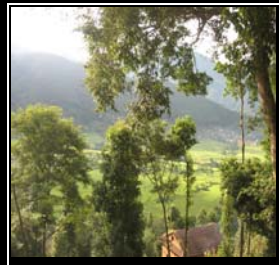




Bio-Briquette in Nepal:

Lessons Learned



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EDITORIAL

ABOUT IDS-NEPAL

IDS-Nepal is a non-profit development NGO, committed to improving the quality of life of poor and underprivileged people in Nepal, in both rural and urban areas. It was established in 2000 with vision primarily through sustainable and community based infrastructure development programs. IDS-Nepal is based in Kathmandu, a regional office in Nepalgunj, and branch offices in the Kapilvastu, Baitadi, Rolpa, Rukum, Jajarkot, Dailekh and Chitwan districts of Nepal.

IDS-Nepal was founded by a number of highly qualified development activists. The current team consists of well-experienced professionals from different backgrounds including: environment, energy, health, engineering, sanitation, skill development and social development fields as well.

VISION

To improve the quality of life of poor and underprivileged people in Nepal

MISSION

To assist in the sustainable and equitable development community infrastructure and improvement of livelihoods by conceptualizing, formulizing, and facilitating the implementation of community managed development projects by ensuring community members' active participation in every step of the project cycle.

WORKING WITH

CECI-UNITERA, CECI-SAHAKARYA, Plan Nepal, DRILIP/DOLIDAR, UEIP Bharatpur, UNDP-SGP/GEF, RVWRMP, IRC Neitherlands, CBW SSP/DWSS, UNICEF Nepal, Care Nepal, FECOFUN, and RWSSFDB

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1.0 INTRODUCTION

Historically, the people of Nepal have been able to comfortably rely on the abundant supply of forest wood to meet their energy demands due to its availability, practicality and affordability. Presently, however, the situation is changing as population increases, energy demand rises and the forested areas decline (Asian Development Bank, 2006). In 2002/2003, the residential sector used 90.6% of the total energy consumed in Nepal and the largest fuel source was traditional fuels (forest, agricultural residues and animal wastes) which accounted for 87% of the total energy consumed in the country. The impact that these consumption patterns are having on the forests of Nepal are realized when further statistics reveal that residents account for 98% of the traditional fuel source consumption and specifically, 89% is fuelwood (Asian Development Bank, 2006). Increased demand for this precious resource coupled with decreasing supply, makes for a grossly unsustainable practice as it is being depleted faster than it can be produced and supplied. This sort of deforestation within the country will prove to be devastating in the long term as the resource, without a doubt, will be completely exhausted and, related negative side effects that are often not considered will be exacerbated. These effects include increased soil erosion, desertification, loss of biodiversity, and negative impacts to land and watershed management.

The culmination of these deforestation practices in Nepal only contributes to the global phenomenon of climate change. This issue is ominous and counteraction may seem futile, particularly for a country such as Nepal, whose global contribution to global warming is negligible in comparison to industrialized western countries. Nonetheless, Nepal has the ability to play a role in climate change mitigation through the use of simple, innovative and feasible alternative technologies. Although the technologies to be adopted in Nepal may appear primitive in comparison to those available in industrialized countries, Nepal needs to take measures that are practical for its own situation. This means identifying the alternative energy technologies that exist in other countries and modifying them to suit the needs of Nepal. Diversification of energy sources and expansion into the alternative energy sector stands to be very successful in Nepal if the energy sources are financially feasible and efficient for consumers.

The increasing demand for these traditional fuel sources not only has detrimental environmental impacts but also has negative social impacts for the rural people of Nepal who account for 90% of the total population and of which, half live below the poverty line (UNDP, 2007). These people rely on such traditional fuel sources as they do not have access to electricity gridlines and other fossil fuel sources such as kerosene are becoming increasingly expensive. Therefore, this reliance on a single natural resource, coupled with the day to day reality of energy shortages and rising fuel prices in Nepal, reveal the imminent need to identify sustainable and affordable alternative energy sources if fuel supply is to meet the ever increasing demand for energy in Nepal.

The bio-briquette is one technology that is a simple yet sustainable technology to be used as an alternative energy source in Nepal. Briquetting is the process of converting low bulk density biomass into high density and energy concentrated fuel briquettes. The beehive briquette is formed through partial pyrolysis, or charring, of various bio-mass including agricultural residues and forest waste vegetation such as the noxious weed, banmara grass. The charred biomass is combined with a limited amount, maximum 20%, of a suitable binding agent and placed into a mould that has approximately 19 holes to allow for proper combustion, thus the name, beehive. Once dry, it may be ignited whereby it will burn for approximately 1- 1.5 hours with virtually no smoke being produced and is an efficient source of energy for household heating and cooking for a 5 member family. Using the bio-briquette for indoor heating is the most popular function of the briquette and the main reason that it is demanded by consumers both within urban and rural locations.

The benefits of using the beehive briquette are extensive as it greatly reduces Indoor Air Pollution (IAP) of homes, reduces the amount of open-flame related accidents, contributes to the reduction of deforestation in Nepal thereby maintaining the carbon sequestration within forests, decreases

the amount of CO₂ and SO₂ being emitted into the atmosphere, decreases incurred fuel expenses of communities and also improves the fertility of agricultural land as cow dung previously allocated to household fuel usage can be utilized in the field. Other benefits include social mobilization, product affordability, income generation, and capacity building for communities that partake in the local production process.

Based on the benefits that are available to the producer and consumer, the bio-briquette has the potential to be a feasible and practical alternative energy solution for Nepal.

2.0 OBJECTIVE

The bio-briquette is growing in population as an alternative energy source in Nepal due to various successes and opportunities but there are certain challenges and obstacles that are inhibiting its production and use throughout the country. The main objective of this report is to:

- i. Identify and analyze the successes and challenges from the perspective of various stakeholders and;
- ii. Provide recommendations of the lessons learned thus far in the bio-briquette sector.

It is anticipated that such analysis and recommendations will be integral to the future development of the bio-briquette. As this alternative energy is relatively new to Nepal, it is important to focus on those stakeholders that are closely linked to the bio-briquette process, primarily, community producer groups. Improving the capacity of the producers will increase the potential for long-term achievements of other stakeholders involved. Therefore, to achieve the main objectives of this report, the focal stakeholder will be the various producer groups supported by IDS Nepal.

3.0 METHODOLOGY

To date, there have been a significant amount of data, research and other information developed in the bio-briquette sector from the vantage point of IDS Nepal as well as other stakeholders associated with the organization. Therefore it is necessary to gather both qualitative and quantitative data from the relevant stakeholders through a variety of mediums.

Primary data collection included field visits to four producer groups with the aid of questionnaires. Representatives from each producer group included the presidents and the producers who were all able to provide invaluable information regarding the progress of the many aspects of the bio-briquette thus far. Other primary data was gathered from IDS employees and other representatives who have been involved with the bio-briquette development since its inception at IDS Nepal.

