Gender and fossil fuel subsidy reform: Findings from and recommendations for Bangladesh, India and Nigeria

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Cover photos: Left to Right: Kerosene "Kupi" lamp (Bangladesh, GSI); Cooking stove Bangladesh, GSI); Queues for kerosene (Nigeria, Spaces for Change).

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EXECUTIVE SUMMARY

The report looks at the impact of subsidies and reform to kerosene and liquefied petroleum gas (LPG) from a gender perspective across three countries (Bangladesh, India and Nigeria). The research was based around two overall research questions namely '*How do existing kerosene and LPG subsidy policies affect the welfare, productivity and empowerment of women and girls in low-income households?*' and *'How might the welfare, productivity and empowerment of women and girls in low-income households change as a result of specific, nationally relevant proposals for the reform of existing kerosene and LPG subsidies?*' These questions were explored using secondary data, household surveys across the three countries, reaching over 2,400 households, and focus group discussions. The questions were answered within the context of hypotheses made during the scoping phase and literature review for the research, based on a review of 28 reform episodes. This research attempted to answer the above questions in relation to an income effect, energy use effect and an energy supply effect, from a gender perspective.

There is a push within the SDGs to 'leave no-one behind'. What this research found is that in many cases, subsidies directed at kerosene and LPG *are* leaving people behind in terms of access to modern energy. In the case of kerosene, households are paying more (Bangladesh) and sometimes much more (Nigeria) than subsidised government prices, sometimes price cuts and subsidies do not actually result in lower prices as identified at the outset via an income effect (Bangladesh, Nigeria), and kerosene reforms have resulted in even higher prices (Nigeria). Yet the lack of alternative and affordable options to practically switch away from kerosene, for both lighting (Bangladesh), and for lighting and cooking (Nigeria) is an issue. Subsidised kerosene continues to lock families into use with attendant health and safety implications. Kerosene price increases seem to have greater impact on women in Nigeria and appear to affect men and women equally in Bangladesh. Whilst many families report an ability to absorb increasing costs through reducing kerosene use or gaining more income, the recent kerosene price hikes in Nigeria saw hardship, with women's incomes more likely to be impacted because they are the purchasers of kerosene. In Bangladesh families reported that they would cut back on food with a potential doubling in price.

With LPG the picture is different. The positive health benefits from cooking with LPG rather than biomass have implications for women because, across all the surveys, women were found to be the cooks. Research in India found efforts to better target and expand the LPG subsidy to poorer women via the PMUY scheme are bearing fruit, with poor women receiving the LPG subsidy via their bank account. However, the research also found that current LPG subsidies are also still very inefficient and untargeted, with many poor families not receiving them at all, and most households (including those in the PMUY scheme) potentially able to absorb price increases without switching away from LPG. Yet some households also reported a likely increase in the use of biomass for cooking if LPG (India) or kerosene (Nigeria) prices go up. This energy use effect from reforms is particularly true for women in rural areas where biomass is more readily available and can be collected for free rather than purchased.

Research found that switching fuels is not only influenced by fuel affordability and consumption subsidies but also by other factors such as the level of education of women (Nigeria), a focus on upfront costs (India), and potentially who has the decision to make energy choices (mostly men in Bangladesh, mostly women for cooking in India and Nigeria). Findings suggest that policy makers could do more to target subsidies away from fuels and towards outcomes. This would likely imply shifting to cash transfers based on gender empowerment outcomes. In terms of energy, this could mean switching support from kerosene and towards solar or grid electricity, or small PV lamps where kerosene is used for lighting. In terms of LPG it could imply targeting cooking or LPG subsidies to households and women who need it most, for upfront costs, via cash, based on purchase, as India is implementing. Indeed, research in India found that over 10 years ago around half of women surveyed were unlikely to participate in decisions about large HH purchases. For India, this research found around three quarters of women made the decision on cooking sources. The PMUY scheme subsidises the upfront cost of LPG and could have enabled increased decision-making power by women, at least on cooking fuels.

The research concludes with five overarching findings. First, overall fuel subsidies are not working well for poor women. Second, better targeting of support for energy access is needed and possible. Third, subsidy reform needs to be undertaken with care, and mitigation measures are needed to protect poor women. Fourth, other factors could be significant for fuel switching and better access to cleaner fuels for women. Finally, investing in subsidy alternatives could empower women more directly. A summary of these and other findings from across the three countries can be found at the end of this report.

Bangladesh, India and Nigeria are described as ‘high-impact’ countries in that the total number of people without access to electricity or clean cooking is the highest in the world, apart from China for access to clean cooking. Many countries (including Bangladesh, India and Nigeria) are reviewing energy subsidies, undergoing reforms, increasing prices but also have goals to increase energy access and women’s empowerment. The opportunity for policy makers to deliver and target policies—such as targeted LPG subsidies in India—that cluster gender and energy access benefits towards poor, often rural, women is high and could help, in the end, to leave no-one behind.

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ABBREVIATIONS

APL	above poverty line
BIDS	Bangladesh Institute of Development Studies
BDT	Bangladesh Taka
BPC	Bangladesh Petroleum Corporation
BPL	below poverty line
CCT	Conditional cash transfer
DBTL	Direct Benefits Transfer for LPG now known as PAHAL
DLHS	District-level health survey
EA	Enumeration Areas
EMI	Equated Monthly Income
FGD	Focus Group Discussion
GDP	gross domestic product
GSI	Global Subsidies Initiative
IEA	International Energy Agency
IGAs	Income-generating activities
INR	Indian Rupee
IRADe	Integrated Research and Action for Development
KII	Key Informant Interview
LPG	liquified petroleum gas
LSI	Lembaga Survei Indonesia
MJ	megajoules
MPCE	monthly per capita expenditure
MRP	Mixed Reference Period
NDS	National Bureau of Statistics
NFHS	National Family Health Survey
NNPC	Nigeria National Petroleum Corporation
NPC	National Population Commission
NSSO	National Sample Survey Organisation
OLS	Ordinary Least Squares
OMCs	Oil Marketing Companies
PPAC	Petroleum Planning and Analysis Cell database
PPMC	Pipelines and Products Marketing Company
PV	photovoltaic
S4C	Spaces for Change
SHS	solar home system
USD	United States Dollar

GLOSSARY

Clean cook stoves	The Global Alliance for Clean Cookstoves (n.d.) rates cook stoves as clean if they meet minimum standards on efficiency, indoor emissions, total emissions and safety.
Consumption subsidy	A consumption subsidy is a transfer that covers some or all of the cost of a product when it is consumed.
Connection subsidy	A connection subsidy is a transfer that covers some or all of the cost associated with using a product for the first time. For LPG, this includes the metal cylinder that contains the gas, the first load of gas in the cylinder and the stove and associated equipment required to use LPG for cooking.
Empowerment	Empowerment is defined as 'the process through which people take control and action in order to overcome obstacles of structural inequality which have previously put them in a disadvantaged position' (ENERGIA, 2012).
Energy sector reform	Structural changes in the policies and institutions that govern any part—production, transmission or distribution—of the energy value chain, and any fuel within this value chain.
Fossil fuel consumer subsidy	A fossil fuel consumer subsidy is a policy that reduces the retail price of fossil-derived energy by shifting part of the cost burden onto other actors in the economy. Most often, the cost burden is shifted onto the public budget, where taxpayer money or foregone tax revenue is used to keep energy prices low. But costs can be shifted in other ways too: for example, by requiring energy distributors to operate at a loss. The economic cost of energy includes opportunity costs, so it is still a consumer subsidy if countries provide domestically produced energy at prices below the international market level. Fossil fuel subsidies do not truly reduce the cost of energy for a country; they simply alter who pays and how.
Fossil fuel producer subsidy	A fossil fuel producer subsidy is a policy that shifts the cost of energy production away from the companies that find, extract, refine and generate fossil energy and onto other actors in the economy. Most often, the cost burden is shifted onto the public budget, including where taxpayer money is used to provide project infrastructure or guarantees, tax cuts are provided to incentivise investments, and access is granted to government land or goods and services for free or at below-market prices.
Gender	Gender 'refers to the socially-constructed attitudes, values, roles and responsibilities of women and men, in a given culture and location. These attitudes, values and roles are influenced by perceptions and expectations arising from cultural, political, economic, social and religious factors, as well as from custom, law, class, ethnicity and individual or institutional bias. Gender attitudes and behaviours are learnt

	and change over time' (ENERGIA, 2012). As a social construct, gender is often defined in contrast with sex, which refers to the assignation of 'male' or 'female' to a body based on the identification of physical, biological differences.
Gender equality	Gender equality is a state where 'there is no discrimination on grounds of a person's sex in the allocation of resources or benefits, or in the access to services. Equality exists when both men and women are attributed equal social value, equal rights and equal responsibilities, and have equal access to the means (resources, opportunities) to exercise them. Gender equality may be measured in terms of whether there is equality of opportunity, or equality of results' (ENERGIA, 2012).
Gender equity	Gender equity refers to 'fairness and justice in the distribution of benefits and responsibilities. Gender equity is the process of being fair to women and men. To ensure fairness, measures must often be available to compensate for historical and social disadvantages that prevent men and women from otherwise operating on a level playing field. Equity leads to equality' (ENERGIA, 2012).
Modern energy access	There is no universally accepted definition of modern energy access. Sustainable Energy for All (2013) states that there is growing consensus that 'access' should not be defined as a binary state (access or no access) but as a continuum of improvement against a number of metrics. This scoping paper defines modern energy access as the supply of fuels and combustion technologies that are reliable, convenient and do not cause indoor air pollution, as well as the increased rate of consumption of such fuels and combustion technologies. By this definition, improving modern energy access might include expanding the supply and increasing the consumption of electricity among households, as well as liquefied petroleum gas, clean cooking fuels, clean cooking stoves, advanced biomass cook stoves and biogas systems.
Non-solid fuel	Non-solid fuels include liquid fuels like kerosene, ethanol and biodiesel, and gaseous fuels like LPG, natural gas and biogas. This is in contrast to solid fuels like wood, charcoal, agricultural residue, dung and coal.
Pre-tax consumer subsidy	A pre-tax consumer subsidy is one that reduces the retail price of energy before any kind of taxation is taken into account. Pre-tax subsidies can take many forms: for example, direct budgetary transfers to state-owned enterprises; legislation that requires energy marketers to operate at loss, with or without compensation; or the provision of domestically produced energy and prices below the international market level.
Tax subsidy	A tax subsidy is one that shifts the burden of energy taxation onto other actors. Opinion differs as to what should be included in this category. It is generally accepted that

	deviations from the established tax structure, such as exemptions from value added tax, are a subsidy. More controversial, but argued by the International Monetary Fund, is the idea that tax rates should reflect the full cost of a good or service to society, and any taxation below this rate is a subsidy. By this definition, tax rates that do not cover the costs of road infrastructure, local air pollution and greenhouse gas emissions are conferring a subsidy.

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1. INTRODUCTION

Analysis of energy subsidy policies rarely considers effects of policies depending upon the gender of the consumer (Kitson, Merrill, Beaton, & Sharma, 2016). Instead, attention has focused on identifying the size and nature of fossil fuel subsidies, assessing performance with respect to aspects of social welfare (e.g., del Granado, Coady, & Gillingham, 2012; Coady, Flamini, & Sears, 2015), price control and supply (e.g., Adeoti, Chete, Beaton, & Clarke, 2016), and their environmental impact (e.g., Gerasimchuk, et al., 2017, Jewell, et al., 2018; Merrill, Bassi, Bridle, & Christensen, 2015). A further body of research considers the effects of reforming subsidies, particularly on poorer consumers, and measures to protect these consumers (e.g., ADB, 2016; Cameron, et al. 2016; Beaton, et al., 2013). Broadly speaking, this literature points to three main effects of subsidies and reform (Kitson et al., 2016): an 'income effect,' where the subsidies represent an effective transfer to household incomes due to lower fuel prices; an 'energy use effect,' where the subsidies may influence the type or quantity of fuel that is used by the household; and an 'energy supply effect,' where the subsidy changes the availability of an energy source. Each of these effects may have specific consequences for women, as described in the figure below. However, to date, there has been no empirical work exploring or quantifying these potential effects. The research described here is a first attempt to address this gap, focusing on the income and energy use effects of subsidies and subsidy reform.

The research focused on three countries where gender inequality gaps exist: Bangladesh, India, and Nigeria. According to the Gender Gap Index of 144 countries, Bangladesh ranks highest at 47 and with the smallest gap, followed by India (108) and Nigeria (122) (World Economic Forum, 2017). Energy access levels to clean cooking and electricity as estimated by limited available metrics are still low (see Table 1). All countries subsidise fossil fuels, with 2016 expenditure on subsidies ranging between 0.4% (Bangladesh) and 0.6% (India, Nigeria) of GDP. These levels are all lower than previous years, such in as 2013, due to lower world oil price (which has reduced the subsidy burden significantly in Bangladesh) and active reforms. Total fossil fuel subsidies per household in 2016 ranged between USD 61 per household in Nigeria to USD 28 in Bangladesh, based on International Energy Agency (IEA) subsidy figures. The research focused on kerosene subsidies in Nigeria (where kerosene is used for cooking and lighting) and Bangladesh (for lighting), and liquified petroleum gas (LPG) subsidies in India where LPG is used for cooking.

Table 1. Fossil fuel subsidies (total, per household) and populations without access to energy

Country	Total fossil fuel subsidies 2014 (million USD)	Total fossil fuel subsidies 2016 (million USD)	Total Subsidies per cent of GDP, 2016 (2013)	Subsidies per household 2016 (USD)	Population without access to electricity in 2016 (million; % of pop.)	Population without access to clean cooking fuels and technology in 2016 (million; (% of pop.))
Bangladesh	3,332	1,018	0.4 (3.2)	28	39 (24%)	136 (82%)
India	35,860	13,352	0.6 (2.5)	48	270 (15%)	781 (59%)
Nigeria	3,598	2,472	0.6 (1.3)	61	76 (41%)	177 (95%)

Source: World Bank, 2018a; IEA, 2014; IEA, 2018; United Nations Department of Economic and Social Affairs, 2017; World Bank, 2018b; authors' calculations.

LPG is a by-product of oil production, stored in pressurised cylinders and predominantly used by households for cooking. LPG is growing as a source of cooking energy fuel in India, though it remains a marginal fuel in Bangladesh and Nigeria. It is an important fuel from a gender perspective because it does not emit levels of indoor air pollution that are dangerous to human health. Biomass collection, preparation and usage has a gendered role, and therefore cooking fuels need a gendered lens for examination. Kerosene is a thin, clear liquid primarily derived from refined petroleum and often described as described as a 'poor person's fuel'. It is used for both cooking and lighting; for example, in Nigeria, while over 60% of households use wood for cooking, this is followed by kerosene (26%), predominantly in urban areas (National Population Commission, 2014; cf. Naibbi & Healey, 2014) and 16.6% of households use kerosene for lighting (National Bureau of Statistics, 2016). There is a growing awareness of the potential health risks of kerosene and that 'policymakers may consider alternatives to kerosene subsidies, such as shifting support to cleaner technologies for lighting and cooking' (Lam et al., 2012, p. 426).

The research was informed by a literature review (Kitson et al., 2016), that reviewed the literature across the three countries in question. The research also reviewed 28 reform episodes from a gender perspective, finding that 18 relied on targeted mitigation measures, including expansion of public works, education and health programmes in poor areas. Gender-sensitive policy-making can consider the extent to which such policies can be designed to compensate for inequalities in intra-household decision-making. This might include the use of universal or conditional cash transfers (CCTs), structured to be more likely to increase the power of women in determining household expenditure decisions. Alternatively, policies might include social assistance measures intended to meet women's essential needs, such as health care, or to enable their participation in the labour market, such as infrastructure programmes or microloans targeted at women.

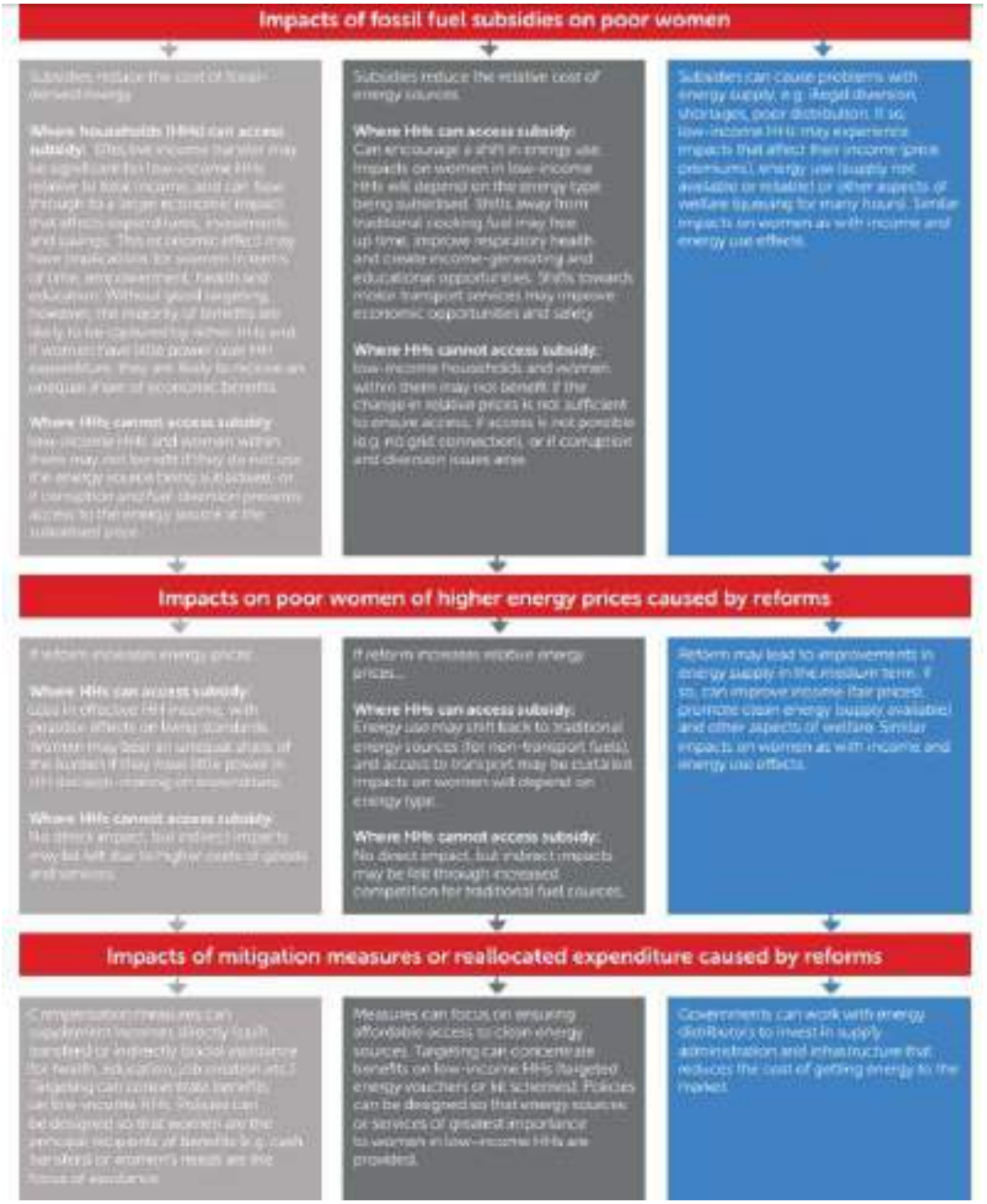
Overall, the literature review (Kitson et al., 2016) also found that there is a substantial body of knowledge examining the range of measures that can address the adverse impacts of increased energy prices resulting from subsidy reform. This knowledge is drawn from analysis of previous reform attempts, as well as more theoretical analyses. However, to date, few of the measures implemented or discussed with respect to fuel subsidy reform consider how the specific effects on men and women can be addressed. As with fuel subsidy policies themselves, reform policies are rarely gender-specific and can thus have unintended impacts upon gender equality. If the government objective is to promote gender equality, reforms should be designed and implemented so as to not only counteract potentially negative effects upon women, but also to maximise opportunities for improving women's lives.

The literature review further revealed that the impacts of energy subsidies, the impacts of energy sector reform, and workable or appropriate mitigation measures associated with any reforms are extremely context specific. Nonetheless, strong evidence indicates that in many countries a significant proportion of subsidy benefits are captured by well-off households, suggesting a general phenomenon of energy subsidy inefficiency if the desired policy objective is to target income and energy access benefits to women and men living in poverty. Based on the literature review, primary research was conducted in three countries, independently with local partners. The research was coordinated across the countries and focused around two main research questions namely 'how do existing kerosene or LPG subsidy policies affect gender empowerment?' and 'how might this change given a change in subsidy policy or mitigation measures?' Overall a qualitative comparative case study approach was taken, consisting of a review of existing secondary data, household surveys and focus group discussions (FGDs) or interviews. Household surveys had a similar structure and questions, as well as being adapted to reflect the context of the country, with country specific analysis.

Figure 1 describes the hypothesis as set out based on the literature review. This is

followed by a chapter describing the overall research methodology. Following that are chapters that approach the research questions from a gender perspective linked to the identified effects (income, energy use and energy supply) for each country: Bangladesh, Nigeria and India in turn. Findings are drawn across all the chapters and summarised in the final chapter.

