessment by looking at policy instruments and policy implementation arrangements. Chapter three provides consolidated assessment of the existing policies related with household energy, health and indoor air pollution. Key findings, policy gaps and barriers are explained in chapter four. Chapter five deals with generic recommendations. The country specific recommendations are discussed in country level report which will be published separately.

### 1.2 Context

More than three billion people still burn wood, dung, coal and other traditional fuels inside their homes. The resulting indoor air pollution is responsible for more than 1.5 million deaths a years-mostly of young children and their mothers. On current trends an extra 200 million people worldwide will rely on biomass for their cooking and heating needs by 2030, according to the International Energy Agency. In spite of critical consequences on poverty, Indoor Air Pollution has not received serious attention among policy makers in national as well as international level until recently.

In the last few decades, several successful technologies/products for alleviating the indoor smoke have been developed but scaling up such technology to reach the poor pose a formidable barrier. Experience has clearly shown that these small scale interventions can not be replicable without appropriate policies by the government. Realizing the importance of sound policies for addressing the problems of indoor smoke, Practical Action Nepal has commissioned this study to assess the policy gaps and also for strategic recommendations to address the policy issues in South Asia . The specific objectives of the research study are:

#### 1.2.1 Objectives of the Research

- To assess the existing household energy and health policy to reduce the exposure to indoor air pollution in South Asia;
- To identify the policy gaps in the implementation of the policy interventions to reduce the exposure to indoor air pollution; and
- To recommend the strategy to improve the policy environment (policy formulation and implementation) to reduce the exposure to indoor air pollution.

#### 1.2.2 Research Methodology and Duration

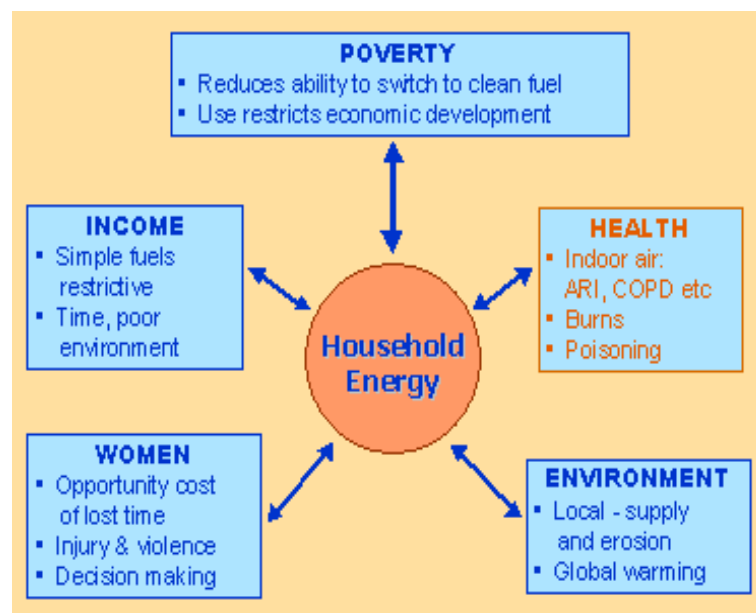
The research was undertaken by specialist research institutions and individual consultant in their respective countries. Both primary and secondary sources were used during the data collection process. The major portion of analysis was done on the basis of secondary information. Several policies relating to indoor policies were reviewed by the researchers and some assessments was also done on the implementation situations of the policies. The research was undertaken from October 2006 to March 2007. To provide feedback on research outputs and also to exchange experiences among researchers, a sharing workshop was organized by Practical Action Nepal from 19-20 Feb 2007.

### 1.3 Linkage between Household Energy and Poverty

Despite important role in poverty alleviation, the role of energy is not fully appreciated. A careful analysis of linkage between energy and vicious cycle of poverty shows the urgency to address the issue relating to indoor air pollution. Dependence on polluting inefficient household energy practices bar people from breaking out the vicious cycle of poverty. It is a well known fact that good health is crucial as household livelihoods rely on the health of family members. Being ill as a result of indoor smoke or having to care for sick children reduces earnings and leads to additional expenses for health care and medication. The linkage between household energy and other dimensions of development are presented in chart 1 below;

**Chart 1:**

#### Broader impacts\Linkages of Household Energy



ARI: acute respiratory infections

COPD: chronic obstructive pulmonary disease

As shown in chart 1, household energy decisions have forward and backward linkages with several dimensions of development including poverty, income, health, women empowerment and environment. Because of poverty, people are unable to switch to clean fuel. Similarly, in the absence of proper energy, people are restricted for economic development. For instance, they are unable to work in night in the absence of proper light thereby reducing the income generating ability. Similarly, women have to spend considerable amount of time in collecting wood thereby reducing the time available for education and income generating activities.

It is very surprising to note that no Millennium Development Goal on energy exist in spite of its critical role in poverty alleviation. Although there is no Millennium Development Goal on energy but energy poverty is one of the many manifestations of poverty and a prevailing feature of deprived rural and urban households in developing countries. Several objectives of Millennium Development Goals can only be achieved by having proper energy interventions. Improved energy services can reduce child mortality rates, improve maternal health, reduce time and transport burden on women and young children and lessen the pressure on fragile ecosystems (see table 1 below)

**Table 1: Energy Interventions and Millennium Development Goals**

Millennium Development Goals	Contribution of improved household energy practices
Goal 1: Eradicate Extreme poverty and hunger	<ul style="list-style-type: none"> <li>• Saving time spent being ill or having to care for sick children will cut health care expenses and increase earning capacities.</li> <li>• Where fuels are purchased, increasing fuel efficiency and thus cutting down on the quantity of fuel needed will ease constraints on already tight household budgets</li> <li>• Improved household energy technologies and practice will open up opportunities for income generation</li> <li>• Access to electricity will provide a source of light for economic activities in the evening and a source of energy for operating, for example, a sewing-machine or refrigerator.</li> </ul>
Goal 2: Achieve universal primary education	<ul style="list-style-type: none"> <li>• With less time lost in collecting fuels and due to ill health, children will have more time available for school attendance and home work.</li> <li>• Better lighting will allow children to study outside of daylight hours and without putting their eyesight at risk</li> </ul>
Goal 3: Promote gender equality and empower woman	<ul style="list-style-type: none"> <li>• Alleviating the drudgery of fuel collection and reducing cooking time will free women's time for productive endeavours, education and child care</li> <li>• Reducing the time and distance that women and girls need to travel to collect fuel will reduce the risk of assault and injury, particularly in conflict situations</li> <li>• Improving women in household energy decisions will promote gender equality and raise women's prestige.</li> </ul>
Goal 4: Reduce child mortality	<ul style="list-style-type: none"> <li>• Reducing indoor air pollution will prevent child morbidity and mortality from pneumonia</li> <li>• Protecting the developing embryo from indoor air pollution can help avert stillbirth, perinatal mortality and low birth weight</li> <li>• Getting rid of open fires and kerosene wick lamps in the home can prevent infants and toddlers being burned and scalded</li> </ul>
Goal 5 :Improve maternal health	<ul style="list-style-type: none"> <li>• Curbing indoor air pollution will alleviate chronic respiratory problems among women</li> <li>• A less polluted home can improve the health of new mothers who spend time close to the fire after having given birth</li> <li>• A more accessible source of fuel can reduce women's labour burden's and associated health risks, such as prolapse due to carrying heavy loads</li> </ul>
Goal 6: Combat HIV/AIDS, malaria and other diseases	<ul style="list-style-type: none"> <li>• Lowering level of indoor air pollution levels can help prevent 1.6 million deaths from tuberculosis annually</li> </ul>
Goal 7: Ensure environmental sustainability	<ul style="list-style-type: none"> <li>• Where biomass is scarce, easing the reliance on wood for fuel through more efficient cooking practices will lessen pressures on forests.</li> <li>• Moving up the energy ladder and using improved stoves can increase energy efficiency and decrease greenhouse gas emission</li> </ul>
Goal 8: Develop a global partnership for development	<ul style="list-style-type: none"> <li>• Recognition in development agenda and by partnership of the fundamental role that household energy plays in economic and social development will help achieve the Millennium Development Goals by 2015</li> </ul>

Source: World Health Organization (2006): *Fuel for Life: Household Energy and Health*



## 1.4 Status of Household Energy and Indoor Air Pollution in South Asia

South Asia is one of the poorest regions of the world despite some economic advances by countries like Pakistan and India in recent years. By the end of 2006, 800 million people live in less than US \$ 1 per day in South Asia. The impact of poverty manifests in poor health status in terms of high infant mortality and under five and maternal mortality. In addition, deficiency in nutrition to live healthy life, low school enrolment specially of girl child, lack of productive employment, low status of women in society are some examples of poverty related problems. Several health problems resulted from poverty and ignorance. Tackling the poverty constitute single most important strategy to deal with poverty related problems in developing countries.

**Table 2: Traditional Energy and Health Status in South Asia**

Country	% of people using solid fuels	Under five mortality rate per 1,000 live births	Maternal mortality rate per 100,000 live births
Bangladesh	88	69	380
India	74	87	540
Pakistan	72	98	500
Sri-Lanka	67	15	92
Nepal	80	82	740

*Source: WHO (2006): Fuel for Life, WHO, Geneva*

Among others, indoor air pollution is a major health hazard in developing countries as several researches have shown positive link between IAP and ALRI, COPD, etc. In the rural setting of South Asia, sizeable numbers of poor people are relying on biomass for their day to day living as they have no alternative as depicted in table 2. Due to ignorance, they rely on traditional methods of cooking which is too dangerous from the health point view. Women and her children are main victims of indoor air pollution as they spend considerable time in cooking.

In India a large population still continues to be dependent on biomass energy, according to the Census of India 2001 of the 138,271,559 rural households, 90% continue to use fuel wood, cow dung cake and crop residue for cooking while 56.4% do not have access to electricity (RGCC, 2001)

Traditional energy sources such as fuel wood, agricultural residues and animal manure constitute a large part (nearly 40%) of the total energy consumption (Planning Commission 1997; MNES 1996; MoF 2000). It is estimated that about 90% of the rural domestic energy demand is met through non commercial fuels such as fuel wood, dung cake and crop residues (Pandey 2002). Among the various bio fuels used for cooking in rural households, share of biomass is relatively high. In terms of quantity, the estimated consumption of fuel wood in early ninety was 252.1 MT; followed by dung cakes at 106.9 MT and agricultural residues at 99.2(Joshi et al.1992).

In Nepal, a substantial amount of biomass is used in the residential sector for cooking in both the rural and urban households. Other than these end-uses, biomass is also used for heating, water boiling and agro-processing. Generalizing the estimated data of 2003/04 regarding the end-use of fuel wood, cooking alone accounts for nearly 80 percent and 64 percent for rural and urban areas respectively. Similarly animal feeding takes the second largest share with 17 percent in the rural sector and 8 percent in the urban sector.

Comparative assessment of the energy consumption in the residential sector within a period of 10 years, using 2001 as the base year reveals the following features:

- existing prominence in the use of traditional biomass, with an increase of nearly 0.85 percent within the period
- a decrease in the use of commercial energy forms by more than 1.22 percent

The energy sector in Sri Lanka is dominated by bio-energy, and especially by fuel wood. The total annual primary energy supplied in Sri Lanka during year 2003 was about 381 PJ (or 9,122 kTOE). This comprises of 50% biomass, 8% hydro electricity and 42% petroleum. The final energy consumption was amounted to about 312 PJ (or 7454 kTOE), 24 % of which was consumed by industrial sector, 25% by transport sector and 51% by household & commercial sectors.

Nearly 80% of the populations of Sri Lanka depend on fuel-wood and other forms of biomass for their daily cooking (Perera & Sugathapala). Thus the major biomass consuming device category is the cook stoves in the domestic sector. Therefore biomass fuels are of crucial importance, especially for rural people who do not have access to other energy sources.

According to Household Energy Strategy Study (2002) biomass fuels account for 86% of total household energy consumption in Pakistan. Fuel wood accounts for 54% of the total. 90% of biomass are being consumed in homes. Bio fuels are mostly used in traditional stoves for cooking and heating. Bio fuels account for 94% of energy used by households in rural areas and 58% in urban areas. Cooking consumes 82.1%, domestic heating 7.3% and water heating 9.8% of total fuel wood used in domestic sector. The share of fuel wood in domestic sector is 54%, dung 18%, agricultural waste 14%, natural gas 7%, kerosene and LPG 3% and electricity 4%. An average bio fuel-using household uses a mixed type of fuels (Fuel wood 2324Kg, Dung 1477Kg, crop residues 1161 kg and charcoal 115 kg).

Four-fifths of Bangladeshis live in rural areas, and their energy needs are primarily met with traditional biomass – straw, jute stick, animal dung, and fuel wood. Over one-quarter (27% or 7.1 Mtoe) of the primary energy consumption in Bangladesh is traditional biomass.

Bangladesh has yet to provide access to modern energy for the majority of its population. Well over half of the total population remains energy-deprived, without access to grid power or modern fuels and reliant on fuel-wood, dung, and crop residues for their cooking needs and candles or kerosene for their lighting requirements. The energy deprivation and biomass reliance contribute to deforestation, drudgery of rural women and children tasked with collecting, processing and using biomass, and health impacts of indoor air pollution. The development of informal rural markets for even low-quality traditional biomass sources (e.g., rice husk and animal dung) is evidence of a decreased supply of readily available biomass, with the result that even fuel sources of last resort are becoming less affordable to the very poor.

## 1.5 Indoor Air Pollution and Health Implications

It has been well established fact that indoor air pollution is a contributing factor to many diseases in South Asia. Analysis of large scale national survey conducted in India reported that women using bio fuels were three times more likely to have tuberculosis than women using cleaner fuels even after controlling the confounding effect of socioeconomic factors (Mishra et al; 1997). A case study in India reported an excess risk of cataract among people using bio fuels (Mohan et al 1989). A study conducted by Mavalankar (1991) in India, reported that pregnant women cooking with bio fuels had greater chance of stillbirth.

As per the reported burden of diseases estimate, indoor air pollution is the third most important risk factor (next to poor water and sanitation and malnutrition) of ill health and responsible for 17% of all deaths among children under five in India (Smith KR, Mehta S, Feuz M. 2004).

A study conducted in a hilly remote area of Nepal to find out the relations between indoor air pollution and ARI in infants and children less than 2 years showed that episodes of moderate and severe ARI increased with increments in the level of exposure to indoor air pollution. The study suggested that indoor air pollution is an important risk factor of ARI (*Pandey, M. R, 2001*). This is because the mobility of children less than 5 years of age is directly proportionate to that of the mother.