Secondary data was received through various research methods, including the use of internet and existing information.

Subsequent to the collection of all information, research and data, the lessons learned were compiled and analyzed.

4.0 ANALYSIS OF ACHIEVEMENTS

Despite the many challenges that exist within the bio-briquette sector, there are also many achievements accomplished by IDS Nepal and other stakeholders. Such accomplishments have aided in the mitigation of existing challenges and have also contributed significantly to the promotion of the bio-briquette.

4.1 Support & Collaboration

In order to fully promote and utilize the bio-briquette, it is essential that the support and collaboration of local, national and international organizations be attained. The collaboration with other organizations allows knowledge, information and expertise to be transferred and disseminated properly and the financial support by other funding agencies enables technology to be transferred, improvements and necessary developments to be made.

a. Funding Support

At the inception of its involvement with the bio-briquette sector in 2004, IDS Nepal was awarded a one year small grant from the UNDP's Global Environment Fund, Small Grants Programme. This initial project involved the coordination and mobilization of the local community forest user group, Bishanku Narayan of the Lalitpur district, to establish the production of the briquette within the community. The establishment of the producer group provided a sustainable source of livelihood and income generation for communities and simultaneously promoted the bio-briquette. IDS Nepal recognized the potential of the bio-briquette and worked to promote support and sustain the Bishanku Narayan Bio-Briquette Producer Group.

Two years later, with additional support from the UNDP, IDS Nepal was able to continue to develop the Community Bio-Briquette and Livelihood Project (CBLP) within the Bishanku Narayan Bio-Briquette Producer Group and furthermore, was able to expand bio-briquette information by delivering bio-briquette training to additional districts within Nepal. These locations include Nepalgunj, Banke in the western region, Turture, Tanahu and Kapilvastu of mid-western Nepal, and Shanti Nagar, Jhapa in the east. From January 2006 to September 2007, IDS Nepal conducted bio-briquette training, established these community briquetting units.

In addition to the delivery of bio-briquette training and development of producer groups, IDS Nepal was also able to take part in the conduction of field and laboratory studies on the bio-briquette to ascertain its quality, identify the impacts of utilizing other biomass materials and develop appropriate tools necessary for the bio-briquette production process.

Without the support of the UNDP, IDS Nepal would have been unable to provide bio-briquette awareness and production training and technical support to local communities throughout Nepal. The financial support of UNDP combined with the technical support of IDS Nepal has allowed local communities to develop the bio-briquette production process as well as has enabled them to utilize this energy resource that otherwise, they may have been unaware of.

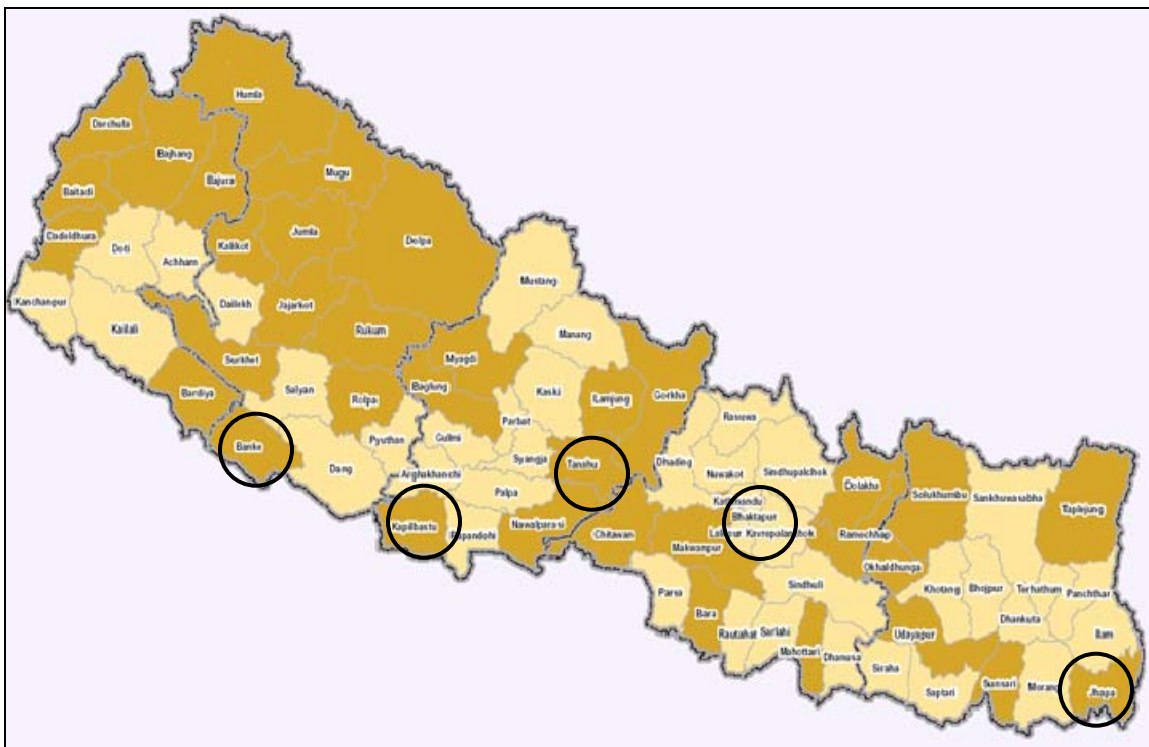


Figure 1: Bio-briquette producer groups supported by IDS Nepal in the districts of Banke, Kapilvastu, Tanahu, Lalitpur, and Jhapa.

b. Collaboration & Networking

The Federation of Community Forest Users Group, Nepal (FECOFUN), as part of its mission, promotes the sustainable resource management for Community Forest User Groups (CFUGs) within Nepal and has joined in partnership with IDS Nepal to promote the production of the bio-briquette by forming over 100 bio-briquette producer groups. This collaboration between the two organizations has allowed IDS Nepal to contribute its technical expertise and FECOFUN to contribute its vast experience and expertise with CFUGs to successfully increase bio-briquette production and awareness in the country.

Another collaborative effort that has been beneficial to the bio-briquette sector is that between IDS Nepal and the Centre for International Studies and Cooperation in Nepal (CECI). IDS Nepal is a national Non-Government Organization (NGO) committed to improving rural livelihoods within Nepal and CECI is an International NGO focused on forming partnerships between developed and developing countries through the exchange of volunteers through its Uniterra program. This has directly benefited the bio-briquette sector as CECI volunteers from Canada have been placed with IDS Nepal to promote, support and develop the bio-briquette process within Nepal.

