

Seminar Report

Environmental Community Awareness Seminar Series

Indoor Air Quality and Biomass Burning



Prepared By

Asta-Ja Research and Development Centre (Asta-Ja RDC)
Kathmandu, Nepal

Supported By

Non-Resident Nepali Association National Coordination Council (NRNA NCC), USA
Community Environment Academy, and Asta-Ja USA

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Table of Contents

1. Background	2
2. Objectives of the Seminar and the Participants	2
3. Programme of the Seminar	3
4. Presentation outline (Contents)	3
5. Questions raised during the discussion session	6
6. Conclusions	7
Annex 1: Power Point Presentation Slides	7
Annex 2: Photos of Seminar on Indoor Air Quality & Biomass Burning	20

1. Background

The “**Indoor Air Quality and Biomass Burning**” seminar was held in Nepalaya Education & Foundation College, Kalanki Kathmandu on 22nd July, 2019 as a part of series of seminars on ‘raising community awareness on environment issues’ with the support of Non-Resident Nepalese Association, USA, Community Environment Academy, USA, and Asta- Ja USA.

Indoor air pollution in developing world from bio-mass smoke is considered to be a significant source of public health hazard, particularly to the poor and vulnerable women and children. About 50% of people, almost all in developing countries, rely on coal and biomass in the form of wood, dung and crop residues for domestic energy. These materials are typically burnt in simple stoves with very incomplete combustion. Consequently, women and young children are exposed to high levels of indoor air pollution every day.

There is consistent evidence that indoor air pollution increases the risk of chronic obstructive pulmonary disease and of acute respiratory infections in childhood, the most important cause of death among children under 5 years of age in developing countries. Evidence also exists of associations with low birth weight, increased infant and perinatal mortality, pulmonary tuberculosis, nasopharyngeal and laryngeal cancer, cataract, and, specifically in respect of the use of coal, with lung cancer. Conflicting evidence exists with regard to asthma. Exposure to indoor air pollution may be responsible for nearly 2 million excess deaths in developing countries and for some 4% of the global burden of disease.

In Nepal, about 78% of the total fuel consumption covers by biomass, and about 80% of it consume in domestic sector- where cooking is the main fuel consumption area. People with low economic status use solid fuel as mentioned in energy ladder. Burning of biomass, mainly fuelwood, emits high pollutants, and thus become a major cause of indoor air pollution in developing countries like Nepal. Such pollutants penetrate deeply into the lungs and are an important factor in the development of acute lower respiratory disease, chronic obstructive pulmonary disease, cancers, and other illnesses. According to a study, about 7,500 people die in Nepal annually due to different diseases caused by indoor air pollution. Thus, awareness and remedial action is urgent.

2. Objectives of the Seminar and the Participants

The overall objective of the seminar was to raise community awareness on indoor air quality & biomass burning of Kathmandu Valley and Nepal. The specific objective of the seminar were as follows;

- a) to provide students a basic knowledge about biomass, indoor air pollution and impact of biomass burning on indoor air quality (IAQ) and associated human health.
- b) to create awareness about indoor air quality so that they could adopt some preventive measures

The participants of the seminar were 42 B.Sc. students from Nepalaya Education & Foundation College (NEFC), Kalanki, Kathmandu. College Coordinator, staffs from NEFC, and three officials from Asta-Ja RDC also participated in the seminar. The list of the participants are in Annex-1.

3. Programme of the Seminar

Dr. Shanti Kala Subedi, Chief Research & Innovation Unit of Himalaya College of Engineering, Lalitpur, was the resource person of the seminar. Executive Member of Asta-Ja RDC, Mr. Bishnu Dayal Singh, gave welcome remarks and highlighted the objectives & importance of seminar to address negative effects of indoor air quality & biomass burning in Kathmandu valley and Nepal. He also briefed about Asta-Ja RDC and its ongoing projects and activities

The program was moderated by Office Coordinator Mr. Hari Bhusal of Asta-Ja RDC, Nepal. Program Coordinator of Nepalaya Education & Foundation Kalanki, Kathmandu highlighted issues of indoor air quality & biomass burning in Kathmandu and thanked the Asta-Ja RDC team for hosting the event in Nepalaya Education & Foundation Kalanki, Kathmandu.

