

# Household Energy, Indoor Air Pollution and Health Impacts

## Status Report for Nepal



## Winrock International Nepal

Under the USAID-Winrock LWA Agreement  
“INCREASED USE OF RENEWABLE ENERGY RESOURCES” PROGRAM



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## ABBREVIATIONS AND ACRONYMS

ADB/N	Agriculture Development Bank of Nepal
AEPC	Alternative Energy Promotion Center
ARI	Acute Respiratory Infection
BSP	Biogas Support Program
BSP/N	Biogas Sector Partnership Nepal
CDD	Control of Diarrheal Disease
CECI	Canadian Center for International Studies and Cooperation
CEPDA	Center for Development and Population Activities
CES	Center for Energy Studies
CH	Child Health
CHW	Community Health Worker
CO	Carbon Monoxide
COs	Community Organizations
COLD	Chronic Obstructive Lung Disease
COPD	Chronic Obstructive Pulmonary Disease
CRE	Center for Renewable Energy
CRS	Contraceptive Retail Sales
CRT	Center for Rural Technology
CSD	Center for Self-Help Development
DFID	Department for International Development
DHS	Department of Health Services
DHSP	District Health Support Project
DOTS	Directly Observed Treatment Short Course
DR	Development Region
EPI	Expanded Program on Immunization
ESAP	Energy Sector Assistance Program
FCHV	Female Community Health Volunteer
FP	Family Planning
FVC	Force Vital Count
GDI	Gender-related Development Index
GDP	Gross Domestic Product
GO	Government Organization
GTZ	German Technical Cooperation
HDI	Human Development Index
HC	Health Center
HP	Health Post
HSSP	Health Sector Support Program
HW	Health Worker
IAP	Indoor Air Pollution
ICS	Improved Cooking Stoves
ILO	International Labor Organization
ITDG	Intermediate Technology Development Group
LPG	Liquefied Petroleum Gas
JICA	Japan International Cooperation Agency
JHU	John Hopkins University

KFW	German Development Bank
KMTNC	King Mahendra Trust for Nature Conservation
MCH	Maternal and Child Health
MHP	Micro-hydro Power
MOH	Ministry of Health
NDHS	Nepal Demographic Health Survey
NEA	Nepal Electricity Authority
NESS	Nepal Environmental & Scientific Services
NFE	Non-Formal Education
NFHS	Nepal Family Health Survey
NHEICC	National Health Education Information and Communication Center
NHRC	Nepal Health Research Council
NTC	National Tuberculosis Center
NTP	National Tuberculosis Program
PCS	Population Communication Service
PHCC	Primary Health Care Center
PM	Particulate Matter
RECAST	Research Center for Applied Science and Technology
REDP	Rural Energy Development Program
RDP	Rural Development Program
RH	Reproductive Health
RHDP	Rural Health Development Project
RSP	Respirable Suspended Particle
SAARC	South Asian Association for Regional Cooperation
SCF	Save the Children Fund
SCHP	School and Community Health Project
SDC	Swiss Development Cooperation
SHP	Sub-health Post
SHS	Solar Home System
SNV	The Netherlands Cooperation Agency
SO	Strategic Objective
TB	Tuberculosis
TSP	Total Suspended Particle
TSPM	Total Suspended Particulate Matter
TT	Tetanus Toxoid
UMN	United Mission to Nepal
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
USEPA	United States Environment Protection Agency
VDC	Village Development Committee
WECS	Water and Energy Commission Secretariat
WHO	World Health Organization

## I. REPORT HIGHLIGHTS

Winrock International Nepal prepared this status report, "Household Energy, Indoor Air Pollution and Health Impacts for Nepal," based on the latest available materials and interaction with key stakeholders. A 'snap shot' of country situation with regard to experiences and lessons related to household energy and health is summarized below for quick reference:

### Overview of Household Energy and Health

- Child infant mortality rate in Nepal is 64.2 and under five child mortality rate is 91 per 1000 (2001);
- Reported incidence of acute respiratory infection (ARI) is 229 per 1000 and the incidence of ARI reported deaths is 184 (2001-02);
- A recent study done by Nepal Health Research Council and others (in 2001) indicate that PM<sub>10</sub> (particulate matter less than 10 microns) concentration for cooking areas as 8,207 µg/m<sup>3</sup> where biomass (wood) is burned and 3,414 µg/m<sup>3</sup> and 1,504 µg/m<sup>3</sup> where kerosene and LPG are used as fuel, respectively;
- A study conducted in a hilly remote area of Nepal to find out the relation between indoor air pollution and ARI in infants and children under 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;
- More than 85% of the total energy demand is met by traditional solid fuels (firewood, agricultural residues, animal waste) in Nepal, and almost 98% in rural areas.

### Key Entities/Organizations Working in the Field of Household Energy And Health

#### Government agencies:

- Health: Ministry of Health, Department of Health Services
- Household energy: Alternative Energy Promotion Center, NEA

#### I/NGOs

- Health: United Mission to Nepal, Save the Children (UK and US), Nepal CRS Company, Mothers' Club, Mrigendra Samjhana Medical Trust
- Household energy: ITDG/Nepal, Center for Rural Technology, Biogas Sector Partnership, Winrock International, King Mahendra Trust for Nature Conservation<sup>1</sup>

#### Multi-lateral and bi-lateral agencies

- Health: World Health Organization, USAID, GTZ, UNFPA, SDC, UNICEF, JICA, DFID
- Household energy: UNDP, Danida, USAID, SNV/Nepal, NORAD, GTZ

### Key Household Energy and Health Programs

- **Biogas Support Program** - The program is implemented through the Alternative Energy Promotion Center (AEPC) and Biogas Sector Partnership. Previously, it was implemented by Biogas Support Program/SNV. The program has installed around 110,000 biogas plants by June 2003. The program plans to install an additional 200,000 plants by 2009.

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<sup>1</sup> There are also various private sectors in the household energy sector like Butwal Power Company, various solar energy, micro-hydro, biogas companies in Nepal

- **National ICS Program** - The program is being implemented through AEPC and Energy Sector Assistance Program (AEPC/Danida) and by the end of first phase in December 2004, 100,000 improved cook stoves (ICS) will be installed and the Government has a target to install an additional 250,000 ICS by 2007. There has been a significant reduction in indoor air pollution with the use of ICS.
- **The ARI Control Program** - The program is implemented by Department of Health Services in all 75 districts, fourteen of which have a special strengthening program of Community Based ARI/Control of Diarrheal Disease.
- **National Tuberculosis Control Program<sup>2</sup>** - Treatment by Directly Observed Treatment Short Course (DOTS) has been introduced in 273 treatment centers with 89% of population coverage since April 2001 and is within the national general health system.

### Synthesis of Lessons Learned

- **Market Development** - The current working modalities and approaches of various household energy programs are proved to be successful in creating demand for these technologies, however they differ slightly depending upon the technology. Scaling up biogas and ICS technologies and market development for moving up to cleaner fuels (like LPG) that targets peri-urban and urban areas (especially the urban poor) is needed;
- **Technology Standardization** - Quality control and specific technical standards are available for biogas and ICS technologies. Technology standardization for new models of ICS and other biomass fuel stoves should be developed;
- **Health Impact Monitoring** - Only ITDG/Nepal is now doing indoor air quality monitoring in one village with traditional stoves and with some interventions. This study together with different household energy technologies should be conducted in many locations and in different settings;
- **Social and Cultural Barriers** - Consumer education, awareness creation etc. are being carried out by these household energy programs but the concept of 'social marketing' needs to be implemented in the country to address various social and cultural barriers.

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<sup>2</sup> Although the association between exposure to biomass smoke and TB has not been confirmed, the TB Program has still be included considering the large number of TB cases in Nepal and based on the recent study in India which shows higher prevalence of active TB with indoor air pollution.

## II. INTRODUCTION

Nepal is a landlocked and predominantly mountainous country sandwiched between India on three sides - East, West, and South, and China to the North. The country spans a total area of 147,181 sq. km with tropical plains in the South (Terai) and the Himalayas in the North within a mean width of 193 km. This tremendous variation in altitude within a relatively short distance is what gives Nepal its varied ecological zones and the range of biological and cultural habitats it enjoys. The Mountains, Hills, and the Terai are three distinct ecological regions running from east-west from North to South, respectively, and form 3 parallel belts spanning the length of the country. The mountainous region is the most sparsely populated region and covers about one third (35%) of the total land area of which only 2% is suitable for cultivation. The hills region, which includes the densely populated Kathmandu and Pokhara valleys, makes up 42% of the total land area, out of which about one-tenth is suitable for cultivation. The Terai region accommodates 47% of the total population and comprises 23% of the total land area, which includes fertile land and dense forests<sup>3</sup>.

For administrative purpose, Nepal is divided into 5 Development Regions: Eastern, Central, Western, Mid-Western, and Far-Western and are further divided into a total of 75 districts. Each district constitutes of, on an average, 60-70 Village Development Committees (VDCs). On average, each VDC includes around 500 households. Nepal's gross per capita income was only US\$250 in 2001 and was further reduced to US\$230 in 2002<sup>4</sup>. The country's economic development has been severely constrained by geographic, topological, and socio-cultural factors including heavy dependence on agriculture and foreign aid.

Mortality and morbidity rates, especially among children and women are alarmingly high in Nepal. Acute respiratory infection (ARI), tuberculosis and other chronic obstructive pulmonary diseases (COPD), complications in child birth, and vector borne diseases continue to prevail at high rate. According to the Demographic and Health Survey 1996, 34.1% of children under 5 were infected with ARI in the two weeks prior to the survey and 18.2% with ARI were taken to the health provider in Nepal<sup>5</sup>. Around 91 per 1000 children do not live to see their 5th birthday. The infant mortality rate is 64.2 per 1000 in 2001<sup>6</sup>. Among several other factors, ARI has been well recognized as one of the major factors for high infant and under five mortality rates in Nepal. The National Program on Control on ARI has been accorded high priority by the Ministry of Health (MOH). Department of Health Services (DHS) has been established under MoH to deliver preventive, promotive and curative health services throughout the kingdom. The Department has wide network of sub-health posts, and health posts in the village level, the district hospital, regional hospitals and the tertiary care centers in Kathmandu together with Female Community Health Volunteers, and other health professionals in the rural areas. The Department works with many other NGOs and donors to carry out the national health programs and outreach programs.

As of June 2001, Nepal's population was 23,151,423. Some 12.12% are under 5 years old. More than 39% of the population is under 15 years old and little more than half the population is in the working age (15-59 years). The total male population is 49.95% and female population is 50.05% in the country. Population growth rate is around 2.25% per annum. Average household size in Nepal is 5.4<sup>7</sup>.

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<sup>3</sup> Central Bureau of Statistics, Statistical Year Book of Nepal 2001, Kathmandu

<sup>4</sup> World Bank, 2003 "World Development Indicators, The World Bank.

<sup>5</sup> UNICEF database on acute respiratory illness at: <http://www.childinfo.org/eddb/ARI/database.htm>

<sup>6</sup> Ministry of Health at: [www.moh.gov.np](http://www.moh.gov.np)

<sup>7</sup> Nepal Population Report 2002 at: <http://www.mope.gov.np/population/demographic.php>

More than 85% of the country's energy demand is still met by traditional sources, including fuel wood (76%), agricultural residues (4%) and animal waste (5%). In rural areas, almost all energy requirements are met by traditional sources, and fuel wood provides almost 90% of the total energy need. Most of the energy (around 60%) is used for cooking and around 8% is for space heating in rural areas<sup>8</sup>. The Biogas Support Program, the National Improved Cooking Stoves (ICS) Program, and the Micro-hydro and Solar Home Systems programs have been quite successful in creating demand, building capacity and controlling quality, and are still underway in the country, focusing on unsustainable firewood consumption in the country. The Alternative Energy Promotion Center (AEPC) has been established as a nodal government institution to coordinate various energy programs in the country. The United Nations Development Program, Danish Cooperation Agency (Danida), the Netherlands Cooperation Agency (SNV/Nepal), German Technical Assistance (GTZ), Norwegian Cooperation Agency (NORAD), European Union, US Agency for International Aid (USAID) are the major donor agencies working in the field of renewable energy in the country. Various other NGOs are also active in disseminating household energy technologies in the country; the Center for Rural Technology (CRT) is one major actor.

Fuel choice is also linked with the socio-economic status of the country. At present around 38% of the total population lives under US\$1 per day. Because of biomass fuel use, indoor air pollution far exceeds standards set by US Environment Protection Agency (more than 5,000  $\mu\text{g}/\text{m}^3$  in some places against the standard of 50  $\mu\text{g}/\text{m}^3$ ). There is strong interest from the government to work in household energy and to reduce infant and child mortality rates and improve women's health, and many donors, NGOs, research institutions are also interested and working on these issues. However, the link between household energy and its impacts on health needs further development. There is an urgent need for developing markets for cleaner fuels and other household energy technologies, standardization of technologies, health impact monitoring and social and cultural barriers in joining household energy and health workers in Nepal. Further details of these issues are highlighted in subsequent sections.

