Title: Can we use 'improved cook-stoves' as an instrument to tackle the twin challenges of development and energy: An assessment in the Indian context?

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Abstract

Energy poverty (EP) is a critical issue in contemporary development policy agenda; particularly, in the context of developing countries. EP related issues in contemporary times requires a twin approach: providing affordable energy to all for economic and non-economic use and ensure that the energy provided is "clean" and is devoid of any additional burden of global (CO2) and local (PM10, SOx) pollutants. In order to provide energy access to the millions (who are not included in the conventional market-based transaction of modern energy resources), the private sector (in some cases, in the partnership mode) have attempted to bridge the energy-deficit. Improved cook-stoves has emerged as viable device, attempting to meet the aforementioned twin objectives. Studies related to cook-stoves have primarily focused on identifying challenges/issues with regards to improved cook stoves and its wider deployment. However there are hardly any studies that focus on (in the Indian context) the intersection of improved cook-stoves and the various business models that operationalizes its development, deployment and wider dissemination. In order to understand the initiatives centered on improved cook-stoves, this paper using a case study methodology, would seek answers to the following questions: (a) How can enterprise-based approaches aid in poverty alleviation?, (b) How can new product development and new business models reach the poor?, (c) How do social entrepreneurship and related business models work? (d) What are viable public private partnerships?

A larger policy challenge, concerning improved cook-stoves, has been to understand and quantify its contribution to global greenhouse gas mitigation efforts. Policy makers in India have considered improved cook-stoves to achieve targets that are embedded within the wider development agenda. However, improved cook-stoves can provide a supplementary option to Indian policy makers to achieve the twin benefits of meeting national development goals and achieve greenhouse gas mitigation. In order to understand the macro-economic aspect of improved cook-stoves in India, this paper would further use the Indian *MARKAL* (market allocation) energy-environment-economy model (an energy optimization model) to understand (using a scenario-based approach), the (quantitative) potential of improved cook-stoves in addressing the development and environmental challenges.

This forcefully considers building support to the cookstoves initiative but finds private players (in conjunction with microcredit and microfinance institutions) to be the dominant players in this arena. The research points towards strengthening the business model, hinging on 'bundling' cookstoves with other development-based finance to rural enterprises and for other economic and non-economic activity. The research also found that there are substantial environmental (global and local) gains in following a biomass-based strategy but calls for framing of the issue in terms of developmental benefits in the near-term while moving on to embed the carbon discourse in the medium to longer-term. This study further develops a policy-prescription in the domain of energy policy in the Indian context.

Key words: Energy Poverty, India, Social enterprises, Energy model

Introduction

Energy poverty (EP) is a critical issue in contemporary development policy agenda; particularly, in the context of developing countries. EP related issues in contemporary times requires a twin approach: providing affordable energy to all for economic and non-economic use and ensure that the energy provided is "clean" and is devoid of any additional burden of global (CO2) and local (PM10, SOx) pollutants. In order to provide energy access to the millions (who are not included in the conventional market-based transaction of modern energy resources), the private sector (in some cases, in the partnership mode) have attempted to bridge the energy-deficit. Improved cook-stoves has emerged as viable device, attempting to meet the aforementioned twin objectives. Studies related to cook-stoves have primarily focused on identifying challenges/issues with regards to improved cook stoves and its wider deployment. However there are hardly any studies that focus on (in the Indian context) the intersection of improved cook-stoves and the various business models that opertionalises its development, deployment and wider dissemination. A few studies[1] (Venkataraman et al., 2010; Global Alliance for CleanCookstoves, 2013; Shrimali et al., 2011) have however focused on the multiple dimensions of improved cookstoves. This paper will build on these studies to provide a more nuanced understanding of the business models underlying the improved cookstoves market and the associated market and non-market based policy response. In order to understand the initiatives centered on improved cook-stoves, this paper using a case study methodology, would seek answers to the following questions: (a) How can enterprise-based approaches aid in poverty alleviation?, (b) How can new product development and new business models reach the poor?, (c) How do social entrepreneurship and related business models work? (d) What are viable public private partnerships?

