Status Report on use of fuelwood in India

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Purpose of the Paper

Though fuelwood remains the principal energy service provider to 70 per cent of Indian population, a knowledge gap still remains in understanding the fuelwood situation. Because of the difficulties associated with wood energy data collection and the decentralized nature of wood energy systems, consumption of wood energy is not monitored regularly in the same way as that of commercial energy sources. Regional and localized studies of fuelwood usage are available in perpetuity but are limited in scope both in terms of the area and type of information covered. A few household energy consumption surveys are national in scope and contain comprehensive and detailed information. But conducting national household energy consumption surveys more frequently or on a regular basis becomes difficult because of the time and money involved. However National Sample Survey Organisation (NSSO) carries out nationwide surveys on household and other sectoral energy use. This report heavily borrows information from NSSO.

The notion that fuelwood extraction is a forestry problem is increasingly being challenged in recent times. Forest degradation and deforestation are no longer attributed to unsustainable fuelwood extraction as supply sources have been diversified. Increasing reliance on non-forest sources and flexibility in household fuel use have taken out the pressure from forests. This report delves further to analyse the following inherent issues.

(a) How does fuelwood fare as a subsistence energy provider for the rural poor?
(b) Has fuelwood been replaced by other forms of energy such as charcoal, agricultural biomass, LPG, and electricity?
(c) What are the sources of fuelwood: Is pressure on forests reducing due to a build up of alternative sources of fuelwood?

Fuelwood Studies

1. Introduction

During the past few decades, India has experienced many changes in its energy consumption patterns—both in quantitative and qualitative terms (CMIE 2001). This is due to the natural increase based on population growth and due to the increase of economic activity and development. The household sector is one of the largest users of energy in India, accounting for about 30 per cent of final energy consumption (excluding energy used for transport) reflecting the importance of that sector in total national energy scenario (Reddy 2003). The pattern of household energy consumption represents the status of welfare as well as the stage of economic development. International Energy Agency predicts, as depicted in Table 1, that population growth will render 2.7 billion people still relying on plant-based energy forms in the year 2030 (International Energy Agency 2006).). But the notion of heightened dependence on fuelwood is increasingly challenged worldwide. Increasing urbanization and rising incomes appear

Table 1: People (in Millions) relying on traditional biomass

Countries	2004	2015	2030
Sub-Saharan Africa	575	627	720
North Africa	4	5	5
India	740	777	782
China	480	453	394
Indonesia	156	171	180
Rest of Asia	489	521	561
Brazil	23	26	27
Rest of Latin America	60	60	58
Total	**2,528**	**2,640**	**2,727**

Source: International Energy Agency 2006

to be slowing down fuelwood consumption. The forest has been the dominant source of fuelwood but increasingly fuelwood is being sourced from non-forest sources. Much fuelwood is now being obtained from tree sources outside forests, such as scrub, bush fallow, dead wood, pruning, and lopping.

2. Household Energy Consumption Pattern in India: Rural urban dichotomy

The rural population in India relies heavily on traditional biomass-based fuels (fuelwood, crop residues, and animal dung) for meeting the energy needs. As per the results of The Household Consumer Expenditure Survey conducted by NSSO in the year 2007–08 which are shown in Table 2,

Table 2: Percentage of households and average MPCE by primary source of energy for cooking: all-India, 2007-08

Primary source of energy used for cooking	Rural		Urban	
	% of hhs	Average MPCE	% of hhs	Average MPCE
(1)	(2)	(3)	(4)	(5)
Firewood and chips	77.6	Rs. 707	20.1	Rs. 780
LPG	9.1	Rs.1,389	61.8	Rs.1,764
Dung cake	7.4	Rs. 713	1.4	Rs. 801
Kerosene	0.6	Rs. 945	7.6	Rs.1,109
No cooking arrangement	1.7	Rs.2,654	5.7	Rs.3,033
All*	100.0	Rs. 772	100.0	Rs.1,472

*includes sources other than those listed in col.(1); such sources accounted for 3.6% of households in rural areas and 3.5% in urban areas

in rural India, over 77 per cent of households in the country continued to depend on firewood and chips for cooking, with only 9 per cent using LPG. In urban India, 62 per cent of households used LPG as major fuel for cooking and 20 per cent of households used firewood and chips (NSSO 2007–08). The survey has taken into account important cooking fuels in terms of percentages of households using them as their primary source along with the average Monthly Per Capita consumer Expenditure (MPCE) of households falling in each category.