### **III. OVERVIEW OF HEALTH IN NEPAL**

Mortality and morbidity rates are quite alarming in Nepal especially among children and women. Acute respiratory infections, chronic obstructive pulmonary disease, and other endemic diseases like tuberculosis, malaria, rabies, vector borne diseases, and child birth complications continue to prevail at a high rate. These problems are associated with persistent poverty, low literacy rates, poor mass education, rough terrain and difficult communication, low levels of hygiene and sanitary facilities. They are further exacerbated by underdeveloped infrastructure, poor public sector management, shortage of adequately trained professionals, and underutilization of resources. The doctor to population ratio in Nepal is 18,439 (one doctor per 18,439 people) and the population to hospital bed ratio is 2,349<sup>9</sup>. The major health issues particularly relevant to indoor air pollution (IAP) are summarized below:

#### **Under 5 Mortality Rate**

There has been a considerable reduction in under 5 mortality within the last three decades in Nepal. Child mortality was reduced to 91 in 2001-02 (infant mortality rate was 64.2 per 1000 in 2001) from the very high rate of more than 200 per thousand live births in 1972. This substantial reduction was

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<sup>8</sup> Please see the section below on household energy in Nepal

<sup>9</sup> Ministry of Health at: [www.moh.gov.np](http://www.moh.gov.np)

made possible through the control of malaria, smallpox, cholera and other highly communicable diseases. Nepal's child mortality rate varies by geographic and developmental regions and rural/urban areas. The rate is much higher in Far-Western and Mid-Western Development regions, in rural areas, and in Mountain Region compared to other regions and areas. The Millennium Development Goal targets to reduce the under 5 mortality rate by two-thirds from the 1990 level of 161.6 to 54 by 2015<sup>10</sup>. The Tenth Five Year Plan of the government (2003 - 2007) has set the target of reducing under 5 child mortality rate from 91 to 72 by 2007<sup>11</sup>. The following table depicts the infant and under 5 child mortality rates by socio-economic and demographic characteristics:

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<sup>10</sup> Progress Report 2002 for Millennium Development Goals, Nepal at:  
[http://www.un.org.np/publications/mdg/07\\_goal4.pdf](http://www.un.org.np/publications/mdg/07_goal4.pdf)

<sup>11</sup> The 10th Five Year Plan 2003 - 2007, National Planning Commission, Nepal

**Table 1: Infant And Child Mortality<sup>12</sup> Rate in Nepal (Per 1000 Live Births)**

Characteristics	NFHS 1996		NDHS 2001	
	Child mortality	Under 5 mortality	Child mortality	Under 5 mortality
Residence				
Urban	22.5	82.2	16.7	65.9
Rural	53.2	143.4	35.4	111.9
Ecological regions				
Mountains	82.2	207.5	51.2	157.4
Hill	43.3	126.9	29.7	93.9
Terai	53	139.1	34.8	112.8
Development Regions				
Eastern	36.3	112.8	29.6	104.8
Central	56.1	137.5	36.4	110.9
Western	37.6	118.8	25.1	83.7
Mid-western	71.2	177.8	41.2	111
Far-western	62.3	178.9	41.7	149.2
Sex of the child				
Male	45.5	142.8	27.8	104.8
Female	56.5	135.5	40.2	112.4

Source: Nepal Population Report 2002, at: <http://www.mope.gov.np/population/chapter3.php>

A number of supportive policies and programs to reduce child mortality are in place in Nepal. The expansion of the health services network, sanitation and family planning, provision of micronutrient supplements, and immunization programs are examples of programs in place or being set up or upgraded. The spread of literacy, increased awareness, decentralized process, and increased ownership in health promotion lead to expect a gradual and sustained improvement in the rate of child survival. On the other hand, child nutrition has received far less than warranted attention in government policies and programs in the country. Diseases attributable to unsafe water, lack of sanitation and indoor pollution are widespread.

### Deaths from IAP/ARI

There is no up-to-date information available on total number of deaths resulting from indoor air pollution (IAP) and acute respiratory infections (ARIs) in Nepal. ARIs have been recognized as one of the major health problem in the country. It is estimated that around 6,000-8,000 people die every year from tuberculosis in Nepal. The total ARI reported deaths was 184 in 2001-02 where the reported incidence of ARI was 229 under 5 per 1000 children in Nepal<sup>13</sup>. It was reported that total deaths among children under 5 years of age due to ARI accounted for over 30% of total deaths in 1999-2000<sup>14</sup>.

<sup>12</sup> Child mortality rate is defined as the probability of dying between age one and five. Under-five mortality rate is defined as the probability of dying between birth and before their fifth birthday

<sup>13</sup> DHS "Annual Report 2001/02" Department of Health Services, Kathmandu

<sup>14</sup> Department of Health Services, 2000 in ENPHO & Welink Consultants, 2002 "State of Energy in the Mountains, Nepal", Kathmantu.

## Life Expectancy for Nepal

The life expectancy for Nepal was 58.95 at the end of the Ninth Five Year Development Plan (2002) and the Tenth Plan (2003 - 2007) has set the target to increase this up to 65 by 2007. The life expectancy at birth is reported as 59.1 years by the Human Development Report 2003. The life expectancy in Nepal is very low compared to other countries is unusual in that female life expectancy lags that of males. The following table depicts male and female life expectancy in Nepal and other representative countries:

**Table 2: Life Expectancy for Nepal and Other Countries**

Countries	Life expectancy - male	Life expectancy - female
USA	74.3	79.9
South Africa	45.1	50.7
Guatemala	63.0	69.9
Mexico	70.4	76.4
China	68.9	73.3
India	63.2	64.6
Nepal	60.1	59.6

Source: UNFPA at: [http://www.unfpa.org/swp/2003/presskit/pdf/indicators\\_eng.pdf](http://www.unfpa.org/swp/2003/presskit/pdf/indicators_eng.pdf)

## Population Below Poverty

Poverty is Nepal's major problem and all plans and policies in Nepal are directed towards poverty alleviation. On the basis of the Tenth Five Year Plan document of the Government, total percentage of people living below the poverty line was 38% in 2002. The UNICEF also reports that 38% of the total population lives below US\$1 per day in Nepal<sup>15</sup>. The poverty level is also directly linked with the choice of fuel for domestic use. People generally move to cleaner, more convenient, more efficient and more costly fuels when their socio-economic condition improves. Most of the development programs in Nepal are specially focused on improving socio-economic conditions and alleviating poverty and others also have some components to address this issue even if they are directed to other specific problem.

## Human Development

Nepal's human development ranking is low even by South Asian standards. The country's Human Development Index (HDI) as calculated in the global Human Development Report 2001 stood at 0.480. The disaggregated HDI values for Nepal highlight significant differences in human capability and welfare at the regional and sub-regional level. Because of far better access to services, resources, and opportunities, the HDI for urban areas (0.616) far outstrips that of rural areas (0.446), where more than 80 percent of the population lives. Nepal's development is clearly urban-biased and in part, this bias explains the persistence of poverty in the rural areas. Human development in mountain (0.378) is far below that in the hills (0.510). Among the development regions, the highest HDI (0.493) is found in the central region followed by the eastern (0.484) and western region (0.479). The other two regions: mid-western and far-western are traditionally been neglected and have lower HDIs.

## Gender Disparities

The country's Gender-related Development Index (GDI) of 0.452 is gearing towards equality (HDI 0.466) but the geographic differences are marked. Following the same pattern of human

<sup>15</sup> UNICEF at: [http://www.unicef.org/infobycountry/nepal\\_statistics.html](http://www.unicef.org/infobycountry/nepal_statistics.html)

development, GDI is higher in urban areas (0.605) than in rural areas (0.426) because of significantly greater access to information, health facilities, and better economic opportunities. GDI is highest in the hills (0.494) while women continue to suffer the greatest exclusion in the mountains (0.355). Women's participation in the political process is only one fifth of that of men; the same pattern is also manifest in professional and even more in administrative jobs. Women's share in earned income is about one third that of men<sup>16</sup>. The Ministry of Health's Second Long-term Health Plan (1997-2017) has also given due consideration to the gender disparity in Nepal's health sector and has well addressed gender sensitivity in the plan. Nepal is typical of most developing countries in that women provide fuel for the home and carry out most tasks that require energy use in home including firewood collection, cooking, and looking after children. Carrying large loads of wood exposes women to injuries from falls and weight carrying, including fractures and miscarriages. The drudgery of everyday chores leaves women in Nepal very little time for other income generating activities or time for themselves.

### Health Expenditure as Proportion of Gdp for Nepal

The 10th Plan indicates that 5.2% of the total Government budget was spent for health expenditure in 2001-02 and this will be increased to 6.5% by the end of the plan period, (2007). The following table depicts health expenditure as proportion of GDP for Nepal and other EPA high priority countries:

**Table 3: Health expenditure in Nepal and other countries**

Countries	Health expenditure as % of GDP
USA	5.9
South Africa	3.7
Guatemala	3.4
Mexico	1.9
China	3.1
India	7.5
Nepal	4.2

Source: UNFPA at: [http://www.unfpa.org/swp/2003/presskit/pdf/indicators\\_eng.pdf](http://www.unfpa.org/swp/2003/presskit/pdf/indicators_eng.pdf)

### Urban vs. Rural Health Disparities

Like many other developing countries, Nepal is striving to achieve health for all. Poverty is still persistent and has severe impacts on the livelihoods of the majority of the people who are poor, socially disadvantaged, living mostly in rural areas and lacking access to resources, and the goal for health for all is elusive and the disparities continue to widen. There is a large disparity in health services in urban and rural areas in Nepal. Most of the health facilities are concentrated in the nation's capital and other urban areas of the country. Most poor people in Nepal's rural areas have little access to modern health care, and emergency services for all people in rural areas are limited. The health disparity can also be seen from the infant child mortality rates in rural and urban areas. According to the Nepal Family Health Survey (NFHS) 1996, the infant mortality rate was 61.1 in urban areas and 95.3 in rural areas. Similarly, Nepal Demographic Health Survey (NDHS) 2001 also revealed that child mortality rate was 50.1 in urban areas and 79.3 in rural areas. The under 5 mortality rates for urban and rural areas were 82.2 for urban areas and 143.4 for rural areas according

<sup>16</sup> Nepal Human Development Report 2001 at: <http://www.undp.org.np/publications/nhdr2001/chapter2.pdf>

to NFHS 1996 and 65.9 for urban and 111.9 for rural areas as per NDHS 2001<sup>17</sup>. The average life-expectancy in Kathmandu district is 74.4 years whereas it is just 37 years in remote mountain district of Mugu presenting the height of health discrepancy. Eighteen of the 20 districts in which life expectancy is less than 55 years are located in Mid-western and Far-western development regions and 17 of them are inaccessible mountain districts<sup>18</sup>. The Second Long-term Health Plan (1997-2017) has well addressed the disparities in healthcare in urban and rural areas. The plan also envisions a health care system with equitable access and quality services in both urban and rural areas. Decentralization in the health sector is receiving increasing priority to respond to rural areas health needs and to increase local participation in health issues.

### **Health Care in Nepal**

Health interventions of the country under Department of Health Services (DHS) can be broadly categorized under three main areas:

- Child Health;
- Epidemiology and Disease Control and
- Family Health.

These programs are underway through the support of different partners, described in the next section. The key health interventions with some association with IAP are briefly described below:

### **National Control of Acute Respiratory Infection Program**

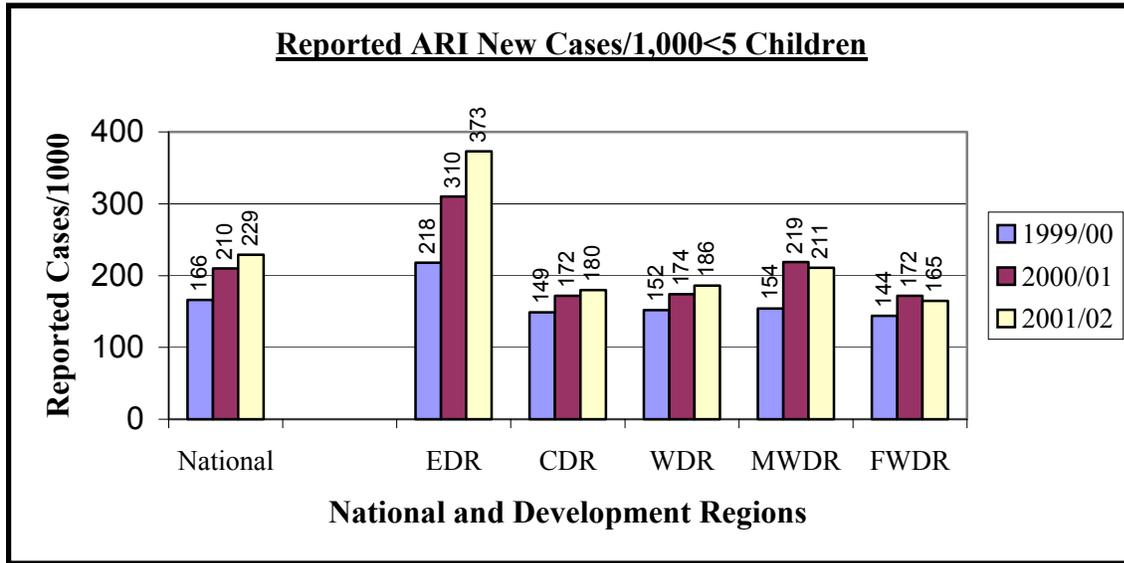
The National Control of Acute Respiratory Infection (ARI) Program is an integral part of primary health care and has been accorded high priority by the Ministry of Health (MOH). The program focuses on children under five because the majority of deaths in this age group are ARI-related. The main objective of this program is to reduce under five ARI related mortality and morbidity and to improve child health in Nepal.

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<sup>17</sup> Ministry of Population and Environment, Nepal Population Report 2002 at: <http://www.mope.gov.np/population/chapter3.php>

<sup>18</sup> Drug Information Development: A Case Study for Nepal at: <http://www.uspdqi.org/pubs/other/NepalCaseStudy.pdf>

**Figure 1 Reported ARI New Cases**



Source: Department of Health Services, Annual Report, 2001-02, Kathmandu

National new reported cases of ARI in children under 5 were 229 per 1000 in 2001-02. The number of reported new ARI cases are increasing compared to the previous years as shown in the figure. The highest number of ARI new cases was reported in the eastern development region (EDR), followed by the mid-western development region (MWDR), western development region (WDR), central development region (CDR) and far-western development region (FWDR) in the year 2001-02. It was also found that around 42.6% of the reported incidences of ARI were pneumonia cases and 3.8% were severe pneumonia cases. It is also reported in the Annual Report that the reported ARI mortality rate has decreased from 0.08 in the year 1999-2000 and 2000-01 to 0.05 in 2001-2 per 1000. The reported fatality rate per 1000 for children under 5 was 0.5 in 1999-2000 to 0.4 in 2000-01 and 0.2 in 2001-02. The decreasing mortality and fatality rates nation-wide as well as in development regions in spite of increasing ARI cases indicate that the accessibility is increasing and health workers (HW) and community health workers (CHW) are detecting more ARI cases and treating them in a timely manner.

The National Control of ARI Program recognizes the important role of mothers and other caretakers in identifying the difference between the need for home care and the need for referral to health facilities. The program has adopted strategies including educating mothers and caretakers, developing a health education program aimed at raising awareness of ARI, training field staff, and continued monitoring of the ARI Control Program. Radio jingles have been broadcast, and posters and pamphlets have been developed and distributed to increase community awareness; adequate budget for local purchase of medicine for ARI was allocated in 61 districts and regular supervision was being carried out in 14 districts of Nepal in 2001-02.

The ARI Strengthening Program, a community level intervention strategy, was also introduced initially in 1995 in four districts: Morang, Sunsari, Makwanpur and Chitwan in collaboration with USAID/John Snow Inc., UNICEF and WHO. The program was later expanded to two districts in 1997-98 and five more districts in 1998-99. The ARI Strengthening Program has also been renamed as Community Based ARI and Control of Diarrheal Diseases Program (CBAC). This program also

supports the Government's National Control of Diarrheal Diseases (CDD) Program, which is another major public health problem among children under five.