Figure 1. Likely impacts of subsidies, their reform and mitigation measures on women



Source: Kitson et al., 2016.

2. METHODOLOGY

On the basis of the literature review, two overarching research questions were established. The first was to understand the extent to which existing subsidies for cooking and/or lighting fuel in each country have distinct gender-disaggregated effects on the welfare, productivity and empowerment of poor women and girls. The second was to understand how specific, nationally relevant reforms might have further gender-disaggregated impacts on poor women and girls, including the provision of alternatives to fossil fuel subsidies. This two-stage approach reflects the fact that the literature review found a paucity of research on the impacts of subsidies themselves on gender; while the policy agenda in many countries is focused on the reform of subsidies, typically the phasing out of kerosene and the provision of LPG, as well as additional policies to incentivise decentralised renewable energy generation. In some countries actual policy changes were introduced during the lifetime of the research project: in Nigeria, the removal of kerosene subsidies; in India the introduction of a connection subsidy, some efforts to improving the targeting of existing subsidies and a series of staged price increases. In countries where no significant policy changes took place, price changes remained hypothetical in nature. The full research questions across all three countries are outlined below.

Table 2. Overall and specific research questions for each country

Overall country research questions	
1. How do existing [energy type] subsidy policies affect the welfare, productivity and empowerment of women and girls in low-income households, taking into account: • Impacts of the subsidy on [energy type] distribution? • The extent to which the subsidised price is actually reflected in [energy type] retail prices paid by consumers? • • The extent to which lower [energy type] retail prices influence household fuel use?	How might the welfare, productivity and empowerment of women in low-income households be impacted through changes in subsidy policies and mitigation measures?
Bangladesh	
How do the changes in kerosene subsidy policies affect the welfare, productivity and empowerment of women in low-income households in Barisal, Rangpur, Chittagong in Bangladesh, taking into account: • Impacts of the subsidy on kerosene distribution? • The extent to which the subsidised price is actually reflected in the kerosene retail prices paid by consumers? • The extent to which lower (higher) kerosene retail prices influence household fuel use?	How might the welfare, productivity and empowerment of women in low-income households change as a result of replacing kerosene subsidies (through price change) in villages with policy interventions intended to promote solar homes, biogas and LPG?
India	
How do existing LPG subsidy policies affect the welfare, productivity and empowerment of women and girls in urban and rural low-income households in two districts—Ranchi (in the state of Jharkhand) and Raipur (in the state of Chhattisgarh)—taking into account ... • Impacts of the subsidy on LPG distribution? • The extent to which the subsidised price is actually reflected in LPG prices paid by consumers? • The extent to which lower LPG retail prices influence household fuel use?	How might the welfare, productivity and empowerment of women in low-income households change as a result of the following policy reforms: • Strengthening the existing LPG distribution network • EMI (equated monthly installment) facility for availing LPG official connection
Nigeria	

How do the changes in kerosene subsidy policies affect the welfare, productivity and empowerment of women in low-income households in urban slums and rural areas, in different geographical zones in Nigeria, taking into account the extent to which changes in kerosene subsidy policy have: • Impacted kerosene distribution; • Impacted kerosene retail prices paid by consumers; • Influenced household choice of cooking fuels?	How might the welfare, productivity and empowerment of women and girls in low-income households change as a result of the following policy reforms: • Policy interventions intended to promote renewable energy? • Policy interventions intended to promote LPG?

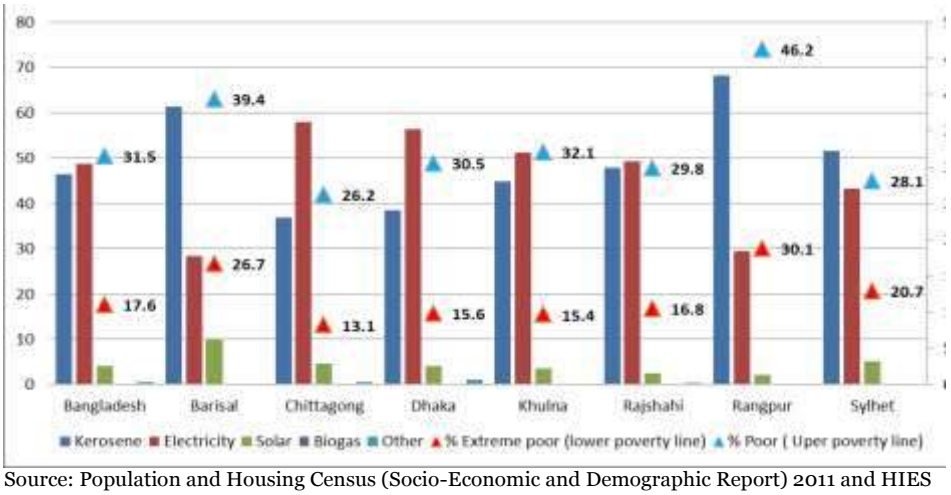
In Bangladesh, Nigeria and India, a qualitative comparative case study approach was taken, consisting of a review of existing secondary data, household surveys and focus group discussions (FGDs) or interviews. Additional research was also undertaken in Indonesia, where only a review of existing secondary data was conducted with regards to LPG use, subsidies and gender impact. Findings from the research undertaken in Indonesia can be found in Kusumawardhani, et al. (2017) and a summary is provided in Box 1 below.

The review of secondary data, conducted for all four countries, included examination of major official data sets such as census data, national socio-economic and household surveys, as well as relevant independent studies. Household surveys (Bangladesh, Nigeria and India) focused on selected regions in each country. A common questionnaire structure was developed, piloted and adapted to suit national circumstances. Where possible, the female head of household was sought as the interviewee.

In Bangladesh, 630 household surveys were conducted between March and May 2017 in the districts of Rangpur, Chittagong, and Barisal, where a substantial proportion of households use kerosene and have high poverty rates. In Bangladesh, the survey was focused in regions where solar or grid electricity is present, or where electricity is not present, and yet a substantial proportion of households are still using kerosene, and regions where the poverty level is comparably higher. Based on this criteria, Bhola, Patuakhali, Barguna of Barisal division (in the southern part of country), Kurigram, Lalmonirhat, Panchagarh of Rangpur division (in the northern part of country) and Banderban, Khagrachori of Chittagong (in the southern-eastern part of the country) were selected for the household survey. Two rounds of households surveys were conducted a pilot survey in January 2017 and a final survey in May 2017 involving 630 households. The final survey questionnaire was conducted with five households from each of the 126 villages. The focus of the research was on kerosene use with women in low-income households—therefore low-income households using only kerosene were surveyed. Households were identified as low-income because of the use of materials used for roofing and walls, mainly kutcha dwellings where the roof and walls of the household are made from mud brick, hay, bamboo or hemp and semi-pucca dwellings were the roof is made from a corrugated iron sheet.

Figure 2. Selection criteria

Figure 3. Access to lighting fuels across divisions with poverty level



Source: Population and Housing Census (Socio-Economic and Demographic Report) 2011 and HIES 2010

Table 3. Distribution of sample across two selection criteria

No. of Villages with prevalence of grid and solar electricity						No of villages	% of Kerosene-using HH
Division	District	both grid and solar electricity	only grid electricity	only solar electricity	neither grid nor solar electricity		
Rangpur	Kurigram	10		4		14	37.03
	Lalmonirhat	7		7		14	26.46
	Ponchogarh	9		5		14	35.71
Chittagong	Banderbaan	2	1	12	6	21	84.93
	Khagrachari	4		9	8	21	87.50
Barisal	Bhola	2		12		14	14.67
	Patuakhali		6		8	14	16.19
	Barguna	8		6		14	9.19
Total		42	7	55	22	126	44.21

Table 4. Type of dwelling

	Type of your dwelling			
	Kutcha	Semi-Pucca	Pucca	Total
No of hh	597	27	6	630
% of hh	94.8%	4.3%	1.0%	100.0%

In India, 810 household surveys were conducted in April and May 2017 in two states, Jharkhand and Chhattisgarh, because of their relative lack of progress in terms of access to clean cooking. 11.66% and 11.18% of households in Jharkhand and Chhattisgarh respectively, used LPG as their main cooking fuel; while 86.90% and 87.74% households used solid fuels for cooking, respectively (Census, 2011). The districts of Ranchi from Jharkhand and Raipur from Chhattisgarh were selected as they represented a balanced mix of rural and urban population (Raipur -36% urban and 64% rural and Ranchi -43%

urban and 57% rural). This is useful to understand the major cooking fuel issues in both rural and urban areas.

In India the research was based on a combination of primary and secondary data. The main sources of secondary data used in the analysis are major national statistical databases that contain information on energy use and gender, as well as some published studies that shed light on specific aspects of the research framework, namely:

- District-level health survey (DLHS)
- National Family Health Survey (NFHS)
- Household consumption expenditure survey
- Employment and Unemployment survey
- Petroleum Planning and Analysis Cell (PPAC) database
- Census 2011, Government of India

In India primary data was collected through household surveys, focus group discussions and personal interviews. The study employed a multi-stage stratified random sampling design for identification of households for primary data collection. Indian Census villages in the rural area and wards in urban area are considered to be the primary sampling units (PSUs). The ultimate stage units (USUs) are the households in both the areas. A total of 810 sample household were surveyed—300 from Ranchi and 510 from Raipur including both rural and urban sample households. The survey had nearly 40 questions with sub-sections, and on average took 60 minutes to complete the survey.

In Nigeria, survey data was collected from 1000 households in two urban slums in Lagos and six rural villages in Imo State. Households were selected based on the Enumeration Areas (EAs) developed for the 2006 census of Nigeria as the sampling frame.
Data collection had three main pillars: an extensive review of secondary data (data mining), two large surveys, and in-depth focus group discussions. The data mining reviewed an extensive amount of journal articles and papers to scope the issue and collect information. Based on this, primary data collection took place, focused on poor women in both urban and rural areas. Data was collected with both numerical and check-box questions, as well as open questions, with a full interview taking about 45 minutes. In addition, two focus group discussions took place in Lagos and Imo State. The focus group discussions took place in Ebutte-Metta (Lagos) with 56 women living or doing business in Badia, Ebutte-Metta and environs, and Ikeduru (Imo) with 27 women living and doing businesses in the six Uzoagba villages surveyed under this project.

Lagos survey: 500 households were interviewed in two urban slums Badia East in Apapa Local Government Area and Ebutte-Metta in Lagos Mainland Local Government Area in Nigeria's South West zone. In Lagos, the surveys targeted an area characterised by a lack of adequate housing infrastructure, clean water and proper sanitation. As with most parts of the country, houses are connected to the grid, but electricity supply in these areas is not stable. The majority of households had an average size of 3 to 6 people (77.8%). A significant number of households were headed by females (24%). Most respondents (85%) had primary or secondary school education, and 3% none at all. 80% of respondents are self-employed, 6.6% are in public sector employment and 4.4% are full-time housewives. Most respondents (55%) claimed to be have household earnings between N1,000 (USD 2.78) and N20,000 (USD 56) per month; 25.8% of respondents did not provide details.

Imo survey: 500 households were interviewed in six villages in Uzoagba community, in Ikeduru Local Government Area, South East zone. The surveys in Imo State took place in a rural area. Whilst Imo State is characterised by lower incidences of poverty compared to the North, when measured by the United Nation's Multidimensional Poverty Index. Almost all respondents lived in their own block houses. Respondents reported that 44.2% of households were headed by females (44.2%). The average size of households surveyed

was 4.8 people. Most respondents (73.6%) had primary or secondary school education, and 6.4 per cent none at all. 55 per cent of respondents are self-employed, 15 per cent run family businesses and 20 per cent are full-time housewives. 44.6 per cent of respondents in Imo earn between N1,000 (USD 2.78) and N20,000 (USD 56.00) monthly while 33 per cent of respondents did not provide information.

FGDs and interviews were designed to collect textured information about the rationale and experiences of vendors and households with respect to the data collected from second and primary sources. In Bangladesh, interviews were conducted in November 2017, and focused on key informant interviews with kerosene dealers and selected households. In India, 16 FGDs were conducted with men and women from low-income households. In Nigeria, FGDs took place with 56 women in Lagos and 27 women in Imo.

Conducted jointly by all partners in the consortium, the analysis is based on interpretation of descriptive primary and secondary quantitative data within the broader context of qualitative analysis of other literature and qualitative data. The comparison between countries is qualitative in nature. Each of the countries was analysed independently before attempting to conduct a comparative analysis, such that perspectives deriving from each individual case would organically inform the larger whole.

Box 1. Indonesian data audit of secondary data

As part of this research a data audit of secondary data was undertaken in 2017 regarding LPG subsidies in Indonesia from a gender perspective, with findings published in Kusumawardhani et al. (2017). Indonesia has subsidised LPG since 2007, when it first introduced the ambitious 'Zero Kero' program to convert households from kerosene to LPG for cooking. The program provided a 'connection' subsidy (a 3 kg LPG tank, stove, regulator and hose) and set a 'consumption' subsidy (a fixed subsidised price for 3kg LPG refills). Both subsidies are universally accessible by all citizens. As of 2014, a nationally representative survey found that LPG was used by 51% of households living BPL (the poor and 'near poor') and 79% of households above this threshold (Lembaga Survei Indonesia [LSI], 2014). The research also found that LPG subsidies are currently expensive to the government and represented USD 1.9 billion in 2016. In 2016 and 2017, several options to reduce subsidy expenditure were discussed publicly by government sources, including the targeting of subsidies to only the poorest 26 million of the 57 million household beneficiaries (Ministry of Energy and Mineral Resources, 2016). These reforms were postponed but some form of targeting reform is still anticipated in the future.

Any potential reforms to LPG subsidies would be likely to target the subsidy to the poor or replace the subsidy with a social assistance cash transfer programme. Currently the subsidies are costly and inefficient and are not targeted at the poor, and despite the subsidies LPG is often sold at very inflated prices. Specifically, survey data on incomes and energy usage collected by Lembaga Survei Indonesia (2014) found that only 30% of subsidy benefits were captured by the bottom 40% of households; while the top 40% of households captured 47% of the subsidy benefits. These estimates are based on the assumption that all households paid the official price per 3kg LPG cylinder of IDR 12,750 (USD 0.9). In reality, data suggests that many households pay above the official price, so actual benefits received may be lower than this.

In Indonesia, a nationally representative 2014 survey found that consumers spent on average 315 minutes per week acquiring 3kg LPG cylinders (LSI, 2014). The majority of consumers reported at least occasional problems with the availability of supply. The most commonly reported problem was that the price was too high (24% of consumers); followed by a lack of supply (14%). The data in the survey does not explicitly link these problems to subsidy policy. In the context of gasoline and diesel, however, there is a well-documented phenomenon where the government has restricted the volume of subsidised energy supply if costs in a year are running higher than budgeted (Lontoh, Beaton & Clarke, 2014).

Overall findings from the report (Kusumawardhani et al., 2017) concluded that subsidies are costly and inefficient in that they are not targeted at the poorest households, and that the wealthiest consume the most 3-kg LPG cylinders per household, more than double that of poor or near-poor households. Despite subsidies LPG is often sold at very inflated prices, sometimes 200% higher than subsidised price. Because of the importance of LPG as a cooking fuel in Indonesia, with associated health and time saving benefits for women over the use of biomass and kerosene, any reforms planned for LPG would need to mitigate negative impacts on the poor and for women. The research suggests that the government could target LPG subsidies to low-income consumers, or, if providing non-energy forms of compensation, to target women; reform the distribution and pricing system, and increase education and communication as to the impacts from other cooking fuels

3. BANGLADESH

3.1. Findings

Current subsidies are not working well for households. Our survey in Bangladesh found that there was little awareness of government subsidies offering price support towards kerosene via state oil companies. Households have not experienced a decrease in the price of kerosene via a passthrough to the consumer from an official price cut from BDT 68 to 65 per litre of kerosene in 2016. Indeed, the research found that in the areas surveyed kerosene prices were higher than the official price by 14%, at an average of BDT 77 per litre, and in some places as high as 17%.

Kerosene subsidy reform needs to be handled carefully. In Bangladesh, poor families use kerosene for lighting. Any increase in the price of kerosene thus needs to be handled with care, especially if households have no opportunity to switch to electricity via solar or the grid for lighting needs. The research found that with a hypothetical 20% price increase most households said they would absorb the cost via an increase in income-generating activities (IGAs), but overall 47% of households would reduce the use of kerosene (alone or in conjunction with other strategies). Given a larger potential doubling of the price of kerosene (50% increase) more households would use multiple coping mechanisms to manage, with 67% of households reducing their use of kerosene as part of their coping strategy as well as other elements, such as reducing expenditure on other goods (e.g. food) and increasing income-generating activities (IGAs). In case of a price shock, overall it seems that women do not seem to be more vulnerable than men, with 74% of households reporting that all members would be equally affected. Furthermore, because men purchase kerosene, a price increase may affect men's incomes more than women's.

However, using regression analysis, the research found that the price differential (between the government and the retail price) of kerosene is negatively related with study duration for both males and females. When a gender comparison is considered, the results reveal that female students do study less on average, but female students are less sensitive than males to price changes in terms of reduced study time. Similar results from regression analysis were found regarding duration of leisure activities, i.e., with an increased price differential both males and females experience less leisure time, but females are less affected by an increased price differential than males. A multinomial logit regression reveals that the mode of decision-making authority (solely by female member/solely by male member/jointly by family members) over usage of lighting fuel does not vary across price differentials. In other words, the price differential does not affect the authority of female members to decide over use of lighting fuel.

Bettering targeting of subsidies is needed. In terms of phasing, it is recommended that grid or solar electricity be available to households before or alongside the reform of subsidies to kerosene, or that kerosene lamps are replaced with small solar lamps that are similarly priced and more affordable. Indeed, at the macro level Bangladesh has seen a reduction in kerosene use alongside an increased electrification of the country. This trend could be accelerated by shifting subsidies from kerosene towards electricity and solar lamps, targeting women and the very poor. The survey found that kerosene costs

families around BDT 210 per month or 4.6% of monthly expenditure. Households perceived the additional income needed to access grid or solar electricity to be about BDT 3,000 per month (15 times higher than kerosene). Monthly instalments for solar home systems were USD 12.75 (BDT 1,073) (Khandker et al., 2014) and several pico PV lamps are now available for less than USD 45 (INR 3,000; BDT 3,485) (Gill et al., 2018). Hence, it might be the case that households are not aware of the actual cost of accessing electricity via grid or solar systems. Keeping kerosene prices artificially low may lock many households into kerosene use. Subsidies towards small solar lamps to replace kerosene lamps in very poor households could be considered alongside grid and mini-grid electrification efforts.

Subsidies are not the only element for fuel switching and access. The research found an overwhelming desire from women to switch away from kerosene for lighting and toward electricity (either solar or grid) from households who are using kerosene and do not have access to electricity in rural Bangladesh. Households mainly want to move away from kerosene because of the poor lighting quality and high price, but little was understood about the health impacts of kerosene across those surveyed. Many women (45%) indicated they would set up IGAs given access to electricity. Yet in Bangladesh this survey found that it was overwhelmingly men (the husband or father only) who take decisions on energy sources for lighting (46.2%) and cooking (39.4%) decisions would be taken by the husband or father only, not women. Even though it is almost only women who undertake the task of cooking. Furthermore, men also have the role of purchasing kerosene (94%). Any government policies to encourage the switch away from kerosene for lighting or toward non-solid fuels for cooking in Bangladesh will need to involve men strongly.

3.2. Bangladesh's Energy Sector

In the past decade, due to poor pricing policies, state-owned energy enterprises in Bangladesh have experienced long-term deficits that have been paid through subsidies. The recent fall in international oil prices has allowed the government to maintain a stable price level, and state-owned companies until recently operated at breakeven point. For example, in 2016 energy subsidies in Bangladesh were estimated to be 0.4% of GDP or USD 1.018 billion (IEA, 2018). Yet in 2013 energy subsidies stood at a much higher USD 4.5 billion, or 3.2 per cent of GDP (IEA, 2014) and almost USD 30 per capita.

The Government of Bangladesh has set out a number of actions to change the energy mix in the Seventh Five Year Plan (2016–2020). These involve increasing gas exploration and establishing a domestic gas allocation policy; setting up a coal import facility; and promoting the careful management and use of LPG imports in the domestic and transport sector. With energy demand always outstripping supply, the government is also aiming to set up an 'energy efficiency and conservation program,' introducing financial incentives for improved cook stoves. It also targeting the development of an 'energy subsidy policy' by FY 2017 at which point liquefied natural gas (LNG) imports may begin. Furthermore, the plan assumes that the subsidy will be capped at 1 per cent of GDP and that 'the subsidy will be targeted to the poor and for supporting the expansion of renewable energy programmes' (Planning Commission, 2015, p. 337).