The survey conducted in Sri Lanka based on health status in combination with IAP reveals the following findings;

- Cooking smoke is a contributing factor for chronic obstructive pulmonary disease – based on a study at Kandy Central Hospital
- Respiratory problems due to inadequate ventilation and cooking with fuel wood – based on a study for the low income families in Colombo suburbs clearly shows that the hospitalization percentage is high for respiratory infections in each year when compared to other diseases. LRI is mainly due to breathing of polluted air either out door or indoor. Research carried out from University of Colombo on risk of cataract formation with exposure to biomass smoke shows following results on variations in the respondents with the number of year's cooked using firewood.

Primitive biomass stoves, used by millions of women in Bangladesh, emit high volumes of smoke. This has a serious impact on the women's health on a daily basis. Running eyes, allergic skin, dizziness and sore throats are the most obvious disorders observed are common. However, long-term health effects related to exposure to smoke might be more serious and have hardly been investigated.

## CHAPTER II: POLICY ASSESSMENT FRAMEWORK FOR HOUSEHOLD ENERGY AND INDOOR AIR POLLUTION

### 2.1 Introduction

This chapter provides a framework to analyze the interventions to reduce the negative impact of indoor air pollution. Then it will discuss key policy instruments for household energy, health and indoor air pollution. Finally, implementation issues regarding IAP will be discussed.

Chapter one summarized the linkages between household energy, poverty, health and indoor air pollution. The chapter argued that since indoor air pollution resulted from various factors, any attempt to analyze the policy issues regarding indoor air pollution will be affected by different policies of the government including energy, environment, rural development, forestry, housing, women empowerment, education, etc. Successful implementation of these policies will contribute to reduce the negative impact of indoor air pollution. Among the several policies, energy policies will have direct impact on reducing the negative impact of indoor air pollution to the poorest of the poor. Therefore, the present research focuses on household energy policies and its impact although references are also made about other policies having some impacts on indoor air pollution.

### 2.2 Framework for the assessment of policies relating to Indoor Air Pollution

To reduce the exposure to indoor air pollution, the following three major interventions are possible.

- Interventions at the sources by promoting improved stove, alternative fuel-cooker combinations and by reducing the need for fire;
- Improving the living environment by improved ventilation and kitchen design and placement of stove; and
- Changing behaviors by reducing exposure through operation of sources including fuel drying, use of lids while cooking and proper maintenance of stove and chimneys

Formulation and implementation of sound policies are critical for the successful implementation of above mentioned interventions. Among others sound policy comprises participation of stakeholders in policy formulation process and implementation of effective policy instruments. Therefore, devising and implementing the policy instruments and facilitating the effective implementation of policies by giving space to all stakeholders are two important dimensions of policy process. Concerning policy instrument, the government can adopt number of options including enabling environment for market, information, education and communication, research and development and regulations and legislations. Integration and coordination, and partnership are critical implementation issues which are discussed below.

## 2.2.1 Policy Instruments

### **Enabling environment for market (Subsidies, tax incentives, direct expenditures)**

Subsidies are provided in LPG, kerosene and biogas in many developing countries. But the experience with subsidies is far from satisfactory. First, in the case of LPG and Kerosene, subsidies have provided more benefits to well off compared to the poor. Second, subsidies bill are too high for government to cope with if it has to be expanded at national level for intervention like biogas. The government can not sustain this. To promote interventions, it would be appropriate to provide some incentives on tax for appliance and some kind of direct expenditure in initial phase such as the installation of biogas plant. Even if there is a case for direct subsidies, it must be well targeted to the poorest of the poor.

### **Information, Education and Communication**

Information, education and communication are key to change the behaviors and also motivate people to go for clean fuel or change cooking technology. The government can take lead role in this by directing Ministry of Education to include indoor air pollution in curricula. Similarly, government can supports several innovative methods including street theatre, drama, radio program, TV program. Equally important is raising awareness of policy makers, donors, and civil society organizations on the dire need to deal with this important but neglected issue so far.

### **Research and Development**

The governments should be active in promoting research and development to deal with indoor air pollution. Survey, development and evaluation of interventions, studies of health effects and research capacity development are some examples of policy instruments which government can use for household energy and health. Surveys are important for planning interventions as it provides useful information. Some examples of survey are study on fuel and appliance use, knowledge of risks to health, willingness to pay for interventions, knowledge of and confidence in credit schemes, etc.

Stronger and better-quantifies evidence of the effects of health of reducing IAP, which includes exposure measurement, is required not only for key outcomes such as ALRI, but also for other health outcomes for which evidence is currently tentative. Government should also take lead in strengthening research capacity development for a wide range of research from national surveys and local surveys, to monitoring and evaluation of interventions, to more complex health studies.

### **Regulation and Legislation**

Regulations and legislation constitute important policy instrument for indoor air pollution despite its complexity in implementation. Two key areas requiring regulation are air quality standards and design standards for appliances. Routine monitoring and enforcement is not practical, but it may be useful to set standards and targets linked to specific assessments. Design standards can be applied to safety (prevention of burns, gas leaks, and explosions); venting of emissions; and efficiency. Although such standards may be difficult to enforce in an informal economy, they could become valuable with wider-scale production. As of now, no regulation and legislation exist in South Asia to air quality standards for indoor air pollution and standards for appliances partly because of ignorance of the need of such interventions and partly because of difficulty of enforcing standards in informal setting.

## 2.3 Policy Implementation

### Integration and Coordination

Since household energy is linked with other dimensions of development, it is essential to have proper integration at macro as well as micro level. This will create synergy and impact will be maximized. For instance, if women empowerment programs also include some components on impact of indoor air pollution and preventive measures, this will help to improve the health conditions of the poor. Similarly, if provision is made for lighting facility in the evening, women will have more time to involve in income generating activities and also for education. So integration will bring about significant impact

### Partnership

The success of any policy or program depends on the active participation of all relevant stakeholders. Government alone has neither capacity nor knowledge to reach the every nook and corner of the society. In the past, many programs designed in the center were failed in the absence of local participation. Since local people have more knowledge on local conditions and their preferences are dominated by values and culture, it would be appropriate to listen to them while formulating and implementing the policy. One of the reasons for success of China stove's program is its ability to adapt stove design to local conditions.

Experience has shown important role of private providers and local NGOs for dealing with interventions related to indoor air pollution. Private providers can play the role of suppliers of different appliances to the local market under the broad guidelines set by the government since it is not feasible for the government to reach all parts of the country. Similarly, NGOs and local community's role are more on raising awareness and also experimenting appropriate technology for the community. Any policy, therefore, demands the partnership among all providers for effective results. Sadly much remains to be done to forge productive partnership among these stakeholders as their relationship is mar by lack of trust and confidence among each other.

## CHAPTER III: ASSESSMENT OF EXISTING POLICIES TO ADDRESS IAP IN SOUTH ASIA

### 3.0 Introduction

In chapter two we discussed policy framework (policy instruments and implementation arrangements) for the assessment of household energy and indoor air pollution. Based on the framework, this chapter assesses the existing policies regarding household energy and indoor air pollution in South Asia.

### 3.1 Adequacy of existing policies in relation to a particular intervention

Indoor air pollution is the results of combination of different factors some of which are directly linked with household energy issues while others are caused by broader issue of development including poverty, education level, and women empowerment. Therefore, tackling indoor air pollution demands intervention not only on household energy but also on a wider development issues. Experience has clearly shown that with the increase in income level, people are normally switching to clean fuel energy. Similarly, improved income lead to better education which motivate rural people to change some traditional behaviors detrimental to health which also lead to better conditions inside house. Therefore, integrating indoor air pollution in development issue is critical and it should be the part of overall development strategy. Since it is not feasible to have dramatic improvement in the standard of living of poor people in South Asia, the only viable option would be to explore some cost effective interventions to reduce the impact of indoor air pollution to the poorest of the poor. In this context, interventions should be focused on three major areas which are sources, living environment and users behaviors. This research assesses the adequacy of existing policies to deal with these interventions.

#### Sources of Pollution

One major cause of IAP is use of traditional fuels as poor people do not have other choices. As discussed earlier, around 70 % of poor people in South Asia still depends on biomass for their energy needs because it is freely available to them in monetary terms. The smoke from these traditional fuels is highly detrimental to health as discussed in earlier chapter.

In addition, the cooking practices in traditional cook stoves also contribute to high level of smoke which leads to unacceptable level of indoor air pollution. In spite of severity of problems, no alternatives exist for clean fuel for poorest of the poor in South Asia as reported by this research. Only a handful of people living in urban areas are using clean energy such as LPG in South Asia. There exists several obstacles in using LPG including financial cost (installation and running cost), difficulty in transporting with poor road network, safety etc.

India is ahead of other South Asian countries in terms of use of LPG. To promote the use of clean energy, the government is providing subsidies in LPG. However the problem is that subsidies provided on LPG has been primarily enjoyed by the middle and high class people as poor people have no access to LPG because of high installation cost. The situation in other countries is even more critical where only handful of urban people is using LPG. In Sri Lanka, Pakistan and Bangladesh, LPG is primarily serving urban markets. It appears that switching towards LPG is not feasible to the poorest of the poor until there is a significant improvement in terms of income and also better road network and incentives for private sector to operate . (See country report for detail analysis)

Kerosene is another fuel which has been used in South Asia but the research shows that its use is more on lightening purpose than cooking in rural areas although a sizeable percentage of urban population are using kerosene because of high installation cost of LPG. Here again, since the beneficiary are not the poorest of the poor, subsidies are diverted to relatively better off population compared to the poorest of the poor. To some extent, subsidize kerosene has helped to address lighting need of the poorest of the poor which is also critical intervention as it allows them to involve in different activities including reading, income generation, social interactions, etc.

Biogas has the highest potential to provide clean fuel to the village level. The governments in South Asia are initiating biogas support programs through a wide range of interventions which include providing one off subsidies to install the biogas, awareness raising activities regarding the importance of biogas, technical training in the construction of biogas pit, etc. Rural Renewable Energy Policies of South Asian countries have given adequate importance to biogas for household energy needs. It outlines the government policies in terms of subsidies, awareness raising, technical training, etc. However, an analysis of situation in South Asia reveals that not enough has been done to expand this in a wider scale. For instance in India, the exploitation of biogas is limited to one third of its potential.

Although biogas program in Nepal has been acknowledged as a successful program but its coverage is miniscule compared to the huge potential. One of the critical issue is why biogas has not been replicated in wider scale in spite of huge potential in South Asia? Several issues are accountable for this. Since government policies outline some subsidies for the installation of biogas, it entails huge cost if replicated in a wider scale. Similarly, the cost of awareness raising and technical training regarding biogas would also add extra burden to the government. Finally, it also demands huge monitoring cost to assess the efficiency and effectiveness of the biogas program. The critical question at this juncture is how to address the huge cost of biogas promotion. One problem is that installation of biogas has been primarily seen as an intervention to meet household energy needs. Its impact in reducing the disease and promoting good health has not been fully appreciated. Similarly, opportunity cost of women who can focus more time on income generating activities as against fuel wood collection for two to three hours is not accounted for.

One way to reduce cost would be to look installation cost as an investment in health and other income generating activities because of saving in time, so that people can be more productive. Therefore, it would be appropriate to divert some resources from Ministry of Health and Ministry of Women Development for this purpose in South Asia. To do this existing policy documents of Rural Renewable Energy are not adequate in these countries as it excludes health and women empowerment dimension of clean fuel thereby denying the role of Ministry of Health and Ministry of Women Development. Since Ministry of Health in South Asia commands sizeable resources from government and donor support, it may be feasible to divert sizeable resources for the promotion of biogas. This demands some changes in existing policies and also appropriate institutional mechanism to promote it. As of now, there exist policy gaps to deal with this critical issue.

As of now government is playing key role in biogas promotion by setting policy and also encouraging private sector's involvement. It is also providing subsidies for the installation of biogas plant in rural areas. The problem with indiscriminate subsidies is that those who can afford will also get benefit from subsidies. Targeted subsidies should be provided to those who are too poor to install biogas. Provision of micro credit to those who are relatively well off (ability to pay in future) would be the best option as it reduces burden to the government and also promote better use of the existing scarce resources.

Electricity and Solar Power are other two important sources of clean fuel. There is still long way to go for complete electrification in South Asia because of heavy start up cost. This is also true with Solar



Power. India has an impressive programs for rural electrification and solar power, compared to other countries in South Asia ( see country report for detail analysis)

Experiences so far have demonstrated that LPG, biogas, electricity and solar power are not accessible to the poorest of the poor community. The only viable option for them would be improved cooking stove to reduce the impact of indoor air pollution. Government and many stakeholders in South Asia have realized the important role of improved cooking stove as an appropriate intervention at source to reduce the impact of indoor air pollution.

Rural Renewable Energy Policies of Pakistan, Nepal, Bangladesh, Sri Lanka have outlined some policy provisions for promoting cooking stoves. In addition, several INGOs and local NGOs and other stakeholders are also experimenting with cooking stoves. Some NGOs in Sri Lanka are promoting ANAGI cooking stove. In spite of policy provision and initiatives by non-state sector, it has not been possible to extend the coverage of the stove as shown by the experience from Sri Lanka. Experience has also shown that improved cooking is not lasting for long time in the absence of adequate repair and maintenance. For instance in widely quoted Indian National Stove Program, only one third of stoves are in operating conditions after three years. In some countries, communities were reluctant to use the improved stove because of local culture and habits. The clear lesson from the stove program in South Asian countries is that top down policy without clear assessment of local needs and preferences is bound to be failure. Technical interventions without adequate consideration of socio-cultural dimension will not be acceptable and sustainable even if accepted by the community.

### **Living Environment**

Promoting proper ventilation in terms of kitchen design and placement of stoves are important interventions to reduce the impact of indoor air pollution to the poorest of the poor as they are too poor to switch towards clean energy. It would be extremely difficult for the government to enforce the standards regarding ventilation and other requirements. Because of this no policy is currently available to enforce these standards in South Asia. As it has a huge potential to reduce the impact of indoor air pollution, government should not pull out from doing anything to deal with this important intervention. There must be some policy provisions which allows stakeholders to design and implement successful interventions. The government can spend money on research and design and also on production of materials for raising awareness.