### **Expanded Program on Immunization**

The Expanded Program on Immunization (EPI) is considered one of the most cost-effective health interventions and is a priority program of the Government. The immediate objectives of this program are to eliminate neonatal tetanus (NNT) (less than 1 case per 1000 live births) by the year 2005, to reduce measles cases by 90% and measles death by 95% from previous levels by the year 2005 and to obtain certification of poliomyelitis eradication by the year 2005<sup>19</sup>. Effective implementation of the EPI program is considered to be contributing directly to the reduction of infant and child mortality and morbidity. The EPI program covers all the 75 districts of the country with appropriate intervention to achieve these objectives. It was also reported that the overall coverage of this program is not uniform throughout the country, some districts achieving more than 100% of their target whereas others are far behind. The program has adopted strategies including providing immunization services mainly through EPI outreach sessions; increasing public awareness about immunization; promoting social mobilization for increased public demand for immunization services; promoting innovative strategies like "National Immunization Day", other supplemental immunization activities like Tetanus toxoid (TT) campaign in 17 high risk districts for immunization coverage and reduced missed opportunities, minimizing drop-out rates and waste rates, and increasing access to immunization.

### **National Tuberculosis Control Program**

Although the association between exposure to indoor air pollution and TB has not been confirmed, it is included in this report because of a study in India. Mishra and Smith recently showed on the basis of an analysis of 260,162 persons age 20 and over in India's 19912-93 National Family Health Survey, that persons living in households that primarily use biomass for cooking fuel have substantially higher prevalence of active tuberculosis than persons living in households that use cleaner fuels. This effect is reduced somewhat when availability of a separate kitchen, house type, indoor crowding, age, danger, urban or rural residence, education, religion, caste or tribe, and geographic region are statistically controlled<sup>20</sup>.

About 45% of the total population is infected with tuberculosis (TB) in Nepal, out of which 60% are in the productive age group. Every year, 44,000 people develop active TB out of which 20,000 have infectious pulmonary disease and are able to spread the disease to others. Introduction of DOTS (Directly Observed Treatment Short course) since April 2001 has already reduced the number of deaths but still around 6,000-8,000 people die from this disease each year<sup>21</sup>.

The National Tuberculosis Program (NTP) is an integrated approach within the national general health system to control TB with the National Tuberculosis Center (NTC) as the focal point. The NTP has coordinated with the private sector, local government bodies, NGOs, social workers and others to expand DOTS and sustain the present significant results of NTP. DOTS has now been expanded to 273 treatment centers with 909 sub-centers throughout the country with 89% population coverage by July 2002. The treatment success rate with DOTS is now around 89%<sup>22</sup>.

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<sup>19</sup> Department of Health Services, Annual Report 2001/02.

<sup>20</sup> Dr. M. R. Pandey, 2003 "Health Effects of Indoor Air Pollution" Glow, Vol. 29, February 2003.

<sup>21</sup> Department of Health Service, Annual Report 2001/02, Kathmandu

<sup>22</sup> Department of Health Service, Annual Report 2001/02, Kathmandu

The National Tuberculosis Program benefits from the help of several domestic and international partners. The Nepal Anti-TB Association plays a vital role in controlling TB in the country. Major international partners include the Norwegian Aid (NORAD), DFID, JICA, WHO, International Union Against TB and Lung Disease (IUATLD), SAARC Tuberculosis Center, Britain Nepal Medical Trust, United Mission to Nepal, and GTZ. These partners work in very close cooperation and meet regularly through a Tuberculosis Control Network.

#### **IV. HOUSEHOLD ENERGY, INDOOR AIR POLLUTION AND HEALTH IN NEPAL**

Almost 85% of Nepal's total energy needs are met by traditional biomass fuels (fuel wood, agricultural residue, and animal dung); fuel wood accounts for about 75% of total energy consumption in Nepal. Rural households use these traditional biomass fuels to meet almost all their energy demand (almost 98%), primarily for cooking (and heating) with traditional stoves. Combustion is very incomplete in most of these stoves and results in high emissions, which combine with often poor ventilation to produce very high levels of indoor pollution. Household energy will be discussed in greater length in the next section. The available information on indoor air quality and the health impacts has been presented below.

##### **Indoor Air Quality**

Information on indoor air quality in Nepal is limited. A recent study done by Nepal Health Research Council and others (in 2001) indicate that PM<sub>10</sub> (particulate matter smaller than 10 microns in diameter) concentration for cooking place was 8,207 µg/m<sup>3</sup> where biomass (wood) is burnt and 3,414 µg/m<sup>3</sup> and 1,504 µg/m<sup>3</sup> at the places where kerosene and LPG are used as fuel respectively.

Another study done by Davidson et al in 18 houses in Nepalese villages in 1986 revealed that the total suspended particle (TSP) was 8,800 µg/m<sup>3</sup>, 21 ppm of carbon monoxide (CO) and 368 ppb of nitrous oxide (N<sub>2</sub>O) where biomass (wood) was used as fuel<sup>23</sup>.

Some other reports have also revealed information on indoor air quality in different locations at different time periods in Nepal. They are summarized below<sup>24</sup>:

Pandey M. R. et. al. monitored the personal exposure levels of Respirable Suspended Particulates (RSP), CO and formaldehyde levels during cooking periods in 20 households with traditional stoves (without chimneys) and again after introducing improved cooking stoves (ICS) in rural areas of Nepal's hill region Nepal between November 1986 and March 1987. The mean concentration of RSP was found to be 8,200 µg/m<sup>3</sup> for 1 hour, and the 1- hour concentration of CO and HCHO



**Smoke from kitchen in the morning in Gatlang village, Nepal**

*Source: [http://www.itdg.org/html/smoke/smoke\\_nepal.htm](http://www.itdg.org/html/smoke/smoke_nepal.htm)*

<sup>23</sup> WHO & Nepal Health Research Council, 2002 "Situation Analysis Environmental Health in Nepal 2002" Nepal Health Research Council, February 2002, Kathmandu.

<sup>24</sup> Nepal Environmental & Scientific Services, 2001 "Final Report on WHO/PoA NO. NEP PHE 001, Result No. 8" Report submitted to Nepal Health Research Council in September 2001.

(formaldehyde) were 82.5 ppm and 1.4 ppm respectively for traditional stoves. In the case of ICS, the mean concentration of RSP, CO and HCHO were 3000  $\mu\text{g}/\text{m}^3$ , 10.8 ppm and 0.6 ppm respectively. Ried et. al, (1986) monitored personal exposures of women to TSP and CO during cooking periods in 60 households with traditional stoves (without chimneys) and improved cook stoves (with chimneys) in the Middle Hills of Nepal, namely, Gorkha, Beni and Mustang. The mean concentration of TSP was found to be 3170  $\mu\text{g}/\text{m}^3$  in Gorkha, 3,110  $\mu\text{g}/\text{m}^3$  in Beni and 1750  $\mu\text{g}/\text{m}^3$  in Mustang with traditional stoves. The mean concentration of CO was 280 ppm in Gorkha, 310 ppm in Beni and 64 ppm in Mustang. In the case of improved cooking stoves, the mean concentration of TSP was 870, 1,370 and 920  $\mu\text{g}/\text{m}^3$  in Gorkha, Beni and Mustang respectively. The mean concentration of CO with improved cooking stoves is not given.

Hessen et. al also monitored TSP and CO for 24 hours and 8 hours in 34 households through principal caregivers using traditional stoves in Jumla, a remote district of Nepal. The mean concentration of TSP was found 8,420  $\mu\text{g}/\text{m}^3$  for 24 hours and 5,000  $\mu\text{g}/\text{m}^3$  for 8 hours. The 24 hours mean concentration of CO was 13.5 ppm and 8 hours was 23.42 ppm.

Another study carried out by Davidson et. al in 1986 measured indoor air pollution inside kitchens in the northern Himalayan region of Nepal where biomass use is very common for cooking and heating. The level of total suspended particulate matter (TSPM) was found in the range of 3,000-4,200  $\mu\text{g}/\text{m}^3$  and RSP in the range of 1,000-1,400  $\mu\text{g}/\text{m}^3$  in the households sampled. It was also found that high per capita biomass fuel was responsible for the excessive pollutant concentrations. A higher concentration of potassium and methyl chloride obtained in a snow sample taken outside of the house indicated that indoor biomass combustion also has an impact on the outdoor environment.

NESS (Nepal Environmental & Scientific Services) monitored PM10 concentration in different localities of Kathmandu: city core area, sub-core area, remote and industrial area for different fuel type (LPG, kerosene, and wood) in 2001. They found that PM10 concentrations in wood burning houses are 6 times greater than in LPG-using houses, and 2.4 times greater than kerosene-using houses. Similarly, PM10 concentration in LPG-using houses was 2.26 times greater than in kerosene-using households. The same study also compared the PM10 concentration levels in two micro-environments in a house: the kitchen and living room. The findings show that the PM10 concentration level in the living room is 1.36 times less in LPG-using houses, 1.26 times less in kerosene-using houses and 5.5 times less in wood-burning houses.

These emission levels are much higher than the national and international standards. The national ambient air quality standards for Nepal are 230  $\mu\text{g}/\text{m}^3$  for total suspended particles (TSP) and 120  $\mu\text{g}/\text{m}^3$  for PM10 in 24 hour average time. The 8-hour average CO standard is 10,000  $\mu\text{g}/\text{m}^3$  for Nepal<sup>25</sup>. The ambient air quality standards of United States Environmental Protection Agency (USEPA) for PM10 are 50  $\mu\text{g}/\text{m}^3$  in annual average and 150  $\mu\text{g}/\text{m}^3$  in 24 hour average. The USEPA 8-hour average CO standard is 9 ppm or 10,000  $\mu\text{g}/\text{m}^3$ . It should be noted that the revised WHO air quality guidelines do not quote values for PM10 because there is growing evidence that there is no safe lower limit of exposure. However, the WHO 8-hour average CO standard is 10 ppm<sup>26</sup>.

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<sup>25</sup> Ministry of Population and Environment, His Majesty's Government of Nepal at:

<http://www.mope.gov.np/environment/air.php>

<sup>26</sup> Bruce, N., Perez-Padilla, R., Albalak, R, 2002 "The Health Effects of Indoor Air Pollution Exposure in Developing Countries" Report submitted to the World Health Organization.

## Health Impacts of Indoor Air Pollution

This clearly demonstrates that women and children who are mostly in the kitchen and inside the house are exposed to high levels of indoor air pollution. There has been consistent evidence that indoor air pollution increases the risk of chronic obstructive pulmonary disease and of acute respiratory infections in childhood, the latter of which is also the major cause of death among children under 5. Similarly, low birth weight, increased infant and perinatal mortality, pulmonary tuberculosis, nasopharyngeal and laryngeal cancer, and cataracts have shown to be correlated with indoor air pollution.

ARI is very important in the Nepalese context because of the climate, terrain and living conditions of the people. ARI, in conjunction with acute diarrheal diseases and/or malnutrition, is a major cause of morbidity and mortality among children under five. According to the Ministry of Health, ARI is the third highest cause of morbidity in Nepal after skin and diarrhea, affecting 3.13% of the total population. Chronic bronchitis falls at the eighth position<sup>27</sup>. Pandey et. al. examined 240 rural children under 2 years of age for 6 months and found a significant relationship between number of hours spent near the fire (as reported by the mother) and the incidence of moderate and severe ARI cases<sup>28</sup>.

Chronic obstructive lung disease (COLD) is another major risk factor in many countries, especially among women, and has been found to be significantly and strongly associated with smoke exposures from cooking on open biomass stoves in several studies, although there are difficulties establishing exposure histories and controlling for confounders. In rural Nepal, nearly 15% of non-smoking women (20 years and older) had chronic bronchitis, a high rate for non-smokers<sup>29</sup>.

There are not many studies available on the health impacts of indoor air pollution in Nepal. Dr. Mrigendra Raj Pandey has done some studies with his other colleagues on this topic in different parts of the country which are summarized below<sup>30</sup>:

An epidemiological study conducted in a rural community in the hilly region of Nepal revealed a significant positive correlation between the prevalence of chronic bronchitis and average amount of time of exposure to indoor air pollution both amongst smokers and non-smokers.

A study conducted in a hilly remote area of Nepal to find out the relation between indoor air pollution and ARI in infants and children under 2 years showed that episodes of moderate and severe ARI increased with increments in exposure to indoor air pollution. The study suggested that indoor air pollution is an important risk factor of ARI.

Another study conducted on the effect of indoor air pollution on respiratory function in 150 randomly selected females, aged 30-44 years, from a rural area situated in the outskirts of Kathmandu showed a

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<sup>27</sup> <http://www.moh.gov.np>

<sup>28</sup> SEECON - Social, Environmental and Engineering Concern, 2000 "Status of Improved Cooking Stove Technology in Nepal" Report submitted to ITDG, Kathmandu, Nepal.

<sup>29</sup> Smith 1996 in SEECON - Social, Environmental and Engineering Concern, 2000 "Status of Improved Cooking Stove Technology in Nepal" Report submitted to ITDG, Kathmandu, Nepal.

<sup>30</sup> Nepal Environmental & Scientific Services, 2001 "Final Report on WHO/PoA NO. NEP PHE 001, Result No. 8" Report submitted to Nepal Health Research Council in September 2001.

fall of mean Force Vital Count (FVC). This decline was found to be statistically significant amongst the smokers but not amongst the non-smokers.

The review of the cases of discharges of ten hospitals with a combined capacity of 265 beds in 1971 revealed that acute respiratory infection (ARI) accounted for 32.1% of mortality for infants less than 1 year and 11.2% for children aged between 1-4. Analysis of the data (April 1982 - March 1983) from Kanti Children's Hospital showed that out of 3,319 cases admitted, 37.8% (1,256 cases) were admitted due to ARI. It was also found that ARI accounted for 49.8% of admissions in the 0-1 age group, 36.3% in 1-5 age group and 13.9% in 5-14 age group.

A survey conducted in Jumla in 1981 revealed that the mortality rate in 0-1 year age group is one of the highest ever reported from anywhere in the world. The total mortality rate was 488.9 per 1000 out of which 333.3 were due to ARI. However, the mortality rate declined drastically in 5-9 age group. It has been reported that such a high mortality rate could be due to various respiratory, bacterial, and viral infections.

A house-to-house survey in Sundarijal (north of Kathmandu) with a sample of 3,258 in 1979 showed that 12% of the adults (>20 years) were found to have chronic bronchitis and 3.1% has associated emphysema. Around 51% of the chronic bronchitis and 38% of emphysema were found among women. The study revealed that chronic bronchitis was 3 times more common in smokers than non-smokers.