In April 2016, when many countries were taking the opportunity to reform energy systems (often through reducing subsidies and sometimes without the need to increase prices), Bangladesh rather reduced official prices, potentially increasing subsidies for oil products. The price for kerosene was reported to be cut by BDT 3 from BDT 68 to 65 per litre (Daily Star, April 2016). This research found that households using kerosene did not know, or benefit from this price cut, since it was not passed through to consumers. More recently there have been calls to increase prices on kerosene because of losses of BDT 11.50 per litre for kerosene (Byron & Suman, 2018). The Bangladesh Petroleum Corporation (BPC) has proposed an 11% increase in the price of diesel and kerosene to BDT 72 per litre (Rahman, 2018). This research, undertaken via households surveys and backed up with key informant interviews, looked specifically at the impact of subsidies and potential prices increases (20% and 50%) in kerosene for women and households.

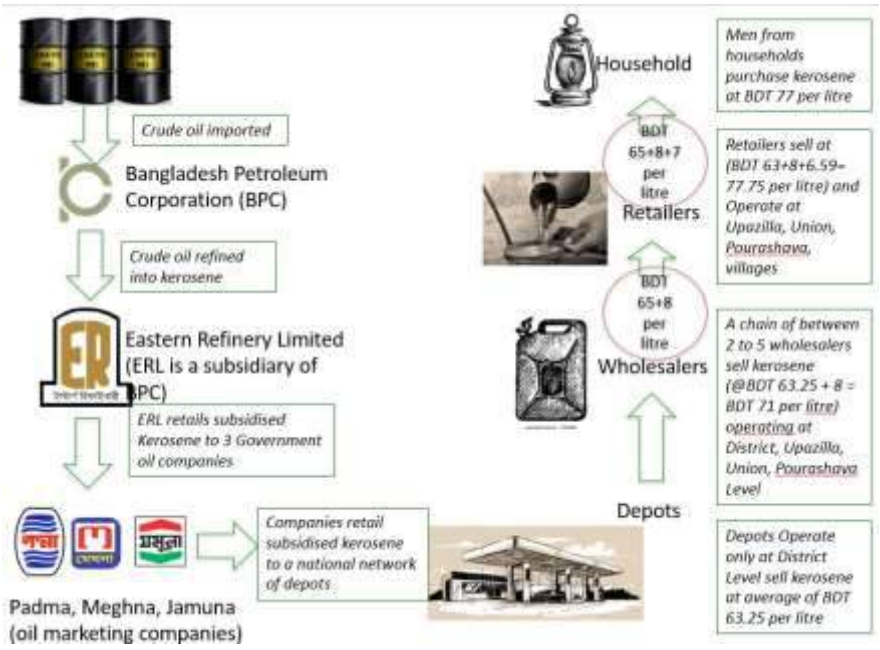
Table 5. Fossil fuel subsidies in Bangladesh compared to subsidies for clean cooking and solar technologies

Fuel and year	Subsidy (% GDP)	Subsidy (US$ billions)	Coverage (million ppl)	Subsidy (US$/person)	Reference
Total fossil fuel energy subsidies 2013	3.2	4.5		29 (per capita)	IEA (2015)
Biogas plant 2014–15	0	0.007	177	39	BIDS from Infrastructure Development Company Limited (IDCOL)
Improved cook stove 2014–15	0	0.001	508	1	BIDS from IDCOL
Solar home system			3 million households (10% of off-grid population) (2013)	23 per unit (2013)	Khandker et al. (2014

Source: Kitson et al., 2016.

Bangladesh has used subsidies as a policy instrument for many years in agriculture, health, education, food and exports, as well as in the energy sector. Subsidies apply to petroleum products (petrol, diesel and kerosene), natural gas and electricity. While energy subsidies have been cited as important for facilitating energy access for the poor, they disproportionately benefit the wealthier sectors of society. Moreover, despite ongoing subsidies to gas and electricity, there are still serious deficits in access to electricity and non-solid fuel cooking fuels across Bangladesh. Bangladesh has expanded electricity access by more than 5 percentage points annually between 2014 and 2016 (World Bank, 2018), and has a significantly expanded access via solar home systems (Khandker et al., 2014). Yet, the country still has the third largest number of people globally without access to electricity (24% of the population, or 39.2 million in 2016), after India (15% of population, 270 million), and Nigeria (41%, 76 million) (World Bank, 2018). Bangladesh is fourth in the world for the largest number of people (134 million) without access to clean cooking (after India: 781 million, China: 572 million, and Nigeria: 177 million).

Figure 4. Diagram of kerosene supply chain and average price per litre in survey areas



The government-determined price is fixed throughout the country, and this price structure should be maintained in any retail transaction. The market registered price is currently BDT 65. Nevertheless, the field survey showed that the price paid by households is significantly higher (on average 13.7%) than the registered price. Kerosene is processed in Bangladesh from imported crude oil. Bangladesh Petroleum Corporation (BPC) is the responsible agency for the import of crude and refined oil. The value chain of kerosene involves a number of stages starting from raw form (crude oil) to final consumption and outlined in Figure 4 above. Enumerators carried out key informant interviews with each agent of the value chain and identified average prices and mark-up between producers and consumers, as well as profit margins. Final retailers revealed profit of between 56-65% as a percentage of the mark-up price, compared to depots with profit of between 16-18% as a percentage of the mark-up price. The full outline of results from the value chain analysis are provided in Annex 1. Findings concluded that

- Retail sellers (from households where mostly men buy kerosene) enjoy the highest profit margin[1] in the value chain of kerosene (56-65%);
- Transport costs came up as a major factor in price differential across all types of sellers; and
- Depots incur the lowest profit margin in the value chain (16-18%).

3.3. Do existing kerosene subsidies work for poor women?

Income Effect

Across the areas surveyed average monthly fuel expenditure costs on average BDT 210 per household per month, or 74 BDT per capita and this is equivalent to 4.6% of monthly

[1] This profit margin is not calculated as an actual monetary amount (here in terms of BDT) but as a proportion. This shows only the proportion of profit of each seller in the respective value addition chain.

expenditure (Figure 7). National data for 2010 finds household expenditure on fuel and lighting in rural areas to be 6.06% of total consumption expenditure (HIES, 2010). In the survey area all kerosene is purchased and used for lighting, with around 30% of firewood purchased and the rest collected. Most fuel used for cooking was collected rather than purchased (Figure 8). In terms of the household fuel mix, almost all households used kerosene for lighting (99.5%), with households using a mix of dried leaves, firewood, agricultural by-products and cow dung/ bhushi[2]/wood powder all for cooking (Figure 5). In the three districts (Kurigram, Lalmonirhat, Panchagarh) of Rangpur, where 50% of firewood is purchased many households are collecting and using agricultural by-products such as paddy and hag, as well as cow dung, bhushi and wood powder for cooking. None of the kerosene-using households surveyed had access to electricity. These households were drawn from across 126 villages, of which only 14 had no prevalence of either grid or solar electricity. Across the sample area around 44% of households were using kerosene: other households in the villages surveyed were accessing electricity, but the focus of the research was very poor women using kerosene.

Figure 5. Percentage of households using different fuels

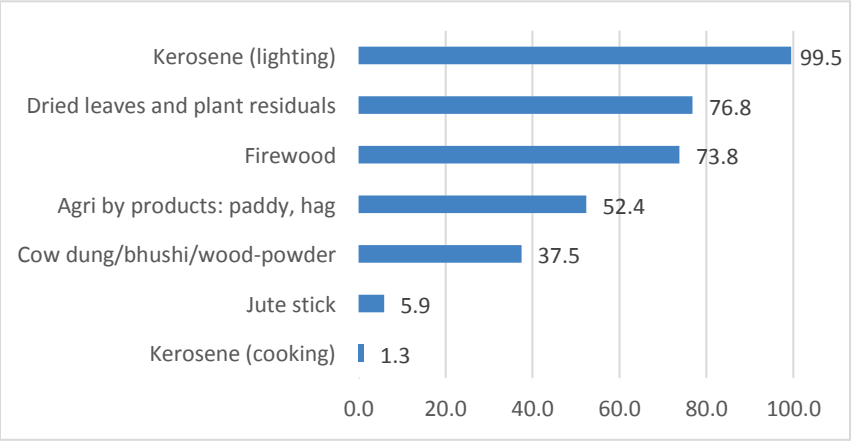


Table 6. Average market price per unit of fuel, BDT

	Rangpur (Panchagarh, Kurigram, Lalmonirhat)	Chittagong (Banderban, Khagrachari)	Barisal (Bhola. Patuakhali, Barguna)	Average in eight districts
Kerosene (litre)	76	78.7	77.3	77.3
Firewood (kg)	2.6	2.5	3.8	3.1

[2] Bhusi is a powder form of wood which is a by-product of the production process of wood furniture or equipment.

Figure 6. Monthly fuel expenditure (BDT)

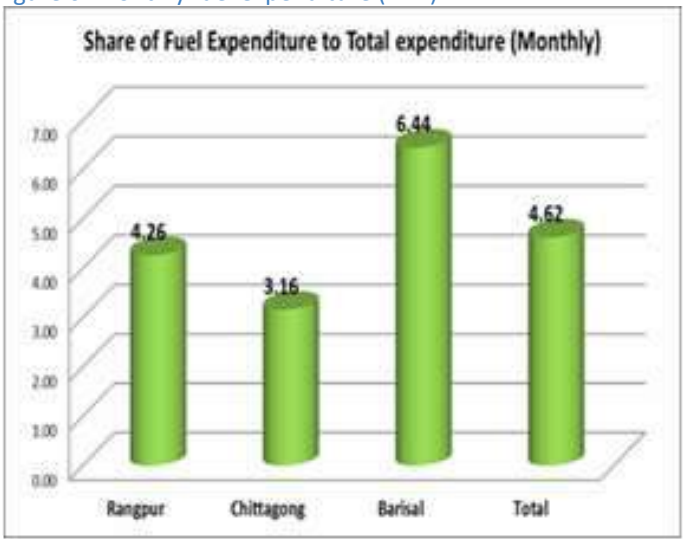


Figure 7. Total and per capita fuel expenditure (monthly)

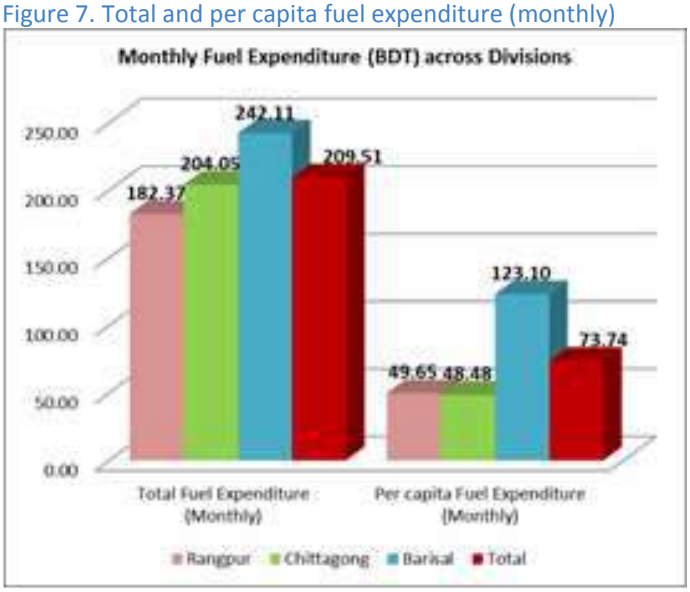
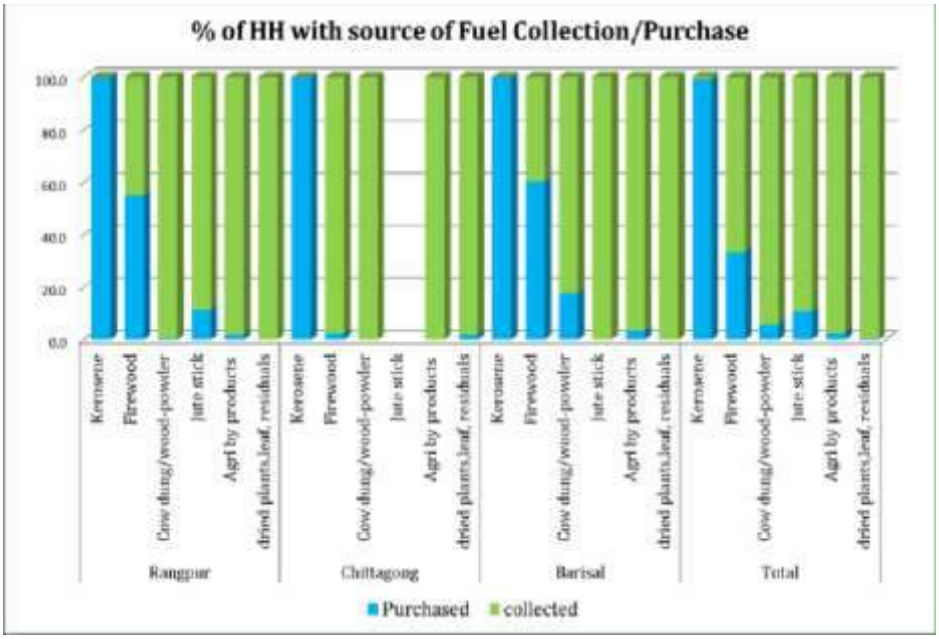
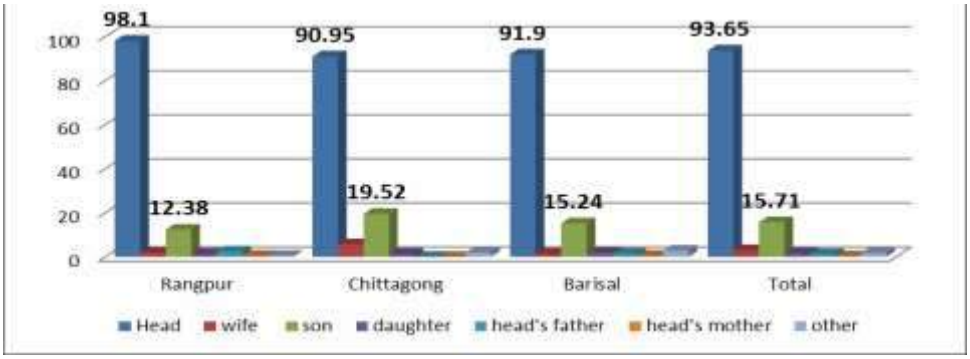


Figure 8. Percentage of households by fuel type, purchased or collected



Men are responsible for buying kerosene for more than 94% of households and reported purchasing kerosene on average about once a week (see Figure 9). The survey found that 99% of households bought from local stores, on average, around 1.5 km away with an average purchase time of around 46 minutes. Almost a quarter of households (21%) purchasing from local stores had faced unavailability of kerosene in the last six months. Virtually no women purchase kerosene and yet 48% of total female respondents are involved in cooking at night using kerosene for lighting. Only nine men reported to be engaged in cooking in the survey of 680 households. A field survey revealed that, on average, women reported spending 80 minutes daily, and that they spend 9 hours and 20 minutes cooking weekly.

Figure 9. Percentage of HHs reporting different family members who buy kerosene

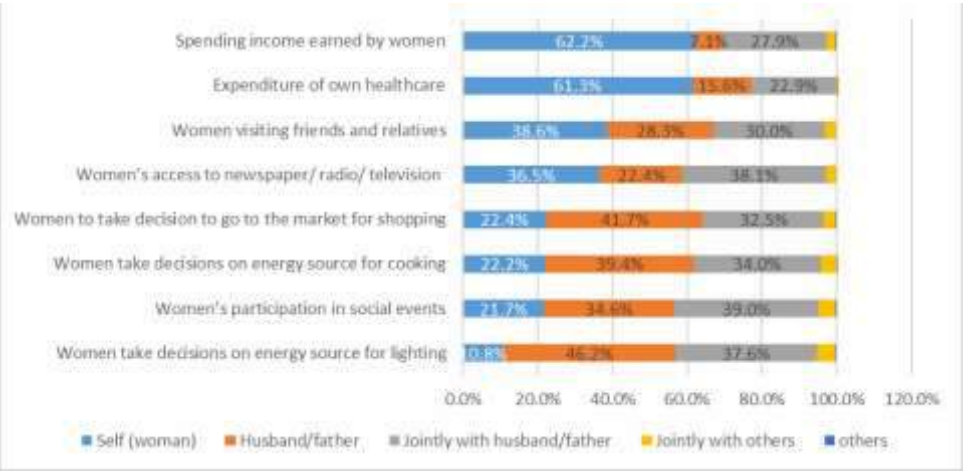


The survey also asked about the level of decision making that women experienced within the household and found that in 62% of households women can decide how to spend any income they earn for themselves. However, only 8.6% of households surveyed have women engaged in paid work, with the majority (44.2%) engaged in unpaid work (household chores), followed by students (30.42%). Women engaged in paid work (121

of a survey that included 1,497 women) are mostly day labourers (agriculture 40%, non-agriculture 40%).

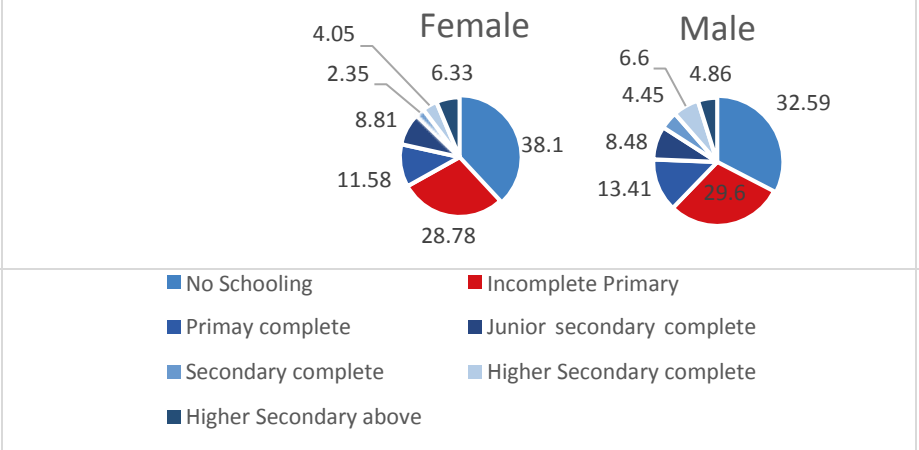
Furthermore, in terms of decision making the survey found that women are able to take a decision about going to the market to shop in less than a quarter of households, and that for key energy decisions around lighting (46.2%) and for cooking energy sources (39.4%) decisions would be taken by the husband or father only. This suggests that in the areas surveyed, even though it is overwhelmingly women who are performing the task of cooking, they do not have the decision-making power to switch energy fuels for cooking, or for lighting sources. Furthermore, because it is men who purchase kerosene, it is also likely men who would need to be targeted to encourage switching away from one fuel to another (e.g., from kerosene to solar), or between one cookstove and another.

Figure 10. Decision-making ability reported for women and different family members, % of households



The survey, which was focused on rural, poor areas of Bangladesh found low levels of education compared to the national average. For example, for 38% of females surveyed had no schooling, with almost 29% of females having not completed primary education (Figure 11 below). Compared to data from the 2011 Bangladesh Population and Housing Census national data which found 9.5% of rural females with 'no class passed' and 35.46% 'primary schooling'(Bangladesh Bureau of Statistics, 2011).

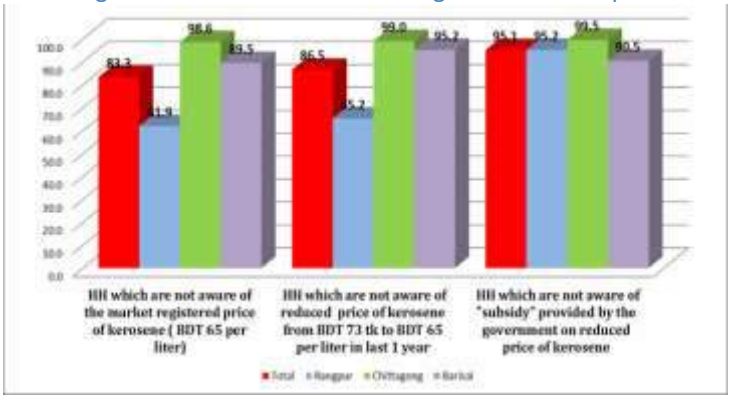
Figure 11. Female and male education levels surveyed, % of households



Energy Use Effect

In Bangladesh more than 80% of surveyed households did not know about the government registered (subsidised) price of kerosene (BDT 65 per litre) and 95% of households were not aware of the subsidy.