The government can also delegate the authorities to local bodies to enforce kitchen standards as they are close to the people. This is not an easy task but need to be supported by appropriate interventions. For instance even if the authority is delegated, local bodies are not competent enough to recommend appropriate kitchen design and other technical requirements. This demands huge capacity development need for local bodies. Similarly, kitchen design and placement of windows are also influenced by local culture, climatic conditions and other factors. It is, therefore, appropriate to have some kind of flexible policy which allows local bodies and local private providers to design situation specific intervention. However, one of the pre-requisites of this is raising the awareness of people regarding the negative impact of indoor air pollution. Unless people are fully convinced of negative impact, they will not come forward to change the existing practices which they are adopting for so long. Awareness raising, by information, education and communication, is one of the key policy instrument to motivate people for changing their style. These interventions have not been given adequate attention in South Asia as shown by the study. In some countries, local NGOs and community groups are initiating this activity in a limited scale without having any significant impact.

Since it would be very difficult to compel people to change the kitchen design and placement of stove, some kind of awareness raising activities may motivate people to change the existing practices. If

people are receptive to the idea of changing the existing design, there must be provision of local builders to assist them. Local bodies can organize technical training to local builders on proper ventilation and kitchen design at the modest cost. In case of new construction, village council or other local bodies should be given mandate to enforce the minimum building standards so that proper ventilation system should be in place. One way to deal with this is to change the existing policies and empower local bodies to enforce simple building code.

### **Changing Behavior**

Changing the user behavior by reducing the exposure through operation of sources including fuel drying, using pot lids to conserve heat and properly maintaining stoves and chimneys and other appliances. Similarly keeping children away from smoke by keeping children in another room (if available) is another important intervention. Currently, no policy exists in South Asia to change the user behavior.

Although this simple intervention could have a dramatic impact in terms of improved health of the poor, very little has been done in this aspect because of several reasons. First, policy makers are unaware of impact of this simple intervention which prompted them to focus on some concrete intervention like subsidies on biogas, kerosene etc. Second, the government has neither capacity nor resources to reach the every corner of the country. This demands some innovations to deal with this important aspect. Third, affected people are not aware of serious impact of indoor pollution and least interested to change the behavior.

There is a tremendous scope to save the lives of people if government promote appropriate policy instrument. Government cannot reach the household of every citizen but it can promote policy which will facilitate in enforcing change. Changing the behavior of the citizen by central government is neither feasible nor appropriate. Government must create an enabling environment where local government, private sector, local service delivery organization, NGOs could play important role. As a part of its decentralization program, local bodies can be empowered to run awareness raising programs to orient people on adverse consequence of indoor air pollution. With close coordination with Ministry of Education, this could be incorporated in the school curriculum. Similarly, local health providers can also bring on board to share experiences as well as resources to promote awareness among the people so that people will be motivated to change the behavior which contributed to reduce the impact of indoor air pollution.

It should be noted that above interventions comprises both technical as well as behavioral changes. Technical interventions such as improved cooking stove and alternative fuel cooker combination will require both financial as well as some technical skills. But significant improvement can be made to reduce the indoor air pollution by changing the behavior of the people which requires more soft skills in terms of raising awareness regarding the consequences of indoor air pollution on health of the people and associated costs. Therefore, any policy to reduce exposure to indoor air pollution must deal with behavioral issues with equal importance. Blanket emphasis on technical issues will not bring about desired change. Sadly most of the policies relating to household energy and health ignore this important dimension.

## 3.2 Implementation of Existing policy

### Key stakeholders in policy implementation

The formulation of effective policy depends on careful selection of stakeholders for that particular policy. Stakeholders can be primary as well as secondary for a particular intervention. Although primary stakeholder's participation is critical for the success of any policy intervention, the importance of secondary stakeholders should not be minimized. Failure to identify primary stakeholders for a particular intervention will have negative effect on policy process. For instance, community users are primary stakeholder in policy interventions regarding promotion and distribution of cooking stoves. If this important group is bypassed in the policy formulation process (as has happened in many cases in the past), the policy can be questioned in terms of its relevancy. Several stakeholders can be identified for a particular intervention. State, private sector providers (market), INGOs and NGOs, community organizations, individuals are some examples of stakeholders. However in the majority of cases, government is taking up major responsibilities at the expense of other actors in the policy formulation process.

Since the success of any policy rests on its sound implementation, the coordination and cooperation of all relevant stakeholders are critical for policy implementation. In the case of household energy and indoor air pollution, the key stakeholders are Planning Commission, Ministry of Environment and Energy, Ministry of Health, Ministry of Women and Social Welfare, Ministry of Forestry, Ministry of Education, etc. The coordination at Ministry level are required for proper planning framework and resource allocations for the implementation of policies. As shown by this research, coordination is missing at central level in all South Asian Countries which leads to duplication and also wastages of important resources. (See country report for detail analysis)

Depending on the governance structure of the country, local government can play several roles. Mostly, local governments are appropriate to monitor overall government policies implementation at local level and also provide space for coordination among different stakeholders to avoid possible overlaps. Running awareness campaigns, with the support from NGO and CBOs, constitute important function of local government.

The other stakeholders have their distinct role based on expertise. For instance, private sector can serve the market by manufacturing equipment (LPG cylinder, improved stoves), distributing and availing repair and maintenance services. NGOs and CBOs can educate people on the importance of proper cooking methods and use of alternative fuels or technology for better health. They can also experiment some new technologies. Research and Academic institutes are best placed to undertake research on impact of IAP on health, effectiveness of proposed technology, etc) In addition to funding support, INGOs and Donor agencies can assist by dissemination of information regarding the best practices which may be relevant.

An analysis of policies documents, relating to household energy, health and Indoor air pollution in South Asia, clearly reveals that the governments are not appreciating the important role of private sectors, NGOs, communities, research institutes to the fuller extent. Lately, some provisions have been made regarding the role of different stakeholders, but much remains to be done in this area. In many cases, what has been promised in the document is not delivered when it comes to the implementation of the policies.

## CHAPTER IV: KEY FINDINGS /POLICY GAPS/BARRIERS

### 4.0 Introduction

Based on the assessment of chapter three and also summary of country level study, this chapter summarizes the key findings/policy gaps and barriers for reducing indoor air pollution in South Asia. Since some of the findings are country specific, this chapter outlines some generic findings/policy gaps in South Asia. The summary of country level findings is annexed in the report.

### 4.1 Key Findings

#### **Low Priorities**

Indoor air pollution has been given the lowest priority in reducing/minimizing air pollution; partly, this is because of lack of awareness of role of IAP in health and other developmental activities. Since impact of IAP is minimal to elites and policy makers, they do not realize the urgency of these interventions. Consequently, other health problems with global consequences such as HIV AIDS get huge priority. Similarly, poorest of the poor who have huge impact of indoor air pollution are either ignorant about health consequences of IAP or too weak to influence policy making process.

#### **Lack of information**

Lack of information on pollution data and health effects may directly affects the policy making decision even though indoor air pollution is much higher than the outdoor air pollution. Although many GOs and NGOs are involved in data collection but the performance is far from satisfactory because it was carried out in an uncoordinated way. Collecting, analyzing and disseminating pollution data and its health effects are major challenges in South Asia.

#### **Absence of a clear cut policy**

To deal with Indoor Air Pollution, no explicit and clear cut policy is currently available in South Asia. The issue has slowly started gaining some mentions in existing policies like national policies on environment, renewable energy, women development, health, etc. However, this is not adequate.

Formation of a separate and full-fledged policy to deal with IAP is critical but it can not be expected in very near future. Since IAP is not the concerns of well off people and also do not fall on the priority of the poor because of their ignorance, it may take quite sometime to lobby for a separate policy for IAP in South Asia. Multilateral and bilateral aid agencies are better poised to play advocacy role for a separate policy.

#### **Poor coordination**

Although, IAP has clear link with several dimensions of development, there exists little coordination among several agencies as reported by this study in South Asia. For instance, the awareness raising programs run by Department of Health are not well coordinated by program run by Department of Energy and Women Development. Therefore, several disconnected programs are implemented in rural communities which results in waste of resources. Similarly, local people are fed up with numerous requests from several agencies to participate in the activities. Although NGOs are running some successful programs but it also lacks coordinated approach with relevant stakeholders. This situation resulted lack of coordinated approach among different agencies that are directly or indirectly responsible for indoor air pollution.

Despite its critical role, household energy and Indoor Air Pollution has been regarded as one small component of rural household. Its linkage with poverty alleviation and women empowerment are hardly appreciated. This resulted in lack of proper institutional framework for coordination and integration. Switching to clean fuel will definitely contribute to reduce the impact of indoor air pollution but switching requires more investment on the part of poor which is only possible through raising standard of living which falls under the domain of various agencies. Therefore, myopic approach to address the IAP will not be appropriate. There should be some kind of holistic approach to deal with this important issue. As of now, policy documents relating to household energy and indoor air pollution are silent in this issue in South Asia.

### **Blurred responsibility among key stakeholders**

This problem is not unique to household energy and health but applicable to many sectors. Lack of clear cut role and responsibilities of different stakeholders (including government, local government, private sector, academic institutions, NGOs, community groups, INGOs, donor agencies) contributes to duplication, confusion, and waste of resources.

This research reveals that policy documents are not explicit on the role of stakeholders. In the absence of clear cut roles and responsibilities, some stakeholders are restricted to limited role in spite of its huge potential. For instance in Pakistan, the role of non-state actors has been restricted to awareness with no mention of their monitoring roles. The role of private sector and NGOs for policy implementation is not explicit in Rural Renewable Energy Policies of Pakistan. Similarly, Nepal's Rural Renewable Energy Policy 2006 is also made passing remarks of role of private sector and NGOs.

### **No integration of technology with behavioural aspects**

Despite the absence of concrete policy on IAP, government in South Asia are promoting several technological interventions to reduce the impact of indoor air pollution. Subsidies to LPG, biogas, kerosene, improved stoves are some examples. However the critical issue is how far policies are formulated on the real needs of the people and how much benefits people are getting from it. In the context of South Asia, it appears that policies do not focus on the need based approach of technology development. Majority of policies fail to give adequate behavioural and social dimension which results in non-acceptance of the policies interventions by the people.

Policy directive are technological focus in its approach with insufficient attention on the relevance of technology with people's needs and resources available with them. The cultural places of technologies are also not given any weightage in energy policies of South Asia. This has lead to the failure of many policies being implemented. (See country report for detail analysis)

### **Weak Implementation arrangements**

Policies fail to identify responsible body or implementing arrangements. Thus policy appears to be sound on paper but it will be difficult to implement in the absence effective institutional structures to support the implementation. In addition policies implementation is mar by delay in decision-making, high organizational costs, leakage of funds, non-accountability, etc.

## CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

1. Despite the almost total reliance of the rural population on biomass, a marked lack of national policy, leadership, and coordinated action existed in relation to household energy and indoor air pollution in South Asia. Therefore, there is a need to develop mechanisms for action and coordination in light of local needs, available institutional capacity, and leadership potential.
2. There is an absence of national policy (and sub national) that acknowledges the contributions of a range of actors (government, business, NGOs, and so on) and sectors (energy, health, environment, finance, and so on) and that result in coordinated action.
3. Normally, communities most at risk exhibit low awareness, low demand, and poverty (often extreme poverty). This requires a combination of user involvement and market approaches which should be supported by the promotion and availability of targeted subsidies or micro credit facilities or both. This has been missing in the policy documents relating to household energy and indoor air pollution in South Asia.
4. Experience has shown that intervention technology, without adequate reference to users' needs have been poorly used and maintained or abandoned.
5. There exists lack of sufficient demands for intervention by the poor. Demand creation is one of the critical policy issues where several actors could play an important role. Once the demand is created, sustainable adoption should also be promoted through greater availability of a choice of appropriately priced interventions through local commercial outlets (artisans, shops, markets).

### 5.2 Recommendations

1. Devising of a draft policy on IAP taking stock from existing policies and findings of the research studies. Effective strategies to reduce the burden of indoor air pollution require commitments from different sectors. Though different ministries aim to address the issue, their efforts stand isolated. Policy needs to be formulated to incorporate environment and health concerns for strategies on energy supply, conversion and use. There is a need for integrated approach and policy to manage this issue in South Asia.
2. Regulatory frameworks are required to provide a supportive policy environment for private sector investment in energy infrastructure that is targeted at cooking and heating needs in both urban and rural areas.
3. A broad based research not merely into the policies but also into the government and non-government programs with a view to identify the cross linkages, gaps and options are required in each country. Ideally, the research programs should be co-sponsored by sectoral agencies which have bearing with energy, health and poverty alleviation programs. Similarly, participation on non-state sector in the process will be essential to instill a sense of ownership from the initial phase of the program.

4. To deal with the information gap, large-scale awareness raising campaigns, educational activities involving relevant sectors, and through the integration of the topic into formal school as well as other relevant professional curricula. International organizations and NGOs should support these efforts as much as possible.
5. The role of media and other civil society actors needs to be enhanced from “merely creating awareness” to one that promote monitoring, accountability and feedback.
6. Non government organizations should be brought to scene when it comes to devising and influencing policies. The culture of influencing policies through communities should be promoted. Involving and engaging those living in poverty, particularly women, and responding to their needs and aspirations, will be critical in identifying and implementing successful solutions.
7. Establishing the role of different actors;
  - Government: Create an enabling environment
  - Non Government/Academia: Awareness, Monitoring, accountability and feedback
  - Private Sector: Provide products and services
  - Donors: Place in their strategic plans, focused programs
  - Communities: Raise voice, find appropriate forums, linkages with various tiers of government and non government actors through their representative groups
8. Realizing the rural demography, improved cooking stoves with improved combustion characteristics, and biogas should be widely promoted to reduce harmful emissions. The important role of biomass should be recognized in the national policies in various social and economic sectors; e.g in rural development and health sectors, in order to develop and support coordination of different sectoral policies.
9. IAP problem encompasses housing, health, gender, energy and environmental implications, specialists focusing on these thematic areas in country governments and inter-governmental organizations should be made to work together to take responsibility.
10. Need for a national level institution to provide quality standard of different equipment for reducing indoor air pollution. Similarly, this institute should also involve in Research and Development to reduce IAP in future.
11. Given the fact that kerosene subsidy is not reaching the targeted end users and diverted towards adulteration, government should consider elimination of kerosene subsidy with other policies to support lighting needs of poor. Provision of subsidy for solar lantern as short term policy and on the long term expansion of rural electrification net work will help in meeting this goal.
12. Need for innovative approach to promote the use of better energy-using devices such as improved stoves, biogas plants, etc. The government should consider setting technical standards (promote stoves which has high combustion efficiency) for and provide credit facilities and encourage promotional support to stove manufacturers.