Chronic bronchitis and chronic obstructive pulmonary disease (COPD) is a leading cause of death and disability of human life around the world. According to a study carried out in four different sites: urban Kathmandu, the Sundarijal and Bhadrabas villages of Kathmandu district from the rural hill region, Parasauni of Bara district from the plain region, and Chandannath of Jumla district from mountain region of Nepal showed the crude prevalence rate of chronic bronchitis to be 11.3% in urban Kathmandu, 13.1% in Parasauni, 18.3% in Sundarijal and Bhadrabas and 30.9% in Chandannath. There were similarly high rate of chronic bronchitis in women and in men. This contrasts with the findings of other studies which show lower prevalence rate among women. A higher percentage of women as compared to men in all the four sites were either non-smokers or smoked lesser quantities. However, a significantly higher proportion of women as compared to men in all the four areas were exposed to indoor air pollution for longer hours. In Sundarijal and Bhadrabas, the increasing trend of the prevalence of chronic bronchitis as the hours of exposure to indoor air pollution increased (even after elimination of the age effect and also among non-smokers) further establishes the definite role of indoor air pollution in causing this disease<sup>31</sup>.

ITDG is now monitoring indoor air pollution levels in different scenarios in remote parts of Nepal and it is expected that the results will be very helpful in understanding the role of improved cooking technologies and levels of indoor air pollution.

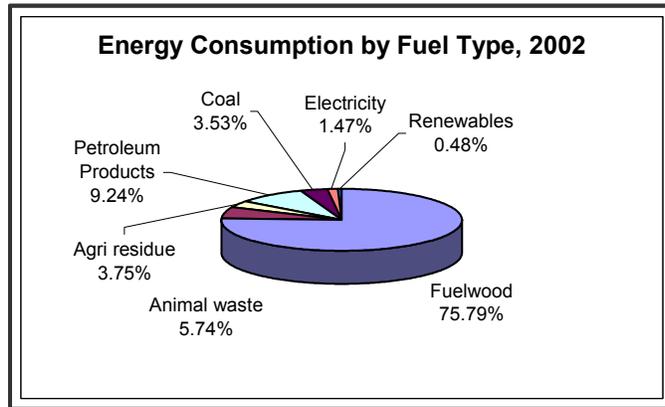
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<sup>31</sup> Dr. M. R. Pandey, 2003 "Health Effects of Indoor Air Pollution" Glow, Vol. 29, February 2003.

## V. HOUSEHOLD ENERGY IN NEPAL

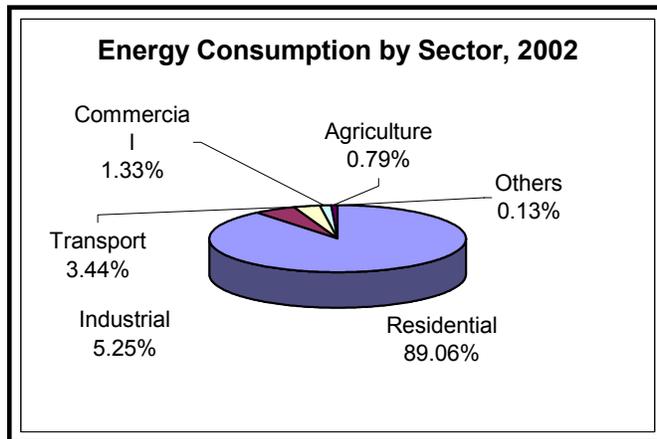
Nepal has a per capita energy consumption of around 15 GJ, which is one of the lowest in the world. Nepal relies heavily on traditional energy sources to meet its energy requirements. According to the Economic Survey 2003, more than 85% of the total energy demand is met by traditional sources, of which fuel wood is the main source of energy as shown in figure 2<sup>32</sup>.

**Figure 2 Energy Consumption By Fuel Type**



The remaining portion of the energy demand is met by though commercial sources, including petroleum, coal and electricity. Imported fossil fuel dominates the commercial sources and electricity accounts for just over 1%. The 10th five-year plan states that a total of 40% of the Nepali population has access to electricity. However, according to the Nepal Electricity Authority (NEA, 2003) only 22 percent of households have access to electricity and 7% from alternative source of energy.

**Figure 2: Energy Consumption by Sector**



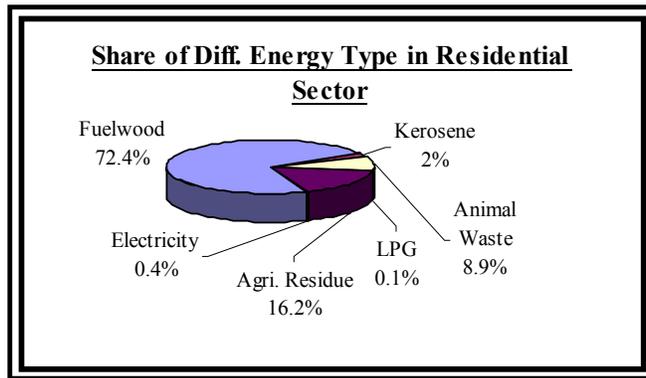
The residential sector consumes almost 90% of the total energy consumption of the country. The industrial, transportation and commercial sectors consume 5.25%, 3.44% and 1.33% of total energy consumption respectively as shown in the figure<sup>33</sup>. The agricultural sector consumes less than 1% of total energy consumption.

Energy end-uses of the domestic sector are mainly cooking and lighting. The total demand of 247 million GJ in the domestic sector in 1992-93 was met mostly (72%) by fuel wood, followed by 16.2% agricultural residue. Commercial energy consumption was nominal, with kerosene and LPG making up 2% and 0.1% respectively in that year.

<sup>32</sup> Ministry of Finance, 2003 "Economic Survey 2003" Kathmandu, Nepal

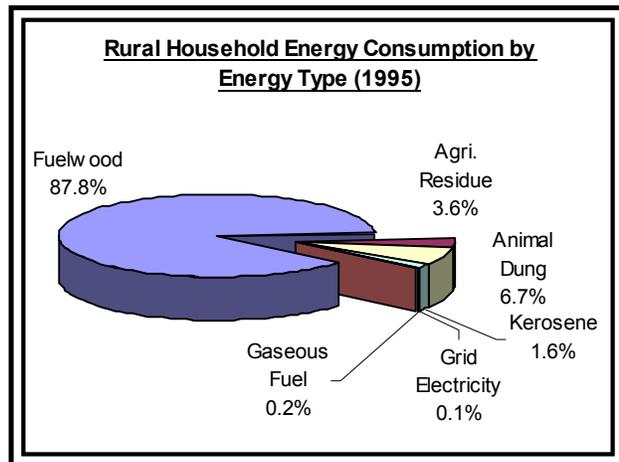
<sup>33</sup> Water and Energy Commission Secretariat, 2003

**Figure 3: Energy consumption in residential sector**



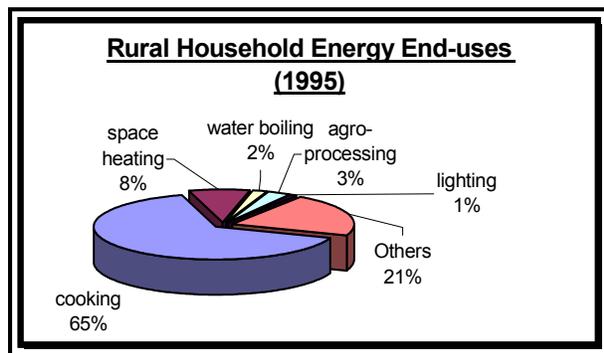
About 85% of Nepal's population lives in rural areas where agriculture is the mainstay. The Water and Energy Commission Secretariat (WECS) carried out a detailed study on energy consumption patterns in rural households in Nepal in 1995. As shown in the figure below, fuel wood dominates almost 90% of the total energy consumption in the rural areas of Nepal. Animal dung and agricultural residues provide the second and third energy sources for rural households.

**Figure 4: Energy consumption in rural household**



The level of electrification was negligible in 1995 as was the use of appliances. Kerosene lamps are the most common lighting appliances in rural areas; they consume about 1 percent of total rural energy consumption. As shown in the figure, rural energy is heavily dependent upon biomass .

**Figure 5: Energy end-use in rural household**



According to the same survey conducted by WECS in 1995, residential cooking is the single largest end-use, accounting for about 65% of total energy consumption in rural areas, followed by space heating, and water boiling, as shown in the figure 6<sup>34</sup>.

Women in rural areas perform most of the household tasks, from collecting firewood and cooking, to looking after children. On average, hills households (without biogas) in rural areas

<sup>34</sup> Water and Energy Commission Secretariat, 1995

consume about 6 tons of firewood during summer and 7.6 tons during winter. Households in the Terai consume 3.7 tons of firewood during summer and 5.4 tons during winter<sup>35</sup>. Wood collection for cooking food is getting tougher as forests get depleted and women have to walk for hours to find wood. The time cost alone can be extreme in rural areas. Estimates range from two to twenty hours per week spent in collecting wood and the distance covered could be significant in difficult terrain. One extreme is reported that women can walk over 20 km per journey in search of wood in Nepal<sup>36</sup>. This level of work and the drudgery of everyday chores leave poor women with little time on other activities, such as earning money or even taking rest and even further contributes to additional threats on health and well-being. Women are vulnerable to back problems from carrying heavy loads, for instance. In rural areas of Nepal, women spend about six hours of their time under hazardous conditions while cooking over traditional stoves that spew highly toxic materials, giving rise to eye infections and other respiratory problems for them, their children and other family members<sup>37</sup>.

## **VI. KEY ACTORS AND STAKEHOLDERS IN HOUSEHOLD ENERGY AND HEALTH IN NEPAL**

### **Government**

#### ***The Nepal Electricity Authority (NEA)***

NEA is the national utility company of the country responsible for generation, transmission, and distribution of electricity. Independent power producers also play an important role by contributing around 20% of the total installed capacity. NEA supplies electricity to a total of around 885,000 customers generating revenues of around Rs 9.7 billion in 2002. NEA is extending rural electrification but most rural households are still without access to the national grid. A Danida funded rural electrification project is on-going in the districts of Kailali and Kanchanpur with a target of connecting 30,000 new households in 34 Village Development Committees (VDCs) of the two districts by 2005-06 with an objective to handover the operation to local users' cooperatives. Another rural electrification project funded by Asian Development Bank (ADB) targets to connect about 123,400 rural households of 277 VDCs in 22 districts of Nepal<sup>38</sup>. Most rural consumers benefit from lower lifeline rates given to customers for the first 20 units of use each month. It is uneconomic for NEA to extend transmission lines to rural areas with dispersed population centers and low consumption. The cost of reading meters, collecting revenue, and checking pilferage is also most difficult in rural areas. It is for these reasons, NEA has recently started to handover electricity distribution systems in the bulk price to the private sectors and cooperatives.

#### ***The Alternative Energy Promotion Center (AEPC)***

AEPC is country's nodal agency responsible for the promotion of renewable energy technologies. It is the central organization through which HMG/N as well as bilateral and multilateral aid channel resources to support distributed energy services. AEPC was established in November 1996 under the Ministry of Science and Technology. The major work areas of AEPC include biogas, micro-hydro, solar, wind, and improved cooking stoves (ICS). AEPC does not directly implement renewable energy projects but works with the renewable energy industries and NGOs to provide decentralized renewable energy services to rural as well as urban communities. AEPC's major program is the

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<sup>35</sup> Integrated Environment Impact Assessment, Biogas Support Program, 2002

<sup>36</sup> Warwick, H and Doig, A, 2004 "Smoke - the Killer in the Kitchen" ITDG

<sup>37</sup> Rural Development Program, GTZ Nepal

<sup>38</sup> Nepal Electricity Authority, 2003 "Nepal Electricity Authority - Fiscal Year 2002/03 - A Year in Review", August 2003, Kathmandu, Nepal.

Energy Sector Assistance Program (ESAP) signed between HMG/N and the Government of Denmark in March 1999. AEPC/ESAP has far exceeded the expected outputs and more than 56,000 ICS, 33,000 SHS and 900 kW new micro-hydro plants were installed by the end of 2003<sup>39</sup>. The Interim Renewable Energy Fund jointly managed by AEPC and ESAP processes requests for grant financing to micro-hydro and solar PV projects. Two additional national level renewable energy projects/programs are now also working under AEPC: Biogas Support Program (BSP/SNV) and the Rural Energy Development Program (REDP/UNDP).

### ***Rural Energy Development Program (REDP)***

REDP is a joint program of HMG/N and UNDP and is a leader in the promotion of micro-hydropower in Nepal. It has approached micro-hydropower from a social mobilization perspective with a holistic approach. The program was started in September 1996, and was later extended to 15 districts. The program has taken micro-hydro as an entry point and disseminated other rural energy technologies like biogas, solar home systems, and ICS. The total power generated from 120 micro-hydro and peltric set systems was more than 1,575 kW by the end of June 2003. By the same date, almost 3,000 biogas plants (with toilet attached), 1500 SHS and 7,200 ICS were also installed<sup>40</sup>. With the recent grant assistance from the World Bank, the program was extended through 2006 and will cover 25 districts in total.

### ***Ministry of Health***

The Ministry of Health (MOH) is responsible for formulating policies and making any necessary arrangements for effective delivery of curative services, disease prevention, health promotion activities, and establishment of the primary health care system. The ministry plays a leading role in improving the health of the people including physical, mental and social well-being, for overall national development with the increased participation of private sector and non-governmental institutions to implement the plans and programs. Followings are the two major plans and policies of the government:

National Health Policy, 1991 - The National Health Policy was adopted in 1991 with the primary objective of extending the primary health care system to rural people. The policy has addressed issues including preventive health services (to reduce infant and child mortality rates); promotive health services; curative health services; basic primary health services; Ayurvedic and other traditional health services; organization and management; community participation in health services; human resources for health development; resource mobilization in health services; private, non-governmental and inter-sectoral coordination; decentralization and regionalization; blood transfusion services; drug supply; and health research.

Second Long-term Health Plan, 1997 - 2017 - This 20 year plan addresses disparities in healthcare, assuring gender sensitivity, and equitable community access to quality healthcare services. Its main aim is to provide a guiding framework to prepare annual health plans and programs, and to coordinate with private sector and NGOs. Some of the targets set in this plan include reducing the infant mortality rate to 34.4 per thousand live births, reducing the under five mortality rate to 62.5 per thousand, increasing the life expectancy to 68.7 years, and increasing total health expenditures to 10% of total government expenditure<sup>41</sup>.