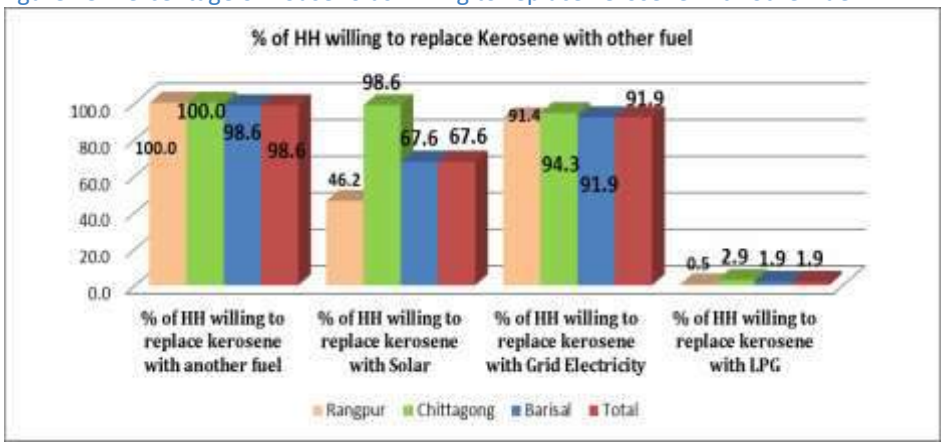
Figure 12. Percentage of households with knowledge of subsidised price of kerosene



A regression analysis was used to test the effect of kerosene price and household income on per capita kerosene consumption. Both price and income were found to be significantly correlated with kerosene consumption. When price increased, kerosene consumption decreased. When income increased, kerosene consumption increased. Looking at the trends, factors that appeared to reduce kerosene consumption were larger household size, higher price differential and greater distance to kerosene purchasing source, and existence of a grid connection in the village. Results from the analysis are available in.

Households overwhelmingly demonstrated a desire to shift away from kerosene and replace kerosene with another fuel. 99% of households revealed their willingness to substitute kerosene with other fuel (Figure 13 below). The households' preference (except Chittagong) was curved toward grid electricity but households surveyed in Chittagong preferring solar over electricity systems to replace kerosene.

Figure 13. Percentage of households willing to replace kerosene with other fuel



Despite price controls and potential subsidies, households revealed that the lack of adequate lighting (92%) and high price of kerosene (85%) as the major factors in households' reasoning behind wanting to replace the fuel. Poor lighting from kerosene came out as the main overall reason as to why households want to switch away from kerosene. The high price of kerosene seemed to be the main factor for around 95% of households in Chittagong and Barisal. 44% of households want to switch away from kerosene because of the soot, but less recognised the health impacts from kerosene linked to these emissions, particularly in Barisal. This suggests that awareness around the health impacts from kerosene is low.

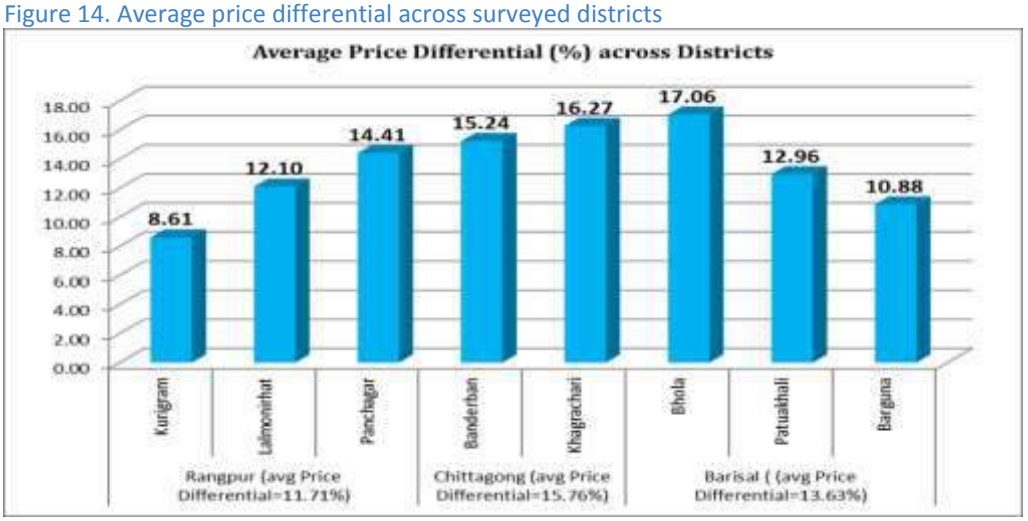
Table 7. Percentage of HHs with different reasons of replacing kerosene with other fuel

	Rangpur	Chittagong	Barisal	Total
Lack of adequate lighting using kerosene	96.67	86.67	92.38	91.9
High price of kerosene	63.81	95.71	94.29	84.6
Dirty and black emissions from kerosene	46.19	57.14	27.62	43.65
Time-Consuming process of collection of kerosene	61.9	6.67	7.14	25.24
Negative health impacts (e.g. coughing, eye diseases) from usage of kerosene	26.67	29.52	5.71	20.63
Unreliable supply of kerosene	4.29	2.86	14.29	7.14
Others	4.76	0.48	0	1.75

Energy Supply Effect

The survey found that the price paid for per litre of kerosene deviates from the official registered price by 13.7% on average, with some districts displaying the highest average price difference between the market price and the official price of BDT 65 of around 17%.

Figure 14. Average price differential across surveyed districts



Most households surveyed (98.7%) buy kerosene from local stores. The average mean retail price paid by households for buying a litre of kerosene was BDT 77 from local stores, and BDT 79 from roadside vendors. The highest price paid for a litre of kerosene was 95 BDT recorded in Barisal, the lowest price paid was 68 BDT recorded in Rangpur. Nowhere was registering a retail price at the official registered price of BDT 65. The processing of

kerosene takes place in Chittagong, yet Chittagong experienced the highest price differential of the fuel. The households also reported their perceptions regarding the high retail price they pay for kerosene. The involvement of middlemen in the distribution channel and profiteering intention of suppliers came up as the major two factors (see Annex 1 for more information on the breakdown of price build-up across the supply chain).

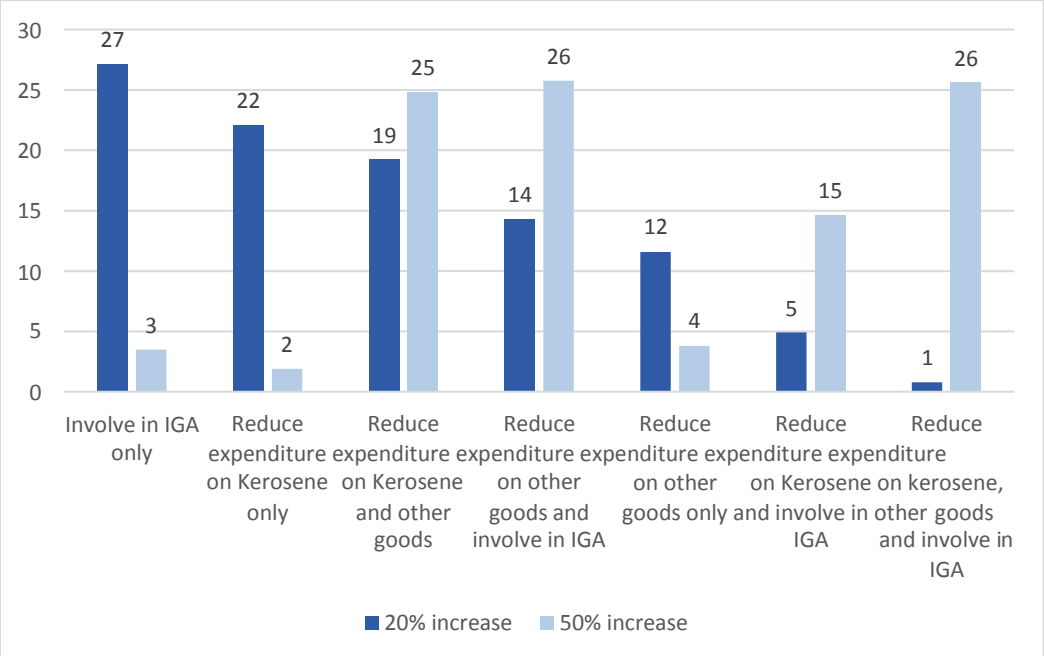
3.4. How could kerosene subsidy reforms impact poor women?

Income Effect

Households were asked directly: if kerosene were no longer available or there was an increase in price, would there be an impact on women's authority in the household across a number of different issues (e.g., from visitation rights to access to the news); however, all households reported that across all activities a woman's authority would not change.

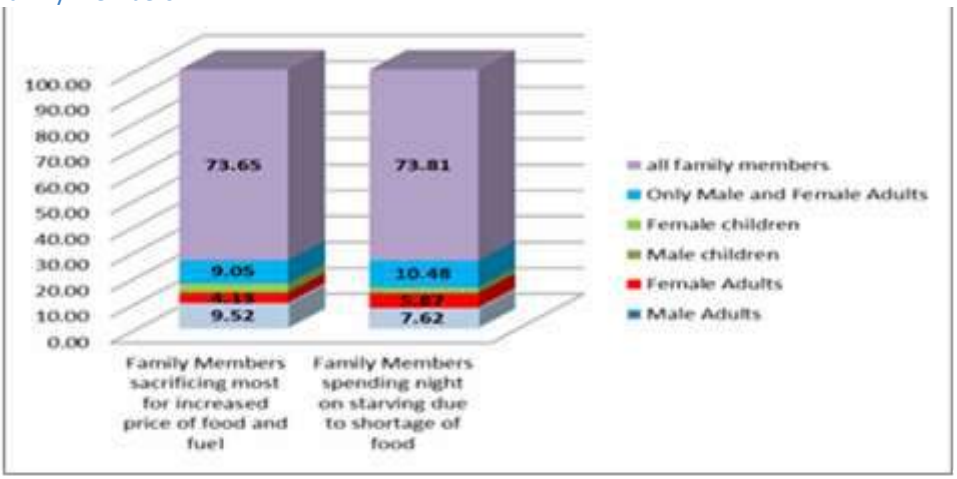
Households were asked about potential coping mechanisms when faced with a potential price increase in kerosene associated with a removal of subsidies. With a 20% price increase most households said they would absorb the cost via an increase in income generating activities (IGAs), but overall 47% of households would reduce the use of kerosene (alone or in conjunction with other strategies) because of the increased price. Given a larger potential doubling of the price of kerosene (50% increase) more households used multiple coping mechanisms to manage, with 67% of households reducing the use of kerosene within their coping strategy including other elements such as reducing expenditure on other goods and increasing IGAs.

Figure 15. Coping mechanisms of HHs (%) given a 20% and 50% increase in kerosene, % households



Where households explained they would increase income by engaging in more IGAs the main approach was to increase working hours by the male household head (all households surveyed registered the household head as male). Other mechanisms for increasing income to cover the increased price of kerosene included drawing on household savings, saving less compared to before, or borrowing. Where households explained they would reduce expenditure on other goods as part of their coping mechanism to manage an increase in kerosene prices the majority indicated that the reduction in expenditure would be made in food, followed by recreation and clothes. This reduction in expenditure on food as a way of coping with a price increase in kerosene being particularly pronounced when faced with a potential doubling in the price of the fuel. If households were to reduce food expenditure to cope with an increase in fuel price, Bangladesh has highly prevalent poor maternal nutrition, and in addition 19 per cent of women 15-49 years are underweight (BMI < 18.5) and among adolescent girls aged 15-19 years, 31% are underweight (USAID, 2018). Therefore, it is likely women could become more vulnerable where households reported a change in expenditure on food, as a result of increases in prices in fuel. On the other hand, households were asked to state which members of the family would be affected most by an increase in either the price of food or fuel. In case of a price shock, overall it seems that women do not seem to be more vulnerable than men, with 74% of households reporting that all members will be equally affected (see Figure 16 below).

Figure 16. Percentage of HHs reporting effect of food and price shock across different family members

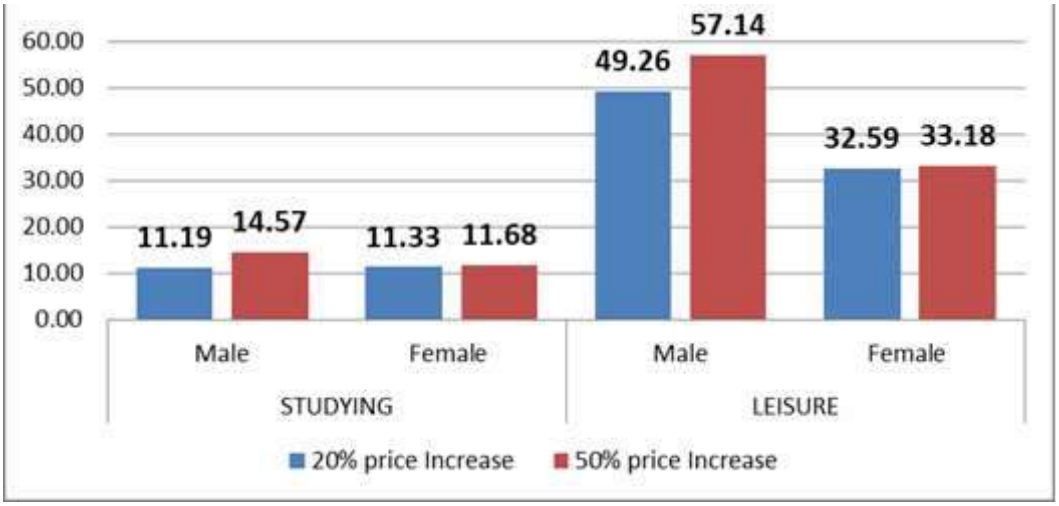


Energy Use Effect

When asked about a potential price increase in kerosene (and therefore the cost of lighting) households were also asked about changes in behaviour for male and female household members in terms of duration of activities including studying, cooking,[3] IGAs and leisure activities, following potential price increases (gross impact), as well as how household behaviour might change to accommodate this (for example shifting activities into daylight hours) (net impact).

[3] Only nine men in the survey were found to be involved in cooking. The result is not surprising because in Bangladesh. cooking is considered to be done solely by women. Even though urban areas seem to be little different, but rural Bangladesh still carries the same perception.

Figure 17. Mean of percentage reduction of activity duration



Note: The mean difference between males and females for studying came up as statistically insignificant under a 20% and a 50% hypothetical price increase in kerosene. For leisure, the mean difference between males and females came up as statistically significant under a 20% and a 50% hypothetical price increase.

Regression analysis suggests that women are less affected from a potential kerosene price increase compared to men in terms of study and leisure duration. When tested against actual kerosene prices, study and leisure duration, it should be noted that female students were found to study less (37 minutes per day) and enjoy less leisure time (17 minutes per day), on average, than males. Yet, females were found to be less affected by an increase in kerosene prices than their male counterparts. This is also supported by the results above, when households were asked about potential changes in duration of activities following hypothetical kerosene price increases. This does not mean that an increased price differential will not be associated with any adverse effects on women. An increase in the price of kerosene will decrease study and leisure duration both for men and women, but women's study and leisure duration will be less sensitive to a price increase compared to men. This means that, for example, given a hypothetical 20% price increase in kerosene, male students anticipated reducing study time by 11.2%, and women by 11.3%. This finding has implications for any potential reform of kerosene subsidies resulting in price increases. As discussed earlier, the government's decision to keep the kerosene price artificially low via subsidies does not seem to deliver the lower official government price, in that households in the survey were found to pay higher prices than the official fixed price.

Energy Supply Effect

The survey areas were chosen because they were rural, high in kerosene use although not lacking in electricity or SHS prevalence. Therefore, the option for households to switch between lighting fuels or services i.e. from kerosene lighting to electricity, when for example, a price rise might be experienced in kerosene, is limited. This is likely because of affordability constraints. Households surveyed being 'stuck' with kerosene use for lighting, with little alternative to switch to either due to a lack of grid connection or the fact that grid or solar electricity is currently financially out of reach. Yet all the households desired to make the shift away from kerosene. Therefore, households were asked about preferences for energy other than kerosene, and about solar electricity and electricity in general.

Women of households were also asked about what changes they might expect for income-generating activities with access to electricity either via the grid or via solar. Most women (54%) explained that they would continue with their current activity, but 45% (where women are not involved in IGA at present) indicated that they would get involved in income-generating activities given access to electricity (see Table 8). This suggests that, given the chance, women are keen to access electricity and many want to set up new income-generating activities, potentially leading to additional income and savings.

Table 8. Percentage of HHs reporting that women will become involved in (or change) IGA (income-generating activity) if the household suddenly received electricity through grid/solar

	Rangpur	Chittagong	Barisal	Total
Begin IGA	27.62	46.19	60.00	44.60
Change the existing IGA	0.95	0.48	2.86	1.43
Continue the existing IGA	71.43	53.33	37.14	53.97

Households were asked about changes in activities carried out by female members of the household if they had more time available as a result of reduced time spent on fuel collection or from more hours of available light. It is interesting to note that households surveyed identified that this would mostly mean more time for women to perform household chores and spend more time with the children, with opportunities for additional activities such as paid work, leisure or study being perceived to be a lot lower: more time for women being translated into greater household productivity but not necessarily women's empowerment.

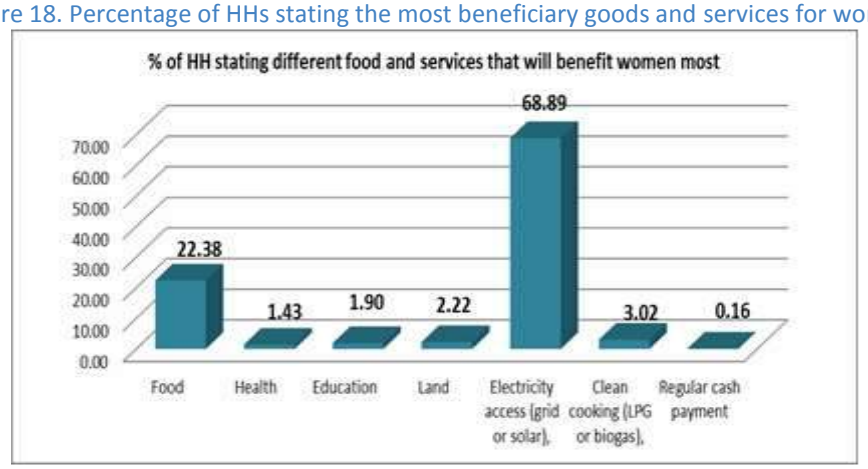
Table 9. Percentage of HHs reporting spending time on different activities by female members of HH if they spend less time on fuel collection or have more daylight

	Rangpur	Chittagong	Barisal	Total
Household chores	93.81	71.43	96.67	87.3
Spending time with children	82.86	64.76	73.33	73.65
Visiting friends and relatives	22.86	82.86	13.81	39.84
Paid work	19.05	2.86	46.19	22.7
Watching tv	5.24	0.95	1.43	2.54
Reading/pursuing education	0.48	2.86	3.81	2.38
Unpaid work - volunteering/community activities	0	0.48	0	0.16

3.5. What subsidies and government support do poor women prefer?

Households were asked to identify those goods and services that they thought would benefit women the most. 69% of households reported that electricity access would provide the most beneficial services for women, well above support for other services including clean cooking and cash.

Figure 18. Percentage of HHs stating the most beneficiary goods and services for women



However, when asked as to why grid electricity and solar systems are not utilised it was the high price of grid electricity and solar system electricity that featured as the main barrier to households. Around 60% of households and 95% of total households reported high price as the reason for not using electricity and solar respectively (Table 10 below).

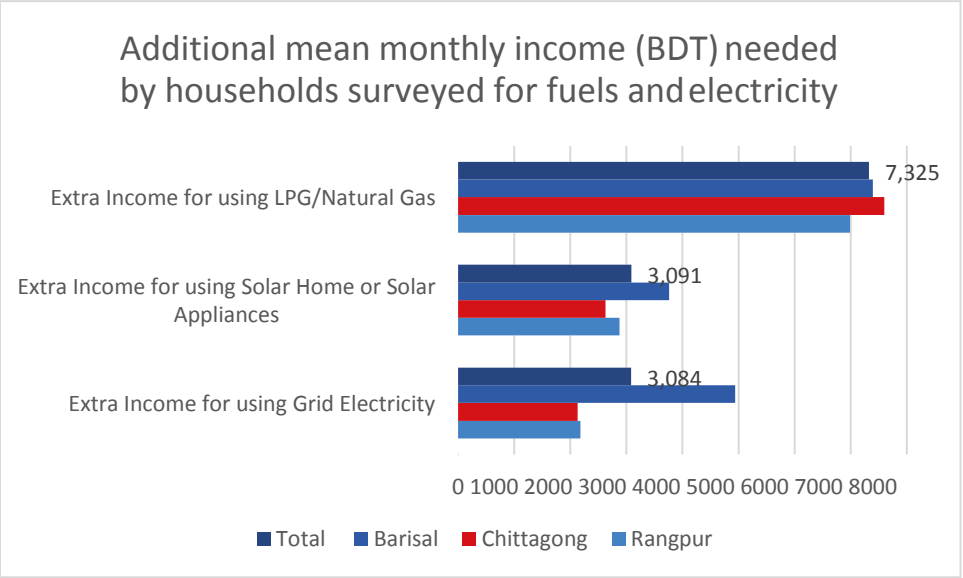
Table 10. HHs reporting high price as reason for not using electricity and solar system

Reasons	Rangpur	Chittagong	Barisal	Total
Grid electricity price is very high	55.71 (n=210)	71.90 (n=210)	57.14 (n=210)	61.59 (n=630)
Solar appliance or Solar Home System price is very high	89.05 (n=210)	97.62 (n=210)	98.10 (n=210)	94.92 (n=630)

In regression analysis of survey data from six countries, Kojima et al. (2011) found that income and relative fuel prices were the two most important factors influencing household fuel choice, followed by education. In Bangladesh, findings confirmed this in that kerosene costs on average BDT 210 per household per month (USD 2.64)[4], or 4.6% of monthly expenditure. Income and relative fuel price also seem key to switching. Households were asked about the additional income needed by households per month to access electricity and the survey found an average of BDT 3,084 (USD 38.70) (grid) and 3,091 (USD 38.79) (solar) electricity (see Figure 19 below). Households perceive the monthly cost of electricity access to be around 15 times higher than kerosene, yet monthly instalments for solar home systems (USD 12.75) (Khandker et al., 2014, p. 13) are actually around five times higher than current monthly spending on kerosene. Households perceive LPG and natural gas to be even more expensive, requiring an additional BDT 7,325 (USD 91.92) per month. Recently, new solar systems are now linked to a 'Free of Cost' government programme under a Money for Work framework leading to a potential disruption of the existing SHS business model and governance concerns (Rahman & Mirza, 2018).