## ANNEX

### SUMMARY OF POLICY RESEARCH ON HOUSEHOLD ENERGY AND INDOOR AIR POLLUTION

#### INDIA

##### 1. Overview of energy scenario in India

In India a large population still continues to be dependent on biomass energy, according to the Census of India 2001 of the 138,271,559 rural households, 90% continue to use fuel wood, cow dung cake and crop residue for cooking while 56.4% do not have access to electricity (RGCC, 2001)

Traditional energy sources such as fuel wood, agricultural residues and animal manure constitute a large part (nearly 40%) of the total energy consumption (Planning Commission 1997; MNES 1996; MoF 2000). It is estimated that about 90% of the rural domestic energy demand is met through non commercial fuels such as fuel wood, dung cake and crop residues (Pandey 2002). Among the various bio fuels used for cooking in rural households, share of biomass is relatively high. In terms of quantity, the estimated consumption of fuel wood in early ninety was 252.1 MT; followed by dung cakes at 106.9 MT and agricultural residues at 99.2 (Joshi et al. 1992).

As per the latest census data, 90% of the rural households and 72.3 % of the total households in India still rely on solid bio fuels for domestic cooking needs. With growth in per capita income and urbanization, households tend to move from use of solid fuels to more convenient gaseous fuel (LPG). During the last decade there is a growth in share of clean fuels for cooking, mainly in urban areas. Factors that contribute to this trend include poor access to biomass fuels in urban areas, inconvenience of transportation and storage and improvement in availability of clean fuels. Nevertheless, poor households in urban areas still use solid biomass fuels in less ventilated kitchen where the levels of pollutants would be high.

Among bio fuels, fuel wood consumption is the highest in rural India, with the states of Madhya Pradesh, Bihar, Orissa, Andhra Pradesh and West Bengal accounting 51% of total consumption. Among the other two fuel categories, the consumption of crop waste was found to be highest in east-coast states (Tamil Nadu, Andhra Pradesh, Orissa and West Bengal) contributing 50% of the total; and that for dung cakes, Uttar Pradesh appeared to be largest consumer.

An important interpretation of high consumption of bio fuels in rural households is that such fuels are available in larger quantities or are easily available as compared to commercial fuels.

The estimated monthly per capita consumption of commercial/modern fuels in rural areas in India is far less than that of bio fuels such as fuel wood and chips and kerosene in all the states, except in Delhi and Punjab. LPG penetration is still very low in rural areas in most of the states with monthly per capita consumption varying between 0.04 (for Madhya Pradesh and West Bengal) and 2.15 (for Delhi).

Projected energy demand shows considerable increase in LPG demand for household cooking. Kerosene requirement is expected to fall with acceleration in rural electrification. However there will be no significant change in bio fuel demand.



## 2. Health impacts of indoor air pollution

Though epidemiological studies linking health impacts of Indoor air pollution carried out in India are limited by number, considerable numbers of studies from other developing countries have reported health risk of exposure to indoor air pollution. More than a dozen studies reported the relative risk of exposure to indoor air pollution with ALRI:

Analysis of large scale national survey conducted in India reported that women using bio fuels were three times more likely to have tuberculosis than women using cleaner fuels even after controlling the confounding effect of socioeconomic factors (Mishraetal;1997). A case study in India reported an excess risk of cataract among people using bio fuels (Mohan et al 1989). A study conducted by Mavalankar (1991) in India, reported that pregnant women cooking with bio fuels had greater chance of stillbirth.

As per the reported burden of diseases estimate, indoor air pollution is the third most important risk factor (next to poor water and sanitation and malnutrition)of ill health and responsible for 17% of all deaths among children under five in India (Smith KR, Mehta S, Feuz M. 2004).

## 3. Key stakeholders in policy formulation for managing indoor air pollution issues in India

Indoor air pollution is a multi-dimensional problem. Many agencies including ministries in the state and central government, planning commission, Research Institutes, Non Governmental Organisations (NGOs), multinational organizations and other donor agencies are involved in managing household energy, indoor air pollution and health issues in India.

The government of India over the years has attempted to address rural energy issues through various committees such as Fuel Policy Committee(1974),Working Group on Energy Policy (1979), Advisory Board on Energy(1985), Energy Demand Screening Group (1986),etc. but to date their has been no single comprehensive energy policy for the country.

The planning commission established by the government of India in 1950 is responsible for assessment of all resources of the country and preparation of development plans for the most effective and balanced utilization of resources and determining priorities. However agreement to the plan is the responsibility of the Prime minister and Chief Minister of the States. Ministry of Finance allocates funds to various ministries to support/implement various development plans.

The Energy Policy Unit in the Planning Commission studies and analyses the inter-sectoral issues on energy. They coordinate with various ministries, local authorities and NGO's to integrate their views in preparing development plans and allocation of funds to various ministries.

Several other ministries which have some impact on indoor air pollution are Ministry of Health and Family Welfare (MoHFW), Ministry of Petroleum and Natural Gas, Ministry of New and Renewable Energy ( MNRE Ministry of Environment and Forest, Ministry of Women and Child Development , Ministry of Rural Development. Among all ministries, Ministry of New and Renewable Energy is directly associated with several interventions including biogas, improved Chullas, Solar power to deal with problems caused by indoor air pollution. However, it does not mean that other ministries have little role. Their role is also crucial as Household Energy issues are linked with so many sectors. While all ministries have some policies/initiatives to address indoor air pollution issues directly or indirectly, integrated approach/coordination between various ministries is still missing.

## 4. Analysis of existing Government policies to address indoor air pollution issues in India

### 4.1 Sources

#### **Access to modern energy services:**

Switching from solid unprocessed biomass fuels to more efficient clean fuels such as LPG, kerosene and electricity can reduce indoor air pollution levels substantially and improve health of many poor people. Compare to other clean fuels, electricity for cooking is expensive and also access to electricity is uneven. About 57% of rural households and 12% of the urban households (total of around 84 million households) in the country remain unelectrified in 2000 (UNDP 2004). Even in the electrified villages, erratic power supply is a problem. Hence use of electricity is not widely accepted option for cooking in India.

Cooking with LPG is convenient and also produces less emission. It has been reported that if a household shift from crop residues to LPG, indoor air pollution levels could be reduced by 95% (Smith, Zhang, Uma et al 2000). Recent cost effective analysis done by WHO reveals that by providing LPG, or biogas to 100 million homes would reduce the exposure levels of harmful indoor air pollution levels among 473 million people and save 282, 000 premature deaths due to respiratory diseases per year (WHO 2006).

The government of India has taken several measures to encourage the use of LPG and kerosene to meet household energy needs. Liberalisation of LPG market improved the availability of LPG and kerosene. Till early 90's, the supply of LPG was limited, as a result very few households used LPG for cooking. Waiting list to get a new LPG connection was long; sometimes it took one or two years to get a LPG connection. In 1993, the government liberalized the LPG market by allowing the private markets to sell LPG and kerosene at market price.

Retailers have been authorized to sell imported LPG, while the custom duty has been reduced in a phased manner. Public sector undertakings (PSUs) have taken measures to increase the availability in rural areas. Extension counters were opened in rural areas. As a result, the number of LPG connections increased from 18.1 million in 1992 to 79.6 million by 2004 (Teddy 2004/2005 )

Historically, the cost of LPG and kerosene for household use have been subsidized through administered pricing mechanism (APM) that allowed cross subsidy (taxed certain fuels such as gasoline, aviation turbine fuel, naphtha, fuel oil and subsidized kerosene and LPG) for all households those who have LPG connection with the public sector oil companies. In the mid 90s the government setup a high level group to go in to the restructuring of the oil industry. As per the recommendation made by the group, phasing out of APM was initiated in 1998 and by 2002, the APM was completely dismantled. But the government still continued to control on the prices of LPG and kerosene. The subsidy on LPG is universal and not restricted to poor or low-income group. Also the subsidy is not restricted to number of LPG connections per household. The distribution of connection and consumption of LPG between the poor and rich and between rural and urban suggest that urban middle and high income category enjoy the maximum benefit of subsidy.

Till early 90s, kerosene was supplied through Public Distribution System (PDS) only and the cost was subsidized. In 1993, the government allowed private firms to import and sell Kerosene however the price is higher than those being sold through PDS. In 1999 , 61 percent of rural households purchased

kerosene from PDS only and 20 percent households depend on kerosene sold through private markets, whereas 19% of households bought kerosene from PDS and market. Whereas in urban areas, 46% of households relied only on PDS and 32% of households bought kerosene only from markets and 22% households used both PDS and market for kerosene (Gangopadhyay et al 2004). Kerosene in rural areas is primarily used as a fuel for lighting, whereas in urban areas its primary use is for cooking. Number of reports suggests that kerosene subsidy is misused by way of illegal diversions. The diverted supply could be for household use (at higher prices than the subsidy price) or for adulteration in transport sector mainly for diesel. It has been reported that the diversion in kerosene supply could be as high as 50% (UNDP/ESMAP 2003).

Considering the misuse of subsidy and heavy burden on the Government's expenditure, it is time to reconsider the existing subsidy scheme. It has been suggested to revise the existing subsidy scheme by targeting the subsidy for lower economic strata. For this, coupon or smart card based subsidy with efficient administrative scheme could be explored (TERI 2005, integrated energy policy, Planning commission 2006).

As a long term policy recommendation, complete electrification of rural households and elimination of kerosene subsidy will provide a way to switch over to LPG.

### **Renewable energy technologies (RET's)**

Historically, the renewable energy program in the country can be traced back to late 1940's involving biogas plants and improved cook stoves programs, but system-wise it was the oil-shock of 1973 that institutionalized the drive for renewable energy. To provide focused attention to the development in a little over two decades since its institutional inception, India's renewable energy program has become one of the largest in the world. The MNRE today offers the legal, financial and administrative framework for promotion and investment for a range of environmentally benign renewable energy technologies (RETs) be it biomass, solar, wind or water.

The important government programs addressing the energy conservation and indoor air pollution are the National program for improved Chulhas (NPIC), National Project on Biogas Development (NPBD) and the solar energy program.

### **National Program of Improved Chullas**

Rural women are the major beneficiaries of this program as the program helped in improving their health and conserved fuel and forest. National Program for Improved Chulhas (NPIC) is the largest rural energy program, in terms of reach, implemented by the MNES through state nodal agencies and NGOs. Under the program IC's with heat transfer efficiency of 20-30% as against the traditional chulhas with efficiencies of 8-10%, were being implemented.

The ministry has also developed over 100 models for various commercial, community and household applications and evolved ISI standards for portable metallic IC's. The IC's not only lead to fuel conservation and a check on deforestation but also help in removal of smoke through chimney. However, with just about 25% of the potential population covered by the NPIC in about two decades of operation and with mud IC's having a life span of 5-8 years considerable challenges remain in scaling up of these technologies. The current IC dissemination rate of 17.6 lakhs/year, as per project achievements, would require another 48 years to cover the remaining potential population. Another setback is since 2002, central government discontinued its support but directed state government to continue the program. As a result many technical backup units were closed. Only few states are taking up actively.

TERI and Winrock international conducted an evaluation study for the World Bank in 2002, documenting the success cases of the NPIC program in India, six states namely Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra and West Bengal (World Bank 2003). The evaluation was based on primary survey and focused group discussions with the various stakeholders. The study concluded that the traditional chulha is still the most commonly used device for cooking (TERI 2004). The study indicated that following could be the reasons for the limited success of the Improved Chullhas program.

- The program was target-driven, rather than need-driven.
- Failed to identify proper market for the stoves, in some regions
- It was introduced in places where people did not spend money for buying stoves or fuels.
- Lack of effective awareness creation: have not effectively promoted the health benefits of improved chulhas.
- Cost of improved stoves could be a significant barrier, especially in areas where little expenditure is planned for stoves or fuel.

### **National project on biogas development**

The National Project on Biogas Development is a centrally sponsored scheme which is being implemented since 1982-83. The National Project on Biogas Development (NPBD), the largest rural energy program of the MNES in terms of investment, is the oldest renewable energy program in the country in operation since 1981-82. The biogas program serves multiple objectives of providing clean and cheap renewable energy for cooking, enriched organic manure, freedom from kitchen pollutants (smoke and soot) and checking the indiscriminate and unsustainable exploitation of natural resources in rural areas.

Cost effective analysis of various models developed under the program by the ministry and by other leading agencies like TERI show that biogas on a life cycle basis is not only cheaper than LPG but also use conventional biomass fuels (dung, fuel wood and dung). For example, a 2 cubic meter biogas plant, considered sufficient for a family of four and requiring about 50 kgs of dung per day, generates about 30 man-days of skilled and un-skilled employment and produces around 1.3 tons of organic manure per year. With the average life of family type biogas plants installed in the country estimated at 10 years (MNES) and the current dissemination rate of 1.48 lakh plants per year, 100% achievement of the identified potential is expected to take another 56 years. Despite the re-orientation of the financial incentives under the National Biogas and Manure Management Program (NBMMP) a modified version of NPBD- considerable opportunities exist for commercialization and market orientation under public private partnership frameworks.

The State nodal departments and agencies and Khadi and Village Industries Commission (KVIC) are involved in implementation of the program. The grass root level voluntary agencies and self-employed trained workers are involved for installation of biogas plants and providing maintenance support. Village panchayats and local bodies, such Mahila Mandal and Yuvak Kendra are also associated with organization of awareness camps and selection of villages and beneficiaries in many States. The program is implemented in a cluster village approach. The proper monitoring of the program is ensured through various initiatives such as, demarcation of area of operation for each agency, sharing of lists of beneficiaries among different agencies, maintaining database of village-wise beneficiaries, embossing identification marks on each plant and fixing of photographs of beneficiaries in subsidy disbursement records.

The government provides subsidy to the beneficiaries to encourage them to adopt the biogas plant. Apart from subsidies financial support is given to the Biogas Development and Training Centres (BDTC) for conducting training programs on biogas construction for turn key workers, user training programs for the beneficiaries and for awareness and publicity.

The efforts of the government in dissemination of the biogas plants is commendable however, there are some barriers in the program namely institutional, economic, technical and lacunae in implementation strategy.