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[1]Venkataraman, C., A.D.Sagar, G.Habib, N.Lam and K.R.Smith, (2010). The Indian National Initiative for Advanced Biomass Cookstoves: The benefits of clean combustion. Energy for Sustainable Development 14, pp 63-72
Shrimali, G., et al., Improved stoves in India: A study of sustainable business models. Energy Policy (2011), doi: 10.1016/j.enpol.2011.07.31
Global Alliance for Clean Cookstoves: India Cookstoves and Fuels Market Assessment, (2013). Dalberg Global Development Advisors

further use the Indian *MARKAL* (market allocation) energy-environment-economy model (an energy optimization model) to understand (using a scenario-based approach), the (quantitative) potential of improved cook-stoves in addressing the development and environmental challenges.

This paper would contribute to the scanty literature of understanding energy-related business models (in the context of energy-related products) and also assess the effectiveness of using 'improved cook-stoves' as an instrument in the larger mitigation policy of India. This study would further develop a policy-prescription in the context of energy policy in the Indian context.

Section 1: Contextualization of the 'problem'

There are three issues that we would like to focus on; in the context of the importance of improved cookstoves. The issues are discussed in the following sub-sections:

Issue 1: What's happening in terms of primary source of energy used for cooking?

Main findings of the NSS (66^{th} round) [Refer Table 1]: Energy Sources of Indian Households for Cooking and Lighting suggests the following:

1. Rural households mostly used firewood and chips as primary source of energy for cooking. At all India level, firewood and chips were used by 76.3% of rural households, followed by LPG, which was used by 11.5% households.
2. In urban areas, however, most of the households used LPG as primary source of energy for cooking. LPG was used by more than 64% of the urban households at all-India level, followed by firewood and chips, used by 18% households.
3. There is a continued dependence on firewood in rural areas, with percentage of households depending on firewood remaining at 76.3% in 2009-10 (a drop of only 2 percentage points since 1993-94), even though the percentage using LPG has increased from about 2% to 11.5% over the same period. On the other hand, the incidence of firewood for cooking in urban areas has fallen from about 30% to 17.5% between 1993-94 and 2009-10 (a drop of more than 12 percentage points.
4. The growth in prevalence of use of LPG in urban areas has been balanced by a decline in use of kerosene, in the first place, and firewood and chips, in the second. In rural areas, the rise in LPG use has been mainly at the expense of dung cake, followed by kerosene and 'other' sources.

Table 1: Percentage of households by primary source of energy used for cooking: 1993-94 to 2009-10[2]

Year	Various fuel types							
	Coke/coal	Firewood & chips	LPG	Dung cake	kerosene	No cooking arrangement	others	All
Rural								
1993-94	1.4	78.2	1.9	11.5	2.0	0.7	4.1	100
1999-2000	1.5	75.5	5.4	10.6	2.7	1.1	3.1	100
2004-05	0.8	75.0	8.6	9.1	1.3	1.3	3.8	100
2009-10	0.8	76.3	11.5	6.3	0.8	1.6	2.7	100
Urban								
1993-94	5.7	29.9	29.6	2.4	23.2	6.3	3.0	100
1999-2000	4.1	22.3	44.2	2.1	21.7	4.3	1.3	100
2004-05	2.8	21.7	57.1	1.7	10.2	4.9	1.6	100
2009-10	2.3	17.5	64.5	1.3	6.5	6.5	1.5	100

Source: NSSO (2012)

To summarize, we still find biomass being a significant source of fuel in the rural energy basket. This prompts us to probe further and understand that why the transition that happened in urban areas did not happen in rural India. Part of the answer lies in the modern energy deficit on the supply side (many rural areas are still unable to access LPG in a sustainable manner – scale and quantity).

Issue 2: What is happening to income in rural India and its impact?

Data (Table 2 and 3) shows that rural income vis-à-vis urban income has not grown sufficiently in the last nearly two decades. Part of the answer lies in reduced percentage of agriculture & allied activities in total GDP and also corresponding increase in rural population but the most pertinent issue seems to be that other expenses (such as on health etc) are forcing rural households to rely more on non-commercial (biomass) forms of energy sources for cooking. Even if we assume that a sufficient share of rural population is willing to access modern forms of energy, they are still unable to save sufficiently from the income accruing to them. This also proves that, even in the case of improved cookstoves, their participation is limited due to financial capacity and hence they are forced to remain in the energy poverty trap – inefficient biomass based local cooking solutions.