[4] Exchange rate used: 1BDT = 0.012548594 USD. xe.com 22 March 2017.

Figure 19. Additional mean monthly income (BDT) needed by households surveyed for fuels and electricity



4. INDIA

4.1. Findings

This research investigated the impact of India's LPG subsidies and their reform from a gender perspective.

India has two main subsidies: the PAHAL (DBTL) policy, which provides ongoing 'consumption' subsidies for LPG refills if users are registered in a database of beneficiaries, which includes the majority of all consumers; and the recently introduced PMUY scheme, which attempts to subsidise the upfront costs of switching to LPG for the first time (a 'connection' subsidy) among women from poor households.

Overall, the research found that India's recent PMUY connection subsidies have helped bring LPG usage to many low-income households for the first time. This has generated positive income and energy supply effects for women, with beneficial outcomes including reduced exposure to harmful indoor air pollution, time savings, reduced drudgery and more gender-equitable responsibility for fuel collection. Nonetheless, much could be improved. More than half of surveyed households in the states of Chhattisgarh and Jharkhand did not use LPG—and thus had not yet benefitted from the PMUY. Further, while the PMUY has had positive impacts on the affordability of LPG connections among some poor households, it is itself based on targeting through data from the Socio Economic Caste Census (SECC-2011), which several experts worry might be unreliable or incomplete, with many errors. The PMUY has also not addressed long-standing issues with the targeting of India's PAHAL (DBTL) consumption subsidies, the most important of which is the large share of high-income households who continue to benefit from the PAHAL (DBTL) consumption subsidy.

Key recommendations

Better targeting of LPG subsidies is needed. The majority of people benefitting from ongoing PAHAL (DBTL) consumption subsidies are higher-income consumers. The PMUY scheme has helped increase access among the poor, with health and time-use benefits for women. Nonetheless, among surveyed households, only 48% of PMUY beneficiaries were among the poorest 40% of households. Further, the PMUY currently includes an optional loan system that may create serious affordability problems for the poorest. The significant inefficiency in PAHAL (DBT) system targeting is striking, with subsidies in 2018 estimated at INR 20,0880 (USD 3.3 billion), more than eight times the volume allocated to the PMUY, estimated at INR 2,496 (USD 0.4 billion). The opportunity cost of this is striking, given the large number of women who remain without access to clean cooking. In our sample, 50 per cent of households did not use LPG.

LPG subsidies are working for poor women who can access them. India's DBTL (PAHAL) system for administering LPG subsidies does not appear to have created problems regarding shortages and related price premiums to purchase LPG on black markets—which is a problem in many other countries. To the extent that PAHAL (DBTL) and PMUY subsidies influenced increased take-up of LPG, they were associated with benefits for

women, including reduced levels of indoor air pollution and time savings, particularly in rural areas where women were predominantly responsible for LPG collection. The one exception to this was in rural areas, where poor distribution networks could create a new time burden for men, with potential negative effects on earnings. In general, women were found to have greater-decision making for cooking energy than men, and the decision to require female beneficiaries of PMUY subsidies is likely to strengthen women's control over decision making.

Subsidy reform needs to be undertaken with care to avoid negative energy access impacts. As the government considers opportunities to reform LPG subsidies through price changes, care needs to be taken to mitigate the impact on poor households. When asked to imagine a scenario where prices increased by 40-50%, 47% of households reported that they would maintain current levels of LPG consumption by reducing expenditure elsewhere or increasing income, while 39% reported that they would continue to use LPG but reduce consumption and 14% of households said they would stop consumption and revert to biomass. This finding is particularly important to consider with respect to current policy design of the PMUY, which only covers half of the upfront costs of conversion to LPG, while offering households a loan to pay for the second half of costs, which is then paid back by withholding the value of PAHAL (DBTL) subsidies on refills until the loan is fully repaid—effectively increasing refill prices during the loan payback period. This policy design is in opposition to the policy's energy access ambitions, actually decreasing affordability for the poorest in the short-term.

LPG subsidies are by far India's most costly and significant policy to promote clean cooking, but they are not the only element that leads to fuel switching and better access. Efforts by oil marketing companies to decrease diversion and to increase the networks of LPG distributors in rural and remote areas have been key to increasing access to LPG. Factors such as education also seem to play an important role in the choice of cooking fuel. The extent of India's commitment to promote LPG has been admirable—but it has also arguably crowded out resources for a more holistic strategy for clean cooking, which should ideally include efforts to overcome non-price factors influencing access, as well as promoting the development of non-fossil cooking technologies for the medium term. This is another area where the large extent of inefficient expenditure on LPG consumption subsidies represents a large opportunity cost. India's draft National Energy Plan recognises the need for a National Cooking Mission to address clean cooking more holistically.

Policy Messages and Recommendations

1. There is a scope to improve the targeting of the PMUY to the poorest households, as many non-poor households with access to a BPL card continue to access LPG subsidy, and many poor households have no access to LPG.

2. It is a clear that the ongoing costs of LPG consumption are an important factor in determining household cooking choices. This being the case, it is important to revisit the design of the current PMUY loan scheme, where households must pay back a loan linked to connection costs through deductions on their consumption subsidy.

3. There is an outstanding need to rationalise subsidy expenditure that is being wasted on the highest-income households—but this must be conducted carefully. This should focus first on the PAHAL (DBTL) consumption subsidy scheme. Any attempt to institute price reforms must be well targeted. Otherwise, a share of poor households may switch back to biomass.

4. In rural areas, when subsidies are helping households convert to LPG, women are benefitting through decreased fuel management responsibility, freeing their time for other activities and reducing their drudgery.

4.2. India's Energy Sector

As of 2015, around 780 million people in India are estimated to primarily rely on traditional forms of cooking fuel (IEA, 2017), in combination with other energy sources. India's biggest policy for addressing clean cooking has been to provide subsidies for liquefied petroleum gas (LPG), a clean-burning gas that is derived by refining crude oil or 'wet' natural gas, and sold in pressurised cylinders. The table below quantifies the national government's expenditure on LPG subsidies, which is the single largest petroleum product subsidy in India.

Table 11. India's expenditure on LPG Subsidies in millions

	2013-14	2014-15	2015-16	2016-17
LPG subsidies (INR million)	576,030	467,507	278,661	204,772
LPG subsidies (USD million)	9,443.1	7,304.7	4,159.1	3,150.3

Source: (GSI, 2017) , Exchange rate in 2014 1 USD = INR 61; 2015 1 USD = INR 64; in 2016 1USD = INR 67; in 2017 1 USD = INR 65 (OECD exchange rates https://data.oecd.org/conversion/exchange-rates.htm) Note: This quantification includes estimates of the total LPG subsidy in India, including fiscal subsidy-cash transfers, under-recoveries, administrative expenditure on running the LPG subsidy schemes, excise duty exemptions enjoyed by LPG cylinders and the subsidy under the PMUY scheme.

Women are predominantly responsible for cooking in India, and any impact of cooking has a disproportionate effect on women and their health. Fuel collection, purchase and preparation also tends to be gendered, with women being primarily responsible for traditional biomass collection and preparation across most of the country, while men tend to bear more responsibility for energy purchases (CSO, 1998). An examination of LPG subsidies as part of a clean cooking transition therefore deserves a gender-disaggregated approach.

As of 2018, India provides subsidies to support LPG take-up and LPG consumption. Its support for LPG has been a highly dynamic area of policy-making over the past decade, with many significant policy reforms. Its major policies are administered by the national government, but many state governments also provide additional assistance to households on initial LPG take-up.

Subsidised LPG is sold in India by the government's three oil marketing companies (OMCs) through a national network of distributors in the form of 14.2 kg cylinders. To access

subsidised LPG, households must obtain an LPG 'connection'[5]—that is, enrol themselves with any one OMC's registry of beneficiaries and obtain the necessary equipment (a stove, cylinder, regulator and hose). Households can apply for a connection for a single cylinder (14.2 kg) or a double cylinder. Connection comes at a significant cost, including charges for a security deposit and the cost of equipment.

This study examines changes in India's LPG policies that have taken place since 2014. In 2014, India provided subsidies for LPG consumption but not for the costs of an LPG connection. Consumption subsidies had been provided for many years, but as of 2014 had begun to be administered through a cash transfer mechanism called the Direct Benefits Transfer mechanism for LPG or 'DBTL,' which is still in place today, renamed PAHAL (DBTL). Under this scheme, households purchase LPG cylinders at market price and the subsidy amount[6] is credited directly to customers' bank accounts to reduce the net price of the LPG cylinder. Customer authentication also requires some form of personal identification, registered to the same household member. A mobile phone can be linked to the registration to facilitate payment, but it must also be linked to the same household member.

In 2014, this mechanism was universal: that is, all households, including the rich, were eligible for the LPG subsidy. Nonetheless, not all consumers benefitted equally. The PAHAL (DBTL) system of transfers with authentication had been introduced to reduce illegal connections and diversion, and it succeeded in significantly reducing the number of registered beneficiaries—but some of the savings were due to households being unable to qualify under the new criteria for registering, and there was no clear national data on the scale of this problem. High upfront costs of connection were another major barrier to access among poor households. A survey of six Indian states found that 95% of households without an LPG connection cited 'high connection cost' as a reason for not using LPG—though 88% also cited 'high monthly expenses', despite the existence of the PAHAL (DBTL) consumption subsidies (Jain et al., 2015).

In 2016, an attempt to improve access for the poor began with the introduction of the Pradhan Mantri Ujjwala Yojana (PMUY). This earmarked INR 80 billion (USD 1.1 billion) to provide 50 million LPG connections to poor households by 2019. The policy explicitly targeted 'the health of women and children,' and built gender considerations into its design: 'Ensuring women's empowerment, especially in rural India, the connections will be issued in the name of women of the households' (PM Ujjwala Yojana, n.d.). The government has reported that the target of new connections has already been achieved as of August 2018 (*Financial Express*, 2018). In anticipation of this, it has committed to achieving 80 million LPG connections for women from poor households by 2019 (Jacob, 2018).

[5] In India, it is common for people to talk about having an LPG 'connection'. This term can cause some confusion for international readers, because it implies some kind of distribution infrastructure, to which one is physically connected. In fact, the term simply refers to having been registered in the country's consumer subsidy system, which requires households to go through several steps to be authenticated. In this paper, we also use the term 'connection' in contrast to a subsidy for 'consumption'. A consumption subsidy is a transfer that covers some or all of the cost a product when it is consumed. A connection subsidy is a transfer that covers some or all of the cost associated with using a product for the first time. For LPG, this includes the metal cylinder that contains the gas, the first load of gas in the cylinder and the stove and associated equipment required to use LPG for cooking.

[6] In March 2014 and June 2015, the LPG subsidy was more than 50 per cent of the market price. See Table 11 for detailed subsidy calculations.

PMUY assists poor households by absorbing half of the cost of acquiring an LPG connection. The government contribution is INR 1,600, which covers the cost of a security deposit (for possession of a 14.2 kg LPG cylinder and pressure regulator), the hose pipe and installation and administrative charges (PM Ujjwala Yojana, n.d.; MoPNG, 2018). The subsidy must be received in a female beneficiary's bank account. Households then have to bear the costs of purchasing their initial LPG stove and subsequent gas refills (MoPNG, 2018). If they cannot pay for the stove and their first refill upfront, the PMUY scheme offers the female beneficiary a loan to help cover these costs (MoPNG, 2016; MoPNG, 2018). No official data was found stating the typical size of this loan, but in 2018 the average cost of a subsidised LPG refill across Delhi, Kolkata, Mumbai and Chennai was INR 495 (IOCL, n.d.), and a review of vendor websites suggests that the standard value of a stove is as low as INR 540 (MySmartPrice.com, n.d.; Flipkart, n.d.). This implies that cost to households in 2018 was at the lowest INR 1,035 and possibly higher, depending on availability of low-cost stoves. Various non-official sources have reported an average loan to households of around INR 1,500 (PM Ujjwala Yojana, n.d.; Anand, 2018). This is paid back in equated monthly instalments (EMI), through deductions from the DBTL subsidy that is transferred for each new LPG cylinder refill.

To acquire a PMUY LPG connection, women from poor households are required to open bank accounts, acquire the *aadhaar* (national identity document),[7] and possess a below poverty line (BPL) card, be part of a poverty database (the SECC 2011) or fall into one of several categories associated with being below poverty line (MoPNG, 2018).[8] If they own a mobile phone, this can also be registered to help facilitate payments.

During the same period, the government has also experimented with a number of approaches to limit LPG subsidy expenditure. This includes a cap on the sale of subsidised LPG cylinders and a voluntary surrender of LPG subsidy called 'GiveItUp'. In 2016, the government introduced income-based targeting that reduced the eligibility of LPG subsidy to only those households whose annual income is less than INR 1 million (USD 15,000). Further, in 2016 the government introduced a series of gradual increases to the price of LPG.

In order to explore the gender-disaggregated impacts of subsidies and their reform, this chapter examines as its baseline the PAHAL (DBTL) LPG subsidy cash transfer mechanism as it operated from 2014 to 2016. It then examines the impact of introducing the PMUY as an instance of reform, as well as more generally exploring households' perceptions of how they would behave in light of any reduction in the PAHAL (DBTL) consumption subsidies that they receive.

4.3. Do existing LPG subsidies work for poor women?

This chapter examines the gender-disaggregated impacts of the PAHAL (DBTL) subsidy as it existed in 2014: a form of a cash transfer mechanism, where households pay market prices for LPG cylinders and then receive the subsidy amount directly in their bank

[7] Under its original design, the PMUY scheme required beneficiaries to have some form of photo ID, and specified that an Aadhaar card or a voter ID card would be sufficient. In March 2017, the government announced that all beneficiaries would be required to possess an Aadhaar card (Ministry of Petroleum and Natural Gas, 2017). Since its introduction, the linking of India's Aadhaar identification system to social security services has been subject to intense debate and legal disputes. In September 2018, the Supreme Court ruled that the government may require the possession of an Aadhaar card to help manage subsidies and benefits (Supreme Court of India, 2018).

[8] Socio-Economic Caste Census (SECC), is a poverty census conducted in 2011 by the state governments of India.

accounts, thereby reducing the net price of LPG cylinders, and without any filters to exclude the rich or target poor households.[9] We draw on a broad review of literature, as well as primary data collected in the states of Jharkhand and Chhattisgarh. These two states were chosen because the study was particularly concerned about the impact of subsidies on the lives of poor women, and Jharkhand and Chhattisgarh are two states with high levels of poverty and the poorest rates of access to clean cooking.[10] In 2011-12, a National Sample Survey Organisation (NSSO) study found that the use of LPG as a primary cooking fuel was lowest in Chhattisgarh, where only 9.5% of the state's households used LPG primarily for cooking,[11] followed by Jharkhand at 13.5% (NSSO, 2015). The average rate of usage of LPG as a primary cooking fuel across the total population of both states was 11.8%.

Income Effect

An income effect is created when subsidies reduce the purchase price of LPG for households, thereby effectively supplementing their incomes (Kitson et al., 2016). An income effect will take place if households are consuming LPG and receiving the subsidy. If subsidies are intended to promote energy access and to ease poverty, it would be most efficient if this income effect were concentrated on poor households. Within the household, the extent to which a subsidy will affect women and men differently will depend upon who typically purchases a subsidised product—and, in the case of the PAHAL (DBTL) system, who receives a subsidy transfer.

As of 2015, a survey suggests that access to LPG in Jharkhand had likely increased but only marginally in comparison to 2011. By 2015, 5% of the households in Jharkhand were consuming a mix of traditional biomass fuels and LPG in some proportion, and 1% used LPG exclusively—as opposed to the 2.9% in 2011 that used LPG as their 'primary' cooking fuel (Jain et al., 2015). Similar state-level data for Chhattisgarh is unavailable.

In order to determine the extent to which poor households experienced an income effect, it is necessary to have a dataset that includes LPG usage and some proxy for wealth. No such data were identified for the beginning of our period of study, 2014. The closest available data are from a survey conducted in 2011-12 (NSSO, 2015, p. 7). This shows that, typically, the percentage of households that primarily rely on LPG increases in line with monthly per capita expenditure (ibid.). As of 2011, across both states, the average rate of LPG usage among the bottom 40% of the population was only 4.6%. Divisions between rural and urban areas were stark. In rural areas in both states, households in the bottom 40% of expenditure—which can be taken roughly as the population of poor households in both states[12]—were not using LPG as a primary cooking fuel at all, and instead used biomass as their primary cooking fuel (see Figure 21). In comparison, among urban households in the bottom 40% by expenditure, LPG was the primary source of cooking fuel for around 9.6% in Chhattisgarh and 26.5% in Jharkhand (see Figure 20). Statistical analysis of NSSO data by Saxena & Bhattacharya (2017) has further found that India's

[9] To help limit unnecessary consumption, the PAHAL (DBTL) system also has an annual cap on purchasing subsidised LPG refills. This varied over a short period, and finally was set at 12 (14.2kg) LPG cylinders. Very few households consume above this level, so despite the long-standing existence of the cap, it has very little impact on the universality of the subsidy policy.

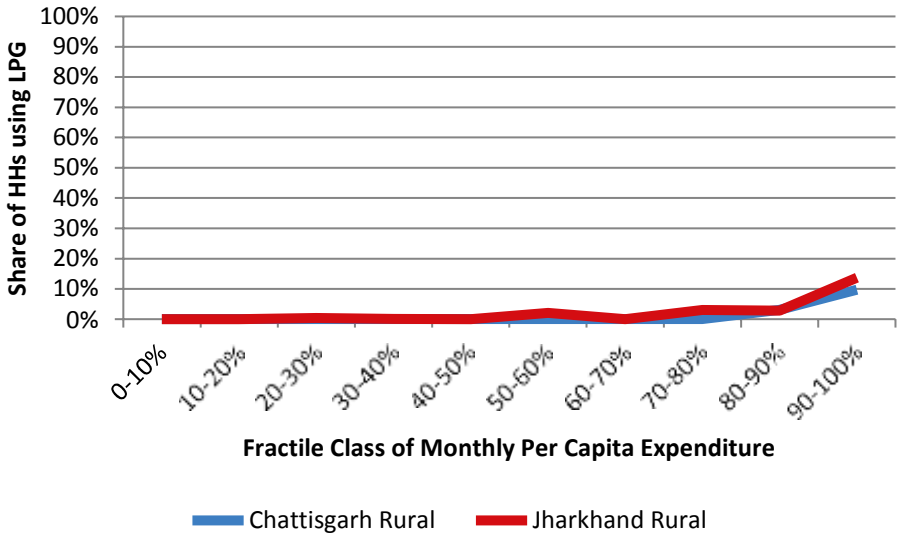
[10] For more details on reasons for state selection see chapter on methodology.

[11] A primary source of cooking implies a fuel, which is the main source of cooking in the last 30 days preceding the survey date. (NSSO, 2015)

[12] As of 2012, the poverty rate in Chhattisgarh was estimated at 40 per cent and in Jharkhand at 37 per cent (World Bank, 2016).

major disadvantaged groups—scheduled castes, scheduled tribes and Muslims—had lower levels of access to LPG than other groups, even when controlling for socio-economic factors that influence demand and supply.

Figure 20. Fractile class of monthly per capita expenditure



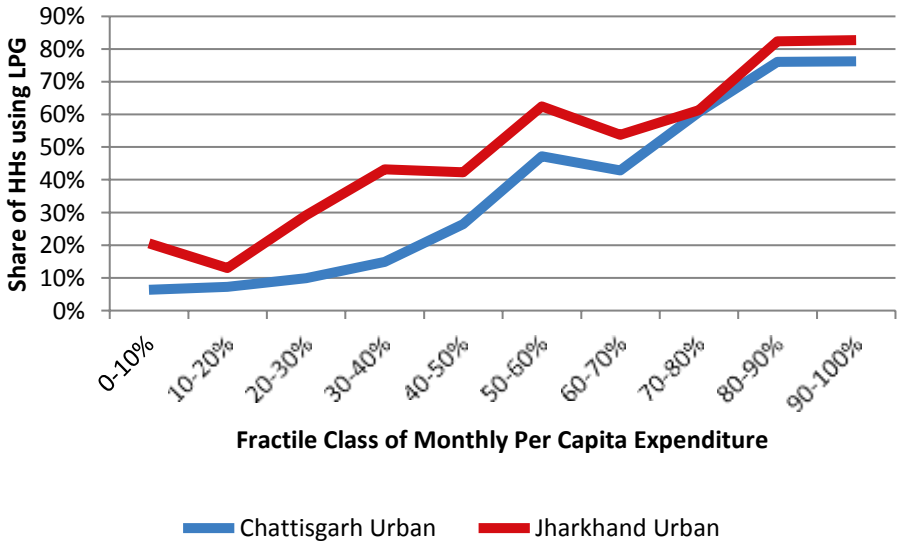


Figure 21. Number of households per thousand using LPG as their primary cooking fuel in each fractile class of monthly per capita expenditure in 2011

Source: (NSSO, 2015)

Note: In interpreting this figure, readers should note that average incomes are lower in rural areas of both states; and that around 75% of the population in each state is non-urban (NSSO, 2015).