There is a need to frame a concrete policy on subsidies for a period of at least five years, within the NPBD. At the field level, several NGOs have effectively integrated biogas program with other developmental programs such as watershed and women's development. There is a need to develop and establish such linkages at the policy level as well.

### **Solar energy program**

The solar energy program in the country is one of the largest in the world covering solar PV for lighting, solar thermal applications for water heating and other applications like solar cookers and solar PV water pumping systems.

The cookers are sold through state agencies as well as associated promoters like Aditya solar shops, NGOs, cooker manufacturers, women's organizations, SHGs etc. The Government provides incentives to the program operating agencies. Support is also provided for organizing promotional activities of solar cookers. Beneficiaries can avail 50% subsidy on the concentrating type solar cooker.

### 4.2. Ventilation

Improved ventilation arrangements in households through hoods, adding windows and creating gaps between the top of the wall and roof can help in eliminating the smoke, thereby reducing the exposure levels to indoor air pollution. In India very few households have this practice. However there is no policy initiative to promote such intervention. There is a need to document such good practices and promote them.

### 4.3 Behavioral changes

Promotion of behavioral changes is one of the effective interventions to reduce exposure levels. For example keeping the children away from stove during cooking, reducing the time spent near fire, placement of stove in a better ventilated place and use of dry fuels for cooking can reduce the pollution/smoke levels.

Awareness creation and educating rural people about the benefits of behavioral changes can help in promoting them. This can be done through formal and informal education methods. Following activities will help in raising awareness level among various stakeholders

- Workshops, seminars and conferences can help in advocating government agencies and policy makers to address issues related household energy, indoor air pollution and health.
- Media channels such as TV, radio, news papers, posters and pamphlets should be used to create awareness about the health implications of indoor air pollution and the need for behavioral changes among general public.

## 5. Key Findings / Recommendations

Addressing indoor air pollution in India would mean making modern fuels (both conventional and non-conventional) and better technologies (including those developed for better utilization of traditional fuels) more popular in rural areas. Recommendations for dealing with this issue are:

- **Need for an integrated policy:** Effective strategies to reduce the burden of indoor air pollution require commitments from different sectors. Though different ministries aim to address the issue, their efforts stand isolated. There is a need for integrated approach and policy to manage this issue.
- **Increase in supply of modern fuels such as electricity, LPG, etc. in rural areas.** Too much dependence on traditional fuels is also an indicator of non-availability of modern fuels and modern energy-using devices in rural areas. Therefore, supply of modern fuels would require:
  - Availability of modern energy-using devices such as electrical appliances, gas stoves, etc. in rural markets, which can be done through: development of means of transportation and
  - Communication in rural areas and establishment of better distribution channels for modern fuels in rural areas
- **Provision for targeted government subsidies:** Considering the merits of LPG in reducing indoor air pollution levels, their usage needs to be promoted in large scale, particularly in the rural areas. The demand for modern fuels, that are relatively more expensive as compared to traditional fuels, is found to be low due to low purchasing power of rural people. Thus providing government subsidies, that reduce the market price of the commodity, would imply increase in demand for modern fuels in rural areas. Though the LPG price subsidy exists in India, it benefits more of urban and high income categories. Considering the government's huge expenditure on subsidy and its beneficiaries, there is a case for targeting the subsidy for poor.
- **Smart card or coupon based delivery mechanism** can be used to effectively target the LPG subsidy.
- Given the fact that kerosene subsidy is not reaching the targeted end users and diverted towards adulteration, government should consider **elimination of kerosene subsidy** with other policies to support lighting needs of poor.
- **Provision of subsidy** for solar lantern as a short term policy and on the long term expansion of rural electrification network will help in meeting this goal.
- Use of better **energy-using devices** such as improved chulhas, biogas plants, etc: The use of such devices would ensure that the traditional fuels such as fuel wood, crop residue, etc. are utilized optimally. Innovative approaches are required to promote improved chulhas.
- The Government should consider **setting technical standards** (promote the stoves which has high combustion efficiency) for improved chulhas and provide credit facilities and encourage promotional support to chulha manufacturers.
- Use of hoods and better **ventilation systems** need to be promoted. Better awareness creation is required to promote these interventions.

**SUMMARY OF POLICY RESEARCH ON HOUSEHOLD ENERGY AND INDOOR AIR POLLUTION****NEPAL****1. Overview of Energy Scenario in Nepal:**

Nepal's per capita energy consumption of about 0.3 ToE (15 GJ) is one of the lowest in the world. Per capita commercial energy consumption, 30 kg of oil equivalent (1.5 GJ), is also very low compared to other countries in the region.

Of the total 380 million GJ the major consumption of biomass energy is localized within the domestic sector with the consumption of about 90.29 percent as compared to 3.47, 1.45, 3.78 and 0.84 percents in the industrial, commercial, transport and agricultural sectors respectively. The pattern of fuel consumption in this sector constitutes of 86.71 percent biomass; 12.72 percent commercial and 0.56 percent renewable, (*WECS, 2006*).

The residential sector energy consumption is the largest. This energy constitutes mainly of biomass energy comprising of 89.41 percent fuel wood; 3.93 percent agricultural residue and 6.66 percent animal dung, (*WECS, 2006*).

It is estimated that, out of the total biomass consumed in the residential sector, 88 percent is accounted for the rural areas and only 10 percent is consumed in the urban areas. There is a tendency of substitution of biomass in the urban areas by the commercial fuels in a slow pace and in the rural sector it is almost status quo. The determining factors being accessibility and affordability, which are comparatively, lower in the rural areas than that in the urban areas (*WECS, 2004*).

A substantial amount of biomass is used in the residential sector for cooking in both the rural and urban households. Other than these end-uses, biomass is also used for heating, water boiling and agro-processing. Generalizing the estimated data of 2003/04 regarding the end-use of fuel wood, cooking alone accounts for nearly 80 percent and 64 percent for rural and urban areas respectively. Similarly animal feeding takes the second largest share with 17 percent in the rural sector and 8 percent in the urban sector.

Comparative assessment of the energy consumption in the residential sector within a period of 10 years, using 2001 as the base year reveals the following features:

- existing prominence in the use of traditional biomass, with an increase of nearly 0.85 percent within the period
- a decrease in the use of commercial energy forms by more than 1.22 percent

**2. Indoor Air Pollution and Health Implications**

Traditional fuel based energy system in Nepal is significant in terms of volume of consumption and net energy content. This is due to the low efficient traditional cooking stoves (5-10%) against the improved cook stoves (15-30%). The common end-use devices are mainly the tripod stand, mud stoves, improved cooking stoves and so on. In these stoves the combustion is very incomplete and thus results in high emissions.

Direct health consequences such as burns to children falling into open fires, as well as the less direct health impacts associated with a range of other energy-related socio economic factors are a result of using traditional biomass fuel. The total evidence available on the health consequences is of variable extent and quality, partly due to a paucity of research attention in this field, but also due to the

methodological challenges of demonstrating cause and effect where a range of social, environmental and other factors interact.

There is consistent evidence that exposure to biomass smoke increases the risk of a range of common and serious diseases of both children and adults. Chief amongst these are acute lower respiratory infections (ALRI) in childhood, particularly pneumonia. A study conducted in a hilly remote area of Nepal to find out the relations between indoor air pollution and ARI in infants and children less than 2 years showed that episodes of moderate and severe ARI increased with increments in the level of exposure to indoor air pollution. The study suggested that indoor air pollution is an important risk factor of ARI (Pandey, M. R, 2001). This is because the mobility of children less than 5 years of age is directly proportionate to that of the mother.

Nearly 300,000 houses in Nepal using fuel wood are exposed to pollution levels of above 2,000 g-C per day<sup>1</sup>. The number of households exposed to the pollution with respect to fuel use clearly indicates the need for moving into the regime of cleaner energy forms

### 3. Analysis of Existing Policies

#### Policy Interventions

The country has no specific policy addressing the issues of Indoor Air Pollution. Even the existing energy policies remain distant from the issues of IAP. Some of the policies which are linked with household energy, health and indoor air pollution are; Science and Technology Policy, Alternative Energy Policy, Hydro-power Development Policy (1992) and Rural Energy Policy (2006).

The Hydro-power Development Policy (1992) underlined the need to cater for remote and inaccessible mountain regions where extension of the national electricity grid is not possible. The policy therefore makes the implementation of small-hydro-power projects in rural and remote area as a matter of priority. The Science and Technology Policy put emphasis for implementing programs for long-term development of Science and Technology through management of natural resources and environment conservation for the overall development and self-reliance. This policy is silent on issue relating to Indoor Air Pollution.

Alternative Energy Policy attempts to provide alternative technology for the poor as a substitute for rural energy needs. However, cost of alternative energy technologies is prohibitive for the rural poor. Subsidy driven approach reveals this dilemma. Technologies are being imported, manpower is not sufficient thus sustainability is yet doubtful. Rural Energy, 2006 sounds out its thrust on indoor air pollution through developing and promoting the use of environment friendly technologies.

The main thrust of Rural Energy Policy is to reduce dependence on traditional fuel sources and on imported oil through development of water resources and non-traditional energy sources such as bio-gas and solar and wind power. But the REP does not focus on the need based approach of technology development. It failed to identify responsible body or how to go about

The major concern of rural energy sector in Nepal relates to rural electrification and providing efficient forms of energy for cooking. Rural-based programs and activities are key priorities in Nepal's own Poverty Reduction Strategy with special emphasis on the mountain and hill areas. Access to modern energy services such as LPG, kerosene, electricity and modern energy services is difficult because of low purchasing capacity of the rural poor. To facilitate the access to electricity, the government has initiated the following programs for micro-hydro technologies:



- a) De-licensing of all electricity installations below 100 kW initiated in 1984
- b) 50 percent subsidy (75 percent in case of remote areas) on electro-mechanical costs, including generators, initiated in 1985

Besides, the Government of Nepal introduces a long-term credit at a lower interest rate for investment in the field of renewable energy. To encourage financial institutions to invest in renewable energy, efforts are underway to create an institutional credit mechanism through credit line and credit guarantee scheme under the Rural Energy Fund, which will supervise and disburse the subsidies.

### **Technology Interventions**

There have been technical efforts in developing and promoting efficient technologies based on biomass, electricity as well as solar. Besides, initiatives are undertaken to introduce new technologies to improve the efficiency of traditional technologies. To improve the living conditions of the rural population of Nepal by easing their access to energy technologies with better performance in terms of productivity, versatility in use and environmental impacts, Biogas Support Programs, BSP and Energy Sector Assistance Program ESAP have been undertaken with the Government of the Netherlands and Denmark respectively

The programs under BSP (through biogas Sector Partnership-Nepal) as well as ESAP (through AEPC) provide subsidies for communities' and households' for the establishment of biogas systems, electricity generation by micro-hydro plants and solar energy solutions. The fund also supports technical assistance in planning and execution of individual plants. Further, ESAP's focus areas also include training in building improved cooking stoves for private households and also for on-grid electrification through Nepal Electricity Authority.

Currently, with non-governmental organizations and the private sector as intermediaries, the programs have reached nearly 500,000 households with different technologies since the inception of the program. Though unintended, these technologies have contributed to reduce the impact of IAP. Besides, the use of hoods leading to significant reduction in IAP have been promoted by Practical Action Nepal and Kathmandu University in recent years ( See country report for detail analysis).

From the review of the policies it is evident that the achievements made in reducing IAP have not come from any intentional efforts either from the government or the stakeholders involved in the promotion of these technologies. It has only been a slogan used for promotion of the technology as a commodity rather than a means for IAP mitigation.

Table 1: Focus Area, Measures Adopted

Approach Point	Measures	Government Policy	Implementing organisations (NGOs/INGOs/CBOs)
Source	<b>Improved cooking devices</b> Chimneyless improved biomass stoves Improved stoves with chimneys	N/A • Targeted Long-term program	• Technology Development and promotion, • Awareness creation, community mobilisation construction, local skill development
	<b>Alternative fuel-cooker combinations</b> • Briquettes and pellets • Charcoal • Kerosene • LPG • Biogas • Solar cookers (thermal) • Electricity	• Yet to be recognised • Restriction in the use • Market –oriented • Market Oriented • Targeted Long-term program • Targeted Long-term program • Targeted Long-term program	• Technology Development and promotion, Awareness creation, community mobilisation construction, local skill development • Technology Development and promotion, Awareness creation, community mobilisation construction, local skill development • Technology Development and promotion, Awareness creation, community mobilisation construction, local skill development
	<b>Reduced need for the fire</b> • Efficient housing	N/A	N/A
Living Environment	<b>Improved ventilation</b> • Hoods / fireplaces/ Windows / ventilation holes	N/A	• Awareness creation, construction, local skill development, pilot programs
	<b>Kitchen design and placement of the stove</b> • Kitchen Improvement	N/A	• Awareness creation, construction, local skill development
User	<b>Reduced exposure through operation of source</b> Fuel drying Use of pot lids Good maintenance Sound operation Reductions by avoiding smoke Keeping children out of smoke	Elements to be to be monitored periodically	• Awareness creation, construction, local skill development, focus areas within the elements to be periodically monitored

There exists an inter-linkage relation between emission, concentration and exposure. Exposure is complex product of three subsystems forming the household energy system: the source, the living environment and users. The analysis of policy measures in these three areas are summarized in Table1.

#### 4. Key Findings/ Barriers/Gaps in the Policy

##### **Policy Barriers**

- Lack of priority in policy regarding biomass energy: The Forestry Acts and Regulations and any other policies do not adequately address the policy issues on biomass energy. Moreover there is no policy document on IAP related matters in Nepal except for the guiding principles of the Five Year Plan Documents of National Planning Commission.
- No integrated/comprehensive energy policy: There is a need for a comprehensive energy policy, which includes Indoor Air Pollution and techniques and technologies to tackle IAP.
- No incentives on biomass based technologies except in Biogas: The government of Nepal has not given any attention and incentives for the development and promotion of biomass energy technologies except for the biogas and improved cooked stoves. As such huge amount of the biomass energy resources is being wasted.
- Policy Support for R & D on Biomass Energy System: There exist no policy support for the research and development of biomass energy system in Nepal.