Over 77 per cent of rural households in the country were estimated to depend on firewood and chips for cooking. Over 7 per cent used dung cake and only 9 per cent used LPG. In urban areas, LPG was the primary source of energy in nearly 62 per cent of households.

Disparities in household energy use exist between rural and urban population and also between high- and low-income groups. The energy carriers are used for multiple purposes, viz., cooking, water heating, lighting etc. Many households use fuelwood for both cooking and water heating; some others use kerosene and LPG for cooking, water heating is done with either fuelwood or electricity. Table 3 presents the urban–rural differences in energy use for cooking— which illustrates that the quality of energy use in rural areas lags far behind urban areas. In urban India, firewood and chips were the primary sources of energy for cooking in 20 per cent of households. Changes in the all-India distribution of households by primary source of energy for cooking since, 2001–02 (NSS 57th round) are shown in Table 3. In urban India, the use of LPG, which has taken rapid strides forward in the present decade, continues to grow, the proportion of LPG users growing to nearly 62 per cent in 2007–08 from 59 per cent in 2006–07, with a perceptible fall in the share of firewood and chips. For rural India, however, the proportion of households using firewood and chips,

which showed no decline in the last five or six years, and instead appears to have actually risen by 2 percentage points remains over 77 per cent, the increase having possibly taken place at the expense of dung cake. The increase in rural LPG use, if any, in the last five years has been slow.

Table 3: Changes in distribution of households by primary source of energy used for cooking

	Percentage of households with primary source of energy used for cooking						
	Coke, coal & charcoal	Firewood and chips	LPG	Dung cake	Kerosene	No cooking arrangement / other / n.r.	All
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
							Rural
64 ('07-'08)	0.8	77.6	9.1	7.4	0.6	4.5	100
63 ('06-'07)	0.8	75.4	8.9	9.1	0.8	5.0	100
62 ('05-'06)	1.1	74.0	9.3	9.0	1.0	5.6	100
61 ('04-'05)	0.8	75.0	8.6	9.1	1.3	5.2	100
59 ('03)	0.9	74.9	9.1	9.3	1.9	3.9	100
57 ('01-'02)	1.2	73.4	8.1	10.5	2.0	4.8	100
							Urban
64 ('07-'08)	2.1	20.1	61.8	1.4	7.6	7.1	100
63 ('06-'07)	2.3	22.1	59.2	1.7	7.5	7.1	100
62 ('05-'06)	3.5	20.9	57.1	1.7	9.2	7.6	100
61 ('04-'05)	2.8	21.7	57.1	1.7	10.2	6.5	100
59 ('03)	3.3	20.0	55.4	1.8	13.0	6.6	100
57 ('01-'02)	3.0	23.3	49.9	1.6	15.3	7.1	100

Source: NSSO 2007-08

In rural areas, although usage of LPG for cooking has grown rapidly, it still accounts for only about 9.1 per cent of total households. A similar trend is seen in kerosene use. Wood fuels appear to be the second most important source of energy for cooking because of relative affordability. Urban households prefer LPG and other energy sources.

3. Assessment of fuelwood sources and supply

Accurate knowledge of the extent of sources and annual availability of fuelwood from different sources on a sustained basis is crucial to understanding likely future trends. With increasing population pressure, the consumption of fuelwood has by far exceeded its supply, thereby causing deforestation and desertification. In India, the land under cultivation has increased from 118 million to 142 million hectares (ha) by 1987, this expansion has included the diversion of 4.5 million ha of forests to agriculture. At present, the total land under cultivation is around 190 million ha and the demand for fuelwood has increased despite rapid growth in the commercial sector.