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<sup>39</sup> Alternative Energy Promotion Center at [www.aepcnepal.org](http://www.aepcnepal.org)

<sup>40</sup> Information received from Rural Energy Development Program

<sup>41</sup> Department of Health Services, Annual Report 2001/02, Kathmandu

### ***Department of Health Services***

The Department of Health Services (DHS) is established as one of three departments under the Ministry of Health with the overall purpose to deliver preventive, promotive, and curative health services throughout the country. There were 79 hospitals, 178 Primary Health Care Centers (PHCC)/Health Centers (HC), 705 Health Posts (HP) and 3,132 Sub Health Posts (SHP) involved in the delivery of basic health services in Nepal under this department in 2001-02. Some of the major tasks of this department include establishing relationships with foreign countries and international institutions with the objective of enhancing effectiveness and developing health services and assisting the Ministry of Health in receiving foreign aid by clearly identifying the areas of cooperation; mobilizing assistance in the implementation of approved programs, creating conducive atmosphere to encourage the private sector, NGOs, and foreign institutions to participate in health services, maintain relation and coordination, quality control of health services by regular supervision and inspection.

### ***Nepal Health Research Council***

Nepal Health Research Council (NHRC) was established in 1991 to promote scientific study and quality research on health problems in Nepal. It was started as a Nepal Medical Research Committee under the Secretary of Ministry of Health in 1981 but was later upgraded as a council to incorporate all the stakeholders involved in the health research network. Its role is to promote health research by providing technical assistance to researchers, promoting ethical health research and providing information support to research scholars<sup>42</sup>.

## **NGOs**

### ***Biogas Support Program (BSP)***

BSP was started in 1991 with support from the Dutch government. It has been successful in scaling up the number of plants from around 11,000 when it started to more than 120,000 plants today and the number of companies installing plants have gone from one to 49<sup>43</sup>. Around 97% of the biogas plants installed are operating in good condition. Biogas is attractive because of its benefits of improved indoor air quality and reduction in firewood and/or kerosene needs. Biogas is present in 65 districts out of 75 in Nepal. BSP is the ISO 9001-2000 certified institution.

Biogas Sector Partnership-Nepal (BSP-Nepal) has been established to take over the BSP/SNV responsibilities and liabilities as well as continue the biogas program in Nepal.

### ***Center for Rural Technology (CRT)***

CRT was established in 1989 with objectives including: to promote and disseminate appropriate technologies, conduct adoptive and action oriented research on indigenous and improved technologies, train and transfer technical information and know-how and to provide information on rural technologies and assist people and organizations to develop and strengthen their technical and managerial capabilities. CRT is involved in the promotion, dissemination and training of ICS, solar cooker, solar dryer, and improved water mills.

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<sup>42</sup> The detailed information on Nepal Health Research Council can be obtained at: <http://www.nhrc.org.np/>

<sup>43</sup> Information received from Biogas Support Program

### ***Center for Renewable Energy (CRE)***

CRE is a non-governmental and non-profit organization established in July 1992. Its main work areas include conducting awareness programs, publishing efforts and success stories on renewable energy and appropriate technologies, undertaking adaptive research, and meeting the needs for demonstration plants. CRE studies, plans, designs, and promotes efficient generation and utilization of renewable energy and appropriate technology as well as innovative means for conserving energy.

### ***Center for Energy Studies (CES)***

CES was established in January 1999 at the Institute of Engineering, Tribhuvan University. The major working areas of CES include human resource development, research and development and awareness programs in renewable energy technologies (RET). CES organizes regular interaction and awareness programs in RET for different groups of people including members of parliament, senior journalists, school teachers, and government officials, among others.

### ***King Mahendra Trust for Nature Conservation (KMTNC)***

KMTNC was established in 1982 as an autonomous, non-profit and non-governmental organization to work in the field of nature conservation in Nepal. Promotion of alternative energy technology among rural communities is a priority program component of KMTNC. It is involved in promoting micro-hydro, biogas, solar energy based technologies and disseminating efficient cooking stoves in its programs in Annapurna and Manasalu conservation areas, Chitwan and Bardiya districts.

### ***Nepal Red Cross Society***

Since its inception in 1963, the Nepal Red Cross Society has been involved in implementing programs including blood transfusion, ambulance, and eye care and is the largest humanitarian organization in Nepal with its network of District Chapters extending to all 75 districts. Reproductive Health and HIV/AIDS awareness are being carried out through launching extensive campaigns and by implementing area-based projects in various parts of the country. The Nepal Red Cross Society has been working in the field of population activities since 1980. The Society has been implementing community-based health programs including the family planning program, HIV/AIDS prevention and control programs, First Aid, Health Education programs, IEC Programs, National Health Campaigns (Safe Motherhood, Condom Day, World AIDS Day, and Immunization Day). These programs are being integrated into its Community Health and Primary Health Care Programs. The Society spent about NRs 116.7 million in 2001-02 out of which NRs 21.9 million was for health education with the Swiss support, NRs 65.6 million for various community development activities with the support from Belgium and Sweden and NRs 6.2 million for HIV/AIDS awareness with Swiss, and Norwegian support<sup>44</sup>.

### ***Aamaa Milan Kendra (Mothers' Club)***

Aamaa Milan Kendra (AMK) is a national NGO established in 1975 with the main objective of improving social, economic and health status of women in general with a special grassroots level focus. It is implementing the "Strengthening Access to Community-based Reproductive Health" project through Aamaa Milan Kendra with financial support from EC/United Nations Population Fund (UNFPA) and the "Adolescent Girls Initiative for Their Reproductive Health (A Gift for RH)" project with financial support from Center for Development and Population Activities (CEDPA). Past and present partners include UNDP, UNICEF, UNFPA, OXFAM/Nepal, the International Labor

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<sup>44</sup> Department of Health, Annual Report 2001/02, Kathmandu

Organization, the Center for Development and Population Activities, and World Education. The Club contributed US\$53,000 in addition to support of around US\$712,500 from EC/UNFPA to carry out various activities in 2001-02<sup>45</sup>.

### ***Mrigendra Samjhana Medical Trust***

Mrigendra Samjhana Medical Trust was established by Dr. Mrigendra Raj Pandey in 1975 with the main objective of providing medical care, health services and social services to the underprivileged community, together with education, drinking water, income and employment generating facilities, improved indoor environment and anti-tobacco activities in the country. The trust has conducted advocacy and special community based action research programs to address the issue of indoor air pollution and tobacco smoking since its inception<sup>46</sup>.

## **Private Sector**

### ***Agriculture Development Bank of Nepal (ADB/N)***

After its establishment in 1968, ADB/N has been functioning as one of the pioneer institutes committed to renewable energy development of Nepal. The bank is actively involved in the promotion of micro-hydro power (MHP), solar home systems (SHS) and biogas installation. The bank has invested for the installation of 4490 kW of micro-hydro through a contribution of NRs 148.2 million as of fiscal year 2001-02. The total number of SHS installed through the bank's contribution is recorded to be 5647 with total investment of NRs 109 million as of fiscal year 2001-02. Similarly, the bank has invested NRs 777 million for the installation of about 51,800 plants as of fiscal year 2001-02. The bank is operating its activities in three broad areas: Development Financing Sector, Poverty Alleviation Program through Small Farmers Development Program and Commercial Banking Sector.

### ***Nepal Contraceptive Retail Sales Company***

The Nepal Contraceptive Retail Sales (CRS) Company is a non-profit social marketing organization operating in the health and family planning sector of Nepal. CRS came into existence in 1978 as a pilot project of the Nepal Family Planning/Maternal Child Health Project of the Ministry of Health, with the prime mission of strengthening HMG's national family planning and primary health care programs by enhancing the level of knowledge and awareness regarding birth-spacing family planning methods (contraceptives) and creating demand by dispensing contraceptive products through retail outlets and medical facilities. Since its inception, CRS Program has been supported by USAID with additional support from the Kreditanstalt fuer Wiederaufbau (German Development Bank - KfW) later on. USAID/Nepal continues to support through USAID-DC the AIDSMARK Project on which the leading social marketing international NGO Population Services International (PSI) is a prime. In 1983, CRS acquired corporate status by becoming a non-profit private limited company, incorporated under the Nepal Company Act 1965. Since then, CRS has grown into a professionally-managed social marketing company in the health and family planning sector of Nepal.

CRS social marketing program includes family planning products, oral rehydration salt, Safe Home Delivery Kits and other health related products. These products being marketed and distributed are widely available all over the country through the traditional (pharmaceutical) and non-traditional outlets. CRS has introduced a commercial distribution system in order to distribute its products

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<sup>45</sup> Department of Health, Annual Report 2001/02, Kathmandu

<sup>46</sup> More information can be obtained from <http://www.msmt.org.np/index.htm>

efficiently in various parts of the country. There are five regional offices, 12 distributors and 1083 non-traditional outlets far exceeding the target of only 648 in 2001-02. The annual expenditure of CRS was Rs. 45.5 million in 2001-02 and the cost recovery through revenue of sales of its products is about 65%<sup>47</sup>.

## **Bilateral and Multilateral Institutions**

### ***Department for International Development (DFID)***

DFID is the UK's international development department, and their program in Nepal supports the priorities outlined in the plan and policies of Nepal and its own country strategy. DFID wishes to assist communities to make appropriate demands on health services for equitable access and quality care. Civil Society Challenge Fund (CSCF) support is countrywide through British INGOs. Technical support of DFID to Nepal consists of a Health Adviser and technical staff on the Safer Motherhood Project (SMP) and District Health Support Projects (DHSP). The SMP districts in Phase 1 are Baglung, Surkhet, and Kailali and the phase 1 DHSP districts are Baglung, Surkhet, and Rupendehi. National-level support is provided through the procurement of contraceptives, and assistance to the national TB and HIV/Aids programs. The approved financial allocations for Nepal are summarized below<sup>48</sup>:

Safer Motherhood Project (£3,632,000/NRs. 334.14 million) 1997-98 to 2002-03. The purpose of this project is to increase utilization of good quality essential obstetric services in NSMP districts.

National Reproductive Health Care Program (£11,041,000/NRs. 256.82 million), with UNFPA from 1997-98 to 2000-01. The purpose of this project is the provision of contraceptives.

Nepal District Health Strengthening Project (£3,721,000/NRs. 342.33 million) 1997-98 - 2001-02.

The purpose of this project is health service delivery and utilization in the project districts, improved in ways that can be replicated elsewhere.

Support to National Tuberculosis Program: (£5,416,000) - Started January 2001 and ending December 2005. The purpose of this project is to provide effective diagnostic and treatment facilities for all patients with TB, within the existing primary health care system.

Program Preparation Phase to develop a Health and Population Program for Nepal (£500,000) 1999 – 2001. The purpose of the program is to improve access to and utilization of quality health services, building on the above existing DFID contributions in health. The first stage involved participation in the Health Sector Review exercise, which should be the basis for a sectoral strategic plan in which key interventions will be identified for support. DFID supports multilateral agencies active in Nepal and British international NGOs that are active in the health sector.

### ***German Technical Cooperation (GTZ)***

German technical assistance within HMG's health sector began in 1994 with the implementation of the Primary Health Care Project. Over the next seven years, projects in the area of reproductive health, physical assets and drug management have been added. In order to improve the development impact and to enhance cost effectiveness, HMG and GTZ agreed to form a more comprehensive health service support package. As such, the 'Health Sector Support Program' (HSSP) was officially launched in January 2001. All former projects, 'Primary Health Care', 'Reproductive Health',

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<sup>47</sup> Department of Health, Annual Report 2001/02, Kathmandu. More information on CRS Company can also be obtained through [www.crs.org.np](http://www.crs.org.np)

<sup>48</sup> Ministry of Health, His Majesty's Government of Nepal at: <http://www.moh.gov.np>

'Physical Assets Management' and 'Community-Based Drug Management', now constitute the components of the new program.

In addition to central level support, HSSP covers five districts. These include Siraha in the Eastern Development Region, Dhading in the Central Development Region, Bardiya in the Mid-Western Development Region, and Achham as well as Doti in the Far-Western Development Region. HSSP follows a two-pronged approach by working at both the district and central level. In partnership with the Department of Health Services (DHS), HSSP focuses in particular on contributing to the development of strategic planning in the Ministry of Health, improving human resources management, and the management of information systems and training. At the district level, the program makes major contributions to improve public health services. This includes regular advanced training for district health staff and, increasingly, the development of innovative approaches to the local management of health services.

The financial allocation for the HSSP first phase (January 2001 to June 2003) was up to DM 11. 8 million (NRs. 413 million).

### ***John Hopkins University/Population Communication Services***

The John Hopkins University/Population Communication Services (JHU/PCS) Nepal Office was established in 1993 with financial assistance from USAID. The overall goal of the JHU/PCS program is to assist the government of Nepal in its efforts to reduce fertility and improve maternal and child health. The primary objective of JHU/PCS is to provide technical assistance to supplement and complement HMG, NGO, and private sector activities on reproductive health and family planning through information, education, communication, and inter-personal communication and counseling interventions. JHU/PCS initiated the Radio Communication Project (RCP) in 1995 to educate Nepalese people about modern contraceptive methods and reproductive health services. In 1995, a distance education pilot program ("Service Brings Reward") was initiated in Surkhet, targeting the health workers of Dang district. The success led policy makers to conclude that the program should continue to broadcast. As a result, "Service Brings Reward" continues to be broadcasted from Radio Nepal in Kathmandu.

Besides working with HMG counterparts, JHU/PCS also collaborated with SCF/USA in promoting the Radio Communication Project. Currently, JHU/PCS is working with the Center for Development and Population Activities (CEDPA) to maximize its audience and to use RCP messages through community mobilization and community networking activities.

### ***Japan International Cooperation Agency (JICA)***

Japan has a long history (starting in the late 1950s) of supporting Nepal's health sector in the following two areas: promotion of public health activities that focus mainly on maternal and child healthcare, and promotion of a health/medical service delivery system. JICA is conducting the Maternity, Child and Community Health Program and the Health and Medical Service Delivery Improvement Program in Nepal. In this endeavor, with technical assistance from JICA, the National Tuberculosis Program started in 1987, continuing to the present. Under the child health program and in collaboration with the Japan Medical Association (JMA), JICA is supporting the School and Community Health Project (SCHP). The major goal of this project is to improve community health by targeting school children and school staff as a means of effectively disseminating health information. For the purpose of transferring technology to Nepalese counterparts, JICA experts and volunteers are also dispatched to various health facilities around the country.