The above data are broadly reliable as a proxy for the distributional incidence of subsidies at a household level in 2014, as the level of LPG consumption subsidies had remained similar over these years. The only major disruption was the 2014 introduction of the PAHAL (DBTL) system for administering subsidies through a cash transfer mechanism, which may have reduced levels of household consumption, at least in its initial years. The PAHAL (DBTL) system requires beneficiaries to register with a bank account and

identification, all held in the name of one household member, with mobile phone registration also possible to help facilitate payments. This system is intended to prevent illegal diversion of fuel, but it can also create barriers to access. In a district of Uttar Pradesh, survey research in 2015 found that only 65% of households had a member who met all of the necessary prerequisites (Parikh et al., 2016). As a result, in the short-term at least, it is likely that PAHAL prevented some households from accessing the subsidy at all. There are no data to indicate how this effect was distributed across income groups but rural and low-income households are most likely to have faced the greatest challenges in obtaining requirements and using them to register. The same study found 15% of the households were not receiving the subsidy in their bank accounts. The most common reason for this was a mismatch in the name on the official LPG connection registry and the bank account (Parikh et al., 2016).

The significance of the income transfer that is or is not received is linked to how much LPG is consumed, what this represents as a share of the average household budget and the share of the cost burden supported by the subsidy transfer. Data from 2011-12 show that urban households in both states spent significantly more on energy than rural households; yet, rural households dedicated a larger share of their total monthly expenditure to energy (see Table 12). In 2011-12, the PAHAL (DBTL) cash transfer system had not been introduced, so the data reflect the costs of purchasing LPG directly in the market at subsidised prices. Even with these subsidies, the data indicate that LPG was a significant share of household budgets. In urban areas, it accounted on average for 1.6% and 2.7% of total household expenditure in Chhattisgarh and Jharkhand, respectively. The size of subsidy transfers in India has varied significantly depending on world LPG prices, but in financial year 2012-13, the average subsidy value per 14.2kg cylinder was estimated at INR 427 per 14.2kg cylinder, around three times the average monthly energy expenditure in these states in 2011-12 (Clarke, 2014).

Table 12. Per capita expenditure on energy 2011-12

	Jharkhand Rural	Chhattisgarh Rural	Jharkhand Urban	Chhattisgarh Urban
Energy expenditure (INR monthly per capita)	90.21	97.84	136.47	137.49
Energy expenditure as a % of total expenditure (monthly per capita)	9%	10%	7%	7%
LPG expenditure as a % of energy expenditure (monthly per capita)	3%	2%	39%	24%

Source: (NSSO, 2014)

The extent to which the income effect may have had gender-differentiated impacts depends on intra-household dynamics—that is the relative income of male and female household members, and how their income is usually spent and shared. The fourth round of the National Family Health Survey (NFHS) conducted in 2015-16 in Chhattisgarh found that only 37% of all women aged 15-49 were employed and earning cash in the 12 months preceding the survey, in comparison to 78% of men. It also found that 58% of married women reported that they earned less than their husbands (Ministry of Health and Family Welfare, 2017). The factors that were associated with women having money that they personally control were: living in urban areas; being older; and having 12 or more years of education (Ministry of Health and Family Welfare, 2017). This suggests significant

income disparity between women and men, which would be concentrated among rural and disadvantaged households. At the same time, 77.9% of married women in Chhattisgarh reported that major household purchases were made jointly with their husband, and 14.1% reported that these decisions were made mainly by husbands (Ministry of Health and Family Welfare, 2017). This suggests that, despite significant intra-household income inequality, women have some degree of control over joint household incomes. No equivalent fourth-round NFHS data were available for Jharkhand, but this state showed similar characteristics to Chhattisgarh in the previous round of the NFHS in 2005 (Ministry of Health and Family Welfare, 2007).

No data were identified in 2014 that showed the extent to which women or men were primarily responsible for purchasing cooking fuel, but it is likely that the introduction of the PAHAL (DBTL) may have biased LPG purchase and the receipt of LPG subsidies towards male household members. This is because the policy required beneficiaries to register with a bank account and identification, as well as optional linkage with mobile phones. Data from the World Bank's Global Financial Inclusion Database show that in 2014 in India, 63% of men over 15 years old held bank accounts, in contrast to 43% of women (World Bank, 2017); while the NFHS found that in 2015-16, only 31% of women in Chhattisgarh owned a mobile phone that they used themselves, and of this sub-population, only 75% could read text messages (Ministry of Health and Family Welfare, 2017).

Finally, it should be noted that the poor targeting of the PAHAL (DBTL) subsidy results in a very high absolute cost for the policy. In 2014, the total value of energy subsidy expenditure on the PAHAL (DBTL) subsidy was estimated at INR 3,869 crore (USD 0.6 billion) (Soman et al., 2018).

Overall, in 2011, the accessibility of LPG was limited in Chhattisgarh and Jharkhand, and most low-income households were cooking on firewood followed by dung cake and coal. As a result, the majority of LPG subsidies in these states were captured by non-poor households, while the majority of poor households used biomass for cooking. Within households, women were likely to have significantly lower personal incomes than men, and the administration of the subsidy policy had likely biased the responsibility of LPG purchases towards men, as well as the receipt of LPG subsidy transfers.

Energy Use Effect

An 'energy use' effect takes place when a subsidy changes the relative price of fuels, thereby increasing the consumption of subsidised fuel. This is particularly important for women, because they tend to be the main beneficiaries of a transition away from biomass, with benefits to health and time use.

Analysis has shown that LPG with consumer subsidies has a lower price per calorific value (INR per megajoule) when compared to other purchased fuels, including purchased biomass (Jain et al., 2015). This implies that when households pay for biomass, they end up spending more on cooking energy than households who exclusively use LPG purchased through the PAHAL (DBTL) system.

While we might expect this to drive an immediate shift towards LPG, the market in 2014 had not shifted accordingly. This is likely because expenditure on LPG tends to require infrequent but high-value purchases, while expenditure on biomass is easier to spread over time in small purchases; and because most biomass, particularly in rural areas, is not purchased. Because women's labour is typically not allocated financial value by households, biomass is often perceived as the lower-cost fuel—and even with very large subsidies, it is highly challenging to bring a cleaner alternative into price competitiveness with a fuel that is perceived to be 'free'.

Any barriers experienced in accessing an energy subsidy can also affect price differentials. As explained previously, as of 2014, the administrative requirements to register under PAHAL (DBLT), as well as initial problems with the receipt of transfers, may have created disproportionate barriers to access among rural and disadvantaged households, and women were less likely to have possessed the necessary prerequisites to become beneficiaries. In addition, in 2014 the upfront cost of acquiring an LPG connection was another important factor in the relative price of LPG vis a vis traditional fuel, reducing the extent to which the price influence of consumption subsidies was likely to influence energy use. The expenditure by a household on subsidised LPG can be broken up into connection costs and consumption costs. In 2012-13, only 13% of the cost of acquiring LPG went towards fuel consumption (IRADe, 2014, p. 4). The remaining 87% of the cost of acquiring LPG was attributed to setup costs (including the security deposit for the cylinder, cost of stove, hose) and administrative costs.

Finally, it should also be noted that even when subsidies increase LPG consumption, it does not necessarily mean that they will significantly drive down the use of harmful, traditional biomass fuels. Fuel stacking—using a dominant fuel along with supplementary fuels—has continued. This saves total cooking fuel costs for households, but it continues to expose them to dangerous levels of indoor air pollution and the time burden associated with fuel collection. In 2010, as access to LPG increased, approximately 12% of households nationally were using both biomass and LPG for cooking, compared to less than 0.5% in 1987 (Cheng & Urpelainen, 2014).

Traditional cooking fuels are associated with health and time costs for women, so an energy use effect is typically expected to bring specific benefits to women. The 1998-99 time-use survey (CSO, 1998), the only official time-use survey available, found on average that women spent 18.32 hours per week on cooking food and cleaning utensils, whereas, men spent 0.62 hours per week. This excludes the time use for collection of traditional fuel, also typically the responsibility of women and young girls in rural areas. Numerous studies have documented the health impacts that women suffer from cooking with traditional fuels, which could be alleviated if indoor air pollution were reduced to safe levels or eliminated (Smith, 2002; Boadi & Kuitunen, 2006; Parikh, 2011; Das, 2012). There is also some evidence on the time savings from shifting to LPG. A GSI-supported study by Parikh et al. (2016) evaluated the impact of fuel switching from biomass to kerosene or LPG among the urban poor in the Ghaziabad Municipal Corporation, Uttar Pradesh. It reported that households were able to save two hours in a week from cooking alone, not including fuel collection for biomass and queueing and traveling time from kerosene collection.

Energy Supply Effect

LPG subsidies can create an energy supply effect by creating incentives for fuel diversion, which in turn can create impacts for men and women, such as shortages that increase the time spent in queues or push prices up. However, LPG subsidies in India under the PAHAL (DBTL) subsidy mechanism are closely monitored, limiting the potential for diversion and shortages.

LPG cylinders are home-delivered, except in some remote rural areas, where households have to collect LPG cylinders from distributors. A study in Uttar Pradesh found that most households purchase a single cylinder, in which they receive one subsidised refill at a time (Parikh et al., 2016).[13] When the single LPG cylinder is exhausted, households have to place a request for a refill. The delivery of a refill takes approximately 3 to 4 days, so households use an alternate fuel while they are waiting for the new supply—charcoal, biomass, or kerosene (Parikh et al., 2016, p10).

The price of LPG can vary depending on the source of purchase. Households that acquire an official LPG connection from an LPG distributor of one of the three government oil companies are charged the government-notified price and receive the LPG PAHAL (DBTL) subsidy. Those that purchase an LPG cylinder from a private vendor operating in the open market can be charged a higher price and are not part of the PAHAL (DBTL) registry, so they do not receive the subsidy. Table 13, below, shows a breakdown of price and subsidies over the value chain just before the introduction of PAHAL (DBTL) in March 2014; and after its introduction, in June 2015. The value of the subsidy can vary significantly depending on the market price for LPG. In March 2014, it was set at almost 70% of the import price; while in June 2015, it was around 45% of the import price; and the final, 'effective' price paid by consumers saw virtually no change.

Table 13. Price build-up of LPG in 2014 (prior to DBTL) and 2015 (under DBTL)

Elements	March 2014 (INR per 14.2 kg cylinder)	June 2015 (INR per 14.2 kg cylinder)
(1) Import Price	**906.43**	**456.39**
(2) Add: storage, bottling, distribution, cylinder charges, delivery charges, any other uncompensated costs	95.34	125.25
(3) Less: Subsidy by central government and oil companies	**628.38**	0
(4) Selling price to LPG distributor (1+2-3)	**373.4**	**581.64**
(5) Add: LPG Distributor Commission	40.7	44.88
(6) Price paid by consumer (4+5)	**414.7**	**626.52**
(7) **Subsidy transfer to consumer's bank account under DBTL**	**0**	**208.68**
Effective price paid by consumer (6-7)	**414.7**	**417.82**

Sources: HPCL, 2014; PPAC, 2015.

[13] Households have an option to pay a higher price and acquire a double cylinder connection that permits them to purchase two subsidised cylinders simultaneously.

4.4. How do LPG subsidy reforms impact poor women?

This section examines the impact of the 2016 introduction of the Pradhan Mantri Ujwala Yojana (PMUY) program on women from poor households, through primary data collected in 2017. The PMUY program provides one-time assistance to households in acquiring an LPG connection, targeted at women from poor households, on the condition that they open bank accounts, show proof of identify and are listed in a poverty database. The subsidy consists of INR 1,600 to pay the security deposit (for a 14.2 kg LPG cylinder and regulator), as well as a hosepipe and other administrative and installation charges. For an LPG stove and a first gas refill, households can then pay directly themselves or take an optional loan, which would be paid back through deductions on the DBTL consumption subsidy. No official data was identified on the cost of a stove and the first refill, but various sources suggest that as of 2018 it is between INR 1,035 to IRN 1,500 (IOCL, n.d.; MySmartPrice.com, n.d.; Flipkart, n.d.; PM Ujjwala Yojana, n.d.; Anand, 2018). Once the loan is fully paid, they can benefit from the DBTL policy as normal, receiving a subsidy transfer in their bank accounts each time they purchased a 14.2kg cylinder of LPG, with a cap of 12 cylinders per year.

This section examines the extent to which women from poor households have benefited through the PMUY scheme. It is based on a household survey conducted in summer 2017, focus group discussions and interviews, as well as a review of secondary literature. Details on the collection of primary data are available in the methodology section.

The project's survey data allowed for households to be classified into five income groups (see Table 14, below) based on equal quintiles. Group 1 has a monthly income of less than INR 6,000 (USD 92) per month. The Government of India's (GoI's) 2011-12 criteria for defining poverty use consumption expenditure, where a five-member household is deemed poor if they spend less than INR 4,860 in total per month in rural areas and less than INR 7,035 in total per month in urban areas (Planning Commission, 2014, p. 60). Given that our sample has income and not expenditure information, it is difficult to directly map the government's poverty criteria onto the sample. The income categories can nonetheless be used to illustrate differences between lower- and higher-income groups in these states.

Table 14. Monthly income classification of sample data from Ranchi and Raipur districts

Income group	Household income					
	Rural households			Urban households		
	Range (₹)	Mean	Standard deviation	Range (₹)	Mean	Standard deviation
Group 1	≤ 5,999	4,537 (92)	1,026	≤ 6,279	5,050 (66)	1,140
Group 2	6,000-7,799	6,724 (97)	625	6,280-8,449	7,417 (65)	476
Group 3	7,800-10,199	8,910 (98)	754	8,450-10,703	9,211 (67)	597
Group 4	10,200-14,206	11,944 (97)	1,084	10,704-14539	12,258 (66)	1,044
Group 5	≤ 14, 207	22,396 (96)	10,101	≤ 14, 540	23,427 (66)	10,125

Note: Figures in parenthesis are number of households

Source: IRADe survey data, 2017

An alternative way to identify poverty is to use the government's poverty card as a proxy. This card, issued to households, has two main different categories: below poverty line

(BPL) and above poverty line (APL).[14] Although it is fraught with design and implementation flaws, as discussed by Jain (2004) and Mahamallik & Sahu (2011), it is another relevant metric for disaggregating the sample. In total, 52% of sample households reported possession of BPL cards, 34% APL cards, and the remaining 14% reported that they did not have official documents to prove their poverty status. A poverty rate of this magnitude is higher than estimated for the two districts from official sources, based on state-wise estimates of average monthly per capita expenditure (MPCE), as per Mixed Reference Period (MRP) for 2011-12 and NSSO 2011-12 district-wise consumption expenditure data—32% in Ranchi and 45% in Raipur (Planning Commission, 2013).

Income Effect

Overall, 50% of households in the sample were using LPG as part of their energy mix, and 22.5% of the sample was using LPG as a primary cooking fuel.[15] The remaining 50% of households were not using LPG at all.

Among the LPG-using households, 52% were BPL card holders and the remaining did not hold BPL cards. Among LPG-using and BPL card-holding households, 31% were using LPG as a primary fuel (11% of all surveyed households).

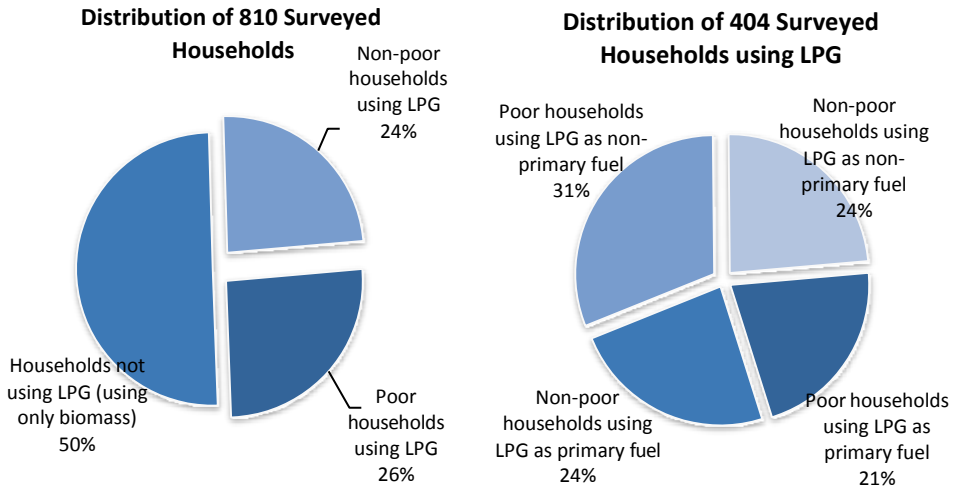


Figure 22. Distribution of surveyed households

Source: IRADe survey data, 2017.

In the absence of district-level data from previous years, it is difficult to compare and conclude to what extent there was a change in the income effect of LPG subsidies by 2017, part of which could reasonably be attributed to PMUY. Nonetheless, assuming that the sample is representative of the total population of both states, this suggests a significant increase in average rates of LPG usage as a primary cooking fuel: an average of

[14] BPL and APL cards derive from India's Public Distribution System (PDS), originally developed to help manage food scarcity and provide food to citizens at affordable prices (MoCAFPD, n.d.). The requirements for BPL status vary between different states, by assessing a variety of parameters that determine whether a household is able to meet its basic food needs.

[15] Calculations on the usage of LPG as a primary fuel are based on the assumption that average monthly consumption of 10 kg of LPG per household qualifies LPG as a primary cooking fuel for the household (Parikh et al., 2016).

22.5% of households in the 2017 survey, in comparison to an average rate of 11.8% across both Chhattisgarh and Jharkhand, as per NSSO data from 2011-12.

Among poor households, around 21% of the LPG-using households were BPL card holders. Although BPL card ownership is an uncertain proxy for poverty, this again compares favourably to NSSO data from 2011-12, when only 4.6% of households in the bottom 40% of rural and urban groups in both states were using LPG as their primary cooking fuel.

Another route of exploring the impact on incomes is by analysing cooking energy per income group. Households use a range of cooking fuels, all totalling up to different levels of cooking energy. This average energy (megajoule) per fuel per month can be calculated for each household by multiplying quantity with the calorific value for each fuel. Figure 23, below, describes the monthly cooking energy for different income groups, disaggregated by fuels. The figure reveals that as income increases, monthly cooking energy use increases. This suggests that despite the presence of PMUY to target connection barriers, the income effect of PAHAL (DBTL) LPG consumption subsidies continues to be limited by affordability constraints. It also reveals that for higher-income groups, where affordability is not a constraint, LPG is still not used for 100% of the cooking fuel mix. This confirms evidence from 2014 that suggests that affordability is not the only limitation for adoption; and that low-cost LPG alone is not sufficient to drive a transition away from harmful forms of biomass combustion. The availability of biomass, along with attitudes toward women's time, labour and other variables, may all be factors that influence rates of LPG usage and ongoing biomass consumption.

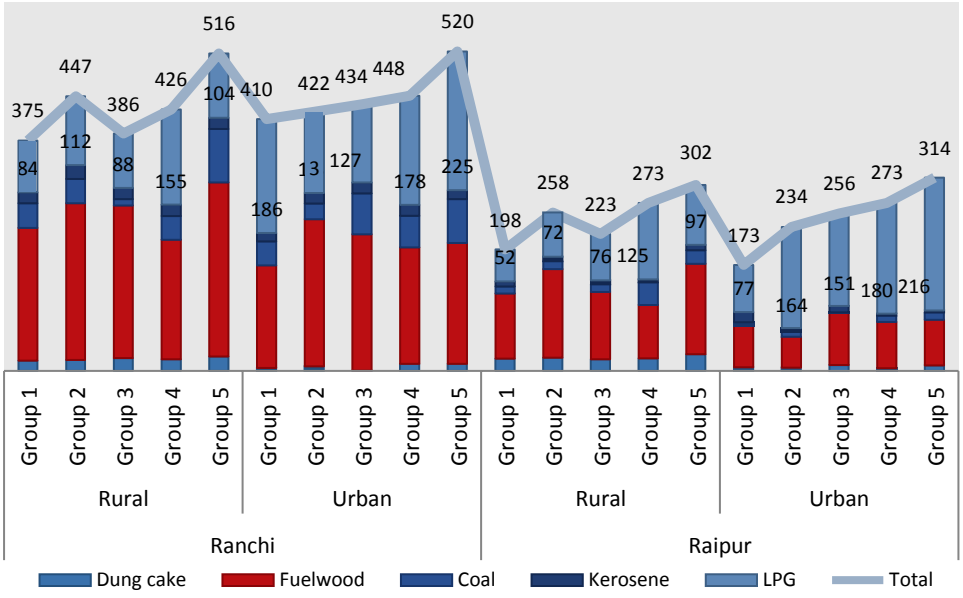


Figure 23. Cooking fuel mix: Average monthly cooking energy consumption (MJ) per household disaggregated by fuels of different income groups in Ranchi and Raipur

Source: IRADe survey data, 2017.