Subsequent to the formation of the above collaborative partnerships, it was identified that there was a lack of information sharing and knowledge dissemination amongst organizations involved with the bio-briquette. Many of these organizations have an immeasurable amount of knowledge regarding the bio-briquette but have been limited in their ability to share their resources, experiences and projects with other sector experts. This lack of information sharing leads to inefficient use of resources, ambiguity and duplication of documents and projects as stakeholders are unaware of what is already being done in the sector. Therefore, the Banaspati Gueetha Resource Center Network (BGRCNN) was formed to aid in the mitigation of these challenges, identify areas of improvement and how current obstacles in the bio-briquette sector can be overcome. The development of a loose network of bio-briquette experts enables organizations to

collaborate on bio-briquette issues, learn from each other, develop new knowledge and disseminate valuable information to the local and national levels within Nepal. The BGRCNN brings the various organizations that have bio-briquette expertise under one common theme in order to increase the organization, efficiency and use of the bio-briquette sector.

Currently, the BGRCNN has been successful in identifying those organizations that have specialized knowledge in the bio-briquette sector and have formed the BGRCNN based on the membership of these key organizations. Once the Network was established, a website was launched for the BGRCNN which includes background information of the bio-briquette in Nepal, member information, news and events regarding the Network and other information that allows anyone who is interested to stay up to date on bio-briquette issues and broaden their knowledge of the bio-briquette. The continual development of the BGRCNN will transpire into organizational collaboration, knowledge transfer, information dissemination and the overall promotion of the bio-briquette in Nepal.

The Network is managed by IDS Nepal with the collaborative efforts from many core member organizations including the Centre for International Studies and Cooperation (CECI-Uniterra), The Federation of Community Forestry Users Groups Nepal (FECOFUN), International Centre for Integrated Mountain Development (ICIMOD), National Academy of Science & Technology (NAST), National College for Information Technology (NCIT), Rural Region and Agro-forestry Development Centre (RRAFDC) and the United Nations Development Program- Small Grants Programme/Global Environment Fund (UNDP-SGP/GEF). All of the aforementioned organizations provide valuable knowledge, expertise, and training expertise that enable the Network to operate at its full potential.

c. Bio-Briquette Companies

Many of the challenges identified by the producer inhibit the producer group's ability to sell their product. To help mitigate such challenges, private companies and other entrepreneurs, act as the much-needed link between producer and market. These companies and individuals support the producer by purchasing the finished bio-briquette directly from the producer, establishing a mode of transportation for the product and delivering the product to previously identified markets including hotels, supermarkets, and other businesses where demand is high for the bio-briquette. It is important that the producer group and private companies establish a working relationship that is understood and accepted by all parties involved.

4.2 Promotional Tools

Because the bio-briquette is a relatively new alternative energy source to be introduced to Nepal, promoting the production and utilization of the source through media, seminars, training workshops, and other promotional materials are all very useful tools in creating the awareness and demand for the bio-briquette. IDS Nepal is committed to promoting the bio-briquette and thus seeks out any opportunity to promote it to local communities, national organizations and international bodies. By promoting the many benefits of the bio-briquette for both consumers and producers, it allows audiences to become aware of an efficient energy source that was once unknown to them. By utilizing many sources of promotional tools, many different target audiences may be reached. Television and website information targets people in urban areas with access to such technology, seminars target professionals and experts in the alternative energy sector, and training workshops and brochures in both English and Nepali languages can be disseminated to more rural areas of Nepal where access to other media is limited.

a. CNN News Coverage

In April, 2008, IDS Nepal was requested by the international news media, CNN, to aid in the development of one news report regarding the bio-briquette and its potential as an alternative energy source to save the forests of Nepal. Because of its knowledge and expertise in the bio-briquette sector, IDS Nepal was able to support CNN through the provision of credible information and data as well as with the ability for CNN reporter, Dan Rivers, to meet with one of the local bio-briquette producer group supported by IDS Nepal, the Bishanku Narayan Producer Group. Interviews with the producer group as well as the chairperson of IDS Nepal revealed information regarding the overall production process as well as the advantages of producing and utilizing the bio-briquette at the local level.

The report was aired on international television and provided positive exposure for IDS Nepal, its involvement with the bio-briquette as well as for the producer group and the bio-briquette in general.

b. National Seminar

In May of 2007, FECOFUN and IDS Nepal with the support of UNDP-GEF/SGP organized one seminar entitled the “National Seminar on Community Based Bio-Briquettes”. Many other organizations contributed invaluable support through the presentation of papers including Practical Action, Nepal Academy of Science & Technology (NAST), Kathmandu University – Department of Mechanical Engineering, SEED and RRAFDC. The seminar’s main objectives were to interact and enhance research and development in the field of bio-briquette, promote briquettes as a low cost, efficient and environmentally friendly source and lesson learning for further improvements of briquettes through feedback. The seminar was a great success and it is anticipated that future seminars will be conducted to further improve the promotion and utilization of the bio-briquette (Please see the abstracts of the papers presented at the seminar in Appendix 1).

c. Promotional Materials

Throughout IDS Nepal’s involvement with the bio-briquette, it has developed important promotional materials that are continually used at various events including training workshops, seminars and distributed as general information to those interested. These materials include one video on the community based bio-briquette aired by NTV television channel in Nepal, information brochures on the bio-briquette process published in both Nepali and English to be disseminated to consumer and producer target groups.

5.0 ANALYSIS OF CHALLENGES

There are a few challenges existing for the bio-briquette but the most fundamental ones can be defined within four main areas:

- i. Production
- ii. Technology
- iii. Marketing
- iv. Government support

Different factors contribute to decreased production, low quality briquettes, unsatisfied producers and consumers and inadequate support but the analysis of such challenges will identify ways to mitigate them.

The producer groups currently supported by IDS Nepal are integral to identifying areas of improvement for the bio-briquette production process. Because the producer groups are one of the key stakeholders of the entire process, it is important to understand and learn from their experiences including their needs and concerns. Meeting and consulting with the various producer groups from Lalitpur, Tanahu and Kapilvastu, brought forth the various challenges that the producer groups are having with the process but also highlighted the dedication that the producers have towards the production and the vision that they hold to make the bio-briquette production process a lucrative and sustainable one.

5.1 Production

The bio-briquette production process is not highly technical but it is a process that needs to be followed carefully to ensure that high quality briquettes are produced for consumers. Failing to abide by the process will result in briquettes that break easily, have poor combustion and therefore, are not appealing to potential consumers. However, if the process is adhered to, the briquettes produced will be demanded by consumers and the producer group will be successful.