[2] NSSO (2012), Energy Sources of Indian Households for Cooking and Lighting, Ministry of Statistics and Programme Implementation, Government of India

Table 2: GDP split between agriculture & allied and total GDP in India[3]

Year	GDP (Agriculture & Allied) at constant 2004-05 prices (Rs in crores)	Total GDP (in crores)	GDP (Agriculture, allied)/Total GDP (%)
1993-94	479592	1522344	31.5%
1999-00	590696	2246276	26.3%
2004-05	650454	2971464	21.9%
2009-10	764817	4516071	16.9%

Source: Economic Survey, 2012-13

Table 3: Estimation of rural and urban average income (using GDP as an indicator)

Year	Rural[4] Population (million)	Urban[5] Population (million)	GDP (Agriculture, in millions)	GDP (non-agriculture, in millions)	Annual Rural Income (per capita, in Rs.)	Annual Urban income (per capita, in Rs.
1993-94	650	229	4795920	10427520	7378	45535
1999-00	719	271	5906960	16555800	8216	61092
2004-05	768	310	6504540	23210100	8469	74871
2009-10	815	355	7648170	37512540	9384	105669

Issue3: What is the overall energy policy of India vis-à-vis traditional and non-traditional biomass?

In 2006, Government of India released its Integrated Energy Policy[6]; which was adopted in 2009. The report (using two growth scenarios) considered that by 2031-32; only 40% of the rural households will be accessing LPG as a cooking fuel and a dominant source in the remaining energy basket would be filled by biomass. Thus biomass still would be critical in securing the cooking energy needs of the poor; with most of the rural electrification progress benefitting lighting requirements. The report even considered that minor rural industrial activity would be supported by biomass-based energy solutions.

In conclusion to Section 1, we assert that biomass would still remain a dominant source of cooking energy in rural India (in the short to medium term) but insufficient income growth is preventing a larger part of rural population to move to the category of modern energy fuels (this includes lack of LPG supply infrastructure as a challenge). This prompts us to explain alternate ways through which rural households

[3] Economic Survey (2012-13), Ministry of Finance, Government of India
[4] http://censusindia.gov.in/
[5] http://censusindia.gov.in/
[6] Government of India (2006), Integrated Energy Policy: Report of the Expert Committee, Planning Commission, New Delhi

can participate in improving their cooking energy profile; which provides local environmental benefits (reduces indoor air pollution) and prevents 'costly' health-related damages.

Section 2: The Policy Response[7]

The National Biomass Cookstoves Initiative (NBCI) was launched by the Ministry of New & Renewable Energy, with the overarching concerns around achieving developmental benefits such as improvements in health indicators and other objectives such as mitigating incremental CO2 emission and ensuring energy security (through reduced dependence on imported oil). The Government recognizes the potential of improved biomass cookstoves and through various assessments has underscored the potential of biomass cookstoves in achieving developmental and other benefits. To start with, the programme has initiated various certification and testing facilities to help the market players in achieving validity through assessments by leading technical institutions of the country.

The primary objectives of this program (through various demonstration projects) are:

- Use of improved biomass cookstoves for providing cleaner cooking energy solutions and to study its causal effect on multiple dimensions such as social, economic and other developmental and non-developmental indicators. Particular emphasis is on understanding the reducing impact of indoor air pollution on women and offsetting labour in collecting additional fuel wood and related biomass in the case of women.
- Use of biomass improved cookstoves in mitigating incremental CO2 emissions by reducing their sectoral carbon footprint and also reducing the quantum of other harmful pollutants, through efficiency gains using technology.