##### **Institutional Barriers**

- Absence of an effective central planning organization: Though there exist Ministry of Forest and Soil Conservation, Ministry of Agriculture and National Planning Commission, for planning of Forest and Agriculture related matters, these institutions overlook the planning aspect of biomass energy resources and technology. Water and Energy Commission Secretariat maintains the database of biomass energy resources but it also lacks have no strategy to deal with indoor air pollution. The Ministry of Environment, Science and Technology look after environment and alternative energy systems and Ministry of Health and Population look upon the health aspects of indoor air pollution. The previous plans and the recent 10<sup>th</sup> Five Year Plan have not address the issues of IAP, and strategies for overcoming these problems in its document.
- Blurred responsibilities between policy formulation, implementation, operational and regulatory institutions: The responsibilities allocated to various organizations for policy planning, strategy formulation, implementation and operation and regulations is not well defined.
- Absence of an institutional framework for coordinated and integrated development: Presently there is no well-defined institutional framework for the coordinated and integrated development of biomass energy system, environment and health. There exist jurisdictional overlaps and the challenge of maintaining coordination between public and local bodies, which have to be sorted out.
- Need for demonstration/ pilot units for boosting the use of technologies. There is a need for demonstration/pilot units for boosting the use of the biomass energy systems.
- Lack of Inventory of locally available biomass energy technologies

### Other Barriers

- Technical immaturity, limited adaptive R & D capacity
- Lack of information about efficient and reliable technologies, health and environment concern on biomass energy resources, market potential etc.
- Low investment in bio-energy because of perceived high risks on investment on biomass technologies.
- Non acceptance of technologies by the communities. For example, beehive briquettes stove was promoted to Phakdung village (2653m) of Khumbu Region in Nepal. After the training period the conclusion was that the making of the briquettes was a dusty affair and disliked by the women because of the high emission of black charcoal dust (Nienhuys, 2003). Similar cases have been reported while introducing the combined use of human faeces and animal dung in biogas technology.

## 5. Recommendations

- Indoor Air Pollution should be considered as a national issue and be included in the Planning Document of National Planning Commission, Living Standard Survey, Energy Promotion Process, local development as well as National Health Policy.
- The Importance of biomass fuels in various social and economic sectors must be recognised; e.g. in rural development and health sectors, in order to develop and support coordination of different sectoral policies. In view of the adverse implication with present practices it is pertinent to educate, inform and communicate the various aspects related with present energy use and its practices to health professionals, communities, national policy makers, program implementers, development workers and people at large.
- Since IAP is an inter-disciplinary and inter-sectoral issue, it is difficult to determine who should take responsibility for it within an institutional framework. Steps must be initiated for identifying institution/institutions for undertaking the task and setting up necessary framework.
- IAP problem encompasses housing, health, gender, energy and environmental implications specialists focusing on these thematic areas, government and inter governmental organizations should work together with research institutes to
  - Review past works, compile necessary data and develop standards that include the emission aspects and the overall conversion efficiency.
  - Enforcements of compliance with the standards should be pursued.
  - Disseminate, create awareness, assess market and develop market mechanisms for promoting certified appliances/equipment
  - Regulate air quality standards and design standards for stoves
- The impact of IAP must be assessed periodically. The issues under consideration are far reaching and must be conducted meticulously.
- With IAP being a new venture in the country, it calls for necessary capacity building for quality assessment, quality assurance and standardization, developing IAP reducing technologies, up scaling/upgrading existing technologies and demonstrating adverse effect of Indoor Air Pollution on health in general and to women and infants/small children in village.

- Developing necessary human resources or upgrading existing capacity of research organizations, health professionals, energy experts, local development personals and community.
- To enable access of the cleaner technology reduce tax on fuel and appliances and also provide time-limited subsidies for initial uptake and generating demand and thereby creating market conditions for lower prices and more consistent quality.
- Access to information and education on health, indoor air pollution, energy, and development must be included in school curricula, and also disseminated through various media as well as adult education programs.
- Linked IAP programs and income generating activities as increasing economic status has been found lure users to move up the "energy ladder" .

**SUMMARY OF POLICY RESEARCH ON HOUSEHOLD ENERGY AND INDOOR AIR POLLUTION****SRI LANKA****1. Overview of household energy, health and Indoor Air Pollution**

In 2001 total population of Sri Lanka was estimated to be 18.7 million and about 79% live in the rural areas. The current estimate of annual population growth rate is 1.2% and the population is expected to stabilize at around 25 million by 2020 (Statistical Abstract 2001). This shows a 40% increase of population than the present. The average size of a family in Sri Lanka is estimated as 4.6. The total land area of the country is 6.5 Mha. About 27% of the land area is under forest cover and 4.5% of the land is under water. Agricultural land including homesteads is about 57%.

The energy sector in Sri Lanka is dominated by bio-energy, and especially by fuel wood. The total annual primary energy supplied in Sri Lanka during year 2003 was about 381 PJ (or 9,122 kTOE). This comprises of 50% biomass, 8% hydro electricity and 42% petroleum. The final energy consumption was amounted to about 312 PJ (or 7454 kTOE), 24 % of which was consumed by industrial sector, 25% by transport sector and 51% by household & commercial sectors.

Nearly 80% of the populations of Sri Lanka depend on fuel-wood and other forms of biomass for their daily cooking (Perera & Sugathapala). Thus the major biomass consuming device category is the cook stoves in the domestic sector. Therefore biomass fuels are of crucial importance, especially for rural people who do not have access to other energy sources.

Main source of energy for cooking in domestic sector is fuel wood. In addition, LPG and limited amount of biomass residues, kerosene and electricity are also used for cooking. With the urbanization, there has been a significant trend of switching from fuel wood to other sources, especially to LPG in urban and suburban areas. Kerosene is mainly used for lighting application in rural areas and small percentage is used for cooking application. Prior to marketing of LPG in the country, considerable amount of kerosene was used for cooking. With the availability of LPG, the use of kerosene for cooking has been decreased. But as a result of the recent price hikes of LPG in the country, people are looking for alternative energy sources, such as fuel wood and kerosene.

**2. Environmental & Health Implications**

The emissions of pollutants during small scale biomass combustion such as in cook stoves is unavoidable due to many factors including the heterogeneous nature of the combustion process, lack of proper control, design constraints, etc. In addition a major part (80-90%) of the potential heat in the fuel is dissipated to the environment due to low efficiencies, resulting in the rise of the kitchen temperature to uncomfortable levels, especially where kitchen ventilation is lacking. The level of pollution and heat dissipation will vary depending on the types of stoves and fuels used. In addition to the level of emission, the exposure level to pollutants and the duration of exposure.

The survey conducted in Sri Lanka based on health status in combination with IAP reveals the following findings;

- Cooking smoke is a contributing factor for chronic obstructive pulmonary disease – based on a study at Kandy Central Hospital

- Respiratory problems due to inadequate ventilation and cooking with fuel wood – based on a study for the low income families in Colombo suburbs clearly shows that the hospitalization percentage is high for respiratory infections in each year when compared to other diseases. LRI is mainly due to breathing of polluted air either out door or indoor. Research carried out from University of Colombo on risk of cataract formation with exposure to biomass smoke shows following results on variations in the respondents with the number of years cooked using firewood.

### 3. Analysis of the existing policies on Indoor Air Pollution

In general, policy formulation responsibility lies with the relevant line Ministry or with several Ministries in case of a subject area that falls under the purview of several Ministries. The formulation method could slightly vary from Ministry to Ministry but in general the following sequence is adopted. The process starts with the input from subject specialists through consultative process of major stake holders. At the same time, its compatibility with the constitution is also looked into. Once it is done, it is considered as a 'White Paper' and makes it available for public opinion and comment. Thereafter the policy documents is finalized and forwarded for the Cabinet approval.

#### **Institutional Structure**

In Sri Lanka, energy and environment aspects are mainly handled by the Ministry of Irrigation, Power and Energy (MIPE) and Ministry of Environment & Natural Resources (MENR) and their agencies. In 1995, in accordance with the economic policy statement of the government of Sri Lanka, which highlights the vital role of the energy sector in the national economy, MIPE was given the responsibility of formulating a national energy policy. The MENR, set up in 1997, has the mandate to provide leadership in formulating and reviewing national environmental policy. The ministry has prepared three main policy documents, the National Forestry Policy 1995 and the National Environment Action Plan 1997, which have direct bearing on bio energy development in the country and National Environmental Policy in 2003. It has also prepared the Forestry Sector Master Plan 1998. It should be noted that, in addition to MENR and its agencies, there are many other ministries and their agencies concerned with the protection of the environment which could have some bearing on indoor air pollution. These include, Ministry of Science and Technology, Energy Conservation Fund (ECF), Forest Department, Ministry of Agriculture, Ministry of Finance and Planning, Ministry of Transport, National Engineering Research and Development Centre, National Science Foundation, Universities, etc. Further, there are a number of NGOs active in Sri Lanka like Integrated Development Association (IDEA). They perform a crucial role in ensuring effective public participation in decisions and actions that pertain to the generation of energy and conservation of the environment.

#### **Existing Policies**

As in the case of policies, there is no single body that could be held responsible for policy relating to IAP. The issue of IAP is indirectly addressed by several policy documents relating to energy, health and environment by different agencies as outlined in previous section.

From time to time, as given below, Sri Lankan Government has taken several initiatives mostly aiming at fuel wood conservation through the improvement of burning efficiencies but not IAP as the prime target.

- 1950s – Introduction of South Indian 'Herl Chulas' to tea state workers.
- 1970s – Introduction of improved stoves by CISIR and some NGOs
- 1980s - National Fuel Wood Conservation Program

As discussed earlier, none of these initiatives were aimed at reducing the indoor air pollution but had other objectives. Further, these have not been communicated properly to the majority of people to whom the program was formulated. Although there is a potential for development of required policies for indoor air pollution control in Sri Lanka, it has not received due consideration in national development plans and programs.

### **National Policy Documents**

Several documents/ reports have been prepared on the national policies related to energy and environment. These include: National Forestry Policy 1995, Forestry Sector Master Plan 1998, National Environment Action Plan 1997 and National Environment Policy 23. The contents of the four main documents related to indoor air pollution are summarized below considering three different categories as sources, living environment and behavior.

### **Sources of Pollution**

To promote improved cook stoves or any other mechanisms there are no policies directly implemented to fulfill the requirement. There are no subsidies proposed or implemented for the manufactures or users of ICSs. Fuel subsidy on kerosene is available in Sri Lanka aiming fewer prizes for rural lighting. The policy documents relating to indoor air pollution are; National Energy Policy & National Forestry Policy. Although the National Energy Policy is still a draft document, its importance has been accepted by the government. The policy outlines several policy relating to household energy. Several policies instruments are proposed for clean fuel such as electricity, biogas, Solar Power but these are out of reach of the poorest of the poor. Similarly, because of high start up cost, its replicability in a wider scale also pose formidable challenges.

Second important policy is Forestry Policy. This document [MFE, 1995] was formulated by the Forestry Policy Working Group, MFE, in 1995. The scope of the policy is forestry in the broad sense, including its biophysical, environmental, socio-political and economic components. This is the foundation of forestry legislation and for developing supportive institutions. The key objectives of the National Forestry Policy are;

- To conserve forests for posterity, with particular regard to biodiversity, soils, water, and historical, cultural, religious and aesthetic values
- To increase the tree cover and productivity of the forests to meet the needs of present and future generations for forest products and services
- To enhance the contribution of forestry to the welfare of the rural population, and strengthen the national economy, with special attention paid to quality in economic development

With the effective implementation of Forestry Policy, it was anticipated that it will indirectly contribute to reduce the adverse consequences of indoor air pollution.

### **National Environmental Action Plan**

The National Environmental Action Plan (NEAP) 1998- 2001 has been prepared by the MFE in order to set the national environmental agenda for the 21st Century. The NEAP is presented in two sections. Section 1 is on strategy to pursue sustainable development, and defines the policies, institutional shifts and actions needed to meet the environmental challenges that will confront the country in the short and long terms. Section 2 presents the sectoral perspective, which includes an analysis of nine key sectors: land, water, biological resources, coastal and marine resources, industry, minerals, energy, built environment, and environment and health. The following recommendations are presented to biomass promotion;



- Encourage establishment of village wood-lots where possible with private sector participation and home gardens.
- Improve efficiency of biomass utilization through the use of fuel wood, gasifiers and energy efficient fuel wood cook stoves.
- Develop collection, storage and processing of urban biodegradable wastes for biogas generation and develop technologies for biogas storage and use.

However, decision-makers in the country do not refer to the policy when taking decisions on the energy sector. Any implementation of elements of the energy policy so far has been through mere coincidence or through the intervention of other individuals or institutions outside the main administration of the energy sector

**Improvement in living environment** – There exist no direct policy which addressed the issue relating to the improvement in the living conditions

**Change in user behavior** – No interventions or policy recommendations could be defined under this category other than reduction of poverty and redesigning the houses for poor.

### **Current technical interventions**

#### Improved Cook stoves

It has been estimated that, in 1997 approximately 97% of the population in rural areas use fuel wood for cooking and the corresponding percentage in urban areas is 78%, giving 93% in total (FSMP 1995).

At present, several organizations are involved with cook stove development and dissemination programs. The Department of Mechanical Engineering, University of Moratuwa undertakes a research and development program of cook stoves under the Asian Regional Research Program on Energy, Environment and Climate - Phase II (ARRPEECII) funded by SIDA, Sweden. Further, under another research study funded by the Senate Research Council of the University of Moratuwa, the development of a testing facility for cook stoves is in progress. Integrated Development Association (IDEA) is in the process of formulating a network among stakeholders in the country, with the support of the Asia Regional Cook stove Program (ARECOP).

#### **Improved kitchen design/chimneys**

Many kitchen improvement programs are implemented in Sri Lanka. It is an important activity in many of the agendas of NGOs (like ITDG & IDEA) and GOs (CISIR, NERD etc). The primary objective of these programs are to maintain a clean (pollution free) and efficient kitchen. Most of houses smoke pollution and ventilation improvements are not addressed properly probably due to high cost and lack of technical know how. To address all issues the first effort in proper kitchen improvement made by IDEA in establishing a demonstration kitchen in one village in southern region of Sri Lanka. Activities done under the project;

- Awareness creation on the project and its benefits
- Social mobilization to secure community participation

IDEA has an opinion that providing chimney hoods were more effective than providing chimney stoves. Chimney stoves were found to be poorly maintained due to practical reasons leading to poor performance, thus making it worse than traditional stoves.