Figure 2: Bio-Briquette Production Process



a. Production Process

It has been observed that some producers make alterations to the bio-briquette production process that reduces the quality of the briquette. One of the main alterations to the process that decreases the efficiency of the briquette is the addition of excessive amounts of the binding agent clay, water or sand, which increases the moisture content of the briquette and reduces its combustibility. Another alteration that causes inefficiencies in the briquette is a lack of compaction. Once the loose materials have been combined with the binding agent, it needs to be compacted as much as possible either through use of hand compaction or screw compaction. If the briquettes have not been fully compacted, once dry, they will be more susceptible to being broken as they are more fragile. Producing low quality briquettes is detrimental to all parties involved. The producers may think that by making such aforementioned alterations, they are saving time and thus increasing their efficiencies. However, low quality briquettes are not transportable as they break easily and those that do reach the consumer have poor combustibility due to the high moisture content and are not demanded by the consumer and the sale of the briquettes will decrease. Therefore, producing high quality briquettes is beneficial to all parties involved, particularly the producer groups that are relying on the production of their briquettes as a means of income generation.

Producers that are engaged in the production of the bio-briquette are generally content with the production process but there are some concerns that affect the production of the bio-briquette. These concerns are related to health, the environment and the social well-being of the producers. One benefit of the bio-briquette is its reduction of Indoor Air Pollution (IAP) when using it for heating and cooking inside the home. Producers are pleased with such reductions, however, there is another type of pollution that occurs during the production process that causes respiratory and sight problems for the producers. These health concerns are caused from the inhalation of the smoke during the burning process of the banmara and also from the charring process as the particles of the charred biomass are inhaled and irritate the eyes. Currently, these problems are only causing minor irritations to the producers but the mitigation of such problems is necessary to ensure that no long term effects transpire and that the producer group remains motivated to produce the bio-briquette.



IAP is decreased when fuel source is switched from firewood to briquette



The smoke emitted during the burning of the banmara causes health concerns for the producer groups

The health concerns are prevalent within the producer group as are the environmental and social concerns. Producers are currently preoccupied with the sustainability of the biomass. Within the forests, banmara is readily available, however, due to unsustainable harvesting techniques, the banmara is decreasing. The current practice to harvest the banmara is by the removal of the entire plant, including the root. This practice reduces the re-growth of the banmara and therefore, the banmara in the forest is less. A reduction in the availability of the biomass means an inevitable reduction in production. This effect is detrimental to producers as many want a sustainable production process to rely on. Without a sustainable and beneficial production process, producers will lose interest in the bio-briquette and will develop other projects to sustain themselves.

5.2 Technology

Due to accessibility, costs and manufacturing issues relating to the technology necessary for production, it is a challenge for the producer group to maintain a well functioning production process.

a. Equipment

The tools that are necessary for production are either manufactured locally within the community or provided by a supporting agency. Locally manufactured equipment is the most practical and beneficial to the producing group as the group is able to confer with the manufacturer directly to ensure the equipment is produced properly and the costs will also be less as the group will not have to incur any transportation costs to have the equipment delivered. However, circumstances exist whereby the equipment cannot be produced locally and must come from a larger external manufacturing company.

This is the situation for the motorized grinding machine that is not mandatory for production but makes the grinding process much less labour intensive, increases production efficiency and is highly demanded by most producer groups. Obtaining such machinery requires access to a supplier, transportation and most importantly, access to financial resources. None of the aforementioned resources are readily available to producer groups and this leaves the producer unable to continually improve the technology for the production process which will undoubtedly improve the overall output of the process and the satisfaction of those involved.



Example of grinding the charred biomass with use of a hand roller

5.3 Marketing

Bio-briquette producer groups are able to benefit from the finished product in two ways. Primarily, they are able to use the bio-briquette for their own cooking and heating purposes and secondly, the producer groups can sell excess bio-briquettes in nearby markets. Selling the briquettes can be an income generating activity for the producer group and funds raised from sales may be allocated to various producer group needs or distributed amongst those involved in the production process. The possibility of generating a profit from the production is a real incentive for community members to become involved in the bio-briquette process however, the challenge lies in being able to identify or develop a demand for the bio-briquette, transport it to the market and sell it successfully to consumers.

a. Supply & Demand

The majority of producer groups are located in remote rural areas with poor access to markets outside of their communities and are unable to identify or establish a demand for their product. The necessary link between producer and consumer is often non-existent and producers are restricted to selling their product only within their own community and using it themselves. This is beneficial to sustain their practice but in order to develop an income generating business, it is integral to the producer group's success that they identify a market to sell their product to. Even if the market is identified, transporting the bio-briquette to the market is another major challenge as transportation costs are too high for the producer group to be able to absorb and the occurrence

of broken or damaged briquettes as they are being transported is also great. Producer groups that sell their product to outside markets without the aid of another company or organization are often unsuccessful as they are unable to obtain a vehicle to transport their product and they cannot afford the fuel expenses. Furthermore, if the briquettes are not packaged properly, often they are damaged while being transported and damaged briquettes cannot be sold to consumers.

Supply and demand for any product needs to be balanced in order to maintain a sustainable business practice. In the bio-briquette sector it has been a challenge to attain such a balance. Producer groups in more rural areas are successfully supplying the bio-briquette but the problem lies in the producer group's inability to identify the demand for their product. This may be due to many reasons. Primarily, the demand may be low because the consumers have easy accessibility to firewood and agricultural wastes such as cow dung that are both inexpensive and practical for their uses and therefore do not have the incentive to seek out alternative energy sources. Communities that rely on firewood or other unsustainable biomass sources can greatly benefit from the use of the bio-briquette. However, due to a lack of awareness regarding the various alternative energy sources and their benefits, many potential consumers are unaware of alternatives and continue to use traditional sources. If the awareness is developed and consumers are conscious of the health, environmental and social benefits of the bio-briquette, then demand for the briquette will improve. The benefits of the bio-briquette include a reduction in Indoor Air Pollution (IAP), decreased consumption of forestry resources and less reliance on expensive fuel sources. Potential consumers demand an energy source that is either equal to or better than their current energy sources in terms of practicality and its feasibility in order to change their energy use.

A further limitation is the slower cook times associated with using the briquette. It has been observed by some producers and others that, using the bio-briquette for cooking purposes is not as efficient as using firewood or other sources. While some consumers are discouraged from using the bio-briquette due to this reason, others recognize it as a benefit. Despite the fact that there are slower cook times involved, the bio-briquette burns efficiently and at a constant rate which allows other activities to be completed while the food is cooking and the user can be sure the food will be ready at a set time. Despite this, there are consumers that are reluctant to use the bio-briquette for cooking purposes. Under such circumstances, it is necessary that the consumer is encouraged to use the bio-briquette for heating purposes and identify a different alternative energy source for cooking purposes as a further means to discourage the use of traditional sources including wood and cow dung.

Although demand in rural areas is decreased due to some limitations of the briquette, larger urban centres such as Kathmandu are demanding the briquette but due to supply limitations, demand is currently exceeding supply. The main cause of decreased supply in urban areas is lack of accessibility. A large majority of the producer groups are located in more remote areas and are unable to transport their product to the markets where the demand exists. Failure to identify such supply and demand issues will cause the production and utilization of the bio-briquette to stagnate and its potential as an efficient energy alternative energy source will diminish. The bio-briquette is both feasible and practical but if the lack of marketing continues, inconsistencies in supply and demand will remain a prevalent problem.