### ***John Snow, Incorporated***

John Snow Inc. (JSI) provides technical assistance for the implementation of USAID's bilateral agreement with the MoH for support to the Logistics and Child Health Programs. Through a subcontract with Management Support Services (MASS), JSI provides logistical support to implement USAID's supplemental work plans for the Control of Diarrheal Disease, ARI, Female Community Health Volunteer, Family Planning and Maternal Health Programs and technical support to the Finance Section, DoHS. JSI provides technical assistance to the MoH to conduct the national CDD/ARI/CB-IMCI and FCHV Programs. At the central level, the JSI Child Health (CH) team assists with planning, training, budgeting, monitoring, and analyses of program implementation. JSI Regional Field Offices support monitoring, supervision, and feedback mechanisms to strengthen program implementation. Through a subcontract with the Nepal Technical Assistance Group (NTAG), JSI supports the Child Health Division (CHD) in the implementation of the National Vitamin A Program (NVAP) and USAID's supplemental vitamin A work plan activities.

### ***Swiss Agency for Development and Cooperation***

The Rural Health Development Project (RHDP) is a continuation of the Primary Health Care, Mother Child Health and Family Planning Project of HMG and the Swiss Agency for Development and Cooperation (SDC). This project emerged in 1991 as an offspring of the Integrated Hill Development Project (IHDP) of 1975-1990. RHDP works with a variety of partners at district and VDC levels in Dolakha and Ramechhap districts to improve the health status of all villagers through a locally adapted, affordable health system that enhances health conditions by providing comprehensive health services at local level. RHDP aims for a healthy society through a process of social development-empowering women and men to take responsibility for health-related community actions that support and facilitate improvement in health services.

### ***United States Agency for International Development (USAID)***

The United States Agency for International Development (USAID) has supported health sector programs in Nepal for more than 50 years. The current country program supports MoH under a five year bilateral Strategic Objective (SO) Agreement covering the period 2001-2005. The program includes activities which support HMG's objectives under the Second Long-Term Health Plan 1997-2017 and the SO agreement focuses on four major sectors, including:

- Family Planning (FP);
- Maternal and Child Health (MCH);
- Prevention and control of HIV/AIDS/STDs; and
- Control of infectious diseases.

To implement these programs, USAID provides on average US\$15 million per year in technical assistance, training, behavior change, communications, and logistics management to support five national level HMG programs: the National Family Planning Program, the National Community-based Child Health Program (Integrated Management of Childhood illness), the National Vitamin A Program, the National Safe Motherhood Program, and the National Female Community Volunteer Program. Under maternal and child health activities, it supports interventions for community-based control and prevention of the primary causes of childhood deaths: acute respiratory infections, diarrheal diseases, and vitamin A deficiency. The interventions are implemented through both the public sector and NGOs in innovative collaborative activities. An important component of the child health program is USAID's support to the Female Community Health Volunteers (FCHVs). The primary partners in of this child health program include The Asia Foundation, Save the Children/US,

CARE/Nepal, Plan International, and John Snow, Inc. Over this strategic plan period (2001-2005), annual funding of around US\$ 15 million is allocated among proposed programs as follows<sup>49</sup>:

Health and Population (SO2)	US\$ 12 million
Private Sector Hydropower (SO4)	US\$ 2 million
Strengthened Governance (SO5)	US\$ 1 million

Some 80% of the total funding is earmarked for population, child survival, HIV/AIDS and other health related programs.

### ***United Nations Population Fund (UNFPA)***

The UNFPA 5th Country Program Support (2002-2006) has been divided into two sub-programs: reproductive health and population and development. A total of US\$16 million has been budgeted for these two programs of which around 12.8 million is allocated for reproductive health. UNFPA extends support to His Majesty's Government through MoH but also joins hands to co-finance with other donor agencies including USAID, UNICEF, GTZ, WHO etc. for support for management capacity, national Female Community Health Volunteers Program and others. UNFPA has also supported the National Health Education Information and Communication Center (NHEICC) to produce and disseminate information, education and communication materials in the areas of family planning and HIV/AIDS.

### ***United Nations Children's Fund (UNICEF)***

UNICEF focuses on improving survival, normal growth and development rates of children by contributing to the national goal of reducing the infant mortality rate from 79 to 50 per 1,000 live births, through protection of children from childhood diseases and reducing the under-five mortality rate from 118 to 70 per 1,000 live births, through reducing under-five morbidity and mortality associated with preventable childhood diseases together with other measures for mortality rate reduction, micronutrient and sustainable community drug program. UNICEF has implemented several projects, some of which are nationwide, while others are implemented only in targeted districts. Nationwide programs include immunization, vitamin A, salt iodization, while district specific programs include the community based ARI project and Safe Motherhood program. Total allocated funding for 2002-2006 is US\$13.6 million out of which US\$1.3 million is for child health and US\$2.2 million is for women's health<sup>50</sup>.

### ***The World Health Organization***

WHO programs in Nepal take a broad-based collaborative approach, effectively working with HMG and its development partners to meet the country's needs and priorities. The program focuses on essential public health and clinical care services.

WHO provides support mainly in the following areas:

- Integrating health and human development in public policies, inter-sectoral co-ordination, and environmental health;
- Increasing managerial capacity at all levels;
- Developing human resources;
- Strengthening district health systems; and

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<sup>49</sup> [http://www.usaid.gov/np/key\\_documents1.htm](http://www.usaid.gov/np/key_documents1.htm)

<sup>50</sup> Department of Health Services, Annual Report 2001/02, Kathmandu

- Assisting nutrition, EPI, reproductive health, HIV/AIDS, Malaria/Kala-azar, CDD/ARI, and child and adolescent health programs and others.

The total program budget for Nepal is around US\$6 million for the biennium 2002-03. This includes \$24,500 for Child and Adolescent Health, \$172,800 for Child and Adolescent Health (Control of Diarrheal Disease, ARI, and Integrated Management of Childhood Illness) and \$24,600 for Women's Health. In addition to that, Nepal also receives support from WHO inter-country program.

### ***Save the Children Fund (US)***

The Save the Children US (SC/US) program has worked very closely with the District Health Office (DHO) in attempting to curb high child and maternal mortality rates since its inception. SC/US also provides support to expand access to immunization services, pre-natal and post-natal check-ups, general treatment, nutrition advice for children, health education and family planning services for men and women. Other programs include care for the disabled, health camps, HIV/AIDS education and prevention efforts, and general efforts in training and research through Ministry of Health, community, local NGOs, clubs, groups and committees. Growth has been rapid and diversified. SC/US has expanded to develop a range of multi-sector programs that cover more than 20 districts and serve more than 526,224 beneficiaries. Areas of expertise include: child survival, reproductive health and adolescent reproductive health, HIV/AIDS prevention, non-formal education, early childhood development, micro-finance and capacity building of partners, NGOs and government<sup>51</sup>.

### ***Save the Children Fund (UK)***

Save the Children UK (SC/UK) began its program activities in Nepal in 1975 with the Nepal Children's Organization and has been implementing maternal and child health clinics since 1976 in Surkhet, 1977 in Dhankuta, 1978 in Baglung, and 1982 in Sindhupalchowk. In 1996-97, these clinics were handed over to respective District Health Offices as per the agreement signed with the Ministry of Health. In recent years, SC/UK has focused on the five major issues of basic education to children, increasing educational access for girls, HIV/AIDS, support to District Child Welfare Committees & clubs, and support to Bhutanese refugee community as per the country strategy plan (1998- 2003).

SC/UK works with children's institutions to facilitate child access to various health services. SC/UK uses and/or develops a variety of methods and processes (Theatre for Development, Appreciative Inquiry and child friendly participatory tools). Most projects involve volunteer community participation because SC/UK wants people to analyze the situation in their own communities and independently plan and initiate activities. SC/UK also works in partnership with formal institutions (governmental agencies and NGOs) and individuals. Another important focus is advocacy involving the use of personal experiences and analyses to encourage commitment to children's rights. At present SC/UK has program offices in Surkhet, Sindhupalchowk, Pokhara and Jhapa with a central office in Kathmandu. Its working areas also include Achham, Doti, and Baglung.

### ***United Mission to Nepal (UMN)***

UMN Health Services Department (UMN/HSD) directly supports health services activities in 12 districts. Through high quality and effective interventions, UMN aims to address local health and health care needs, and also to model appropriate strategies that can be replicated more widely. These

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<sup>51</sup> Ministry of Health at: [www.moh.gov.np](http://www.moh.gov.np)

12 districts are: Okhaldhunga, Kathmandu, Lalitpur, Makwanpur, Gorkha, Lamjung, Kaski, Syangja, Palpa, Banke, Dailekh and Jumla. The health services activities of UMN are:

- Hospitals in Okhaldhunga, Patan, Amp Pipal and Tansen (total 466 beds);
- Integrated Community Health and Development Projects in Okhaldhunga, Lalitpur, Makwanpur, Gorkha and Palpa Districts and Lalitpur Sub-Metropolitan City;
- Lalitpur Nursing Campus and Tansen Nursing School;
- Secondments to TU Institute of Medicine, Lalitpur Sub-Metropolitan City, Palpa District Health Office, Nepal Nursing Council, UNICEF;
- National-level Consultancy Units in Mental Health, Nutrition, Oral Health, HIV/AIDS, Rehabilitation for Physical Disabilities, and Reproductive Health;
- Central administrative and technical support - TB control and 'tb.net', Medical Supplies Department, health services consultancy, government liaison, planning, and evaluation of health projects.

### ***The Asia Foundation***

The Asia Foundation is a private, non-profit, non-governmental organization dedicated to supporting programs that contribute to a peaceful, prosperous, and open Asia Pacific community. With a network of 14 offices throughout Asia, an office in Washington, D.C., and headquarters in San Francisco, the Foundation addresses issues on both a country and regional level.

Since 1992 The Asia Foundation has supported family planning programs in Nepal through local non-governmental organizations. Currently, it supports 27 NGO clinics in 10 rural districts providing family planning and reproductive health services to over 1.2 million people. The contraceptive prevalence rate is 38%, well above the national average. Services are delivered through static and mobile clinics. Each static clinic provides services to approximately 20,000 people in five village development committees (VDC). The goal is to assist the Government of Nepal in its effort to reduce fertility and improve maternal and child health<sup>52</sup>.

## **VII. INDOOR AIR POLLUTION AND/OR HOUSEHOLD ENERGY PROGRAMS AND PROJECTS IN NEPAL**

### **ITDG - Smoke, Health and Household Energy Project**

ITDG Nepal has been active in indoor pollution related activities for several years. ITDG Nepal has been implementing a project entitled "Smoke, health and household energy" to help poor people, especially women and children, to reduce the major health risks caused by smoke from kitchen fires, through awareness of the dangers of smoke and interventions to alleviate it. In addition, this project intends to:



**A Gatlang woman with her child near traditional stove**

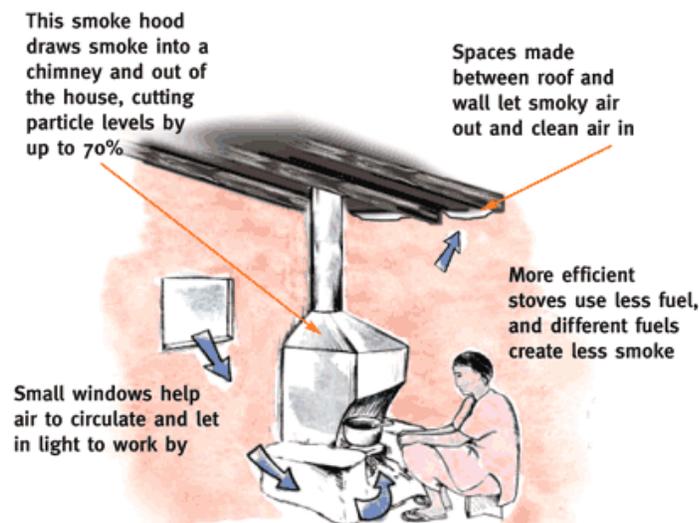
Source: [http://www.itdg.org/html/smoke/smoke\\_nepal.htm](http://www.itdg.org/html/smoke/smoke_nepal.htm)

<sup>52</sup> Ministry of Health at: [www.moh.gov.np](http://www.moh.gov.np)

- inform on dangers of smoke and locally-appropriate solutions;
- inform policy-makers, beneficiaries (cooks) and artisans on sustainable and affordable ways to reduce indoor air pollution;
- indoor air quality measurement through monitoring and user surveys;
- development of appropriate indoor smoke alleviation technology for high hills; and
- disseminate the successful technology locally and internationally.

**Figure 6: Effective use of smoke hood, improved stove and ventilation to reduce IAP**

Source: [http://www.itdg.org/html/smoke/smoke\\_index.htm](http://www.itdg.org/html/smoke/smoke_index.htm)



The current project is located in the village of Gatlang in the high hills of the Rasthewa district, Nepal. Gatlang lies in a cold mountain region in northern part of Nepal, where communities need biomass for space heating as well as cooking. Food is predominantly cooked over a three-stone fire (pine wood fuel) and tripod. Respiratory infection has been identified as a major health problem among women and children.

ITDG Nepal conducted two rounds of carbon monoxide (CO) and particulate matter (PM) monitoring and household surveys in two different seasons (winter

and summer) before the intervention. The survey results indicated unacceptably high levels of particulate matter, averaging 1,264  $\mu\text{g}/\text{m}^3$  during winter and 761  $\mu\text{g}/\text{m}^3$  during summer, which gives an overall average of 1,075  $\mu\text{g}/\text{m}^3$ . After introducing the smoke hoods, average indoor air pollution was reduced to an average of 406  $\mu\text{g}/\text{m}^3$ .<sup>53</sup> United States Environmental Protection Agency (USEPA) ambient air quality standards for PM<sub>10</sub> are 50  $\mu\text{g}/\text{m}^3$  annual average and 150  $\mu\text{g}/\text{m}^3$  for a 24 hour average. Based on a series of discussions with the community and specialists, ITDG Nepal designed chimney hoods and installed in the participant households. The preliminary findings of post-intervention survey (third round) indicates that there has been significant reduction in indoor smoke post-intervention. The indoor air pollution monitoring is in progress.

ITDG Nepal's experience indicates that there are various feasible options available to reduce smoke in homes, including home insulation and stove design to reduce fuel use. The technology options may vary as per the temperature, house structure, income level and cooking practices. It is thus essential that such monitoring of indoor air quality be measured in many different parts of the country for a longer time first with their traditional stove and then with different interventions.