Both the above objectives are in line with our earlier arguments but as evident, focus is on two primary aspects: (a) developmental benefits, and (b) affordability. The study by Venkataraman et al. (2009) have asserted that, "clean energy option……could yield enormous gains in health and welfare for the weakest and most vulnerable sections of society. At the same time, cleaner household cooking energy through substitution by advanced-combustion biomass stoves (or other options such as clean fuels) can nearly eliminate the several important products of incomplete combustion that come from today's practices and are important outdoor and greenhouse pollutants", which is consistent with our earlier arguments in support of improved cookstoves. Two major initiatives have been initiated by the Ministry

[7]http://www.mnre.gov.in/schemes/decentralized-systems/national-biomass-cookstoves-initiative/

of New and Renewable Energy: (a) using the CDM route to lower the cost of upfront investment or consumer finance as a viable long-term mitigation strategy (theMinistry in collaboration with GIZ, German has developed a Programme of Activities (PoA) for CDM in biomass cookstoves and same submitted to UNFCCC for registration on 31st of December, 2012) and (b) creating a separate institution (the Bionergy Corporation of India) for looking specifically at biomass based energy solutions. Both these solutions are in a very nascent stage and the role of private players in the cookstoves business is imperative for financial and business sustainability of the initiative.

Section 3: What is the 'Alternative'?

NBCI is principally envisaged as a capacity building exercise, by demonstrating the viability and scalability of a cookstoves program; in an implicit partnership with private enterprises. This program has gone a step further and recognized many private cookstove players for providing such options. The interesting point that is to be assessed is the operational/business models of these private sector players. Shrimali et al. et al. (2011) has clearly identified that such private players find it unviable to operate in the "Bottom of the Pyramid" segment due to insufficient capacity of the consumer to pay upfront for the cost of the cookstove. In continuation of many studies, the Global Alliance on Cookstoves (2012) produced a market assessment of the Indian cookstoves market. The study analysed various business models across multiple private sector players and drew some broad conclusions, in line with our earlier assertion that rural households are unable to afford improved cookstoves through the incremental 'possible' income growth. The Global Alliance on Cookstoves (2013) highlighted the multiple consumer finance options prevalent in India and in order to critically assess these options, in the light of our research, it will be useful to get a grip on these multiple options. The following table summarizes the various options and its multiple challenges:

Table 4: Various financing models in operation in the cookstoves space

Financing Option	Features	Challenges
Carbon Finance (CDM)	USD 10-25 carbon credit claimed by manufacturer and passed on to consumer as lower price	Carbon credits are risky to rely on as a source of revenue
Non-carbon "buy-down" performance based grants	Provision of performance based subsidies to lower upfront cost	Creates market distortions and difficult to measure performance
Microfinance	Small loans to purchase cookstoves	Magnitude of loans are low and unable to help buyers to buy cookstoves
Installment/Pay as you	Pay as per predefined installments	High collection and other

go		transaction costs
Corporate/institutional financing	Selling through corporate or other institutions	Creating a shared value to make sense for corporates/institutions
Commercial loans	Offering of loans at high interest rates, through cookstove player as a collateral	Cookstove market player must prove commercial worthiness
Social impact investment	Funds that seek to create social impact	Very few players with typical orientations that change from time to time
Subsidized loans	Commercial credit is subsidized through donors or loans provided by long-term impact investors	Managing multiple stakeholders
Grant funding	Funds from multiple agencies to meet certain goals, such as government and international development agencies	May change as priorities change

Source: Global Alliance on Cookstoves, 2013

Section 4: The Research

In order to understand the effectiveness of various business models, intense engagement with select rural women was undertaken in a select location of rural India[8]. The engagement comprised of intensive unstructured interviews, focus-group discussions and group interviews. The respondents had been participant of a skill training module, wherein they were trained to be entrepreneurs. Typical feature of the respondents is represented below[9]:

1. Females (68 numbers) in the age-group of 28-45.
2. Average income – INR 3,500 to 5000/- per month
3. 95% self-employed (some form of entrepreneurship, either skill or non-skill based)
4. Rural retail shops – selling grocery, solar lamps, etc.
5. Some of the women were trained as beauticians
6. Nearly 50% were using traditional methods of cooking, including biomass as a fuel

[8] The study area comprised of a district in South Maharashtra. The respondents were from a select group, which were undergoing or had undergone a course wherein they were trained as entrepreneurs. The participants were given general training on working as an entrepreneur, as well as were given skill based training. This was a part of a larger program of building women-oriented enterprise culture in economically disadvantaged region, which exhibits multiple vulnerabilities such as increased exposure to natural calamities. This program is managed by a large NGO, supported by the private sector.