5.4 Government Support

It has been stated in the Government of Nepal (GoN), National Planning Commission's tenth fifth year plan that one objective for energy use in Nepal is to develop and expand alternative energy sources as powerful tools for alleviating poverty, raising purchasing power of the rural people by developing alternative energy technologies based on the local resources, increasing consumption of alternative energy and reducing dependency on imported energy through the proper utilisation of local resources (GoN, National Planning Commission, 2007). Various sectors including the government have put a strong emphasis on development of renewable energy development but

due to the disintegration of efforts made by various agencies in the development of renewable energy, little has been achieved (Bahadur, Arjun, 2007). Within the GoN, The Alternative Energy Promotion Centre (AEPC) is the agency that supports energy sector development within Nepal. Currently, AEPC supports biogas, solar energy, micro-hydro and other biomass energy sources. The mandate of the AEPC is to promote the use of renewable energy technologies to meet the energy needs in rural areas of Nepal and acts as an intermediary institution between the operational level Non-Government Organizations (NGOs) and private promoters of renewable energy sources and rural communities. Certain alternative energy sources, especially biogas and Improved Cook Stoves (ICS), have been exemplary of successful implementation and utilization of alternative energy through the collaborated efforts of NGOs and Government, however, regarding AEPC's support to the biomass briquette, it is virtually non-existent. It is stated in the 2006 Subsidy Policy that "regarding other renewable energy, no subsidy has been provided but studies, research & development, trainings and pilot projects will be undertaken in the field of biomass briquettes" (Alternative Energy Promotion Center, 2008).

The bio-briquette has not been identified as a significant alternative energy source by the Government of Nepal and because of this, it is difficult for NGOs involved with the bio-briquette to receive the assistance and support necessary to develop the bio-briquette in Nepal. The lack of national priority by the Government in the form of subsidy assistance or other support makes it much more challenging for the bio-briquette to become a well known alternative energy source.

6.0 OPPORTUNITIES

Bio-briquette awareness is slowly increasing throughout Nepal and various forms of biomass briquetting are being promoted and utilized throughout the world. The biomass, technology and use of the briquette differ but the main objective is the same; to minimize the dependence on traditional, unsustainable fossil fuel sources through the identification and adoption of affordable and practical alternative energy sources. Therefore, it is important to the further development of the bio-briquette in Nepal to be aware of, and learn from, such international developments and recognize the many opportunities available for bio-briquette expansion in the country. This can be achieved through research of and collaboration with organizations working in the bio-briquette sector in other countries. It is useful to identify the progress being made in countries that are similar to that of Nepal and therefore it is relevant to focus on Nepal's neighbouring country, India. The two countries have many similarities regarding demographics, geography, climate, etc. and the needs regarding energy sources are also more parallel than in comparison to other countries. Furthermore, India has been achieving significant developments in the bio-briquette sector and because of these achievements Nepal can be attaining valuable knowledge from the progress being made.

6.1 International Opportunities

In both developed and developing countries, biomass briquetting is being utilized locally by rural households, schools, hotels and other businesses and is also growing in popularity amongst various industries for large scale heating and gasification purposes. Furthermore, the bio-briquette is also being mass produced to meet the large scale demand. Some countries are implementing the bio-briquette in a similar manner to Nepal as a small scale production process that utilizes simple technology and is primarily utilized by households while other countries have successfully identified ways to produce the biomass briquette at a large scale and sell the product to industries and large institutions capable of using the briquette in heating systems including boilers and furnaces. Others yet are also receiving substantial government and international support for producing, utilizing and promoting the bio-briquette.

In India, biomass briquettes are being promoted within residential school systems. One organization, Nishant Bioenergy Consultancy Ltd., developed a specialized cook stove that uses biomass briquettes as the main fuel source in substitution for Liquid Petroleum Gas (LPG) and is ideal for institutional scale cooking. The development of the cook stove that uses an alternative energy source was recognized by the prestigious Ashden Award and Nishant was rewarded for its achievements in 2005 not only because it is an environmentally friendly energy source but also because of the financial benefits associated with the stove. Nishant recognized that with rising fuel prices, it is becoming increasingly important to use alternative energy sources. Although the initial capital cost of the stove may be of a concern to some consumers, Nishant provides financial support by allowing the purchaser to repay the cost within 18-24 months with the funds saved from its decreased fuel bills (Ashden Awards, 2005). This development is exemplary of an alternative energy source that is practical and affordable for consumers and reduces the reliance on unsustainable and expensive fossil fuel sources. Therefore, this development has social, financial and environmental benefits associated with it.

Within industrial sectors in various countries there has been an increasing amount of bio-briquetting being used in industrial plants that previously relied on coal for gasification of their boilers and are now being retrofitted to enable the use of various forms of biomass briquettes. Such examples of this include various power plants in India that have switched from furnace oil and coal to biomass briquettes that not only have a higher calorific value/kg., which indicates an improved rate of combustion, but also saves on fuel costs for the power plants. This modification in fuel sources is achieved through retrofitting existing boiler systems which allows proper bio-briquette combustion within the boiler.

Switching fuels in various industrial plants does not only reduce greenhouse gas emissions, it also contributes to the economic value of the plant through the use of the Clean Development Mechanism (CDM), a key mechanism in the Kyoto Protocol. The CDM helps countries meet their emission targets and encourages the private sector and developing countries to contribute to emission reduction efforts by earning Certified Emissions Reduction (CER) credits. These credits are given to projects in developing countries that reduce the amount of emissions being released and can then be traded or sold to industrialized countries that want to meet their emission reduction targets (UNFCCC, 2008). The chemicals manufacturing plant, Lanxess India Pvt. Ltd, is one example of an industrial plant that has registered as a CDM project by switching its boiler fuels from Furnace Oil (FO) to biomass briquettes, enabling the plant to reduce its emissions and also to sell its CER credits, each of which is equivalent to 1 tonne of CO₂ (Lanxess India, Monitoring Report, 2007). Such fuel switch CDM projects are becoming more common in various parts of the world including India, Africa, Latin America and Asia, while the buying countries are predominantly European countries and Japan (UNFCCC, 2008).

In some developed countries, including the U.S. and various parts of Europe, companies are focusing their attention on specializing in the manufacturing of bio-briquette equipment needed for mass production of bio-briquettes. Depending on the type of press used to make the briquettes, anywhere from 50-2,500 kg. can be produced per hour (C.F. Nielsen, 2008). Such equipment is being purchased for industrial and process boilers including pulp mills, food plants and other industries that have access to biomass including agricultural or other wood wastes necessary to make bio-briquettes and are also aiming to decrease their emissions of CO₂, SO_x and NO_x (Center for Applied Energy Research, University of Kentucky, 2006).