### **Improved Cooking Stove (ICS) Program**

The history of ICS development goes back to the 1950s with the introduction of some Indian models. Since then, a number of ICS programs run both by the government and I/NGOs with variety of stove designs and different strategies have promoted ICS in rural areas of Nepal. The National Planning

<sup>53</sup> Personal communication with Mr. Pramod Amatya, Program Team Leader, ITDG Nepal

Commission in the 1980s included ICS in an attempt to address a fuel wood problem in the country, which then helped to revive interest and efforts. This was also reflected in the FAO assisted Community Forestry Project in 1981. In the early 1990s, the Research Center for Applied Science and Technology (RECAST) modified stove designs, which can be built completely from cheap and readily available local materials. These designs are still being promoted by various organizations with minor improvements taking place from time to time. To complement these efforts, the Alternative Energy Promotion Center (AEPC) started the National ICS Program with the support from Energy Sector Assistance Program (ESAP/Danida) in 1999. The budget of this program is NRs 61.2 million (DKK 6.8 million).



**Woman Cooking in ICS**

Source: <http://www.gtz.de/nepal/downloads/cookingstoves.pdf>

Improved cooking stoves (ICS) are modified versions of traditional stoves, with a higher efficiency (around 10% in traditional stoves vs. 15-25% for ICS) and less smoke inside the house. Other benefits of ICS include reduction in firewood consumption by 30-35%, reduction in women's labor, time savings for fuel wood collection and cooking, improved indoor air quality and the health benefits thereof. The effectiveness of ICS in reducing indoor air pollution can be illustrated with the help of a comparative study for CO and Total Suspended Particulates (TSP) carried out between traditional cooking stoves (TCS) and improved cooking stoves (ICS) in the hills and mountains of Nepal as shown in the table below:

**Table 4 Comparison between CO and TSP for Traditional Stoves and Improved Stoves**

Study location	Pollutants	Exposure on traditional stove	Exposure on ICS	% reduction	References
Gorkha	CO	280 ppm	70 ppm	75	Reid, 1986
	TSP	3170 µg/m <sup>3</sup>	870 µg/m <sup>3</sup>	73	
Beni	CO	310 ppm	64 ppm	79	Reid, 1986
	TSP	3110 µg/m <sup>3</sup>	1370 µg/m <sup>3</sup>	56	
Mustang	CO	64 ppm	41 ppm	36	Reid, 1996
	TSP	1750 µg/m <sup>3</sup>	920 µg/m <sup>3</sup>	47	
Bardibas	CO	82.5 ppm	11.6 ppm	86	Pandey, 1990
	TSP	8200 µg/m <sup>3</sup>	3000 µg/m <sup>3</sup>	63	

Source: Cited from Sharma 1995 in SEECON, 2000 "Status of Improved Cooking Stove Technology in Nepal", ITDG Nepal.

ICS can also be used for heating by adding a cast iron or mild steel plate fixed tightly over the pot-holes or by using a metal chimney, which radiates heat to the ambient air, although consideration must be taken to avoid burns cause by touching the metal chimney. Similarly, by attaching a back-boiler to the side or around the chimney, ICS can also be used for heating water.

There are 7 basic models of ICS currently being promoted in Nepal with 1, 2 and 3 pot openings<sup>54</sup>. The choice of particular stove model is determined by the requirements including institutional vs residential users, size of family, type of cooking (human or animal feed), type of fuel wood used (wood, agricultural residue, animal dung cake), and kitchen design. AEPC/ESAP uses a user-pay, no subsidy model. The user must pay for materials (5 iron rods, about NRs 50-90) and a promoter fee of about NRs 150 - 250 depending upon the village. This cost may also vary with transportation costs, if any. The promoter must make 2 follow up visits with no additional charge. The life of the stove varies with user maintenance, with good care a stove lasts for about 2-3 years.



**One pot hole ICS during construction**

Source: <http://www.icsnetwork.org/photos/pho.php?cid=2>

The key collaborating partner of this program is the Center for Rural Technology, Nepal (CRT/N), which facilitates the training and implementation of this program through various government organizations (mainly Women's Development Division and other government agencies) and other NGOs working in this area. Around 25% of the stoves built by promoters are monitored by technical staff through random technical tests. AEPC/ESAP also provides certification to the promoters. Some 50,000 ICS were installed under this program by May 2003.

It is expected that total of 100,000 ICS will be installed at the end of Phase I in December 2004 in over 500 Village

Development Committees (VDCs) of 26 mid-hill districts of Nepal<sup>55</sup>. The exact number of installed ICS in Nepal is not known, however, it is estimated that around 175,000 ICS have been installed so far in Nepal through various organizations<sup>56</sup>. The 10th Five Year Plan (2003-2007) of the Government plans for an additional 250,000 ICS disseminated in Nepal. Other organizations are also involved in disseminating ICS in Nepal. The World Food Program will disseminate institutional ICS in around 4,000 schools under "Food for Education Program" in cooperation with AEPC/ESAP. Rural Energy Development Program (REDP/UNDP) has also installed around 7,200 ICS in their 15 program districts as of June 2003. Rural Development Program (RDP/GTZ), CARE/Nepal, Center for Self-Help Development (CSD), Rural Community Development Society (RUCODS), and Canadian Center for International Studies and Cooperation (CECI) are other major players in disseminating ICS in Nepal<sup>57</sup>.

Despite its various advantages, ICS do have some limitations in Nepal. It is still hard to reach the poorest of the poor in the rural areas who cannot afford this price. The ICS has very low heating efficiency and is not easily adapted in the mountain region. Poor quality of workmanship and dimensional variations during construction may render the efficiency lower than claimed. There is a strong demand to carry out adaptive research and development analyzing stove options for high altitudes and tropical areas. Strong monitoring and further efforts on wider dissemination of this technology is necessary. Furthermore, no final evaluation of improved cooking stoves has ever been done in Nepal. The Phase II of AEPC/ESAP is looking into some of these issues. Specific requirements and suitable stove designs for urban and peri-urban areas are still overlooked in Nepal.

<sup>54</sup> The detailed technical information on ICS can be obtained at: <http://www.crtnepal.org/html/icsdomestic.html>

<sup>55</sup> Personal communication with Ms. Karuna Bajracharya, ICS Component Coordinator, AEPC/ESAP

<sup>56</sup> Personal communication with Mr. Rajan Thapa, ICS Coordinator, CRT/N

<sup>57</sup> More information can be available at CRT coordinated site: [www.icsnetwork.org](http://www.icsnetwork.org)

## Biogas Dissemination Program

Biogas is a mixture of methane and carbon dioxide produced from methanogenic bacteria while acting upon biodegradable materials in an anaerobic condition. While biogas technology was first introduced in Nepal in 1955, and subsequently promoted by the United Mission to Nepal, and the Agricultural Development Bank Nepal in the 70s and 80s, biogas dissemination gained real momentum after the initiation of Biogas Support Program in July 1992 with support from the Netherlands Development Cooperation (SNV), His Majesty's Government of Nepal. The German



**A Nepali woman cooking in biogas**

*Source: BSP/Nepal*

Development Bank (KfW) strengthened the program in the third phase (1997-2002) with financial assistance to subsidy and credit components. The BSP was started with just about 11,000 plants and by the end of the third phase (end of June 2003), there were more than 120,000 plants spread over 65 of Nepal's 75 districts.

The SNV/Biogas Support Program has proved to be a successful model of development cooperation.

The program has adopted the following strategies:

- Uniform technical design of biogas plants;
- Thorough quality control and monitoring of production, installation and after sales services of participating biogas companies;
- Continuous R&D efforts to improve biogas plants to best meet the needs of the end-users;
- Outreach and awareness programs;
- Financial support for end-users by providing a subsidy of US\$80–160 (NRs 6,000-12,000 per plant);
- Stimulation of financial support mechanisms such as micro-credit facilities.



**Biogas used for lighting**

*Source: BSP/Nepal*

The program has pre-qualified 44 biogas private companies over the years that are responsible to find customers and build the plants as per the standards and guidelines set by the BSP. After completion of the plant, they can claim for the subsidy from BSP. Most of the biogas plant parts are manufactured in Nepal through 13 workshops. Around 35 NGOs have been mobilized to carry out different activities in order to disseminate the technology. The program has also mobilized about 60 micro-finance institutions in order to facilitate the financing of the plants. BSP claims that around 97% of the plants installed are operational and 72% of the total plants have toilets attached. About 80% of the total plants are 4m<sup>3</sup> and 6m<sup>3</sup>, and the remaining plants are mostly 8m<sup>3</sup> and 10m<sup>3</sup>. A 6m<sup>3</sup> plant would require around 36 kg of cow dung per day (mixed with equal amount of water) in the hills region to result in 3.5 hours of stove burning; 45 kg is required in the Terai for 4.5 hours of stove burning because of the retention time for Terai is about 55 days against about 70 days in the hills. Around 60% of the biogas is used for cooking. The average plant costs about NRs. 25,000<sup>58</sup>.

<sup>58</sup> More information on biogas can also be obtained from [www.bspnepal.org](http://www.bspnepal.org)

There are many benefits of biogas. Each biogas plant saves more than 3 ton of firewood per year and more than 32 liters of kerosene per year. Each biogas plant also produces about 1.75 tons of fertilizer, which can be used in the fields and can replace chemical fertilizer.

A recent study carried out by Winrock Nepal and others have found that each biogas plant can mitigate about 5 tons of CO<sub>2</sub> equivalent per year<sup>59</sup>. According to the Integrated Environmental Impact Analysis carried out by BSP for 600 biogas users and 600 non-users, it was found that non-biogas users have 4% higher rates of respiratory diseases than biogas users<sup>60</sup>. The qualitative information from various household surveys carried out by BSP have revealed that health problems including respiratory illness, eye infection, asthma, and lung problems have decreased after installing the biogas plants, as shown in the following tables<sup>61</sup>.

**Table 5: Health benefits of biogas (1)**

Disease	Problems in the past (HHs)		Present status of HHs	
	Yes	No	Improved	Remained same
Eye infection	72	18	69	3
Cases of burning	29	71	28	1
Lung problem	38	62	33	5
Respiratory problem	42	58	34	8
Asthma	11	89	9	2
Dizziness/headache	27	93	16	11
Intestinal/diarrhea	58	42	14	44

According to the Biogas Users' Survey 2000 with 100 samples, biogas has positive impacts on the health of the users. Out of 42 respondents who had respiratory problems in the past, it was reported that the problem has improved for 34. Similarly, the situation has also improved for those who had asthma, eye infection, and lung problems.

**Table 6: Health benefits of biogas (2)**

Disease	Decrease	Increase	No disease
Eye infection	20	-	80
Cough	53	-	47
Headache	33	3	67
Nauseous	5	-	95
Chest pain	15	1	85
Lethargy	11	-	89
Respiratory disease	41	-	59
Malaria	8	2	92
Typhoid	10	4	90
<b>Overall (%)</b>	<b>22</b>	<b>1</b>	<b>77</b>

<sup>59</sup> Integrated Environment Impact Study, BSP and Carbon Benefit Study of Winrock Nepal and EcoSecurities

<sup>60</sup> Integrated EIA Report, 2002 Biogas Support Program

<sup>61</sup> Annual Biogas Users' Survey 1999 and 2000

Similarly, according to the Biogas Users Survey 1999, 22% of the total respondents have reported that their various diseases have decreased once they started using biogas and 77% reported no disease.

There is no quantitative information available on the indoor air quality with biogas plants in Nepal. However, a comparative study carried out in India has revealed that total suspended particulate (TSP) concentrations increase as the fuel is changed from biogas to LPG to kerosene to charcoal to root fuel to dung cake to wood to crop residues. The net concentration of TSP was found to be 0.25  $\mu\text{g}/\text{m}^3$  in biogas to 0.32 with LPG, 0.48 with kerosene and so on with 5.74  $\mu\text{g}/\text{m}^3$  with crop residue<sup>62</sup>.

### **Rural Energy Development Program**

The Rural Energy Development Program (REDP) was started in August 1996 with support from UNDP with an objective of enhancing rural livelihoods through the promotion of rural energy technologies, primarily micro-hydro following a community mobilization process. The program was first started in five districts and an additional 10 districts were added later, following the successful implementation of the first five. As of June 2003, 120 micro-hydro and peltric set systems with 1,575 kW installed capacity was installed in the program districts. The program has also installed 2,953 toilet-attached biogas plants and 7,200 ICS. With the recent grant assistance from the World Bank, the program has been extended through 2006 and will cover 25 districts in total.

The program has been successful in institutionalizing rural energy systems in Nepal in terms of support for formulating policy measures at the central level, decentralized energy planning at the district level and implementation and management at the community level. REDP applies its holistic approach to community based rural energy systems including dissemination of technologies, integration of micro-hydro with irrigation and drinking water, human resource development, energy based micro enterprises, health and sanitation and internalization of technologies. The formation of self-empowering community organizations (CO) at the grass root level is one of the key components of REDP that has resulted in the initiation of myriad activities other than energy based on people's participation. There are 2,738 COs in 15 districts out of which 1,361 are male COs and remaining 1,371 are female, mobilizing a total of 55,433 community members<sup>63</sup>.

These interventions from different organizations for different technologies are now briefly analyzed in terms of four key areas of focus of USEPA led "Partnership for Clean Indoor Air":

**Market development** - The current working modalities and approaches of these programs have proved to be successful in creating demand for these technologies, however they differ slightly depending upon the technology. The ICS program (AEPC/ESAP) for instance does not give any direct subsidy to the users. The program has adopted an integrated approach to develop the market for ICS through awareness and information campaign and support for various capacity building activities including training for local NGOs, promoters in the districts and other stakeholders. The program has developed criteria and guidelines for promoter's selection and other aspects of implementing the program. It is important to note that AEPC/ESAP does not implement the program, but rather facilitates the implementation through NGOs and community-based organizations, who are responsible for training, backstopping, monitoring and supervision of the program. Direct subsidy is given to biogas users in order to create demand, support the poor and be able to control quality. This

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<sup>62</sup> Smith, K. et. al, "Greenhouse Gases from Small Scale Combustion Devices in Developing Countries, India" June 2000, Environment Protection Agency.

<sup>63</sup> Detailed information on REDP can be obtained at: [www.redp.org.np](http://www.redp.org.np)

strategy, coupled with promoting private companies to construct the plants as per the guidelines of the program, has been instrumental in creating markets for biogas. This program also adopts the strategy of creating awareness, providing subsidies and controlling the quality of the plants constructed by the private companies and thus has been successful. The Biogas Program also mobilizes micro-finance institutions to provide loans to needy farmers, which has also been instrumental in increasing market demand. Rural Energy Development Program, on the other hand, works with the communities to implement rural energy systems, mainly micro-hydro. The program provides support for community mobilization, subsidy for micro-hydro (also through AEPC/ESAP), capacity building and income generating trainings required for sustainability of the micro-hydro plants. One thing common to these programs is that have all adopted an integrated approach and work with the NGOs and the private sector to the extent possible.

