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POLICY Brief

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Fuel for the Clean Energy Debate – A Study of Fuelwood Collection and Purchase in Rural India

In many parts of rural India the use of wood for fuel is the cause of significant environmental and health problems. Efforts to help people switch to cleaner fuels have not been effective and fuelwood use remains high in the countryside. To help find a solution to this challenge, a new SANDEE study from the districts of Orissa has looked at the factors that influence fuelwood use amongst village people. It finds that people are more likely to switch from collecting to purchasing fuel wood as they become better off. However, it also finds that when households reach a certain level of affluence they may switch back to using local labour to collect fuelwood for them.

Arabinda Mishra from the Department of Policy Studies at TERI University, New Delhi, undertook the study. His findings show that improvements in economic affluence alone may not be sufficient to bring about a significant transition to clean fuels in rural areas. For this reason, he recommends that there may be a need to continue with price subsidies on clean fuels such as kerosene and LPG. He also recommends that any moves to get people to move away from fuelwood should go hand in hand with effective forest conservation programmes.

THE FUELWOOD CHALLENGE

For rural households living in close proximity to forests in India fuelwood has a dual significance. It is their predominant source of domestic energy. Its collection and sale is also an important part of their livelihood. This is particularly true for households in deprived regions. The fact that fuel wood is so important in rural India is a major cause of concern due to the health and environmental impacts that it causes. For example, respiratory illness linked to fuelwood use is a leading cause of under-five child mortality in rural India. Moreover, forest degradation in the Indian mid-Himalayas is being driven by the collection of fuelwood and fodder by local villagers.

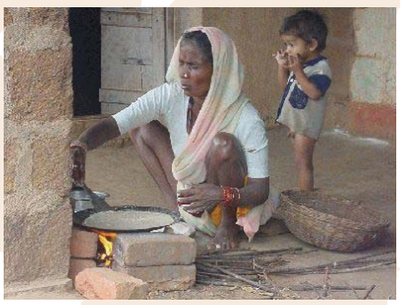
Because of these problems the Indian government has been trying to get rural households to switch to relatively clean fuels like kerosene, LPG, electricity, natural gas and biogas. This has principally been done through price subsidies on the kerosene and LPG that is supplied by state-owned oil companies. However this approach has been criticized as ineffective and regressive and the government's aim is now to reduce the subsidies it offers. One of the main reasons why the switch to cleaner fuels is taking so long is because, in many rural areas, fuelwood is freely or cheaply available and the labour needed to collect it is also readily available. There is therefore little incentive for even rich households to make a switch.

WHY DO PEOPLE BUY OR COLLECT FUELWOOD?

Mishra's study looks at the factors that influence the collection and use of fuel wood by rural households. In particular, he focuses on what makes households switch from collecting fuelwood to buying it. This area of behaviour is of particular interest and relevance to the clean fuel challenge facing India. This is because it is felt that households are more likely to switch from fuelwood to cleaner fuels if they are purchasing fuelwood from local markets rather than collecting it using either family labour or cheap hired labour.

The research was carried out in two districts in the state of Orissa. According to recent estimates, 47.2% of the Orissa's population lives below the poverty line. The incidence of poverty is greater still among the area's largely forest-dependent indigenous tribal communities. These account for nearly a fourth of the state's population.

This policy brief is based on SANDEE working paper No. 37-08, 'Determinants of Fuelwood Use in Rural India: Implications for Managing the Energy Transition' by Arabinda Mishra from the Department of Policy Studies at TERI University, New Delhi. The full report is available at www.sandeeonline.org



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There is considerable variation among the 30 districts of Orissa in terms of their development status, the social composition of their populations and their forest cover. This is true for the two districts selected for the study, Gajapati and Ganjam. However these two areas do lie adjacent to each other and share a common link in the form of the Harabhangi Irrigation Project. The downstream irrigated area of the Harabhangi Project marks the beginning of the coastal plains in the Ganjam district. The project's upstream dam and its catchment area fall in the hilly Gajapati district.

Mishra's study is based on information from a survey of 600 households from 20 selected villages spread across the two districts (300 in each district). He uses the information gained from this survey to look at why households choose to either collect or buy fuelwood. He also uses it to assess what factors make households switch their behaviour from collection to purchase. His assessment takes into account the fact that rural households typically derive income from multiple sources. He focuses, in particular, on the link between the decisions that households make about their energy choices and the availability and cost of labour.