4. Presentation outline (Contents)

The PowerPoint presentation from Dr. Shanti Kala Subedi included

- Biomass Burning
- Air Pollution / Indoor Air Quality (IAQ)
- Major Pollutants
- Current Status
- Sources of Indoor Air Pollution
- Strategy/Policy and Challenges

4.1 Biomass Burning

Biomass is an organic material made from plants and animals, mainly wood, crops, manure, and some garbage/organic waste. These are non-renewable energy resources, but mainly use as cooking fuels.



Indoor Air Quality (IAQ) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Understanding and controlling common pollutants indoors can help reduce risk of indoor health concerns.

4.2 Major pollutants

Biomass burning is the main cause of indoor air pollution. Direct emission of CO comes from biomass burning and fossil fuels like natural gas, propane and oil as a common bi-product. A study showed that average level of CO in homes without gas stoves is 0.5 to 5 ppm, properly adjusted gas stove- 5 to 15 and poorly adjusted gas stove ->30 ppm. Hence range of pollution also depends on type of fuels and stoves as well. However, the average concentrations of PM10 in poor households using biomass stoves may exceed standards for ambient air pollution levels promulgated by developed countries.

Besides, common indoor air pollutants are released from dust mites, moulds, fungi, bacteria and pests including cockroaches, mice and rats. Several products such as finishes, rug and oven cleaners, paints and lacquers, paint strippers, pesticides, mosquito repellants, dry-cleaning fluids, building materials, and home furnishings also release indoor pollutants. Biomass burning, coal and kerosene, emits substantial amounts of pollutant matter (PM2.5 to PM10), Carbon Monoxide (CO), Nitrogen Oxide (NO₂) and Sulphur dioxide (SO₂). These pollutants trigger asthma and allergy symptoms among children and women.

4.3 Current status

It has been estimated that more than 2.4 billion people (approx. half of total population) generally among the world's poorest, rely directly upon biomass, e.g. wood, crop residues, dung and other biomass fuels for their heating and cooking needs.

Deaths from indoor smoke from solid fuels

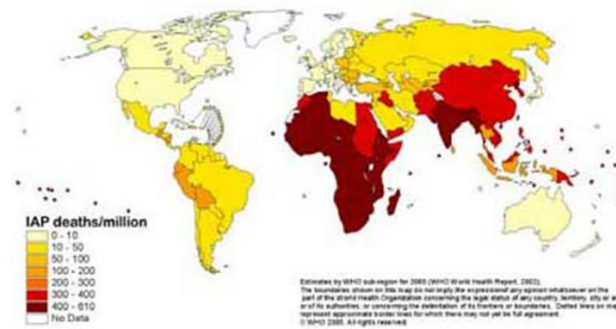


Figure 1: Impact of indoor air pollution in the world

In case of Nepal, about 78% of the total fuel consumption covers by biomass, and about 80% of it consume in domestic sector- where cooking is the main fuel consumption area. People with low economic status use solid fuel as mentioned in energy ladder. Burning of biomass, mainly fuelwood, emits high pollutants, and thus become a major cause of indoor air pollution in developing countries like Nepal. Such pollutants penetrate deeply into the lungs and are an important factor in the development of acute lower respiratory disease, chronic obstructive pulmonary disease, cancers, and other illnesses. According to a study, about 7,500 people die in Nepal annually due to different diseases caused by indoor air pollution. Thus, awareness and remedial action is urgent.