PMUY's impact on the incomes of poorer households may also be affected by its targeting and administrative requirements. The PMUY targets households depending on BPL card ownership, but inclusion and exclusion errors in the existing BPL targeting system are therefore also a concern for PMUY subsidies. Table 15, below, shows the distribution of 126 households enrolled in LPG subsidies through PMUY (126 out of 810, 15% of the

overall sample). Though all these households have BPL cards, only 48% of card holders are from the poorest 40% of households (groups 1 and 2 in Table 15, below), while 36% of card holders are from the richest two groups (group 4 and group 5). This suggests that there is substantial potential for further improving targeting of PMUY to the poorest.

Table 15. Distribution of 126 PMUY beneficiaries across income groups (numbers are count of households)

	Rural		Urban			
Income Groups	Ranchi	Raipur	Ranchi	Raipur	Total	Total %
Group 1	12	10	7	1	30	24%
Group 2	6	16	6	2	30	24%
Group 3	3	11	2	4	20	16%
Group 4	8	18	3	0	29	23%
Group 5	5	7	5	0	17	13%
Total PMUY Households in Sample					126	100%

Source: IRADe survey data, 2017.

While PMUY and PAHAL (DBTL) both have similar administrative requirements, the PMUY is significantly different from PAHAL (DBTL) in requiring all beneficiaries to be female household members. This may have negative and positive impacts for women in low-income households. On the one hand, as noted in the analysis of subsidies in 2014, women may be less likely to possess the documentation required for registration, so designing the PMUY in this way might cut off certain households who would otherwise register through a male household member, with health and time implications for women. On the other hand, this requirement may help drive women's access to financial services and mobile phones, creating important spill-over benefits. Gender inequality linked to financial inclusion has also narrowed dramatically since 2014 as part of larger drives to promote financial inclusion nationally (Ministry of Finance, 2018). The Global Financial Inclusion Index reports that as of 2017, 83% of men and 77% of women over 15 years old in India had a bank account, compared to only 63% and 43% in 2014 (World Bank, 2017). While a gap still exists, it has narrowed significantly in a short time. By emphasising the need for women's agency, the policy may also help contribute towards improved empowerment for women.

Overall, the evidence suggests that a significant increase in LPG usage has taken place since 2014. As the most significant new policy development, it seems reasonable to conclude that the PMUY has played a significant role in creating a large share of these new users. This is consistent with government reports that PMUY has provided over 35 million new connections across the country as of April 2018 (PPAC, 2018). Other factors, however, will also have contributed to the change, and it is difficult to accurately estimate the relative role they may have played. These factors likely include: the ongoing influence of low prices through the PAHAL (DBTL) system, alongside growing incomes; efforts to improve LPG distribution in rural areas (see the sub-section on 'Energy Supply' below for more information); efforts to improve financial inclusion, and thereby ability to register for both PAHAL (DBTL) and PMUY support; and growing household awareness about LPG and its convenience.

In theory, the PMUY policy ought to have improved the targeting of the existing PAHAL (DBTL) subsidies to some extent. This is because the PMUY adds a disproportionate number of low-income households to the overall list of beneficiaries, such that a higher overall share of DBTL (PAHAL) beneficiaries will be low income. This comes at the cost, however, of increasing the total overall number of beneficiaries and thereby the overall total burden of LPG subsidy expenditure. It also assumes that low-income PMUY beneficiaries will consume similar levels of LPG to any new high-income beneficiaries that have been added—but data on fuel consumption suggests that this is not the case. As a result, it is not feasible to determine whether the PMUY has affected the efficiency of the DBTL (PAHAL) system, other than to note it has increased overall costs. It should be noted, however, that a 2018 review of India's energy subsidies found that the cost of PAHAL (DBT) subsidies had grown from INR 3,869 in FY2014 to INR 20,880 in FY2018 (USD 0.6 to 3.2 billion), while expenditure on the PMUY in FY2018 was only INR 2,496 crore (USD 0.4 billion) (Soman et al., 2018). This illustrates the extent to which inefficient expenditure may have an opportunity cost in terms of the income effect that could be clustered on the poorest, as well as the relative emphasis placed on consumption subsidies rather than connection subsidies.

Urban households have higher cooking expenditure than rural households

Energy prices are calculated as INR spent per MJ. At the time of the survey, market price of dung cake was INR 3 per kg, with a calorific value of 1.7 MJ per kg. This created an energy price for dung cake at INR 1.76 per MJ. Similarly, energy prices for other fuels are calculated in Ranchi and Raipur (see Table 16 below). In terms of energy prices, subsidised LPG is more affordable per calorific value than other purchased fuels, as the price per MJ is the lowest, implying less fuel is required to generate the same energy. However, particularly in rural areas, it is challenging for any subsidised fuel to compete with biomass that is considered freely available, because women's time and labour are not attributed financial value. The introduction of the PMUY has not influenced this challenging problem.

The sample data reveals that as incomes increase, households' cooking expenditure as a share of income decreases (see Figure 24, below). In urban Raipur, where LPG adoption increases with income, the lower energy price of LPG contributes to a sharper decline in energy expenditure. Urban households spend a higher share on cooking energy than their rural counterparts because urban households use a higher proportion of purchased fuels, rather than collected or prepared fuels.

Table 16. Fuel wise energy prices in Ranchi and Raipur

Fuel	Market Price (INR per kg)	Calorific Value (MJ per kg)	Energy Price (INR per MJ)
Dungcake	3	1.7	1.76
Fuelwood	Ranchi (6.24); Raipur (8.5)	2.4	Ranchi (2.6) Raipur (3.54)
Subsidised LPG	35	27.3	1.28

Source: IRADe Survey Data, 2017.

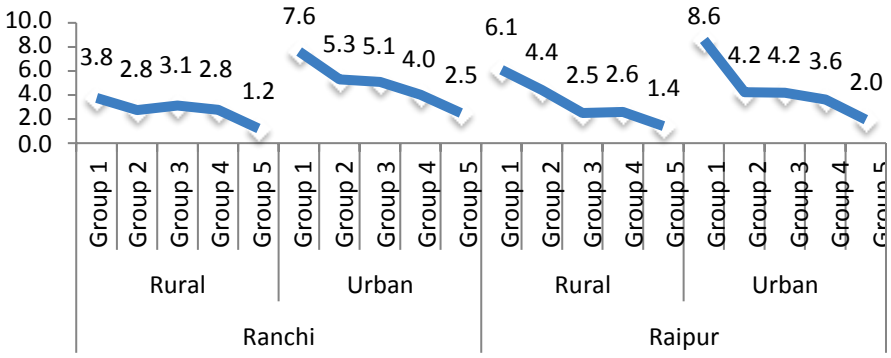


Figure 24. Cooking energy expenditure as a percentage of household income

Source: IRADe Survey Data 2017

In rural areas fuel management responsibility transitions from women to men with LPG adoption

When identifying the impacts of existing LPG subsidies in 2014, no detailed data were available on the gender-disaggregated responsibilities for collecting or purchasing different energy types—only NFHS data on large household purchases. Our survey revealed that women are responsible for collection and preparation of fuels like dung cake and fuelwood; and while women were still predominantly responsible for LPG collection, a larger share of men were involved compared to other fuels (see Figure 25, below). The main exception to this was in rural areas, where LPG collection was predominantly the responsibility of men. This is likely because LPG is not delivered at the house and has to be collected from the LPG distributor. This suggests that as households transition from biomass to LPG for cooking, the role of women in fuel management declines and that of men increases—but that this may reflect existing gender norms about men and women's roles, and not necessarily improved burden of responsibility between men and women.

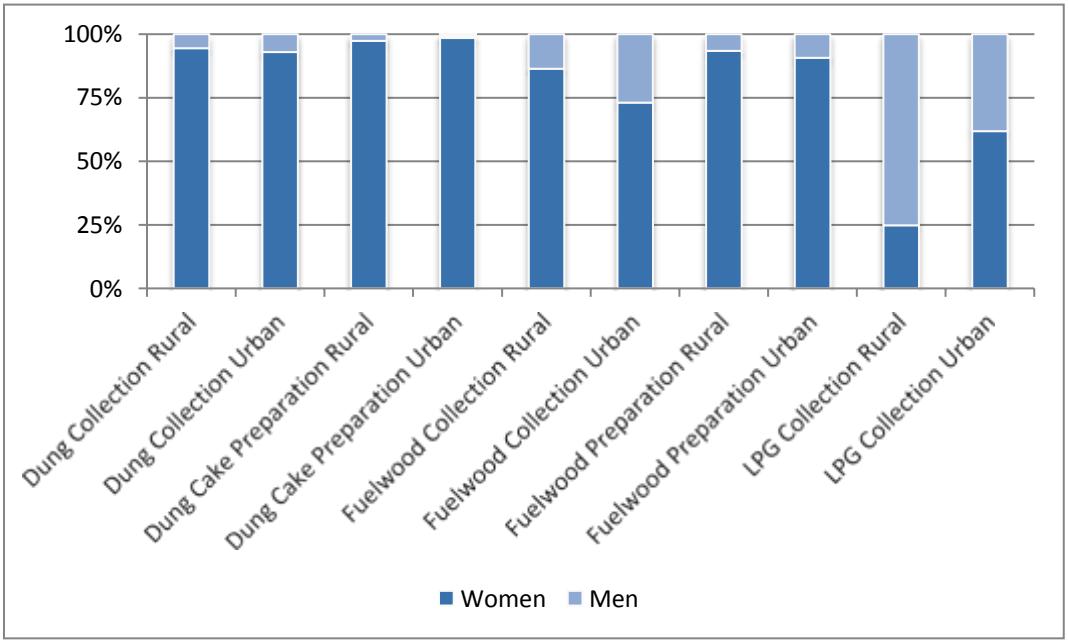


Figure 25. Fuel management: Gender-disaggregated responsibilities in collection and preparation for different fuels

Source: IRADe survey, 2017

Choice of cooking fuel is determined by women

Our survey found that in 74% of households women made decisions on cooking energy sources (see Figure 26 below). This is consistent with the 2015-16 National Family Health Survey that observed that 77.9% of married women in Chhattisgarh reported that major household purchases were made jointly with their husband (Ministry of Health and Family Welfare, 2017). Since the PMUY scheme provides only female beneficiaries with subsidies for an LPG connection, it is reasonable to infer that it has placed more decision-making power in the hands of women.

This survey found that men were found to be decision makers for lighting energy needs in 77% of households, and women decided lighting energy needs in only 12% of the households. It remains unclear if men may be making decisions on lighting because it may involve exchanges with external agencies and stakeholders. This assumption draws from existing studies that women may not be decision makers for energy decisions that invoke social restrictions on leaving their home (Cecelski, 2004; Cooke, Köhlin, & Hyde, 2008).

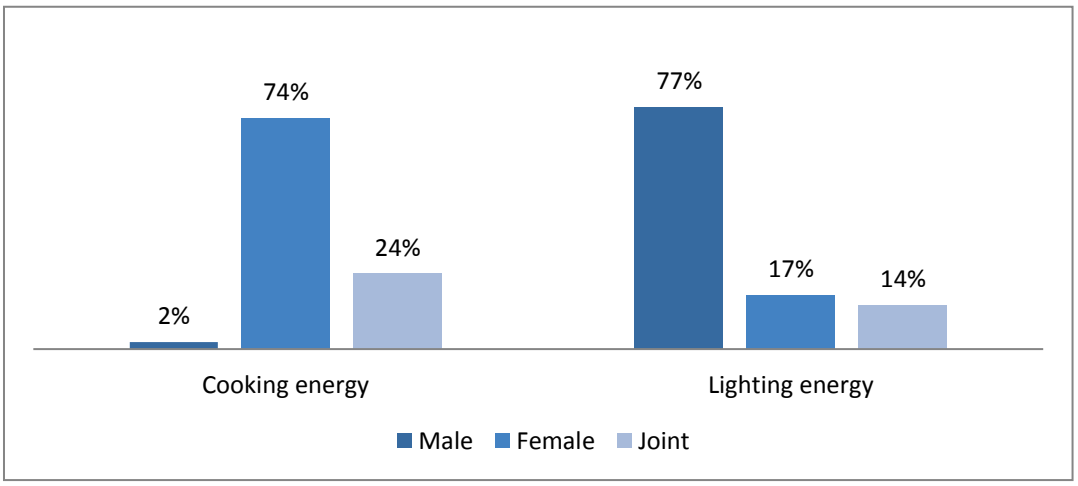


Figure 26. Decision making on cooking and lighting energy

Source: IRADe survey, 2017.

Coping Mechanisms

The survey studied responses of households to a hypothetical price hike of between INR 300-400 per cylinder. This amounts to an increase that is between 40% to 50% higher than the official price of May 2017. It would effectively mean a removal of the current subsidy. This is a relevant benchmark, as it closely matches the situation of households under the PMUY that have chosen to take out a loan (or EMI) to afford initial connection costs. To pay back the loan, these households are subject to deductions on their DBTL consumption subsidy, effectively requiring them to pay market prices.

In our survey, 50% of households did not use LPG for cooking and therefore were not accessing the subsidy. Out of the remaining 50% of our sample using LPG (404 households): 47% of LPG-using households reported that they would absorb higher costs to continue use of LPG, by either reducing expenditure on other goods, or, increasing income; 39% of LPG-using households reported that they would continue using LPG but

cut costs by reducing consumption levels and fuel stacking; and 14% of households reported that they would stop using LPG and switch back to using biomass such as dung cake or fuelwood. The share of households who would reduce LPG use or stop using LPG was larger among PMUY households: 49% and 23%, respectively. This suggests that the PMUY's loan system is counter-productive. By subsidising the costs of connection, it will create access to LPG for the first time. But by requiring households to pay back the costs of a loan through deductions on their PAHAL (DBTL) subsidies, it may significantly influence household decisions to purchase refills, and reduce the likelihood of transition to LPG as a primary cooking fuel.

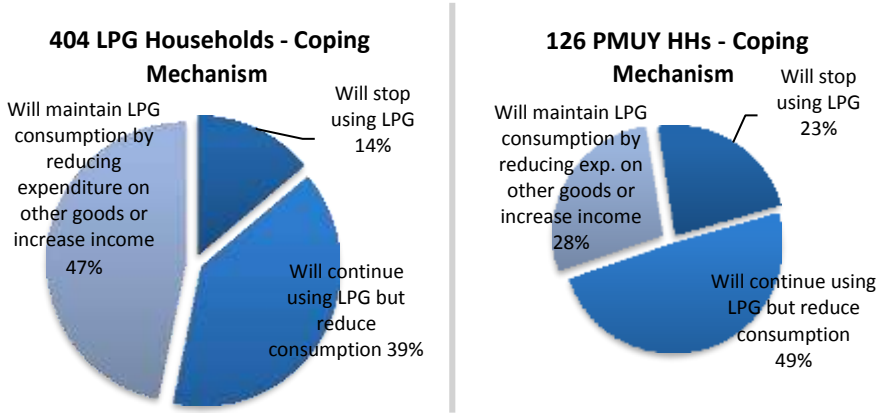


Figure 27. Household response to a price increase in LPG across households using LPG (left) and among PMUY households (right)

Recognising the challenges with the PMUY loan system, in mid-2018, one of India's three major oil marketing companies announced that it would defer loan collections from households for their first six refills (Abdi, 2018). Although this may only postpone these problems with affordability, some analysts argue that the approach is justified because as households become accustomed to the higher convenience of LPG over time they will judge that it is in their interests to maintain consumption (Jain et al., 2018). The interaction between age of connection, income and affordability requires further investigation to conclusively substantiate.

Energy Use Effect

Even as access to LPG by poor households has increased, fuel stacking continues among many households. The survey data reveals that for most households, across income groups and urban and rural areas, a combination of fuelwood and LPG is their largest cooking source. Sample households from Ranchi and Raipur are now using on average 344 MJ per month to meet their cooking needs, 45% of this energy is sourced from fuelwood and 39% from LPG (see Figure 28, below). As noted above, households report that this stacking behaviour is often affected by large price shocks, and many low-income households would shift fuel use in the circumstances of a large price change—or, in the case of the PMUY loan system, large deductions in the value of PAHAL (DBTL) fuel subsidies.

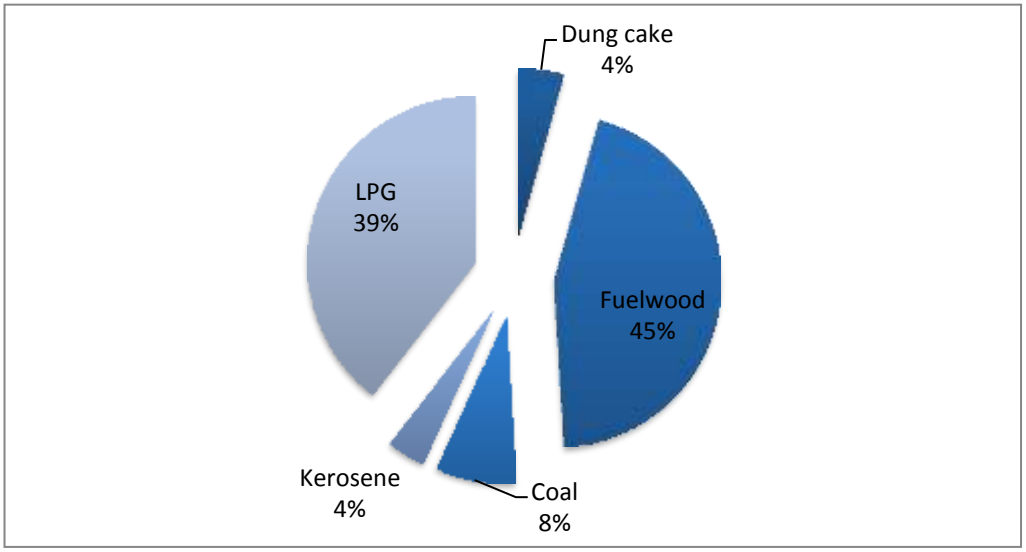


Figure 28. Fuel stacking: Average monthly cooking energy of 344 MJ per household sourced from different fuels for all surveyed households

Source: IRADe survey, 2017.

Focus group discussions with women revealed that they used LPG sparingly, because when the cylinder was exhausted they were either unable to arrange the cost of the refill cylinder or for its delivery. In five group discussions (out of 16), women said the lack of a doorstep delivery meant the man of the household had to be asked to forgo his daily wage and instead make a trip to the LPG distributor to pick a cylinder. This prompted women to use LPG sparingly and supplement it with biomass fuels even though LPG helped them save time and was a cleaner fuel.

Because of the gendered role of fuel collection, preparation, cooking and utensil cleaning, the survey captured that more women spend time on these activities compared to men. Also, women from households using biomass spent more time in these activities when compared to households using LPG.

- **Time spent in fuel collection and preparation:** Women in focus group discussions spoke about the drudgery of collecting and preparing biomass. They spoke about the heavy head loads they have to carry and a lack of storage facilities to keep the biomass dry, especially in monsoons. Women also revealed that it was a gendered role, as only women and young girls often spent time collecting firewood and preparing biomass.

- **Time spent in cooking and utensil cleaning**: 647 households cook two meals a day, while the remaining 163 cook three meals a day. Among households cooking two meals a day, only women cook both meals and the time spent on cooking and cleaning was reported to be lower with LPG than with biomass (see Table 17 below). Women saved on average about one hour per day due to reduced cooking and cleaning times on LPG compared to cooking on biomass.

Table 17. Fuel wise per capita cooking and cleaning time for households cooking two meals (in minutes)

Fuel Used	Morning		Evening	
	Cook	Clean	Cook	Clean
Biomass	77	30	73	28
LPG	49	22	47	23

Source: IRADe survey, 2017.

The survey found that usage of LPG by a household was associated with women having more time to pursue other activities such as leisure, reading the newspaper, watching television and time with children (see Table 18, below). Women in households using LPG reported that they spent 20 minutes more on leisure and 10 minutes more on reading the newspaper or spending time with children, as compared to women from households not using any LPG. While these findings were correlated with LPG usage, they were not necessarily caused by them. This observation could be influenced by several factors, including an association between LPG usage and households having higher household incomes, being in an urban or rural location, or having higher average levels of education.

Table 18. Share of LPG in cooking fuel mix and women's time (in minutes per day)

	Leisure	Reading newspaper /magazine	Watching Television	Time spent with children	Community Participation
No LPG (biomass households)	79	20	74	118	35
LPG Households	98	24	79	134	38

Source: IRADe survey, 2017.