Overall, Mishra tests the theory that if it costs more for a household to collect fuel wood (in terms of the overall cost of labour) than to buy it, then that household will prefer to purchase fuelwood from a market or will switch to an alternative cleaner sources of fuel.

FUELWOOD USE IN GAJAPATI AND GANJAM

As expected, Mishra finds significant differences between the two districts. Households belonging to less privileged tribal and caste categories are dominant in the upstream district, Gajapati. The downstream district, Ganjam, has a higher average gross annual household income. While Ganjam is the more developed district in socio-economic terms, Gajapati has a significantly greater extent of forest cover.

Fuel type and use

Fuel type	Number of household users		
	Cooking	Heating	Lighting
Fuelwood	589 (98.2)	3 (0.5)	0
Twigs	84 (14.0)	7 (1.2)	0
Charcoal	20 (3.3)	0	0
Cowcake	29 (4.8)	1 (0.2)	2 (0.3)
Kerosene	17 (2.8)	2 (0.3)	549 (91.5)
Electricity	29 (4.8)	0	70 (11.7)
LPG	9 (1.5)	0	1 (0.2)

Figures in brackets are percentage of total sample size (N=600)

In terms of fuelwood use, a majority of all the surveyed households (42%) collect fuelwood (either from the forest or from other-than-forest sources, or both) solely for own consumption. About 3.3% households collect and purchase fuelwood, while 15.3% only buy fuelwood. In both regions, the forest is the dominant source of fuelwood, however households in the downstream irrigated area have to travel nearly twice as far to reach the forest compared to those from the upstream area.

The average amount of fuelwood collected every month by upstream households is nearly double the amount collected by downstream households. However, the monthly consumption of fuelwood is, on average, almost the same for both Gajapati and Ganjam.

An overwhelming majority (98.2%) of the households surveyed use fuelwood for cooking, either as the single energy source or in combination with other traditional and modern fuel type. The use of clean fuels like kerosene, electricity and LPG in cooking is limited to only 9% of the households. However, over 90% of the sampled households use kerosene for lighting.

WHAT MAKES PEOPLE PURCHASE FUELWOOD?

A comparison of the households that collect and buy fuelwood shows that, in general, 'purchasing' households belong to the more socially-privileged upper-caste groups, have larger number of members, are more educated,

are economically better-off and cultivate larger landholdings. They are also located at a greater distance from the forest, and consume less fuelwood per head per year.

An assessment of the main factors that influence households' behaviour shows that, as expected, lack of access to cleaner fuel substitutes like electricity and LPG makes it more likely for a household to purchase fuelwood. It is also clear that an increase in household earnings raises the chances of it switching from collecting to purchasing fuelwood. At the same time, it is apparent that at very high levels of income, and in the absence of alternative fuel sources, households may revert back to collecting fuelwood using either their own labour or hired workers.

These findings suggest that income-generating opportunities should be made available to poor households to help them to make the shift to purchasing fuelwood or cleaner fuel alternatives. It is also clear that supply-side interventions alone will probably fail to wean asset-poor rural households - that have access to cheap labour - away from the use fuelwood.

At the same time, the fact that relatively rich households may revert back to fuel wood collection shows that boosting economic wealth alone may not be sufficient to bring about the desired energy transition in rural areas. This means that there may be a need to continue with price subsidies on kerosene and LPG as well as ensuring easy availability of these fuels. Such moves should also be backed up by the creation of effective forest conservation strategies that discourage the collection of fuelwood.

These findings question the economic feasibility of shifting to cleaner fuels, particularly for poorer households. Mishra found that these households spend around 6% of their annual income on fuelwood every year. He then assessed local people's willingness to pay for fuelwood. He found that the amount the downstream households were prepared to pay for fuelwood – and therefore for other cleaner fuel options to take its place – was actually comparable with what they would have to spend if they did switch to electricity or LPG. This shows that the switch to cleaner fuels is, at least, within the bounds of feasibility for many households.