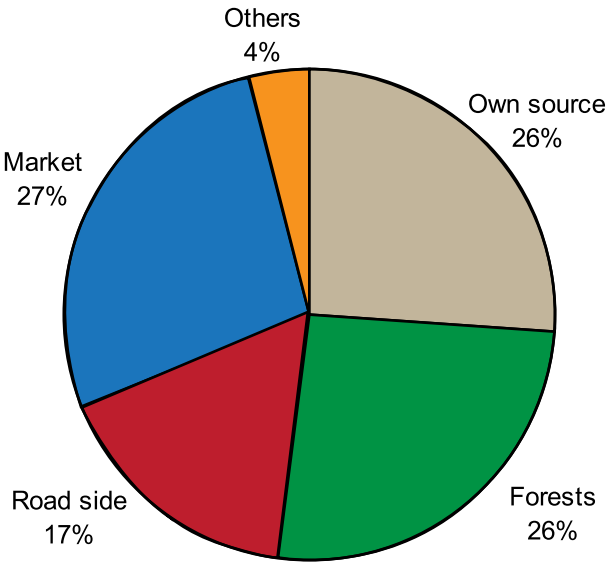
Forests were considered the main source of fuelwood studies conducted earlier. Most of the fuelwood studies under review have focused on consumption and were not able to assess the sources in a proper way. Often, the annual availability has been estimated inaccurately. Among nationwide studies, two, (NCAER 1985) and (Natarajan 1995), have estimated the sources on the basis of replies from the households in a single survey. In this sort of a survey, the sustainability of the supply cannot be judged without knowing the increments of different sources. The sources as estimated by NCAER are presented in Figure 1. The study conducted by NCAER assumed that all the fuelwood sold in the

markets had originated from state forests.

In the subsequent study done in 1992–93 only for rural India, NCAER found that the sources of fuelwood collection had undergone rapid change. Nearly one-half of the households collected fuelwood from their own farms and only 17 per cent from forests.

Since the implementation of the social forestry and large-scale afforestation programmes, the area of production of fuelwood has gradually shifted from forests to non-forest areas. A lot of fuelwood is now being produced from trees planted along roads, canals, farmlands, and wasteland. Actual production data at the national level from both sources are, however, lacking.

Figure 1: The sources of fuelwood in India in 1978-79



Source: NCAER 1985

An assessment of tree resources outside the forests of a few states has revealed that the quantity of fuelwood estimated to be produced from outside forests and wastelands is quite sizeable. For example, a forest-deficient state, Haryana, has surplus fuelwood produced from outside forests. Similarly, in forest-rich Kerala, most of the fuelwood requirements of the rural population are met with from trees grown on the homesteads. Further, measures taken by the Government to conserve biodiversity and existing forest resources has resulted in an increase of restricted areas where removal of fuelwood is not permitted. Since the area under forests is not likely to expand due to competition with agriculture and other land uses, fuelwood will be produced from outside forests, from farm forestry, common wastelands, and agroforestry. India has a well-articulated forest policy which has evolved and passed through three phases, namely: industrial forestry, social forestry, and priority for environment and support for Joint Forest Management (JFM). In the 1980s the aim of social forestry phase was to reduce pressure on natural forests by meeting the fuelwood and other wood-product requirements of the local population from outside the forest areas.

4. Fuelwood Consumption, Forests, and Community Forest management

The availability of fuelwood significantly influences its consumption. The population centers in proximity to the forest resource have higher per capita consumption than those lying farther, as an adequate quantity of preferred fuel (wood) is available and mixing/ substitution with inferior fuel (crop residue, dung cake) is not required.

A study conducted in Gujarat revealed that the villages with a forest resource have almost twice the per capita consumption of fuelwood as that of villages without forests (Pinto et al. 1985). The rural areas having no forests compensated fuel needs by increasing the share of agricultural residues, dung cake, and kerosene. Similarly, the Jammu and Kashmir wood balance study found decreasing consumption of fuelwood with increasing distance of forests from the village.

The study found that beyond 8 km, consumption is almost constant. As the distance from the forest increased, fuelwood was substituted by dung cake and kerosene oil. The per capita consump-

tion of dung cake was 43 kg in the villages within forest areas and 102 kg in villages beyond 8 km from the forests. Similarly, the consumption of kerosene oil increased from 1 litre to 11.5 litters. The study also found a strong correlation between the forest area of the district and per capita consumption of fuelwood. The fuelwood consumption studies done by the Forest Survey of India in forested areas of the country also give high consumption rates, especially in the forest-rich states of Arunachal Pradesh, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. The per capita fuelwood consumption ranged from 423 kg to 1320 kg (Rai and Chakrabarti 1996). Presence of community led forest user groups has decisive effect on fuelwood consumption rates. Decentralized forest management through such user groups in India was promoted through the Joint Forest Management (JFM) guidelines.