4.4 Sources of indoor air pollution

- Biomass Burning
- Mold and pollen
- Tobacco/smoke
- Household products, pesticides and insects

4.5 Strategies to increase indoor air quality and reduce associated health and environment impacts

- Reduce the practice of biomass burning: shifting from solid fuels to cleaner renewable energy technologies; use like biogas as alternative fuels
- Improved design of stoves and ventilation systems
- Do public awareness of the health risks of indoor air pollution. For example: the message to mothers to keep small children away from constant contact with fires especially during cooking time
- Make home a non-smoking area: reduce tobacco use
- Keep a clean home; keep track of the humidity
- Reduce the use of synthetic fragrances; keep indoor plants to promote air filtration, test for radon, formaldehyde, asbestos etc.

4.6 Remedial measures / Initiation/ Policy

In the session national and international initiations to address indoor air pollution was discussed. Sustainable Development Goals, mainly Goal # 7, 11 and 13, which are related

to clean energy supply, were also discussed as an international initiation. Relevant current energy and environmental plan and policy in Nepal were also highlighted in the presentation, where students were found very interested and aware about the contexts.

Some national initiations mainly -*Clean Energy Policy, 2006, National Indoor Air Quality Standard and Implementation Guidelines 2009; Renewable Energy Subsidy Delivery Mechanism, 2013; and the Biomass Energy Strategy 2017* have been formulated in Nepal. On top of that- Ministry of Population and Environment is preparing to implement its strategy to promote clean cooking technology in all households across the country as per the plan to make Nepal free of indoor pollution by 2022. Similarly, the ministry is also working on policies that will ensure availability of modern clean energy, using solid biomass, in all the households by 2030.

4.7 Challenges

- Technical know-how about pollutants
- Socio-economic factors for choosing clean fuels
- Behavioral and cultural factors e.g for using biogas etc.
- National policy and programs

Power Point Presentation slides are given in Annex 2

5. Questions raised during the discussion session

5.1 How a humidifier can help improve indoor air quality?

Humidifier helps to maintain favorable indoor temperature and prevent from having excessive moist or dry air condition. When the air inside home is too dry or moisty, it raises un-comfortness and high chances to get infected from air pollution, and spread diseases. Moist air also increases mold and radon effects. Hence, it is important to maintain humidity to get clean indoor environment.

5.2 How children are getting more infected from indoor air pollution since they are not involved in cooking?

Most of the mothers carry their children on lap when sitting in kitchen for cooking (Figure 2). Children are one of the most vulnerable groups to indoor air pollution, as infants and young children have a higher resting metabolic rate and higher rate of oxygen consumption per unit body weight than adults. Therefore, their adverse exposure to any air pollutant may be greater. The resistivity against smoky air infection is found low in children, so they are more vulnerable.

5.3 How indoor air pollution threat to women?

Women, after children, suffer from spending more time indoors and doing essentially all of the cooking. Total suspended particulate matter, high level of toxic pollutants, smoke density and oil vapors increase the risk of respiratory infection, lung cancer, cataracts, cardiovascular and other

diseases. A study showed that health tests to measure smoke levels in the lungs found that women had an average carbon monoxide (CO) reading of 7.77 ppm, while children had an average reading of 6.48 ppm. This suggests that children had CO levels similar to those that would result from smoking about seven cigarettes per day.

5.4 What will be the impact of awareness programs to reduce indoor air pollution?

There is an urgent need to create awareness among people about the issue and the serious threat it poses to their health and well-being. Education should help people in finding different ways of reducing exposure with better kitchen management and protection of children at home for cleaner indoor air. Cleaner, better quality air will improve energy at work and home activities. There is no question that prevention is the best solution not only to the public, but also to policy makers to ensure their commitment and awareness about health effects of indoor air pollution. It needs initiation and solidarity.

6. Conclusions

The seminar was a great success on raising awareness among the participants on indoor air quality & biomass burning in Kathmandu valley and Nepal.