#### 4. Key findings / Policy Gaps/ Barriers

- Indoor air pollution has been given the lowest priority in reducing/minimizing air pollution and policymaking. There are no institutions responsible for the promotion of ICSs and formulation of policies in relation to indoor air pollution in the country, resulting in the lack of national-level coordination among different agencies.
- At present, there are many GOs and NGOs involved in indoor air pollution activities, but in an uncoordinated manner. These organizations have limited capacity and resources to undertake any type of implementation projects successfully. Moreover, their involvement and interests, in most cases, are just driven by the availability of funding for particular projects rather than influenced by long-term national interests, thus failing to have a real impact. In particular, village-level social organizations are very weak in promoting new technologies.
- The ICS have significant impact in the country even though the majority of households still use conventional stoves. Although a number of training programs have been conducted for the manufacturers of ICSs, the quality of most of the stoves available in the market is substandard.
- An institutional barrier to the efficient implementation of policies also lies in the inefficient functioning of government institutions as a result of delay in decision-making and implementation, high organizational costs, leakage of funds, non-accountability, etc.
- Lack of information on measured data indoor air pollution and direct health problems is another barrier to the development of policies and strategies. Likewise, manufacturers, entrepreneurs and users of ICSs lack information on costs and health benefits, performance, operation and maintenance, etc. This lack acts as a barrier to the early adoption and popularization of ICS. In particular, lack of information on pollution data and health effects may directly affects the policy makers decision even though indoor air pollution is much higher than the out door air pollution. Out door air pollution is visible to more people at once and harm is relatively much low.
- 80% of families are still cooking with fire wood and they have their mind set created on cooking with biomass and its taste. Cooking with LP gas or with electric cookers is not very attractive for Sri Lankan woman. They prefer to cook using fire wood due to following reasons;
  - Mentality created on the taste difference and high taste can be get through cooking with fire wood
  - Fear on using LP gas
  - High cost for electricity
  - Unawareness on health effects due to IAP
- Lack of proper education at different levels is a barrier to the effective transfer of information on indoor air pollution. Awareness of indoor air pollution and associated environmental & health aspects among the general public is minimal. There are no specific subject modules on indoor/outdoor air pollution in the curricula of primary and secondary education systems. Even at tertiary level, the relevant subjects are taught only in some engineering fields of specialization.
- More comprehensively, the approach to energy & environment within development programs is itself a barrier. As a result, there exists a wide gap in integrating pollution control and financial

support for this with income generating activities for low-income groups. The present loan schemes of local banks and other financial institutions do not accommodate small scale pollution control projects, unless they are integrated with an income-generating activity. Such a limitation is based on their past experience of poor recovery of loans in rural areas.

- As initial costs of kitchen improvements, construction of chimneys are moderately high for rural & urban poor, dissemination of such technologies requires a supportive financial environment and subsidies, at least during the initial stage of adoption. Most of the financial institutions do not have a separate identified credit line for the energy/ environmental sector. Further, inadequate information and past experience of success and reliability of environmental projects in the country have resulted in long delay in approving loans and reluctance to finance these projects in general.

## 5. Recommendations

### **Establishing National Level Institutional Framework**

There should be a National level coordination effort and holistic approach in Research & Development to reduce IAP in future. Also there should be a National level institutional to provide quality standard.

### **Clarifying the Role of Stakeholders**

Effective implementation of policy rests on active participation of stakeholders including government, local authorities, private sector, community, donors, research institutes, etc. The clear demarcation of role among key stakeholders is critical otherwise confusion and duplications surface. Central government is responsible for taking initiatives to implement policy instruments, finding finances for R & D and assists to overcome all barriers discussed in this report.

Local authorities can assist central government in the routine monitoring of policies. Private sector will have important role in marketing and making of ICSs and other related products with government's subsidies. INGOs & NGOs can play important role in handling of dissemination of information and assisting educational program. Leading NGO "Integrated Development Association (IDEA)" is in the process of formulating a network among stakeholders, with the support of the Asia Regional Cook stove Program (ARECOP).

Donors can assist the government and R & D organizations to overcome financial barriers on intervention/promotion of policy instruments and appliances. Finally community will have critical role to influence for behavioral changes among people by explaining health and other benefits from change in the behavior. They can also assist government in implementing proposed policy instruments.

### **Promoting Policy Instruments**

Since poor households face many barriers to adapt from a range of interventions, it is essential to have an enabling policy. This area of practice is complex and evolving, often requiring solutions that are highly setting specific. Following interventions are suggested for the implementation.

#### 1. Information, education and communication

Empowering the poor through information is critical. As shown by research, significant improvement can be made even by changing some behavior with minimum financial cost, the strategy should be to disseminate the information relating to household energy, health and indoor air pollution. In the school

level curricula household energy (Types of fuels used, efficient cook stoves, ventilation etc), health (health effects, mitigation options etc) should be integrated.

Media including radio, television, and newspapers can be used to raise awareness and disseminate information on technologies and opportunities to support implementation, such as promotions of improved stoves, change in the user behaviors, importance of clean energy for better health targeting various types of audiences including decision makers, professionals, and the public. Adult literacy programs can be used to raise awareness and share experience of interventions, and innovative methods.

## 2. Taxes & Subsidies

Tax on fuels and appliances - Reduced tax on fuels (LP gas & Kerosene) and appliances (Gas cookers, improved cook stoves etc) may promote development of distribution networks and uptake, and it may be seen as efficient if there is evidence of health, education, and economic benefits.

Similarly, subsidies on fuels such as kerosene can be applied to promote use by poor households. Time-limited subsidy on specific products (for example, clean fuel appliances, connection to grid) may be a useful method for promoting initial uptake, generating demand, and thereby providing market conditions for lower prices and more consistent quality.

## 3. Regulation and legislation

Indoor Air quality standards - Although Sri Lanka have air quality standards for urban air, no standard exists for indoor air. Routine monitoring and enforcement is not practical, but it may be useful to set standards and targets linked to specific assessments.

Design standards can be applied to safety (prevention of burns, gas leaks, and explosions); venting of emissions; and efficiency. Although such standards may be difficult to enforce in an informal economy, they could become valuable with wider-scale production.

## 4. Direct Expenditure

Public program provision of appliances - Large-scale public provision of appliances, such as improved stoves or clean-fuel appliances, has generally been found unsuitable. Some form of targeted provision or partial subsidy where households have made informed choices and commit to cost sharing may be useful to stimulate demand and act in favor of equity.

Funding of finance scheme - Meeting everyday cooking is seen as a lower priority. Good opportunities may exist where biomass fuel is purchased and where cost saving combines with other valued benefits, such as increased prestige and cleaner kitchens. Support for such schemes, mainly in the form of raising awareness, skills training in managing funds, and seed funding (the main source of funds being from users) may be cost-effective.

## 5. Research & Development

Surveys of fuel and appliance use, knowledge of risks to health, willingness to pay for interventions, knowledge of and confidence in credit schemes, and the like are important for planning interventions.

Evaluation of interventions should be conducted in a range of settings, using harmonized methods, if possible, that allow local flexibility but permit comparison with other types of interventions and other locations.

Stronger and better-quantified evidence of the effects on health of reducing IAP, which includes exposure measurement, is required not only for key outcomes such as ALRI, but also for other health outcomes for which evidence is currently tentative.

**SUMMARY OF POLICY RESEARCH ON HOUSEHOLD ENERGY AND INDOOR AIR POLLUTION****PAKISTAN****1. Overview of Household Energy**

Some 80% households in Pakistan use traditional biomass fuels including wood, dung and crop residues. Worryingly high proportion of Pakistan's female and children population suffers from diseases that are partly or wholly linked with indoor air pollution including low birth weight, tuberculosis and asthma to name just a few. Besides severe health impacts of indoor air pollution the current fuel use practices have negative social and economic effects for households in general and women and children in particular.

**2. Use of Household Energy in Pakistan**

- According to Household Energy Strategy Study (1992) biomass fuels account for 86% of total household energy consumption in Pakistan. Fuel wood accounts for 54% of the total. 90% of biomass is being consumed in homes;
- Bio fuels are mostly used in traditional stoves for cooking and heating; Bio fuels account for 94% of energy used by households in rural areas and 58% in urban areas. Cooking consumes 82.1%, domestic heating 7.3% and water heating 9.8% of total fuel wood used in domestic sector;
- Cooking is the major end use of fuel wood, crop residues, dung, natural gas and LPG;
- The share of fuel wood in domestic sector is 54%, dung 18%, agricultural waste 14%, natural gas 7%, kerosene and LPG 3% and electricity 4%;
- An average bio fuel-using household uses a mixed type of fuels (Fuel wood 2324Kg, Dung 1477Kg, crop residues 1161 kg and charcoal 115 kg) ;
- In Pakistan the availability of firewood and other alternative fuels and the availability of labor resources for collection purposes are important determinants for consumption;
- Whereas urban household purchase 86% of the fuel wood need, over 69% of the total consumption is collected free, mostly by women and children, in rural areas.
- Per capita wood fuel consumption is estimated to be 0.27 tons in Pakistan. Per capita consumption of wood energy is higher in rural areas and lower in urban areas, where it decreases as the size of the city increases.

**3. Assessment of the Existing Policies**

Since early 1990s Pakistan have produced a range of policy relating to environment, renewable energy, housing, health and women empowerment. Key policies include: National Environment Policy 2005, National Health Policy 2001, National Renewable Energy Development Policy 2006, National Technology Policy 1993 and Recommendations of National Commission for Science and Technology, 2000, National Policy for the Development and Empowerment of Women 2002, National Housing Policy 2001. In principle, all these policies are linked with indoor pollution in one way or other. Sadly,

none of the policies have given serious consideration to issues relating to indoor air pollution (see Country Report for detail policy analysis). Some of the key findings of the policies survey are:

- No explicit and clear cut policy is currently available in Pakistan to deal with the issue.
- The issue has slowly started gaining some mention in existing policies like National Policies on environment, renewable, women development etc.
- National Environment Policy is the most recent and comprehensive as compared to other policies when it comes to the issue of IAP since it hints at various programs and measure that can effectively be employed to this end.
- Formation of a separate and full-fledged policy to deal with IAP can not be expected in very near future.
- However the existing policy options can be employed as starting points to make inroad for IAP in available policy instruments.
- The role of non state actors has been restricted to awareness with no mention of their monitoring roles

Besides the national policies, during the last few decades, there can be traced direct or indirect efforts and program both by public sector organizations and non government organizations to address the issue of IAP. Thought to control IAP has not always been the primary objective of these program, these efforts have and could have been fruitful in making homes free from IAP. Here is given very brief description of these programs and institutions that have been involved in these programs.

In Pakistan the history of improved metal and mud stove programs initiated by the government sector institutions can be traced back to late 70s and early 80s when then functional Appropriate Technology Development Organization (ATDO) and renewable National Directorate of Renewable Energy initiated improved cook stove programs. Some of these programs were supported by GTZ and designs proposed by GTZ were largely employed. The evaluation documents currently available show that these programs met different fates. For instance the programs initiated by NDRE could not be made successful where as the Improved metal stove program initiated by ATDO (Now Pakistan Council for Renewable Energy Technology) remained quite successful especially in the Murree Tehsil of Rawalpindi District. However the improved mud stove program initiated by the same agency could not even take off.

Various non government organizations like Aga Khan Building Improvement Program (BACIP), Escort Foundation, Rural Development Program, Rural Support Programs etc initiated improved cook stove programs and building improvement projects with the support of Global Environment Facility of UNDP.

#### 4. Key Findings/Gaps/Barriers

It is evident from the policy review section that non existence of comprehensive policies and commitments and consistency in programs is one of the biggest barriers in addressing indoor air pollution in Pakistan. Here is given a very brief description of other barriers that have contributed to the issue of IAP in Pakistan.

##### **General Barriers**

- Absence of explicit and focused policy instruments, laws, regulations and standards
- Flawed policies and programs
- Weaker implementation owing to a number of factors (governance, financial resources, monitoring and feedback)
- Lack of synergy between the policies and programs
- Lack of coordination among the institutions involved
- Lack of consultation with and involvement of communities, non state actors
- Restricted role of media
- Inconsistency in government and non government programs

##### **Specific Barriers**

Besides these barriers which are general in nature the other specific barriers can be categorized as:

##### Technological:

Lack of technological options like improved cook stoves and wide gulf between designers and providers of technology and users is one of the key factors that hindered the technology improvement and access to improved and affordable technologies especially for the poor households.

##### Institutional

Weaker institutions with even weaker mechanism for monitoring, evaluation and feedback

##### Informational

Absence of horizontal flow of information across the institutions, and vertical flow of information from communities to policy makers and technologists and vice versa

##### Financial

Policy commitments without due provision of financial resources to operationalize these policy goals and commitments

##### Social

Efforts to promote technologies without understanding the cultural, social and economic context of the users, and resistance to change largely on part of communities



### Infrastructural

Lack of servicing; for instance lack of after-provision service for improved stoves, lack of refilling services in case of LPG cylinders etc.

## 5. Recommendations

- The development debate in Pakistan largely remains encircled around issues with no reference to policies. There is though a need of explicit policies to deal with IAP, the existing policies do provide a base to start the discussion on IAP that can be led to the formation of formal policies and programs. Implementation of the programs and policies have not been given due consideration. There is thus a severe crisis of implementation of policies. Based on this conclusion, following policy recommendations are suggested for making house free from pollution:
- A broad based research not merely into the policies but also into the government and non government programs with a view to identify the cross linkages, gaps and options.
- The non government actors like research and policy institutions need to adopt the role of a "Policy Watchdog".
- The role of media and other civil society actors needs to be enhanced from "merely creating awareness" to one that promote monitoring, accountability and feedback.
- Decentralization of decision making and implementation of the programs without losing the centrality of focus and programs.
- Non government organizations shouldn't be considered as "communities" rather communities should be brought to scene when it comes to devising and influencing policies. The culture of influencing policies through communities should be promoted.
- The roles of different actors; Government: Create an enabling environment  
Non Government/Academia: Awareness, Monitoring, accountability and feedback, private sector: Provide products and services, Donors: Place in their strategic plans, focused programs, communities: Raise voice, find appropriate forums, linkages with various tiers of government and non government actors through their representative groups.
- Devising of a draft policy on IAP taking stock from existing policies and findings of the research studies.