Joint Forest Management (JFM) has been the key policy instrument in stemming forest degradation and promoting the conservation of natural resources. This program had been initiated in 1990 as an experimental strategy to promote conservation, equity, and benefit sharing between the forest-resource dependent community and the forest department. Joint Forest Management recognized the inextricable linkage between forest conservation and sustainable utilization of forest products and the role of forest-dependent community to bring about the desired result. By 2001, some 45,000 JFM groups were protecting approximately 12 million ha of government forests (Kumar 2002) though the total forest land under community management is much higher than the above figure as several traditional forest management activities are not recognized by JFM.

Community forestry management advocates an inclusive policy which takes into account the community needs and simultaneously aspires to efficiently manage the common-pool resource. Does this arrangement have an impact on the fuelwood extraction practices among groups characterized by social, economical, and cultural heterogeneity and the policy regulations being grounded by the state?

There are two distinct ways in which community forestry may affect the fuelwood extraction pattern. The restrictive approach of the management is expected to render diminishing extraction of fuelwood. However, if community forestry results in forest regeneration and if forest closure is carefully planned, then medium and long-term program effects will not be negative (Bandyopadhyay and Shyamsundar 2004).

There is variation in fuelwood consumption among participant and non-participant households in the community forest management programs. Household participating in the management activities like plantation, forest clearing, lopping etc. stand a better chance of access to resources (Khare et al 2000). The households participating in JFM activities consume more fuelwood than the non-participating households. Joint Forest Management and other forms of community forestry are benefiting participants in the short- to medium-term. The participants benefit because they are able to take part in forest-related activities and/or because they are better informed about rules and regulations (Bandyopadhyay and Shyamsundar 2004).

However, the effect of people's use of natural resources on forests can change over time, depending on markets and institutions as well as the resilience of forests themselves. So it is obvious that these changes shall have a cumulative impact on forest resources and the fuelwood extraction pattern may show an altered trend.

5. Implications of using fuelwood

Use of biomass is not in itself a cause for concern. However, when resources are harvested unsustainably and energy conversion technologies are inefficient, there are serious adverse consequences for health, the environment, and economic development. About 1.3 million people—mostly women and children—die prematurely every year because of exposure to indoor air pollution from biomass. Valuable time and effort are devoted to fuel collection instead of education or income generation. Environmental damage can also result, such as land degradation and regional air pollution.

The environmental impacts of energy use are not really new. Wood burning has contributed to the deforestation of numerous regions of the world. Even at the early stages of industrialization, local pollution of air and water was a well known problem. What is relatively new is the acknowledgment of linkages between regional and global environmental problems and the implications of those problems. Though the importance of energy in enhancing human well being is unquestionable, the conventional production and consumption of energy is closely linked to environmental degradation. It threatens human health and quality of life in the long run as well as affecting the ecological balances and bio-diversity.

Fossil fuel combustion causes environmental problems at various levels. Its consumption produces more carbon dioxide than any other human activity. This is the biggest source of the anthropogenic greenhouse gas emissions that are leading towards change in atmospheric composition and could alter the global climate system.

6. Is there any way out?

If the fuelwood consumption patterns continue along the current path, then energy use is neither compatible with a sustainable future for the country nor with sustainable environmental and human needs. An energy system that addresses the greenhouse gas emissions and an efficient fuel mix is the need of the hour. For sometime now, India has been promoting "greenhouse-gas friendly" policies to deal with environmental problems (Parikh 2004). These policies include:

- Energy conservation
- Promotion of renewable energy sources
- Abatement of air pollution
- Afforestation and wasteland development
- Economic reforms, subsidy removal and joint ventures in capital goods.

Among other issues, energy pricing is one of the most important and largely debated.

7. New policies in the energy sector

The Government of India announced a new investment policy for different sectors in 1991 for facilitating the inflow of foreign capital and to encourage entrepreneurs to invest in India. Equity participation in commercial and industrial ventures has been freed from all restrictions and foreign companies can now invest up to 100 per cent of their equity in different activities including the petroleum, electricity, and coal sectors. The two most recent policies in relation to the growth of LPG, which has direct bearing on the consumption of fuelwood, are mentioned below:

a) India formulated a new exploration licensing policy in 1998 to allow private and joint venture companies to enter into the arena of oil and gas exploration.

b) In the Hydrocarbon Vision-2025, finalized in 2000, it is proposed that 45 per cent of the total energy needs of the country will be met through hydrocarbons by the year 2025, compared with

the existing contribution of 42 per cent. The mixture of oil and gas will change from the existing 35 per cent and 7 per cent to 25 per cent and 20 per cent, respectively, which will facilitate better energy efficiency, lower pollution, and easier availability of LPG for cooking.