The seminar was very helpful to student participants in gaining knowledge about Indoor air pollutants, understanding sources and effects of Indoor air pollution & biomass burning, and identifying important remedial measures for pollution control. Participants realized the responsibility of all stakeholders including students and common citizens in supporting environmental awareness programs undertaken by various agencies including NRN, Community Awareness Academy, Asta-Ja USA and the Government of Nepal for meeting the goal of clean, green and prosperous Kathmandu valley and Nepal.

Annex 1: Power Point Presentation Slides

Asta-ja Research and Development Centre
Kathmandu Nepal

Indoor Air Pollution from Biomass Burning



Dr. shanti Kala Subedi

Himalaya College of Engineering /TU

ChyasaI, Lalitpur, Nepal

22/07/2019

Presentation Outline

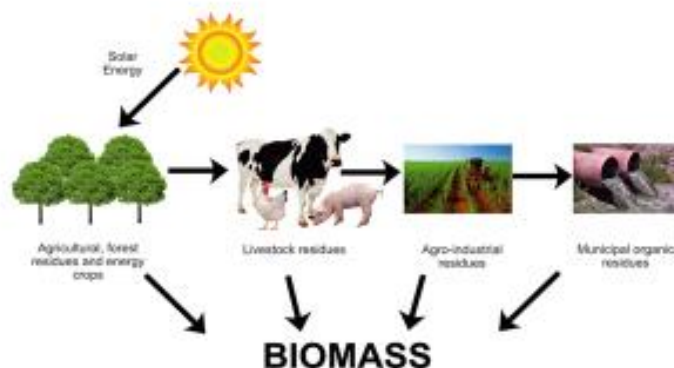
1. Biomass
2. Air Pollution
3. Pollutants
4. Status
5. Challenges

Biomass

Biomass is organic material made from plants and animals.

Biomass contains stored energy from the sun.

Examples of biomass fuels are wood, crops, manure, and some garbage/ organic waste.

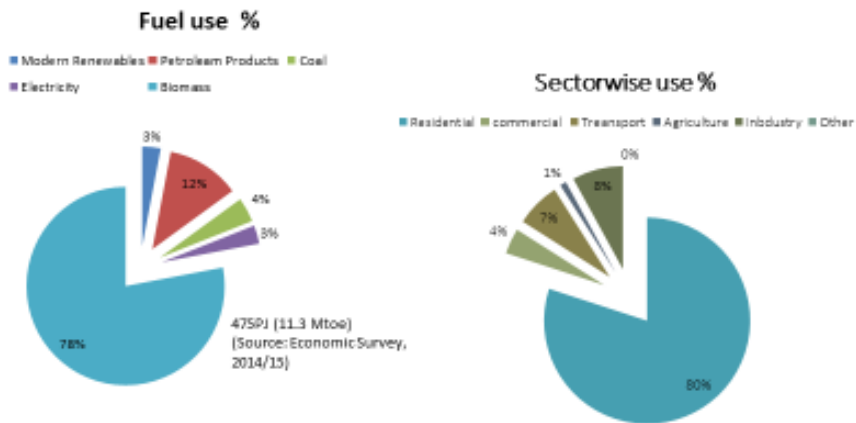


Composition of Fresh Air

CLEAR IAS Permanent Gases of the Atmosphere

Constituent	Percent by Volume	Concentration in Parts Per Million (PPM)
Nitrogen (N ₂)	78.084	780,840.0
Oxygen (O ₂)	20.946	209,460.0
Argon (Ar)	0.934	9,340.0
Carbon dioxide (CO ₂)	0.036	360.0
Neon (Ne)	0.00182	18.2
Helium (He)	0.000524	5.24
Krypton (Kr)	0.000114	1.14
Hydrogen (H ₂)	0.00005	0.5

Fuel use pattern



- Currently, over 78 per cent of energy consumption of Nepal is supplied by traditional biomass energy, which includes firewood, cattle dung and agricultural residue. 80% energy share taken by domestic sector.
- According to a study, about 7,500 people die in Nepal annually due to different diseases caused by indoor air pollution.