SPEEDING THE TRANSITION TO CLEANER FUELS

The slow transition from biomass to clean fuel types in India is commonly explained in terms of the higher costs of the more environmentally-friendly fuel types along with the lack of an effective supply network in the rural areas. Mishra's study adds a vital extra consideration to this discussion and shows the effect that labour and income have on the decisions that rural households make about their energy supplies.

Mishra's findings also highlight potential problems with the government's policy of reducing subsidies on cleaner fuels. It is clear that there is a danger that such as

WTP estimates

Study area	Variable	Income quintiles				
		q1	q2	q3	q4	q5
Upstream	mean annual household income per capita (rupees)	1113 (*278*)	1971 (*276*)	3144 (*339*)	4526 (*643*)	8872 (*4499*)
	mean WTP per household member (rupees)	9.2 (*32*)	4.7 (*12*)	8.6 (*25*)	7.6 (*30*)	44.5 (*131*)
	mean WTP as % of mean annual household income per capita (%)	0.8	0.2	0.3	0.2	0.5
Downstream	mean annual household income per capita (rupees)	1478 (*491*)	2635 (*289*)	3606 (*305*)	5365 (*613*)	13012 (*8722*)
	mean WTP per household member (rupees)	122.7 (*133*)	126.5 (*175*)	120.1 (*161*)	158.8 (*219*)	337.7 (*317*)
	mean WTP as % of mean annual household income per capita (%)	8.3	4.8	3.3	3.0	2.6

SANDEE

The South Asian Network for Development and Environmental Economics (SANDEE) is a regional network that seeks to bring together analysts from the different countries in South Asia to address their development-environment problems. Its mission is to strengthen the capacity of individuals and institutions in South Asia to undertake research on the inter-linkages among economic development, poverty, and environmental change, and, to disseminate practical information that can be applied to development policies. SANDEE's activities cover Bangladesh, Bhutan, Nepal, India, Pakistan and Sri Lanka.

SANDEE's Policy Brief Series seek to inform a wide and general audience about research and policy findings from SANDEE studies.

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policy will lead to increased fuelwood extraction from forests. Overall, Mishra's study points to the need for a three-pronged approach to encourage a move to cleaner fuels: this would involve an effective forest conservation strategy alongside livelihood improvement and fuel subsidy programmes.

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FUEL CHOICES - THEORY AND PRACTICE

Household fuel choice is the subject of a lot of research and has generated a number of different theoretical models. Early thinking on this issue was based around the 'energy ladder model' and the associated notion of 'fuel switching'. In the simplest version of this model, household fuel choice is mostly determined by income and passes through a 'linear' three-stage switching process. This starts with solid biomass fuels and, with increasing economic prosperity, leads to a transition phase involving kerosene, coal and charcoal. It finishes with LPG and electricity. This model is based on the assumption that fuelwood is an inferior choice and that it makes economic sense for wealthier households to buy other fuels rather than collect fuelwood.

The 'energy ladder' model is now being widely questioned. Growing empirical evidence from rural communities suggests that more complicated processes are at work. Firstly, researchers have highlighted the phenomenon of 'fuel stacking', in which richer rural households opt for a mix of modern and traditional fuel types to meet larger energy requirements. Secondly, there is evidence to suggest that determinants other than household income may be as important, if not more, in explaining fuel choices by rural users. It is becoming clear that that there is usually a multiplicity of factors working in tandem in the fuel choice decision-making process.

Recent research has shown found that fuelwood use and dependence increases with forest biomass availability irrespective of income levels. There is also evidence that fuelwood shortages in rural areas (due to forest degradation) tend to induce households to switch in the short-run to use either fuelwood from private trees or agricultural waste as their main source of energy. In the long-run such shortages cause them to alter the mix of private trees in their own land in favour of trees that can supply fuelwood.

The 'multiple factors – multiple fuels' model has important implications for public policy makers who see clean fuels for households as a 'good thing' and who are working to achieve an energy transition from solid biomass to LPG and electricity. In particular, the phenomenon of fuel stacking implies that traditional subsidy-based policy interventions are unlikely to succeed in phasing out fuelwood and other traditional fuel types from the energy portfolio of rural households. This is particularly true if the opportunity costs of collecting and producing such fuels are significantly lower than the prices of their cleaner substitutes.