In the context of Nepal, some of these developments that are occurring internationally may not be suitable for the bio-briquette sector within this country. However, it is still important to observe what is being accomplished in other countries, learn from the technologies being developed and the approaches being taken in the promotion of the bio-briquette and customize the strategies to fit within the bio-briquette development in Nepal.

7.0 RECOMMENDATIONS

Objectively analyzing the achievements of the bio-briquette and realistically identifying the challenges of the energy source thus far allows for feasible and practical recommendations to be found. In order for the bio-briquette to expand and be developed as an alternative energy source utilized in this country, recommendations need to be considered and where possible, implemented.

7.1 Efficient Training & Standardization

Bio-briquette producers that are already producing and those people that are interested in being a part of the production process both need to be aware of the production process that must be adhered to so that high quality briquettes are continually produced. This means clearly identifying sustainable harvesting methods for the banmara that allows the banmara to regenerate and making the producers aware of the potential negative repercussions of failing to follow the correct steps in the production process and producing low quality briquettes. This can be easily achieved through efficient and thorough bio-briquette production training delivered by those organizations that hold the knowledge and expertise regarding the process.

Standardization in the production process is integral to the continued production of high quality bio-briquettes that are demanded by consumers. Standardization means that all bio-briquette producer groups are trained on the proper steps to follow in the production process and are encouraged to abide by the production process steps that were taught to them throughout training sessions.

7.2 Technology Transfer

It has been observed that despite the fact that the production process is relatively simple and requires a minimal amount of technology, there are certain tools and equipment that would make the production process more efficient and less labour intensive for the producer groups. These include identifying the ability to invest in a motorized grinding machine for the producer group and allocating financial resources to providing proper face masks, hand gloves and other simple protective clothing that will greatly minimize the health concerns of the producers and increase the overall production rate of the group.

7.3 Follow-up & Monitoring

Once training has been completed and producers are successfully producing the bio-briquettes, conducting follow-up and monitoring activities is essential to ensuring that producers needs and concerns are continuing to be met, the production process is being adhered to and technological advancements to the production process are being made. Without proper follow-up and monitoring producers may become stagnant in their production as they may become frustrated with unmet demands or bio-briquettes produced may become of a low quality standard as producers may begin to make alterations in the process that produce fragile and inefficient briquettes. Conducting monthly or bi-monthly follow-up activities through meetings with the producer groups will ensure the process is being followed and at the time of the meetings, producers can have all of their needs, concerns and comments addressed.

7.4 Financial Support

Producer groups are enthusiastic about the bio-briquette but the discouragement lies in the groups' inability to support itself financially in order to improve upon the production process and continue to produce the bio-briquette efficiently. A majority of the needs and concerns can be alleviated through both technical and financial support to the producer groups. Financial support from external organizations alone will not mitigate all producer concerns but it definitely aids those producer groups who are aware of the technological improvements that could be made to their production groups but do not have the financial means to make such changes.

Currently, producer groups are limited in their ability to sustain themselves with the money earned from their bio-briquette production and most producer groups engage in bio-briquette production as a side project that is secondary to other more lucrative income generating activities. It is understood that for many of the producer groups, by the time all of the members of the producer groups have received their share from the revenue no funds are remaining. However, if the producer groups could manage the funds in a way that allowed a small percentage of the total revenue from each month to be allocated to a sort of savings account, the accumulated funds could be allocated to either investing in improving their bio-briquette production process or used for a communal purpose. Training producer groups on developing a savings program could be done simultaneously with the production process training program. This sort of training would be simple but also very advantageous to the group in the long term and eventually allow the group to become completely self sustainable and generate a significant source of income for the members of the producer group.

7.5 Development of Private Companies

The private companies are integral to the promotion and marketing of the bio-briquette. The link that they provide between consumer and market is essential and without such a link, the producer is left to identify the market and sell their product independently which is a very difficult task when the producer group is removed from the market and consumers. Continued development and support to the private companies will strengthen the partnership between company and producer and allow the companies to develop into a profit generating business.

7.6 Promotion

Promoting the bio-briquette within Nepal is crucial at this point in time. Failure to identify demand for the briquette will result in excess supply and little demand and failure to promote the production of the briquette amongst local communities will mean the opposite, demand exceeding supply. Therefore, it is important to promote the bio-briquette to various target groups including producers, consumers and other interested parties. Highlighting the affordability, income generation potential and other health, social and environmental benefits through the use of media including television, radio, newspaper, etc. as well as literature, seminars and workshops will only provide positive exposure to the bio-briquette, alleviate people's scepticism of the briquette, and allow consumers to realize functions and benefits of using such an alternative energy source for their heating and/or cooking purposes.

7.7 Diversification of Alternative Energy Sources

Currently within IDS Nepal, the beehive bio-briquette is the only alternative energy promoted by the organization. Although it is of fundamental importance that the briquette be further developed and expanded upon, it is also necessary to recognize the need to promote other alternative energy sources in situations where the briquette is not a feasible option for producers or

consumers. Alternative energy programs supported by other NGO's and government bodies including the AEPC include:

- i. Biogas
- ii. Solar panels
- iii. Micro-hydro

It would be of benefit to IDS Nepal to explore other alternative energies to promote and do so through collaborative efforts with other organizations that have certain expertise in the promotion and implementation of specific alternative energy methods and through the potential support from the government agency, the AEPC.

8.0 CONCLUSION

The bio-briquette is growing in population as an alternative energy source in Nepal due to the interest, research and support of various local communities, national organizations and international agencies. Identifying and analyzing the lessons learned thus far in the bio-briquette sector is integral to the future development of the briquette and how the various stakeholders involved in the bio-briquette currently can contribute to the sustainable development of the bio-briquette as an alternative energy source in Nepal.

Analysis of the bio-briquette thus far in Nepal identifies the many successes accomplished but also reveals the need for further promotion and support if the many stakeholders engaged in the bio-briquette sector are to overcome the present challenges existing in the bio-briquette sector. Therefore, the analysis of the achievements and challenges and consideration of the recommendations will enable NGO's like IDS Nepal and other local, national and international organizations to continue to develop and expand the bio-briquette sector. The bio-briquette has the potential to be a great alternative energy source for rural and urban communities throughout Nepal and through continued promotion, development and expansion, producers, consumers and others will be aware of the many social, health and environmental benefits of the bio-briquette and utilization within the country will increase.