8. Growth of LPG

In recent years, liquefied petroleum gas (LPG) supplies have eased up. The LPG market has been opened to private retailers who have been authorized to sell imported LPG. The commission given to retailers has been increased to ensure better consumer service, quality product supply, and improved safety measures. The custom duty on the import of LPG has been reduced from 85 per cent to 25 per cent and now 16 per cent. Private retailers have been also allowed to produce LPG cylinders, the shortage of which has been a perennial problem in increasing LPG supplies. For easy transportation of gas to distant places, expansion of the pipeline network has been accelerated.

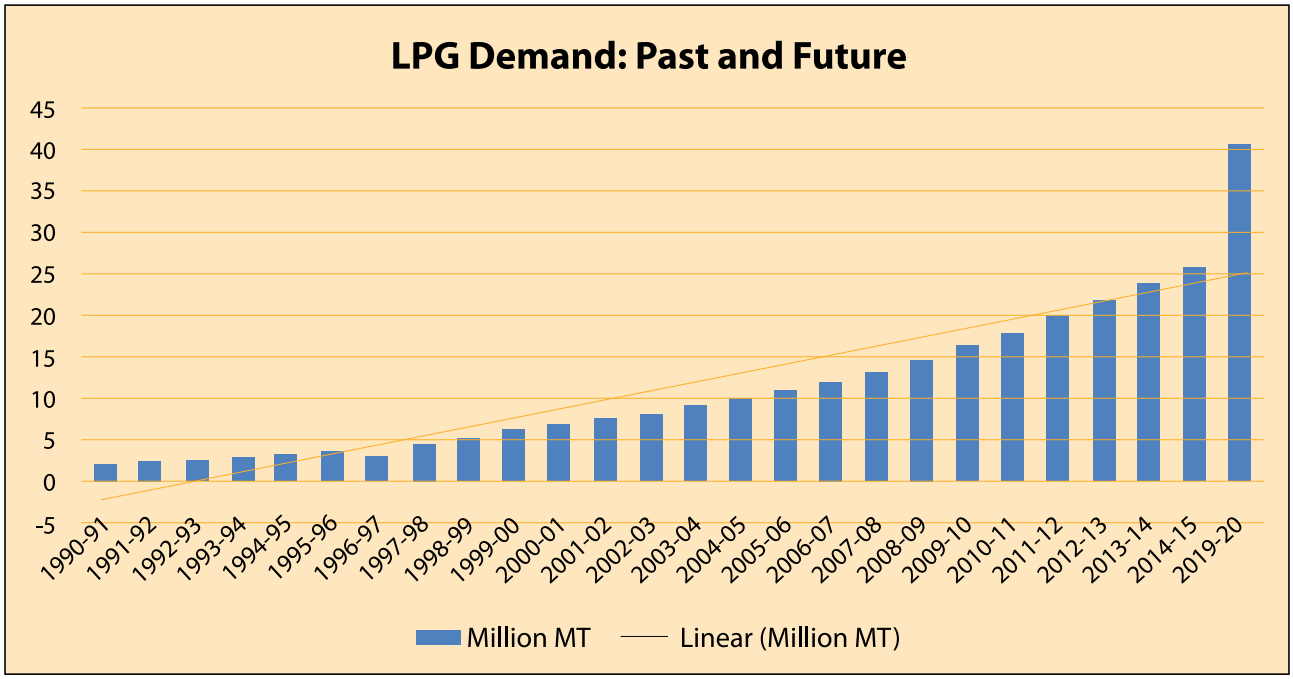
A special scheme has been launched to extend LPG connections to the rural sector with associated reduction in the quota of subsidized kerosene, by opening extension counters in rural areas falling within a 15 km radius of the normal trading area of urban distributors. Some of the state governments are providing grants to poor people to meet the initial cost of buying gas stoves etc. In Himachal Pradesh, a strong financial incentive is provided to use LPG in an effort to slow deforestation.

The demand for liquefied petroleum gas has grown from less than 200,000 tonne in 1970–71 to over 12 million tonne in 2006–07. Apart from commercial and industrial establishments, 94 million households use LPG. About 86 per cent of LPG is being consumed by the household sector alone (see Figure 2).