**SUMMARY OF POLICY RESEARCH ON HOUSEHOLD ENERGY AND INDOOR AIR POLLUTION****BANGLADESH****1. Overview of energy scenario**

Bangladesh with over 144 million people is one of the most densely populated countries in the world. Energy sources in Bangladesh can be broadly classified into three categories: a) traditional b) commercial and c) renewable. It is estimated that about 55 percent of the country's energy is met through traditional energy sources. Most of them are used for cooking. Excessive use of biomass energy already exceeds the regenerative limit thereby inviting energy crisis in rural areas.

The total forest area covers only 14 percent of the total land area in Bangladesh. Thus fuel wood collection from forest is difficult. Agriculture residues and dung are commonly available in and around the household premises. It becomes more difficult to collect biomass fuels in monsoon season especially during the flooding period.

Electricity, petroleum products, natural gas and coal are the major commercial energy sources. Bangladesh has potentially very large natural gas resources but with small reserves of oil and coal. Petroleum products are mainly used for transportation and rural lighting purposes. The total consumption of petroleum in 2000 was 3.23 million ton, all of which was imported.

The total coal deposits are 1.75 billion tones. Mining has started in a small scale. The yearly consumption of coal in the country is over 1 million tones. Bangladesh, being a rather flat country, is not much suitable for hydro-electricity. The total potential is estimated to be 755 MW in which total 230 MW is being produced.

As of December 2005, in the process of the development of renewable energy, about 24,000 biogas systems and 60,000 solar home systems have already been constructed in Bangladesh. These renewable energy systems alone are contributing to about 19 MW equivalent powers. In Bangladesh the average cooking requirement per family per day is estimated to be 5 hours in rural households. Each household needs about 3 tones of biomass per year to cook their food. Assuming that 55 percent of households use biomass for cooking, about 40 million tones of biomass fuel will be required every year for cooking only. Supplied of such large quantity of biomass put extra high pressure on the forest. Besides it will also cause indoor air pollution, as biomass smoke is considered to be a significant source of public health hazard, particularly to the poor and vulnerable women and children.

Use of agriculture and animal waste for cooking purposes rather than for its use as an organic fertilizer has adverse affect on maintaining the soil fertility, thereby reducing crop production and-productivity of land. The implications of bio mass fuel demand also contributions to climate change to respiratory illnesses including other diseases.

Four-fifths of Bangladeshis live in rural areas, and their energy needs are primarily met with traditional biomass – straw, jute stick, animal dung, and fuel wood. Over one-quarter (27% or 7.1 Mtoe) of the primary energy consumption in Bangladesh is traditional biomass.

Bangladesh has yet to provide access to modern energy for the majority of its population. Well over half of the total population remains energy-deprived, without access to grid power or modern fuels and reliant on fuel-wood, dung, and crop residues for their cooking needs and candles or kerosene for their

lighting requirements. The energy deprivation and biomass reliance contribute to deforestation, drudgery of rural women and children tasked with collecting, processing and using biomass, and health impacts of indoor air pollution. The development of informal rural markets for even low-quality traditional biomass sources (e.g., rice husk and animal dung) is evidence of a decreased supply of readily available biomass, with the result that even fuel sources of last resort are becoming less affordable to the very poor.

## 2. Indoor air pollution and health implications

Usually, women in Bangladesh prepare meals on mud stoves, often in unventilated kitchens in the country. These stoves usually lack a chimney. This causes the release of combustion products directly into the small kitchen as smoke (the term “smoke” here covers all chemical compounds resulting from a combustion process, including CO<sub>2</sub> and water). A second important factor contributing to IAP is the quality of the available fuel. Through depletion of wood supplies and higher prices, a shift to the use of lower grades of biomass fuel is common. The long preparation times in the kitchen, resulting from low-grade fuel and the many dishes cooked over one stove, cause high exposure to smoke particles. It is feared that health effects have gone beyond acceptable limits.

Primitive biomass stoves, used by millions of women in Bangladesh, emit high volumes of smoke. This has a serious impact on the women’s health on a daily basis. Running eyes, allergic skin, dizziness and sore throats are the most obvious disorders observed are common. However, long-term health effects related to exposure to smoke might be more serious and have hardly been investigated.

## 3. Analysis of existing policies

National Energy Policy (1996 ) Power Sector Policy (1999), Energy Conservation Act (2004 are some of the efforts which are linked with household energy, health and indoor air pollution. Realizing the importance of electricity in household energy, Power Sector Policy has made several provisions for the electrification. The Policy outlines subsidies to rural and urban poor using very little electricity, subsidies for paralyzed Freedom Fighters and for mosques, temples, churches and other prayer places. The policy made it clear that the effectiveness of subsidies in reaching targeted consumers shall be reviewed and revised from time to time and future subsidy programs shall be based on these reviews. To promote private sector participation in electricity generation, the policy clearly mentioned that GOB will not regulate the price of electricity generated from renewable energy source. The price shall be negotiated between the sponsor and the consumers. ERC will protect the interest of the sponsors and the consumers. Some of the incentives as outlined in the policy are;

- Renewable energy project sponsors whether semi-government, private companies (foreign or local), NGOs shall be exempt for corporate income tax for a period of 15 years.
- 100% depreciation in the first year for solar photovoltaic, solar thermal projects and 100% depreciation in five (5) years for wind, biomass, geothermal, tidal and small hydro projects.
- The sponsors will be allowed to import plant and equipment without payment of customs duties, VAT (Value Added Tax) and any other surcharges as well as import permit fee provided that the equipment is not manufactured or produced locally.
- Repatriation of equity along with dividends will be allowed freely.
- Exemption from income tax in Bangladesh for foreign lenders/companies.

- The foreign investors will be free to enter into joint ventures.
- Power generation has been declared as an industry and the companies are eligible for all other concessions which are available to industrial projects.
- The private parties may raise local and foreign finance in accordance with regulations applicable to industrial projects as defined by the Board of Investment (BOI).
- Local engineering and manufacturing companies shall be encouraged to provide indigenously manufactured equipment of international standard to renewable energy project sponsors.
- Tax exemption on interest on foreign loans and on capital gains from transfer of shares by the investing Company.
- Remittance of up to 50% of salary of the foreigners employed in Bangladesh and facilities for repatriation of their savings and retirement benefits at the time of their return.
- No restrictions on issuance of work permits to project related foreign nationals and employees.
- Foreign owned companies duly registered in Bangladesh will be on the same footing as locally owned companies with regard to borrowing facilities.

National Energy Policy 1996's main objectives are to: (i) provide environmentally sound and sustainable energy for continued economic growth; (ii) meet the energy needs of different areas and socioeconomic groups; (iii) ensure development of indigenous energy sources; (iv) ensure sustainable operation of energy utilities; (v) ensure rational use of all energy sources; and (vi) encourage public and private sector participation in the sector

Based on policy document, it can be safely said that Government of Bangladesh (GOB) has formulated impressive guidelines for the Renewable Energy Development in the country. As per GOB policy guidelines the Power Cell/Energy Regulatory Commission will:

- Assist in issuance of license for renewable energy projects sponsored by private entrepreneurs in a localized area.
- Identify and assess the potential of establishment of renewable energy projects, which could make a significant contribution to energy needs.
- Recommend financing and delivery mechanism to increase the affordability of renewable energy systems for the rural poor.
- Encourage NGO's and private sector organizations in development of renewable energy and suggest strengthening the industrial requirements for successful implementation of these projects.
- Recommend required training facilities for technology transfer needed to support commercialization of renewable energy technology.
- Represent government in international institutions related to development of renewable energy.

- Identify the type and extent of support needed from international organizations.
- Consider existing infrastructure and future plan of different utilities before issuance of licenses for establishment of renewable energy projects.
- Resolve issues pertaining to jurisdiction of geographical area of different utilities

The overall progress of National Energy Policy has been summarized in the following table 1.

Table 1: Progress in the implementation of National Energy Policy

Sector	NEP Major Indicative Polices	2006 Status
<b>Renewable Energy</b>	<ul style="list-style-type: none"> <li>• Undertake systematic assessment of biomass resources of all types</li> <li>• Conservation of biomass to be implemented through modern technology, e.g., improved cook stoves and biogas digesters</li> </ul>	<ul style="list-style-type: none"> <li>• No progress</li> <li>• Some activities, e.g. Grameen, BCSIR, BRAC, LGED</li> </ul>
<b>Rural Energy</b>	<ul style="list-style-type: none"> <li>• Waive all taxes and duties on RE technologies</li> <li>• Energy needs of the rural areas are to be given priority within overall development of the energy sector</li> <li>• Planning will be based on economic viability and sustainability using a master plan process</li> <li>• Incentives will be provided to encourage productive uses in electrified areas</li> </ul>	<ul style="list-style-type: none"> <li>• No progress</li> <li>• REB and PBS have successfully electrified 1.8 million households since 1996</li> <li>• Emphasis on the area electrification model has increased the capital subsidies necessary, thus affecting viability of many PBSs</li> <li>• Intensification of loads in electrified areas remains a problem, contributing to poor financial results by PBSs</li> </ul>

As shown in the above table, it can be safely said that very little progress was made in the areas of renewable energy and energy efficiency. Two major consequences of policy gaps are lack of progress in addressing modern energy for cooking which has put continued pressures on biomass resources, including fuel wood. It also has huge impact on the poor as traditional biomass becomes expensive to collect because of pressure on forests. Excessive use of animal dung also put pressure on agricultural productivity

Health Policy and Forestry Policy of Bangladesh are also silent on the issues relating to indoor air pollution. (See country report for detail analysis.)

### 3. Key Findings\Policy Gaps and Barriers

- No more specific intervention indicated on improved cook stove, biogas, gasification, briquette, biomass utilization, ventilation, behavioral changes etc. in the present policies. Biomass has not been included in the national accounting system as because its' not considered as commercial energy.
- Inadequate technical expert, equipment even few research have been conducted in the country.
- No more institutional capacity available in the country. Related information also limited both in local and national level to disseminate throughout the country. Inter-organizational relationships not been established in formal way yet.
- No budgetary allocation found in the national budget to process or modifies biomass as standard fuel. Biomass not considered as commercial energy sources because they are not included in national accounting system.
- The people who are living in rural community and slum areas they are unaware about ARI, COPD, etc. caused by smoke.
- Though there are no more specific indications on household energy and indoor air pollution found in the national policies, however, to improve enabling environment particularly for woman & children different NGOs, institutions, society/networks have been working in different locations of the country in scattered way.
- IAP is dangerously high for many poor families in Bangladesh. Concentrations of respirable SPM (PM<sub>10</sub>) are 300 ug/m<sup>3</sup> implying widespread exposure to a serious health hazard..
- The econometric results indicate that fuel choice significantly affects indoor pollution levels i.e. natural gas and kerosene is significantly cleaner than biomass fuels. Accessibility of cleaner fuel is essential through government policy.
- Low-income people rely heavily on biomass fuels to meet their energy needs. The energy demand from a growing population is threatening the country's physical environment. Sustainable development requires wide distribution of commercial forms of energy that will enable the population to ease the pressure placed on overexploited biomass energy sources.

### 5. Recommendations

- Government should find way of various form of biomass utilization and can consider as commercial energy and include its contribution in the national accounting system.
- Ventilation and behavioral issues should include both in formal and no-formal education system to create awareness in the community and the country at large.
- Electronic and printed media can play a vital role to mitigate the IAP and improve the household energy options. More interaction with media is necessary at this time.

- Support for technical expert, equipment is needed from abroad in urgent basis.
- More awareness programs should be taken in the community level to raise grassroots voices which would help to influence in policy level at last.
- A common platform can be useful to identify best practices that would be good evidence to influence policy change.
- Strengthen local entrepreneurs on maintain regular production and distribution of material to the users. Develop new entrepreneurs each and every districts of the country.
- Energy policy must enable improvements in energy access among all Bangladesh citizens. Most government energy investments have favored urban over rural areas. An efficiently organized energy sector can bring immense benefits to both rural and urban citizens, to the poor and those with higher incomes.
- More efficient use of biomass fuels is also required. The government should encourage the sale of coal for domestic cooking in rural areas. This would also require the distribution of suitable stoves. More Biogas plant dissemination can be a long term program. These innovations have the potential to reduce the health problems associated with indoor pollution, and to relieve pressure on forest resources.
- The government should undertake high profile social marketing activities intended to improve utilization of biomass fuels in rural areas. There is a potential to increase adoption of more efficient stoves and expand forest plantations. These are examples where government public education activities can have a meaningful impact on energy policy.
- A concrete initiative to be taken to draw attention of National Planning Commission to give importance on it.

**References**

WHO: Fuel for Life, Household Energy and Health, World Health Organisation, Geneva, 2006

Practical Action Nepal: Policy Gaps Study in Household Energy, Health and Indoor Air Pollution in Nepal, An unpublished policy research, 2007

Practical Action Nepal: Policy Gaps Study in Household Energy, Health and Indoor Air Pollution in India, An unpublished policy research by TERI, India, 2007.

Practical Action Bangladesh: Policy Gaps Study in Household Energy, Health and Indoor Air Pollution in Bangladesh, An unpublished policy research, 2007

Practical Action Nepal: Policy Gaps Study in Household Energy, Health and Indoor Air Pollution in Pakistan, An unpublished policy research, 2007

Practical Action Sri Lanka: Policy Gaps Study in Household Energy, Health and Indoor Air Pollution in Sri Lanka, An unpublished policy research, 2007

Eva Rehfuss: Fuel for Life: Household Energy and Health, Geneva, World Health Organization, 2006

Shrestha, Jagan Nath and Ghimire, Ram Prasad: Household Energy and Indoor Air Policy in Nepal, Unpublished Article, 2006

Bruce N, et al. Indoor Air Pollution. In: Jamison DT et al. eds. Disease control priorities in developing countries in developing countries, 2<sup>nd</sup> Ed, New York, Oxford University Press, 2006

Hugh Warwick and Alison Doig: Smok-the Killer in the Kitchen, Indoor Air Pollution in Developing Countries, Published by ITDG Publishing, 2004

Smith, K and S Mehta: The Global Burden of Diseases from Indoor Air Pollution in Developing Countries: Comparison of estimates, prepared for WHO/USAID Global Technical Consultation on Health Impacts of Indoor Air Pollution in Developing Countries., 2000

World Bank: Diseases control priorities in developing countries, World Bank New York, 2006

WHO: Addressing the Impact of Household Energy and Indoor Air Pollution on the Health of the Poor, World Health Organization, Geneva, 2006

Bruce,N, Perez-Padilla R, Alablak, R: Indoor Air Pollution in developing Countries: a major environmental and public health challenge, WHO Bulletin,2000, 78: 1078-1092