Carbon emissions from burning of various biomass and fossil fuels

Source	Carbon emission (gram)
1 kilogram of wood burned in a traditional mud stove	418
1 kilogram of agricultural residue in a traditional mud stove	381
1 kilogram of dung in a traditional mud stove	334
1 kilogram of kerosene in a pressure stove	834

SN	Category	PM 2.5 - 10 (microgram per cubic metre)	CO ppm
1	Smoke per episode within room	14	65.5
2	Biomass	263	62.6
3	Clean Fuel	133	few
4	Non-Ventilation	0.45	11
5	Ventilation	0.1	1.6-4.4
6	Pollutant coverage (Kitchen)	652	5.1-5.8
7	Pollutant coverage (outside the kitchen)	297	few
8	Open fire space (Traditional mud stove)	0.45	4.4
9	Improve cooking stove	0.1	0.7

Air pollution

Outdoor air pollution

Outdoor air is often referred to as ambient air. The common sources of outdoor air pollution are emissions caused by

Deforestation, Transport

Industry /Brick factory

Residents & Ozone

Wider Impact on Health, Climate change, Global warming

The most common air pollutants of ambient air include:

Particulate matter (PM10 and PM2.5)

Ozone (O3)

Nitrogen dioxide (NO2), Carbon monoxide (CO)

Sulphur dioxide (SO2)

Indoor air pollution

Biomass Burning

Mold and pollen

Tobacco smoke

Household products and pesticides

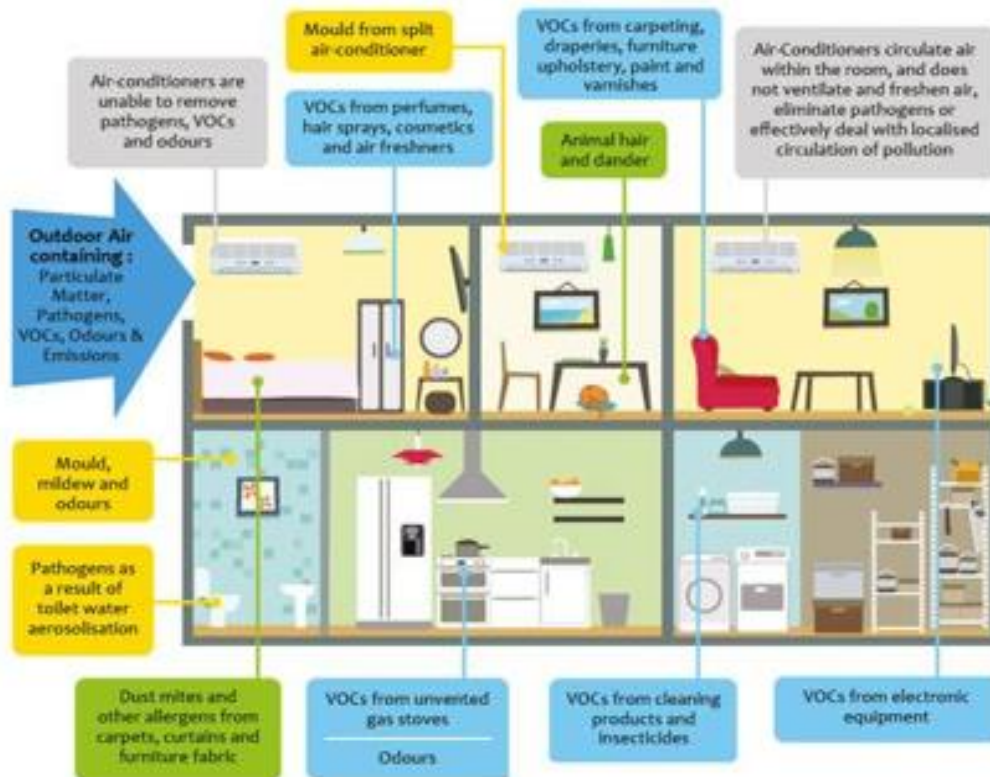
Gases such as radon and carbon monoxide

Materials used in the building such as asbestos, formaldehyde and lead

Impact on Health

Indoor Air Pollution sources

Air Quality at Home



Sustainable Development Goals (SDGs) and Indoor air pollution

The 17 Sustainable Development Goals aim to end extreme poverty and create a healthy, sustainable world by the year 2030.