The LPG demand of 7.75 million tonne in 2001–02 was estimated to reach over 12 million tonne in 2006–07. According to the 58th round of the National Sample Survey Organisation (NSSO), more than 51 per cent of urban population has switched over to liquefied petroleum gas as cooking gas. The demand–supply gap was estimated to be more than 2 million tonne in 2006–07 and gap widens each year.

9. Electrification of villages

As already stated, rapid growth in the electricity sector and the rural electrification programs have led to high levels of village connections. The percentage of electrified villages has increased significantly. About 87 per cent of Indian villages are now served by electricity compared with 40 per cent in 1980. Although the electricity provided in the rural areas is highly subsidized, the connections in households are still about 40 per cent of the total households (it was 14 per cent in 1980). This is mainly due to low income, cost of connection, and poor quality of houses (ESMAP 2001). One consequence of rural electrification is the development in the use of electrical appliances. At least 12 per cent of rural households in India owned radios, television sets, ceiling and table fans, and irons in 1996 (ESMAP 2001). With rising rural income, the trend towards more appliances will continue. Almost all households that have electricity connections also use kerosene for lighting, mainly because electricity supplies to villages are erratic and services are poor. In such situations, kerosene is necessary to maintain a backup system. The expansion of electricity connections to rural households in future will depend on economic development and the construction of concrete houses.



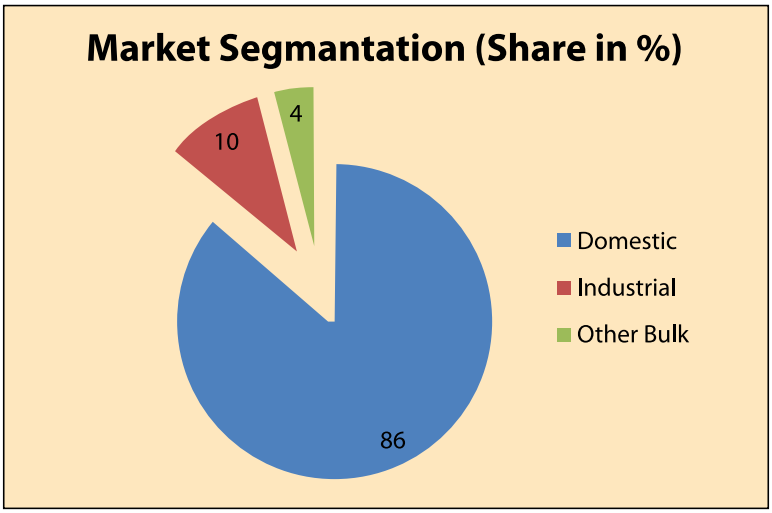


Figure 2: Demand of LPG in India and the market segmentation

10. Conclusion

Fuelwood still serves as the major source of energy in the rural areas and the business of fuelwood collection is the livelihood option that is most resorted to, fo millions of people. Fuelwood collection as a livelihood strategy is a strong indicator of severe rural distress, ecological degradation, and the failure of agriculture to sustain the rural economy. For many, it is a sole survival option though it generates only nominal monetary gains. Fuelwood collection is not a legitimate forestry activity in India despite its economic importance to rural dwellers and significance from rural livelihood perspectives.

Provisioning of energy security at the village level can be assured and sustained at long run when energy generation from biomass gets due attention. Since fuelwood has been and will continue to be the primary energy provider, the possibilities should be looked into of mainstreaming the use of biomass as efficient and reliable fuel at the household level. So it can argued that efficient handling and management of biomass with all its complexities can substantially meet the unmet demand through decentralized energy systems leading to a greater energy security for the villages and even to small-scale industries.

To cater to the need of biomass demand, more and more land area may be brought into afforestation activity thus significantly enhancing tree and biomass cover. This would foster rural development through accelerated economic growth, in turn stimulating growth of farming and rural industry. The decentralized energy solution would create new opportunities for employment and livelihoods.

It is imperative that appropriate measures need to be taken by the federal and state governments to introduce policies that support the development and dissemination of clean and efficient sources of energy. The impacts of climate change are looming over the horizon, coupled with the increase in energy demand; hence, concerted action has to be taken to ensure availability of clean fuels and better energy devices so as to prevent environmental degradation and health ailments.

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