**Technology Standardization** - This aspect has been well addressed in these programs. The Biogas Program has developed uniform designs for different sizes of biogas plants and private installation companies MUST follow these standards. The ICS program has also developed 7 specific designs of ICS, which are now being promoted. The local NGOs, promoters and other concerned people/institutions are trained to build only these models and their qualities are controlled regularly. The design, installation and power verification are also carried out for micro-hydro systems and only pre-qualified private companies/NGOs are allowed to carry out these tasks. ITDG is now designing smoke hood, which could be used in many households once the project is successful.

**Health Impact Monitoring** - These interventions are basically guided by reducing firewood consumption, and health impact monitoring was not a priority in the past. As such, there is very little information available in terms of health impacts of these technologies. Some qualitative information is available from Biogas Program and some individual researchers have measured the indoor air quality with traditional stove and ICS. ITDG Nepal has just started to monitor the indoor air quality in Gatlang with traditional stove and after some interventions like smoke hood, improving the ventilation.

**Social and Cultural Barriers** - The Biogas Program has been successful in addressing social and cultural barriers, especially with attaching toilets to the biogas digester. Some people, especially in rural areas are still skeptical about using ICS because of some social and cultural barriers like they cannot see the flame touching the pot, danger of termites eating the roof in absence of smoke, need to change the location of stove every few months, not enough heat is available for space heating, among others. However, once they see their neighbors using the stove successfully, stove adoption has ramped up quickly. The ICS Program has made some adjustments in the design so that the chimney can be temporarily disconnected to smoke the roof for insecticidal benefits.

### **Nepal Smoke and Health Forum**

A consultative meeting of major stakeholders on March 9, 2004 has established a "*Nepal Smoke and Health Forum*" in order to:

- share knowledge and experiences on indoor air pollution and health;
- analyze various issues in household energy, indoor air pollution and health sector;
- develop strategies on awareness and smoke alleviation efforts;
- support advocacy and policy influence activities;
- carry out any other activities in other pertinent issues.

In order to achieve these objectives and to broaden the scope of this forum, an ad hoc committee has also been formed under the chairmanship of Dr. Mrigendra Raj Pandey, a renowned medical doctor who has been studying the effects of indoor air pollution and its health impacts for more than 25 years. The ad hoc committee members include representatives from the government (health and household energy), donors, I/NGOs, and research organizations, including Winrock International Nepal and ITDG as secretariat.

## **VIII. LESSONS LEARNED AND RECOMMENDATIONS FROM HOUSEHOLD ENERGY INTERVENTIONS IN NEPAL**

Biogas, ICS and micro-hydro (and solar home systems) are the three main successful household energy interventions in Nepal; of these, biogas and ICS have contributed significantly to reducing firewood consumption and lowering exposure to indoor air pollution for hundreds of rural families. Although emissions from ICS burning solid fuels are still higher than from gaseous fuels, substantial reductions in exposure can be achieved in comparison with the use of traditional stoves. Key "lessons learned" from these household energy interventions in Nepal include:

***Needs - oriented:*** Solutions developed should meet the needs and wishes of the consumer targeted;

***Implementation modality:*** These programs have chosen other NGOs, private sector, and community based organizations as implementers, focusing on facilitation, awareness creation, capacity building, networking and most importantly quality control. These programs have also been successful in reducing program costs in this modality.

***Participatory approach:*** Users, producers, promoters and other stakeholders should participate in design, implementation and monitoring of the project.

***Holistic approach:*** Varied components, including energy saving measures, resource conservation measures, and improved health impacts should be integrated.

***Local situation:*** Local socio-economic and cultural situations should be considered.

***Sustainability:*** Sustainable supplies of improved stoves and other solutions should be made available without interruption and local people should be engaged in manufacturing and promotion.

***Promotional activities:*** Awareness creation, sensitizing, advertising can be carried out to launch the intervention. This may include some incentives to the users either in cash or in kind.

### **Scope for Future Interventions in Nepal**

Looking at the local situation, the following strategies should be considered for wider implementation of any interventions in Nepal:

- Strengthening government, and creating awareness for multilateral and bi-lateral organizations on the link between household energy, indoor air pollution and health impacts and their commitment to work to help the poor in an coordinated way;
- Facilitating collaboration with government agencies, private organizations, NGOs, and donors at the local and national level;
- Involvement of community, especially women would be required;

Support for technology development, micro-credit and other financial mechanisms suitable for the needs of the users, policies promoting more equitable access to cleaner fuels, information dissemination, capacity building, and small business development.

A wide range of interventions are available in the household energy sector to reduce indoor air pollution and associated health effects. These interventions can be categorized according to the level at which they are effective:

- **interventions at the source of pollution** – The largest reductions in indoor air pollution can be achieved through interventions at the source of pollution. This includes switching from biomass fuel to more efficient and cleaner fuels, including biogas, LPG, and electricity;
- **interventions to the living environment** - This includes improving ventilation in cooking and living area through chimneys, smoke hoods, eaves spaces, and enlarged repositioned windows; and
- **intervention to users' behavior** - This includes changing user's behavior through awareness and social marketing, providing messages to keep children away from the fire while cooking, dry wood before cooking, and open windows and doors while cooking.

Based on the above discussions and keeping in mind the "lessons learned" from existing household energy interventions, the following interventions as grouped in the four key areas should be considered for the future in Nepal:

### **Market Development**

Following specific interventions fall under market development:

#### ***Scaling up ICS Dissemination.***

The current national ICS Program is concentrated only in the hill districts of Nepal. ICS technology should also be disseminated in the plains (Terai) and in the mountains. The ICS technology should also be made accessible through some financial mechanism to the very poor who cannot even afford just few hundred rupees. The existing ICS models together with new models improved for suitability in the Terai and mountain regions should be disseminated widely to provide tangible health benefits to most rural households, especially to women and children. ICS is an inexpensive household energy technology with the potential to generate great social benefits.

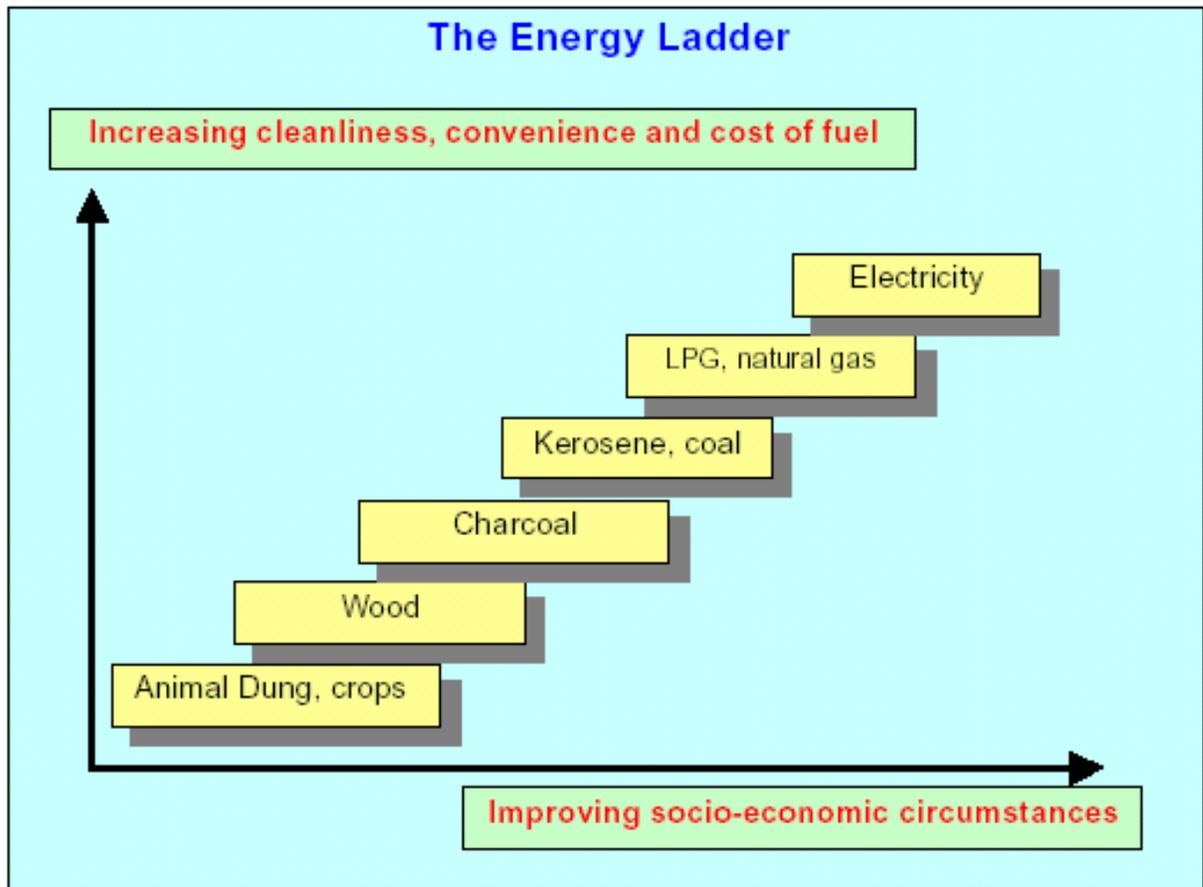
#### ***Moving up the Energy Ladder***

Maximum benefits in terms of reducing indoor air pollution can be achieved through the use of alternative fuels like biogas, LPG, and electricity. The type of fuel used typically increases in cleanliness, convenience, efficiency and cost and moves up in '*The Energy Ladder*' as the socio-economic condition of users' increases, as shown the figure below<sup>64</sup>:

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<sup>64</sup> Adapted from Smith et al 1994 in Bruce, N. Perez-Padilla, R et. al 2002 "The health effect of indoor air pollution exposure in developing countries" WHO.

Figure 7 The Energy Ladder



The existing biogas program is dedicated to reaching poorer communities including in remote areas and thus no separate program intervention is suggested at this stage. Electricity is still very expensive to be used for cooking. Isolated mini-grids from micro-hydro and solar home systems are mostly used for lighting and operating small electric appliances.

So, scaling up existing biogas and ICS technologies is essential in Nepal, especially for the rural areas. Another potential area for intervention is to support the switch over to cleaner fuels like LPG (mostly from kerosene, and charcoal) and increasing access to more efficient cooking devices, targeting peri-urban and urban areas of Nepal. The construction of more tightly sealed buildings, reduced ventilation, the use of synthetic materials for building & furnishing and the use of chemical products are contributing to increased exposure to indoor air pollution in peri-urban and urban areas. LPG burns with a far higher efficiency than other stoves, and consequently produces far less emissions in addition to greater cleanliness and



LPG cylinder being used in Nepal

convenience, and thus should be considered as a viable option. Currently, LPG cylinders are available in only one size and cost about NRs. 700 each, with an initial deposit of around NRs 2,000 required. In addition, the LPG stove is also more expensive than other stoves, starts at about NRs 700. These barriers could be addressed through supplying LPG cylinders in different sizes, and micro-finance or other financial mechanisms can be arranged for up-front cost. Commercialization of improved stoves should be focused on, and will increase sustainability. However, it is necessary to implement a pilot project to test the many dynamics (including reliable supply) of this intervention before implementing on a larger scale. Such a project to support a shift to cleaner fuels and to more efficient cooking devices in urban and peri-urban areas (especially to the urban poor) should include at least following main activities:

- A study on the present household fuel consumption patterns and health situations in peri-urban and urban areas;
- Particulate matter and CO measurements before and after the interventions in the urban and peri-urban areas;
- Design and implementation of the Urban Household Energy Program to support a shift to cleaner fuels and improved technologies which could vary from shifting from kerosene to LPG or to install improved cooking stoves instead of traditional stoves.

### Technology Standardization

Technology standardization for existing ICS models is needed based on feedback received so far, and some improvements in the existing models should be carried out to make them easily adaptable in the Terai and mountains. Standardization of other new biomass stoves like the 'Rocket Stove', small gasifier stoves should also be developed and their market should also be tested. These portable stoves could be used by poor people who move from place to place and who still use wood while living in peri-urban and urban areas. The Vesto Cooker developed in Swaziland is an example of gasifier stove, which could also be used in Nepal with some minor modifications. This stove can use any biomass fuel (wood, dung, charcoal) except coal, is economical and results in 50% fuel savings<sup>65</sup>. Information on other biomass cooking stoves and other related information can also be obtained from the website: <http://solstice.crest.org/discussiongroups/resources/stoves/>

Experiences of bread ovens and other institutional cookers in Uganda, South Africa and the activities being carried out by FAO and GTZ can be further explored and tested for institutional use in Nepal.

### Health Impact Monitoring

There is very little information available on the health impact monitoring of household energy interventions in Nepal. ITDG has just started in one area and there is a need to carry out such impact monitoring in terms of indoor air quality and other diseases in Nepal. There is a need to develop a more systematic population based approach to assessing and monitoring over time patterns of fuel use, indoor air pollution and exposure in many different settings in Nepal again with different interventions.



Vesto Cooker

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<sup>65</sup> Detail information is available at [www.newdawnengineering.com](http://www.newdawnengineering.com).

### **Social and Cultural Barriers**

The concept of 'Social Marketing' has been applied to HIV/AIDS, contraceptives, tuberculosis, and immunization in Nepal, but not to indoor air pollution and other household energy interventions in Nepal, which also pose a great threat. It is thus high time to start social marketing to address the problem of indoor air pollution, role of household energy technologies and behavior change techniques. This will also be instrumental in addressing other social and cultural barriers in adopting new and improved technologies. The program should focus on the following main activities:

- Awareness creation among donors and government agencies on the central level and advocate for synergies between health and household energy programs and other policy interventions to address issues related to indoor air pollution and its health impacts.
- Awareness creation among the general public towards the serious health impacts of indoor air pollution and the need for behavior changes.
- Promotion of cleaner fuels and more efficient cooking devices in both rural and urban areas.
- Carrying out various activities to address other social and cultural barriers in adopting new and improved technologies.
- Monitoring of the impacts of social marketing through different indicators like number of households with improved cooking devices, number of households shift to cleaner fuels, percentage of population aware of health impacts of indoor air pollution.

Looking at the nature of the activities and the target groups, different types of activities like seminars, workshops, field visits should be carried out. Similarly, different media channels like radio, TV, newspapers (both national and local), banners, posters, pamphlets in both Nepali and local language should be used.

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