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Appendices

Appendix 1

Theme paper

Bio-briquette: A good choice for alternative energy and environmental conservation

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Environment change is becoming the most serious and urgent problem the world faces. Already, we have experienced disturbing changes to our climate. The vast majority of scientists agree that much of the change to the climate is man-made through our ever-increasing exploitation of fossil fuels. Global energy use is rising rapidly and Nepal is following this trend where total consumption for the decade ending 2000 grew at almost 13% per year while per capital consumption grew at 10%. These rates will continue to grow as the country develops, poverty levels decrease and the population becomes more affluent. Thus, in the same manner that climate change and energy use go hand-in-hand, energy and development go hand-in-hand.

The importance of energy in progress and development cannot be over emphasized. However, the current global energy system is unsustainable, not just in environmental terms, but also in economic terms. In Nepal where there is a severe shortage of energy, it is imperative that we find alternate and renewable sources of energy. Biomass briquette is one such renewable technology. It can be substituted for firewood in rural areas for use in cooking and heating. Pyrolized or beehive briquette is particularly well suited for rapid delivery to rural areas given its small scale technology that is easy to adopt and has very low capital costs.

Benefits of bio-briquette are numerous, in addition to responding to the energy. Environmentally, when used in place of firewood, it prevents deforestation, has positive effects in carbon sequestration and less harmful emissions to health. Briquette can also be used for income generation and as a means to promote gender and socially disadvantaged caste equity when production is targeted towards these groups.

Greater information dissemination about benefits of briquette program need to occur. It should be a major component of the nation's strategy for rural development and environmental conservation. Additional research and advancement in briquette technology and biomass types needs to occur. Government policy should be modified to encourage these actions.

Keywords: Briquette, climate change, policy, renewable energy

Abstracts of presented papers

Community based Beehive Briquette Program- An Innovative Option for Better Livelihood of Rural Women in Nepal

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In Nepal, the total energy consumption is divided into forest wood 77%, agriculture residue 9% and petroleum product, coal and electricity 14%. In order to meet energy demands rural people are massively using trees, which is the major cause depletion of forest. It is also the cause of soil erosion, landslides, natural imbalance, environmental degradation, desertification, and drought. In the present days also traditional energy sources such as fire wood, agricultural residues and cattle dung are playing the vital role to fulfill the energy demand in rural as well as urban areas in Nepal. During these years, environmental friendly community beehive briquette technology is initiated by different organizations as suitable alternative energy option to meet the rural demand of energy specially for cooking and heating. This paper presents the different aspects of presently initiated community based beehive briquette within the different Forest Users Groups of Nepal by the technical support of Integrated Development Society and UNDP/SGP/GEF. This technology is based on indigenous concept of blacksmith of the rural parts of the country and slightly improved making simple in technology, cost effective, environmental friendly, and pollution free and is easily transferable by community women trainers within the community. In practice, this technology is providing household energy demand in rural area and entrepreneur women groups are supporting for their livelihoods.

In conclusion, this simple technology is highly replicable by which global climate change problems; indoor smoke problems for rural poor women can be decreased by supporting the rural women.

Keywords: Biomass, Energy, Community, Women Groups and Sustainability

BIOMASS BRIQUETTE TECHNOLOGY IN NEPAL: PRESENT STATUS, IMPORTANCE AND FUTURE NEEDS

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Nepal is the highest traditional fuel consuming country in Asia. Energy consumption in Nepal is categorized in residential, industrial, commercial, transport and agricultural sector. The residential sector consume about 90% (334 of 369 MGJ) of national share, which is fulfilled by traditional biomass (mostly firewood and limited extent of residues of crops and animals; and charcoal) and commercial energy source of about 95% and 5% respectively. Indoor air pollution (IAP), which is the part of daily life of about two and half billion people worldwide, is one of the fourth greatest risks of deaths and diseases. Acute respiratory infection is the third and chronic bronchitis is the eighth leading cause of morbidity in Nepal. Though the average deforestation rate has been

decreased from 2.1 to 1.4% from 1990-2000 to 2000-2005 respectively, the Nepalese people, particularly the women, have to move several hours of walk to collect firewood.

The alternation of biomass fuel is not feasible for the vast majority of household in foreseeable future. Very few organizations are involved in order to mitigate IAP and deforestation through various interventions including few types of biomass briquettes. Biomass briquette is a good substitute of wood/LPG/ kerosene and would be supportive to conserve national economy through reduced importation of kerosene and LPG. More emphasis should be given on banmara (forest killer) beehive briquette because banmara is considered as a weed which is available year round at no monetary cost and cannot be used as a fodder as well. Furthermore, the production cost of this briquette at community level is comparatively affordable than rice husk briquettes.

Biomass briquetting is an environmental friendly technology which provides rural employment. To widespread this technology in future, the government should recognize the research and promotional organizations and provide research and development support including subsidy. There should be at least five years extended government or donor support to develop local institutions and local expertise. Strong coordination between the organizations with similar goals is also essential.

Keywords: Energy, indoor air pollution, deforestation, biomass briquette, banmara beehive briquette

Briquetting options and NAST Bio-briquetting Experience

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Animal dung briquettes, agro and forest wastes have been in use in Nepal since time immemorial. These fuels are difficult to handle, transport, store, and are fire hazardous. Further, they burn fast and the thermal efficiency is low. To improve the fuels characteristics, handling, storage, etc different briquetting technologies are used. Briquettes help in the efficient utilization of waste biomass and in the reduction of fuel wood. To address the problems of biomass fuels different type of briquettes were first introduced in Nepal through JICA-RONAST joint research project National Research and Development Center for Alternative Energy during 1992-95. The project introduced coal beehive briquettes, charcoal/coal briquettes and later biocoal/biobriquettes using many different kinds of biomass. The biomass laboratory undertook R&D on biobriquettes using forest and agro wastes such as Banmara, Pine needles, sugarcane bagasse, etc. blending them with coal and lignite to improve fuel characteristics. Banmara, a big problem for forest propagation, was first identified and introduced as a potential raw material for Biobriquetting. Biobriquettes were further promoted in cooperation with the Institute for Himalayan Conservation introducing a roller press briquetting machine. Later, simplified rice husk briquetting technology was introduced through AIT/SIDA project along with Gasifier stoves. To popularize and promote Beehive briquettes NAST played a catalytical role by awarding Mohan Dhoj Basnet award to Dr Krishna Raj Shrestha for research on beehive briquettes. NAST is still continuously engaged in R&D on biobriquettes to improve the fuel characteristics of biobriquettes including beehive briquettes. Some important issues such as different raw materials (biomass, clay),

technologies for beehive briquettes are continuously being studied. It constantly provides research and analytical support to many different educational, government and non-government organizations on biobriquettes and heating devices.