Goal 7 targets access to clean and affordable energy supply

Goal 11 addresses on sustainable cities and communities is crucial in our urbanizing world.

Goal 13 tackles climate change issues such as switching to cleaner energy, cooking and transport solutions

Nepal's Constitution 2072 (Fundamental Rights)

Ways To Improve Indoor Air Quality

1. Reduce biomass burning for cooking; make biogas an alternative solution
2. Provide enough ventilations :
3. Make your home a non-smoking area,
4. Reduce tobacco and biomass burning
5. Keep a clean home.
6. Keep track of the humidity
7. Reduce the use of synthetic fragrances.
8. Indoor plants to promote air filtration
9. Test for Radon

Indoor air quality (IAQ) w.r.t. Volatile organic compounds (VOCs)

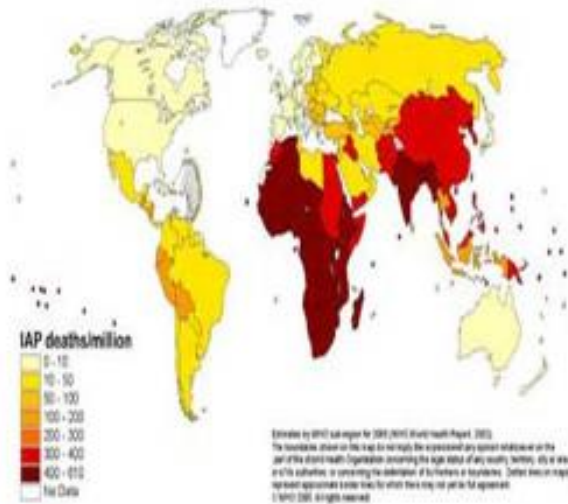
IDT IAQ Rating	Reference Level*	Air Information	TVOC (mg/m ³)	Air Quality
≤ 1.99	Level 1	Clean Hygienic Air (Target Value)	< 0.3	Very Good
2.00 - 2.99	Level 2	Good Air Quality (if no threshold is exceeded)	0.3 - 1.0	Good
3.00 - 3.99	Level 3	Noticeable Comfort Concerns (Not recommended for exposure > 12 months)	1.0 - 3.0	Medium
4.00 - 4.99	Level 4	Significant Comfort Issues (Not recommended for exposure > 1 months)	3.0 - 10.0	Poor
≥ 5.00	Level 5	Unacceptable conditions (Not recommended)	> 10.0	Bad

Health Effects

Pollutant	Type	Effects
NO ₂	Immediate	irritation to the skin, eyes and throat, cough etc.
CO	Immediate	headache, shortness of breath, higher conc. May cause sudden deaths.
RSPM	Cumulative	Respiratory illness (upper and lower), Acute (Asthma) and chronic (COPD), Lung cancer,
SO ₂	Immediate	lung disorders and shortness of breath
Radon	Cumulative	Lung cancer
Formaldehyde	Immediate	irritation to the eyes, nose and throat, fatigue, headache, skin allergies, vomiting etc.
Asbestos	Cumulative	Lung cancer
Pesticides	Immediate	Skin diseases
VOCs	Immediate	Liver, kidney disorders, irritation to the eyes, nose and throat, skin rashes and respiratory problems.
O ₃	Immediate	eyes itch, burn, respiratory disorders, lowers our resistance to colds and pneumonia.