[9] For more details concerning the study area, please refer to Appendix I

The primary question was to find whether the selected women would prefer to buy an improved cookstove and if yes, what would be the preferred financing option/model. The basic probing question was to examine their behavior towards financing cookstove through internal savings or through other forms of financing mechanisms (the incremental or primary earning through rural enterprises, as mentioned in the box above). The results were startling. None of the women were interested in devoting a part of their income towards a cooking solution. They were more oriented towards putting their eggs in the "education" basket for their children. It points towards our earlier assertion and their belief that education would build their income-earning potential and thereafter increased income growth would facilitate their transition towards a clearer cooking option. This is a fact which is corroborated by the NSS findings on the nature of energy consumption (discussed at length in Section 1). Atleast in the short-term, it is quite evident that no internal financing mechanism would be able to trigger a shift towards an improved cooking solution and therefore, innovative financing solutions would need to be considered and explored.

Interview data revealed a set of primary impact parameters and respondents were probed on the broad weightage one would attribute to the expected positive impact, through income again. The following table summarizes the key outcomes and in the order of priority (Table 5):

Table 5: Impact Parameters

S.No.	Major theme	Explanation
1	Building human capital (Social risk mitigation through education)	95% of the women earnings were predisposed towards accumulating physical capital, so as to finance future educational requirements of their children
2.	Livelihoods security	Incremental earning through women enterprises offsetting the insecurity of the jobs held by their husbands/male members of the family in the informal economy (every amount is precious, which leads formalizing the informality of the male members in the family)
3.	Vulnerability Reduction	Incremental income is invested to safeguard against vulnerabilities (economic, environmental or social): 90% had bought life insurance policies and were paying premium on a regular basis
4	Health and Hygiene	95% were not concerned with slow impact of air pollutants, and were more concerned to invest incremental saving in building better sanitation facilities

Evidently, upfront capital finance for cookstoves is not a priority of women and an appropriate strategy has to be developed to enhance the penetration of cookstoves. It becomes necessary to highlight the nature of these women and their economic activity. All the women who were interviewed or engaged with were involved in an entrepreneurial venture. Most of these ventures were retail-based in nature and financed through microloans. It seemed, through our engagements, that microfinance option, if bundled with improved cookstoves could prove to be the most preferred option for the financing option as the women were more interested in opening of a retail outlet and they did not mind topping up a cookstove as a package from the microfinance institutions but not as an independent option. For microfinance institutions, it makes a lot of sense because then either through individual or group lending, they are able to establish multiple channels through the same window and once scalability of this option would be achieved; it would become easy for targeted institutional finance to be routed through these retail enterprises.

Section 5: The Energy and Climate Change Issue

This brings us to the point where we need to estimate whether such a transition (to improved cookstoves) would mitigate sufficient CO2 from the energy sector and to what extent and how would it affect other developmental issues such as primary energy requirements, reduced deforestation etc. This evaluation has exclusively focused on the energy dimensions of biomass and the related CO2, under the assumption that the biomass used is not consumed in a sustainable fashion (implying that there are clearly quantifiable measurement indicators to prove that effective deforestation is happening).

Using MARKAL[10] (an energy optimization model) for India, a long-term energy scenario assessment was undertaken. It is a multi-period long-term model of the integrated energy system, which encompasses the extraction, transformation and the end-use of as complete a mix of energy forms as is desired (Fishbone and Abilock, 1981[11]). The representation in the model of the various is explicit through the quantification of each individual technology that plays a role in the energy system. The model consists mainly of the description of a large set of energy technologies, linked together by energy flows (and/or material), and called the Reference Energy System (RES). The model is driven by a set of demands for energy services. In addition, the model possesses a clearly defined objective, which is usually (but not necessarily) chosen to be the long-term discounted cost of the energy system. The objective is optimized by running the model, which means that the

[10] MARKAL is an acronym for the MARket Allocation model, used for long-term energy projections. This model is a bottom-up demand driven model and works on the principle of finding the energy pathway which gives the least energy system cost.