Keywords: Agroforest wastes, Banmara, Biobriquetting technology, Beehive briquettes, Biocoal, Biobriquettes

Performance Analysis of Commercially Available Briquettes using ICS

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Briquettes are gaining wide popularity as an alternative fuel for cooking and heating purposes in Nepal. This environment friendly and economic bio mass fuels are made using constituents like charcoal produced from agricultural residues, such as rice husk, and forest waste vegetation (like Banmara grass). The use of Briquettes prevents problems like deforestation thus resulting in prevention of soil erosion. It provides cleaner burning fuel reducing indoor air pollution and improving the health standards of peoples especially of women who spend their time mostly in kitchen in case of rural villages. With the growing popularity of Briquettes as alternative biomass fuel, it is necessary to standardize them on the basis of their performance.

The experiment based research project carried out at Kathmandu University and National Academy of Science and Technology is concerned with the performance analysis of different commercially available Briquettes using ICS. The tests are performed on metal stove with insulation and also on mud stove. The results obtained from the water boiling test, proximate analysis test, smoke index test, kitchen performance test and calorimeter test will be used to suggest the different manufacturers and policy makers to take necessary steps towards standardization of briquettes. Also the results of this research project will give the present status of the condition of qualities of Briquettes manufactured in Nepal.

Keywords: Biomass, Briquettes, Alternative fuel, Standarization

ANALYSIS AND TEST REPORT ON BEEHIVE BRIQUETTE/STOVES: BIOMASS LABORATORY, NAST

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Energy is one of the most important aspects of life. Due to population growth and over-consumption, conventional source of energy is declining day by day. This indicates energy crisis in near future. Developed countries have started to search alternatives to the existing source of energy. They are using hydrogen, ethanol and a number of other natural products in the form of clean and renewable energy. But such technologies are still beyond the access to the country like Nepal. Even though Nepal is a developing and agricultural country, it has enormous source of biomass in the form of agricultural/forest residues, a number of ecologically parasitic plants etc. Using such waste going biomass in the form of fuel would solve the energy need of rural people. Though these biomasses contain high energy in them, they cannot be utilized to their fullest if used in their natural form. Fortunately, many technologies have been introduced which can be employed to convert such materials into highly energetic fuel source. Briquetting is one of such technology to make waste biomass useable as fuel.

Beehive briquette is a cylindrical and perforated mass of about half kg. It is made by charcoal of biomass binding with a suitable binder. Once ignited, it undergoes much effective charred combustion uninterruptedly. It is more efficient and superior to fuel wood so it can be used in place of fuel wood. Using BHB promotes environmental sanitation, prevents deforestation, saves users from indoor pollution and helps in sustainable development. Above all it is much cheaper than kerosene and fuel wood. It can be used in cooking as well as heating purposes. Briquetting technology is sustainable only when BHB and stoves can be used efficiently.

Metallic stove needs insulation so that the heat loss will be controlled for better efficiency results. Application of mud composite insulation as in the case of CEE stove, is suggested to improve the stove efficiency and control heat loss. The efficiency tests performed with the CEE stove show that the BHB HP is a little better in comparison to the BHB LP. Although the simple smoke tests show that the briquettes emit very little smoke, tests of the combustion emission should be performed to establish that the pollutants (NO_x, CO, PAH, etc) in the combustion process are minimum for safety use indoors.

Keywords: Renewable energy, Briquetting technology, BHB, Energy saving, efficiently, environmental pollution

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Mr. Ram Bhadur Lo, Mr. Suvas Devkota,

Federation of Community Forestry Users' Group of Nepal (FECOFUN) is a pioneer civil society organization working for sustainable forest management by securing peoples' rights to natural resources. Due to the over dependency on imported fuel, the country has been under continual fuel shortage. The result is that, the pressure on the forest resources has increased tremendously. In this context, the FECOFUN has been facilitating to local users in producing bio-briquettes by utilizing forest residue and other minor products to address the demand of the fuel. Sales of briquettes has also become a good income source for the poor and marginalized people, however they are facing challenges marketing of briquettes.

Currently, Kathmandu, Lalitpur, Gorkha, Dhading, Dang, Pyuthan and other districts are working in enhancing the capacity of production and marketing of bio-briquette at local level.

Women's Participation in the Banespatti Gueentha (Bio Briquettes) Program

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Bio Briquettes are famous as a source of fuel in rural Nepal. Traditionally, Women and children are involved in making Briquettes. People use Bio Briquettes as a source of income, especially in the Madesh. Usually, Nepali people use Cow/ Buffalo dung and agricultural residue to prepare Bio Briquettes. Now, IDS Nepal has invented environment friendly Bio Briquettes and implemented pilot action research project at Bisanku Narayan VDC of Lalitpur district. This technology has been adopted by FECOFUN.

Above 10 years of economically active labor force 68.39% work load of firewood collection is shared by women. Among unpaid workers above 15 years contribution of women in cooking is 88.57%. (NLFS 1998/99) Banespatti Gueetha can be an alternative of LPG, fire wood, Kerosene and electricity too in the rural as well as urban area. Banespatti Gueetha reduces smoke from Kitchen, which is very important to decrease diseases e.g. eye and respiratory diseases. It can be a good source of income to the rural people. It is easy to make and store Bio- Briquettes. Women and children are happy from this project, because they are benefited from the concept of Bio Briquettes.

IDS and FECOFUN are taking responsibilities to disseminate information. We should aware to share workload by family members, especially the male members of the family. Otherwise, women will be overburdened due to the commercial production of Bio Briquettes.

Marketing and Technical Aspects of Bio Briquette: Issues and Challenges

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RRAFDC, Bara

Energy is an inseparable part of human life. Firewood is the most important energy source of Nepal, which alone accounts to about 70% of the total amount of energy consumed. However, very little investments and supports have been allocated to its development as compared with other energy sources. Out of total land area 1,47,181 sq. km, forest covers about 29% and shrub land covers 10.6%. In addition to this, forest area is decreasing day by day because of increasing human population and livestock. A substitute for fuel wood use in different sectors is charcoal, briquette, electricity, solar energy, petroleum, biogas and others. The substitution impact, however, is still very low.

Nepal is rich in two sources of energy, i.e. hydropower and forest. Due to the lack of affordable alternatives and technologies, people are overwhelmingly dependent upon the easy available resource firewood'. So, effective, sustainable and rational utilization of firewood is most important for the conservation of energy and forest resources of Nepal. We can produce briquette and charcoal for rational utilization of firewood. Yields and qualities of charcoal for briquette vary with wood species, method and temperature of wood carbonization, carbon content of charcoal and moisture content.

The paper, to be presented by RRAFDC has included basically the technical and marketing aspects of the briquette. The facts on technology extension as well as its adoption for the livelihood promotion of the poor are shown in the paper. Basically, the practical experiences as

well as learning are included in the paper. The major specialization area as well as geographical coverage with suitable technological backstopping by RRAFDC is covered by the paper. The major focuses of the paper are as below:

- Historical background and objectives
- Specialized implementing area
- Briquette production and marketing channel
- Contribution to the development of nation
- Limitations and conclusion
- Briquette production process photo slides

Keywords: Briquette, Technology, Issues, Challenges