Impacts

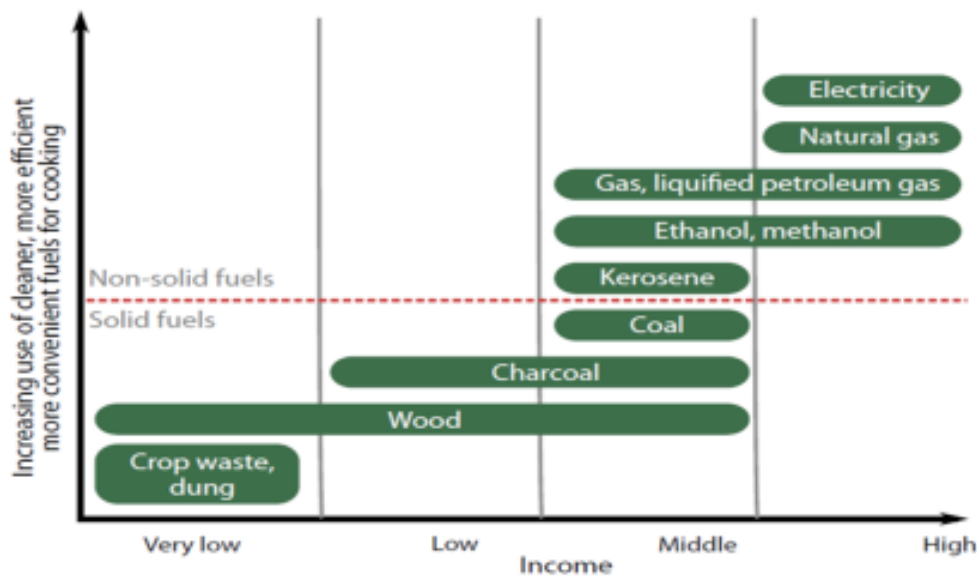
Deaths from indoor smoke from solid fuels



According to current World Health Organization estimates, more than half of the world's population (52%) cook and heat with solid fuels, including biomass fuels and coal

It has been estimated that more than 2.4 billion people, generally among the world's poorest, rely directly upon biomass, e.g. wood, crop residues, dung and other biomass fuels for their heating and cooking needs.

Energy ladder



National Policy and Strategy

- Rural energy Policy, 2006
- 2012 National Ambient Air Quality Standards (Updated from 2003)
- Renewable energy subsidy policy 2013
- National Indoor Air Quality Standard and Implementation Guidelines 2009 by, 2013
- Renewable energy subsidy delivery mechanism, 2013 (ICS Focussed)
- Clean Cooking Solutions for all by 2017 thereby ensuring indoor air pollution free Nepal

- The Biomass Energy strategy 2017,

- **HIMALAYAN NEWS SERVICE Kathmandu, March 19** : The Ministry of Population and Environment is preparing to implement its strategy to promote clean cooking technology in all households across the country as per the plan to make Nepal free of indoor pollution by 2022.

- The ministry is also working on policies that will ensure availability of modern clean energy, using solid biomass, in all the households by 2030.

HOW CAN I REDUCE INDOOR AIR POLLUTION?

If you're wondering what steps to take to prevent air pollution in your home you can start with making a checklist based on the common pollutants and see what you use in your property. From there you can replace or reduce the usage of that item. Increasing ventilation is always a good place to start.

- 
Small changes, like replacing a log burning fire with a **'BIO FIRE'** can make all the difference.
- 
If you're concerned about the level of air pollution in your property, an **AIR PURIFIER** can provide a reduced level of particulate matter count.
- 
Building regulations in cities like London are pushing for the requirement of **AIR FILTERS** in commercial properties and workplaces.
- 
Being **AWARE AND VIGILANT** of the impact air pollution has on health is key to creating a healthier, cleaner way of living.

Challenges and opportunities

Technical know-how about pollutants

Socio-economic factors for choosing clean fuels

Behavioral and cultural factors e.g for using biogas etc.

National policy and programs

Awareness



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Annex 2: Photos of Seminar on Indoor Air Quality & Biomass Burning