[11] Fishbone, L.G. and H. Abilock, "MARKAL, A Linear Programming Model for Energy Systems Analysis: Technical Description of the BNL Version," *International Journal of Energy Research*, pp 353-75 (5), 1981

configuration of the RES is dynamically adjusted by the model in such a way as to minimize the long-term discounted system cost. The optimizing feature of the model ensures that the model computes a partial economic equilibrium of the energy system at each time period (Loulou et al., 1997[12]). The key model features are highlighted in the table below:

Table 6: Features of the MARKAL model

Features	**Typical characteristics**
Regional coverage	India
Model class	Energy system optimization model
Model foresight	Perfect foresight
Technology dynamics	Capital stocks, penetration rate constraint
Fossil fuels	Coal, natural gas, oil
Traditional biomass	Yes
Modern biomass	Yes
Carbon Capture and Storage	Yes
Nuclear	Yes
Wind power	Yes
Hydropower	Yes
Other renewables	Yes
Substitutes to petroleum as transport fuel	Electricity, modern biomass, hydrogen

This long-term (till 2050) evaluation was guided by two future visions: business-as-usual (BAU) and low-carbon scenario (LCS). In the latter case, global CO2 emission alignment was undertaken through ascertaining emission limitation in the 2 degree C limiting condition. This limiting condition was imposed through a global carbon price (applicable for all regions equally). Assuming that 20% of the household energy needs for cooking is met through biomass based energy solution and assuming an efficiency gain

[12]Loulou, R., Shukla, P.R. and Kanudia, A., "Energy and Environment Policies for a Sustainable Future: Analysis with the Indian MARKAL Model," Allied Publishers Limited, India, 1997

of 15% through improved cookstoves, some estimation of primary energy requirements has been worked out and also CO2 mitigation has been estimated (see Table 7 and Figure 1)[13].

Table 7: Primary energy (EJ)

		2020		2030		2040		2050	
Total	2010	BAU	LCS	BAU	LCS	BAU	LCS	BAU	LCS
Oil	5.63	6.78	6.78	9.12	9.12	10.77	10.77	12.12	12.12
Gas	2.84	5.20	5.20	7.28	7.28	11.83	11.83	18.72	18.72
Coal	12.68	22.61	22.61	31.31	31.31	38.55	38.55	47.40	47.40
Nuclear	0.57	1.38	1.38	3.81	3.81	10.11	10.11	26.07	26.07
Hydro	1.51	2.35	2.35	3.02	3.02	3.41	3.41	3.60	3.60
Biomass	6.19	6.85	6.80	7.33	6.86	5.70	3.74	10.61	2.13
Wind	0.09	0.40	0.40	0.49	0.49	0.61	0.61	0.69	0.69
Other renewables	0.11	0.70	0.70	0.79	0.79	1.14	1.14	1.24	1.24
Total	29.60	46.29	46.22	63.16	62.69	82.12	80.17	120.45	111.97

From Table 7, one can easily deduce that there is some shift (due to increased energy efficiency) happening in the biomass sector due to improved cookstoves, but the shifts are more towards the latter part of the next 40 years. Figure 1 gives us a snap shot of the CO2 mitigation benefit that is achieved through a wider dissemination of the improved cookstoves. If we start quantifying the revenue stream towards the latter part of the first half century of the 21st century, we will realize that more revenue stream is generated once critical deployment of cookstoves happens. However, (as Table 8 indicates); there are substantial co-benefits in terms of incremental improvements in the emission of local pollutants. These local pollutants have significant impact on "out of pocket" expenses and therefore it makes viable economic sense to pursue a biomass-based cookstoves strategy to improve ambient environmental conditions.

[13]Four input characteristics defines the model: technical efficiency, fixed and operation & maintenance cost, supply of biomass and penetration. The model (in this research) is evaluated for the two scenarios is evaluated by changing only the technical efficiency and penetration. The supply of biomass is not considered as a binding constraint and biomass of different types is not distinguished. The cost of cookstove is considered to be INR 1000 at 2005 price levels, with 10% considered as Operation & Maintenance costs. This cost is comparable with the natural draft cooking solution generally available in the market.

Figure 1: CO2 emission (mT) for the two scenarios

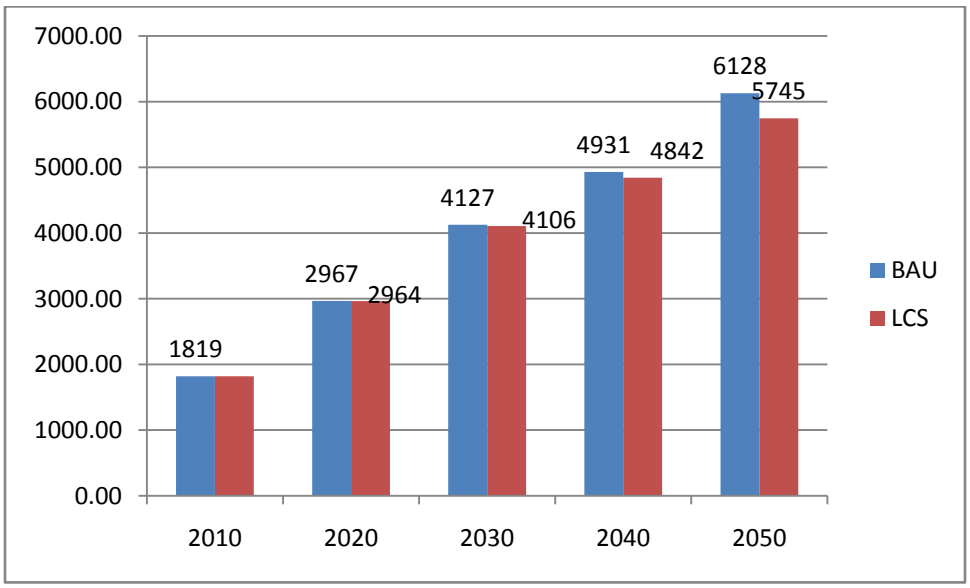

Table 8: Emission (in mT) of other pollutants in the two scenarios

Pollutant	Scenarios	2020	2030	2040	2050
NOx	BAU	0.28104	0.300384	0.233579	0.43486
	LCS	0.27899	0.281249	0.153458	0.087172
CO	BAU	4.841	15.09248	11.73594	21.84907
	LCS	4.738	14.13105	7.71034	4.379869
VOC	BAU	1.69995	1.816959	1.41287	2.630374
	LCS	1.68755	1.701214	0.928235	0.527285

Section 6: Conclusions

This section generates a policy prescription for the cookstoves sector, as a conclusion from this research:

1. Promotion of market-based private players in the improved cookstoves domain is a good strategy, but some ways of institutional financing mechanisms as an inbuilt option should be encouraged (maybe private players to be encouraged to link their business operations through certain MFIs to provide cookstoves as a 'bundled' option). There are some success stories in this regard and one would like to consolidate on these gains.
2. Focus on income-growth of rural households is a key strategy. This would entail creation of an enabling policy environment to support diversification of rural based economic activity, which takes advantages of increased market-access post economic liberalization.

3. Access to improved cookstoves should be routed through a developmental agenda by quantifying the developmental (health) or environmental (CO_2 mitigation) gains and exploring mechanisms to access development financing models to offset high-entry cost for cookstoves in rural households. Government of India is exploring the CDM route in this regard but scale is an important determinant of its success.
4. Policies to frame a wider dissemination of improved cookstoves in the short-run should be pitched as a developmental benefit (which the Government has realized and therefore appropriately framing it) but in the longer term, the strategy of wider use of improved cookstoves should be weaved into the broader narrative of energy policy of India, providing substantial gains in terms of global environmental benefits, such as mitigating substantial CO_2 from the energy sector.

Appendix I

Latur district of the state of Maharashtra is the study area for this research. As per the 2001 census, the district had a population of nearly 2.1 million, with nearly 69% of the residents living below the poverty line. Approximately, 20% of the population belonged to SC and ST communities and the average literacy rate was found to 72%. Latur district has many urban centres (Ahmadpur, Ausa, Latur, Nilanga, Udgir) and nearly 945 villages (Census 2001) in the district. This research was stationed in the Latur urban centre, where trainees arrived from nearby villages and adjoining urban centres.

There are many oil mills, milk power processing and many SMEs located in the district. These SMEs are primarily engaged in metal work processing. However, the selection of the district was more determined by its disaster related vulnerabilities. The district has been identified as earthquake prone (massive earthquake of 1993 is an example) and also prone to frequent bouts of cyclone and drought.