Some women in focus group discussions shared how the acquisition of an LPG connection has empowered them to travel out of their villages for short durations. Because male household members were willing to cook on LPG stoves in the absence of women, but they were not willing to use fire wood or cow dung cakes for cooking as it was more work.

Energy Supply Effect

Along with PMUY, to improve the supply and accessibility of LPG, the oil marketing companies aimed to introduce an LPG distributor in each block[16] by 2019 (PIB, 2015). By 2016-17, more LPG distributors are concentrated in the remote and rural remote areas (see Table 19 below).

[16] A block is an administrative unit and a sub-division of a district.

Table 19. Increase in LPG distributors, 2014 to 2017

LPG Distributors	FY14	FY15	FY16	FY17	H1 FY 2016	H1 FY 2017
Urban Distributor	7,172	7,334	7,492	7,677	7,558	7,739
Rural Distributor	1,885	2,263	2,852	3,152	2,948	3,302
Remote Rural Distributor	4,839	6,333	7,572	7,957	7,708	8,182
Total All India	13,896	1,593 0	1,791 6	1,878 6	18,214	19,223

Source: PPAC, 2018.

Differences in Subsidised and Non-Subsidised LPG Prices

The survey found that India's subsidy systems largely seemed to be functioning as intended. Shortages of LPG cylinders were rare: only 6% of households said they found a shortage of LPG cylinders in the last three months. Most households were also paying the official price for subsidised LPG: between INR 800 to INR 840 per cylinder (14.2 kg), which was the range of the official price at the time of survey in the two districts. Both of these factors suggest that India's subsidy system has succeeded in reducing large-scale diversion of subsidised LPG that is significant enough to cause shortages and drive up prices through black markets ails. This is in stark contrast with subsidised kerosene in Bangladesh, Nigeria and even within India, where leakages, diversion and shortages severely restrict availability and create large time costs and price premiums.

It should be noted, however, that the official price does not include home delivery charges that distributors, particularly rural distributors, may charge. Further, as noted, above, in rural areas it is often not possible to arrange home delivery. In this case, men are largely responsible for collecting LPG cylinders, and households reported that this may require them to forego daily earnings. While this shifts the burden of fuel collection from women to men, freeing up women's time, it creates an added cost for LPG purchase in rural areas that may reduce overall household income benefits and incentives to shift to away from traditional biomass.

4.5. What subsidies and government support do poor women prefer?

LPG remains the desired cooking fuel for most households, as the survey found 86% households desired cooking on LPG to other fuels. The LPG subsidy, particularly the PMUY has created several benefits for women. In focus group discussions (FGDs), women revealed that they preferred using LPG-based cooking because of its welfare benefits related to health and time. 'Smokeless cooking' using LPG did not create eye and lung diseases, unlike with cooking using biomass. Using LPG also reduced drudgery, as it enabled women to use a lower percentage of biomass in the fuel mix, such as cow dung cake. Women in the FGDs explained that they did not prefer to use cow dung cake, because they feared it was not hygienic. The reduced use of biomass also reduced time spent cooking and on cleaning utensils, which typically gather black soot because of biomass-based cooking.

Women using LPG shared that they have to rely on biomass when the LPG cylinder is exhausted. Households with a single LPG cylinder connection have to place an order for

refill, and in many villages in the absence of doorstep delivery women have to wait for the man to go to the LPG distributor to pick the cylinder. This creates a delay of a few days that is filled by using biomass for cooking.

Apart from cooking fuels, women expressed dissatisfaction with the wage gap between men and women while working as agricultural labourers. Women in FGDs explained that their working hours were reduced because of childcare responsibilities that limited the time they spent on agriculture fields, but the slightly reduced hours should not create a significant wage gap. At the time of the focus group discussion, women's daily wage rate was half of the men's wage rate.

5. NIGERIA

5.1. Findings

In 2016, subsidies on kerosene in Nigeria were reformed, and the official pump price of kerosene tripled. Little is known about how this affected women, especially in poor households, who use kerosene for cooking and lighting. This research aims to fill this gap and analyses the impact kerosene subsidies and their reform have on poor women, as well as on gender roles, and how this impacts women's empowerment. It builds on extensive research by Spaces for Change (S4C) based on primary and secondary sources. Two household surveys with 1,000 women and two focus group discussions were conducted in urban slums in Lagos and six rural villages in Imo State with women from low-income households.

Kerosene subsidies were not working well for women. The cost of subsidies was high: USD 3.38 billion were spent on kerosene subsidies between January 2012 and July 2013. But these subsidies were neither efficient not effective in promoting access to kerosene. Households still used a wide variety of energy sources for cooking and lighting, and biomass accounted for 64% of cooking fuels, especially in rural areas. Households reported prices that were between two and six times the official sales price. Fuel distribution was unreliable, and characterised by smuggling, inefficiencies and corruption. During periods of kerosene scarcity, women would often queue for hours. The informal sector played an important role in supplying kerosene to poor households. Closer proximity, sales in smaller quantities and a variety of containers, as well as less queuing seemed to outweigh higher prices at informal vendors.

Subsidy reform needs to be undertaken with care. While the subsidy system did not work well, women were negatively affected when prices went up. Most households would use less kerosene or resort to biomass. While only 18% of households in Lagos reported switching to or using more biomass, over 50% of rural households would employ this strategy, particularly the poorest. Households that were comparatively better off were more likely to spend more or reduce other expenditure. The higher cost of kerosene reduced available household income, especially women's budgets. Kerosene scarcity persisted or was even worsened after reforms, with over 60% of households in Lagos reporting that they experience scarcity often or very often. The pressure on budgets, switching back to biomass, and persistent kerosene scarcity impact women's welfare, productivity and empowerment.

Subsidies are not the only element that leads to fuel switching and better access. Fuel subsidies are not sufficient to promote the use of modern fuels. To promote alternatives to biomass—especially LPG and electricity—several factors are necessary: Reliable distribution systems that are adapted to the needs of poor households, awareness campaigns about the health benefits and safety of LPG, and better regulation. The surveys found a high correlation between the level of education and the preference for modern fuels. The opportunity cost of women's time is higher when a woman is educated. If women's time is not valued, 'free' collected wood will always be the cheaper option.

Better targeting of support to women in low-income households is needed. Untargeted fuel subsidies are an inefficient tool to support poor women. An important share of subsidies will always be captured by households that do not need it. In addition, the

subsidy system in Nigeria was characterised by diversion of funds. To empower poor women, support needs to be targeted to their energy needs, for example through direct cash transfers. The negative experience with inefficiencies in kerosene subsidisation should inform discussions about support for LPG.

Invest in women instead of fuels. The large sums invested in subsidising one fuel could be used more efficiently to support women's economic and social empowerment. Women indicated their preference for support with jobs, health, education and the general cost of living. There is therefore a large potential to improve the effectiveness of social programmes to empower women.

Policy messages/recommendations

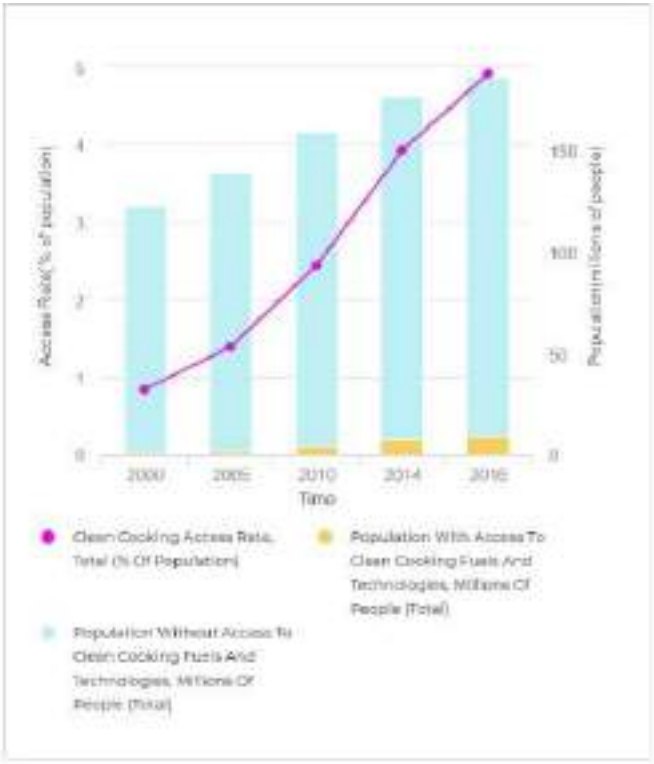
1. **Use a mix of strategies to promote women's energy access**. Reliable distribution systems that are adapted to the needs of poor households, awareness campaigns about the health benefits and safety of LPG, and better regulation are needed.
2. **Better targeting of support to poor women is needed.** Support needs to be targeted, for example, through cash transfers to poor households, but also better distribution and safety.
3. **Invest in women instead of fuels.** Investing directly into women's education, providing business opportunities or financial empowerment through cash transfers can be expected to have better results.

5.2. Nigeria's Energy Sector

Nigeria has a long history of subsidising petroleum products. For household kerosene, the government fixed an official sales price that was below the market price of the product and paid the price difference to marketers. The official price was not uniformly enforced across the country. Partly due to the challenges in the petroleum importation and distribution systems, kerosene shortages were widespread, with episodes of scarcity frequently recorded. At the same time, the cost of these subsidies was high: USD 3.38 billion were spent on kerosene subsidies between January 2012 and July 2013 (PWC 2015). In 2016, subsidies to kerosene were reformed while the official pump price of the product tripled.

Kerosene is a 'poor people's fuel' and is used by many poor households in Nigeria for cooking and lighting. While kerosene is a polluting fuel that can be harmful for health, it often replaces biomass as a cooking fuel, especially in urban areas. Both in urban and rural areas, women are primarily responsible for cooking with kerosene and a host of other cooking fuels. Taking the traditional gendered roles within households into account, the use of energy can have differentiated impacts on men and women. It is therefore important to understand how energy use can influence gender empowerment, as well as the linkages between kerosene subsidies, reform and gender.

Figure 29. Access to clean cooking in Nigeria, 2000-2016.



Source: SDG7, n.d.

This chapter will analyse the impact kerosene subsidies and their reform have on poor women as well as on gender roles, and how this impacts women's empowerment. It will do so by analysing the effects of subsidies on energy use, income and energy supply. It will also explore alternatives to fossil fuel subsidies for energy access, particularly cooking gas and renewable energy, and present the preferences that women stated.

This paper builds on extensive research by Spaces for Change (S4C) based on primary and secondary sources, including two household surveys with 1,000 women, as well as focus group discussions. The surveys were conducted in urban slums in Lagos and six rural villages in Imo State with women from low-income households (cf. section on methodology).

Energy and economic context

Nigeria is Africa's largest oil producer and has the largest economy in Africa. Nevertheless, the riches are unequally distributed, and Nigeria ranks 152 out of 187 in inequality rankings.[17] While Nigeria has experienced fast economic growth, 53% of the population lived on less than USD 1.9 per day in 2009 (World Bank, 2018c). Poverty levels are higher in rural areas, and in particular the northern states (NBS, 2016). While Nigeria is a major exporter of oil, many petroleum products are imported, due to limited refining capacities.

[17] A ranking of the income Gini coefficient that measures the deviation of the distribution of income among individuals or households within a country. For more information, see http://hdr.undp.org/en/content/income-gini-coefficient.

Energy access has been increasing steadily in recent years. Electricity access rose from 48% in 2006 to 59% in 2016 (World Bank, n.d.). Nevertheless, the supply is not stable and power cuts are frequent. Access to clean cooking[18] stood at 5%. While more people have gained access to clean cooking, the massive population growth that Nigeria is experiencing has meant that more people were without access to clean cooking in 2016 (177 million) than had been 16 years before (121 million) (SDG7, n.d.; cf. Figure 29).

Table 20. Access to electricity and clean cooking in %, 2016.

Electricity (2016)	59.3
- Urban	86
- Rural	41.1
Clean cooking	4.9

Source: World Bank, n.d.

Gender and energy

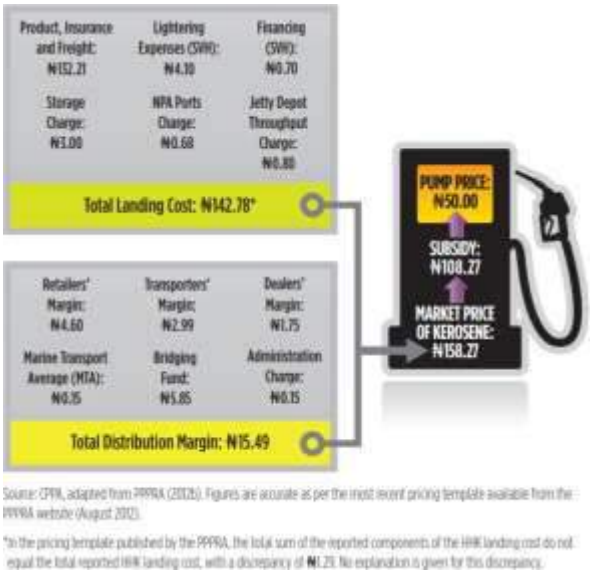
Huge geographical disparities account for wide differentials in human development outcomes for girls and women in the country. In the North-East, poverty levels stood at 72%, compared to 26% in the South-East and a national average of 54%. 71% of young women in the North-West are unable to read or write, compared to 10% in the South-East. Women own 4% of land in the North-East, and just over 10% in the South-East and South-South (British Council, 2012). Some of the reasons responsible for this include early marriage, early childbirth, poor sanitation, and the shortage of female teachers (British Council, 2012). While Nigeria ranks only 122nd on the Global Gender Gap Index (WEF, 2017), it scores relatively high on the criterion on economic opportunity and participation. Energy use is important for women and impacts gender roles, both in terms of alleviating the burden of domestic tasks performed by women, but also in opening up new economic opportunities. In performing their traditional gender roles, women need energy for domestic work such as cooking, heating, laundry, cooling, lighting, storage etc. The 2013 National Energy Policy recognises this and includes as one of its primary objectives to 'promote gender sensitivity and draw special attention to rural needs' (Energy Commission of Nigeria, 2013). It also aims to ensure the availability and effective distribution of kerosene as an alternative to fuelwood in the interim.

[18] Clean cooking is shorthand for access to clean fuels and technologies for cooking, following the World Health Organization guidelines for indoor air quality (WORLD BANK, 2018B).

5.3. Do existing kerosene subsidies work for poor women?

Until 2016, household kerosene was subsidised through a reimbursement mechanism that targeted marketers. A subsidiary of the Nigerian National Petroleum Corporation (NNPC) imported and distributed kerosene, while most independent marketers would receive kerosene from their depots. The government paid the price differential between the market price and the government-regulated price (see Figure 30; for a detailed description of the subsidy mechanism, cf. Aramide et al., 2012, Appendix A). Large sums were spent on these subsidies: USD 3.38 billion was spent on kerosene subsidies between January 2012 and July 2013 (PWC 2015).

Figure 30. Subsidy mechanism for kerosene.



Source: CPPA, adapted from PPPRA (2012b). Figures are accurate as per the most recent pricing template available from the PPPRA website (August 2012).

*In the pricing template published by the PPPRA, the total sum of the reported components of the HHK landing cost do not equal the total reported HHK landing cost, with a discrepancy of ₦1.29. No explanation is given for this discrepancy.

Source: Aramide et al., 2012

The following section will assess how these subsidies affected the uptake of kerosene (energy use), the impact on women's household budgets (income) and on the availability of kerosene (energy supply).

Energy Use Effect

Even though kerosene was subsidised, households in Nigeria used a wide range of fuels for their energy needs. For cooking, wood dominated the energy mix (64%), especially in rural areas. The large difference between urban and rural areas may be due to the limited availability of collected firewood in urban areas, and the fact that women are more frequently engaged in income-generating activities and are less available for time-consuming tasks like fuelwood collection. Most of the collected wood is collected 'for free' from both farmed and unfarmed community areas and woodlots owned by the household (NBS, 2013). The use of fuelwood for cooking is particularly high in the northern states, which are characterised by higher levels of poverty and unemployment and lower levels of employment (Naibbi & Healey, 2014).

Kerosene made up 26% of the energy mix and was the main fuel in urban areas (cf. Table 15; similar figures in NBS, 2012). The use of LPG is low in the country, with the majority of LPG users located in Lagos and Ogun in the South West region. (Accenture, 2011).

Table 22. Cooking fuels used by households in Nigeria

Cooking Fuel	Urban (%)	Rural (%)	Total (%)
Electricity	0.7	0.2	0.4
LPG/natural gas/biogas	4.6	0.5	2.3
Kerosene	47.6	8.7	25.5
Coal/lignite	0.7	0.0	0.3
Charcoal	5.3	1.6	3.2
Wood	37.9	89.3	63.7
Agricultural crops/grass	0.2	3.1	1.8
Animal dung	0.0	0.1	0.1
No food cooked in household	2.9	2.4	2.6
Total	100	100	100

Source: NPC, 2014, p. 14.

For lighting, the picture is even more diverse (see Table 22). There is a large difference between urban and rural areas. More than 70% of urban dwellers use electricity, followed by kerosene. In rural areas, where electricity access is lower, only 25% of households use electricity, while 21% used kerosene. The surveys confirmed this diversity, with the large majority of households using several energy sources for lighting.

Table 22. Lighting fuels used by households in Nigeria

Regions	Collected Firewood	Purchased Firewood	Grass	Kerosene	Electricity PHCN	Gas	Generator	Battery/ Dry Cells	Candles	Other
Urban	1.2 (2.6)	1.2 (1.5)	0.1 (0.4)	9.7 (32.8)	72.9 (57.2)	n.a. (0.2)	4.9 n.a.	9.1 (3.6)	0.5 (0.4)	0.2 (1.2)
Rural	6.2 (9.5)	1.4 (3.6)	0.1 (0.7)	21.2 (41.3)	25.6 (20.0)	n.a. (0.1)	4.5 n.a.	38.5 (19.6)	0.7 (0.9)	1.6 (4.2)
NGA	4.1 (6.8)	1.3 (2.8)	0.1 (0.6)	16.6 (38.0)	44.8 (34.7)	n.a. 0.1)	4.7 n.a.	26.6 (13.3)	0.6 (0.7)	1.1 (3.0)

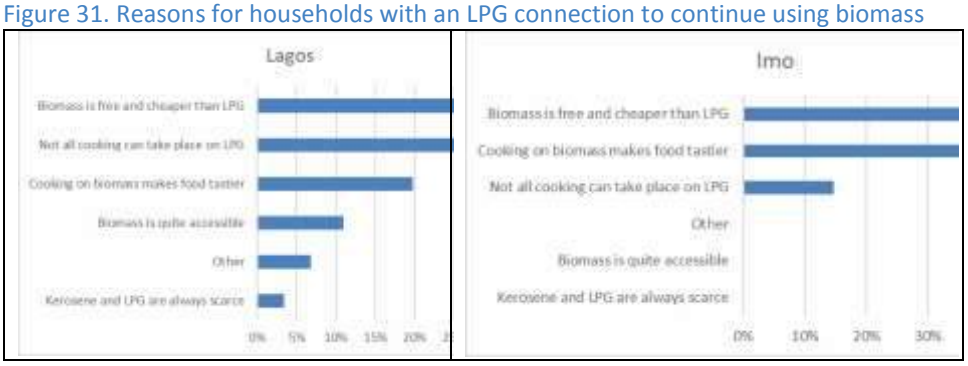
Note: Numbers in brackets from 2010/2011. Numbers not in brackets from 2015. Power Holding Company Nigeria (PHCN) 2016 only. Sources: NBS, 2016, p.40 and NBS, 2013, p.38.

The household surveys also point to the fact that almost every household in Imo State uses some quantity of kerosene. The focus groups pointed to the use of kerosene as a back-up fuel for lighting. For cooking, almost all participants in focus groups said they would completely abandon a fuel source for cooking when they switch to another type of fuel. Nevertheless, at least the use of firewood as a back-up fuel in case of emergency or scarcity of other fuels was reported.

While households continue to use a wide range of fuels including biomass, the surveys found an almost uniform preference for electricity for lighting and a strong preference for liquid cooking fuels, especially in urban areas. In Lagos, households identified kerosene (66%) and LPG (27%) as the preferred fuels for cooking. This confirms the perception of liquid fuels as 'aspirational' fuels in urban areas. In rural areas, households preferred wood stoves (44.6%), followed by kerosene (30%) and LPG (24%). The preference for modern fuels such as LPG was also found to increase considerably with level of education.

The reasons for using different cooking fuels were explored in focus group discussions and surveys. Affordability was cited as the key issue for the type of fuel used, referring both to the cost of the fuel and cooker compared to available income. Availability was another key concern, with kerosene supply particularly affected by scarcity. The assumed properties of fuels, e.g. firewood burning faster, and the taste of meals cooked with wood were also cited. Safety concerns about explosions and fires seem to hinder the uptake of LPG. Respondents perceived charcoal as fast to use, causing less soot and a useful fuel for small-scale cooking businesses. The household surveys also asked why households with an LPG connection kept using biomass (see Figure 31). Most households cited the fact that biomass was cheaper, cooking needs that cannot be met with LPG, and the taste of food cooked with biomass.

Figure 31. Reasons for households with an LPG connection to continue using biomass

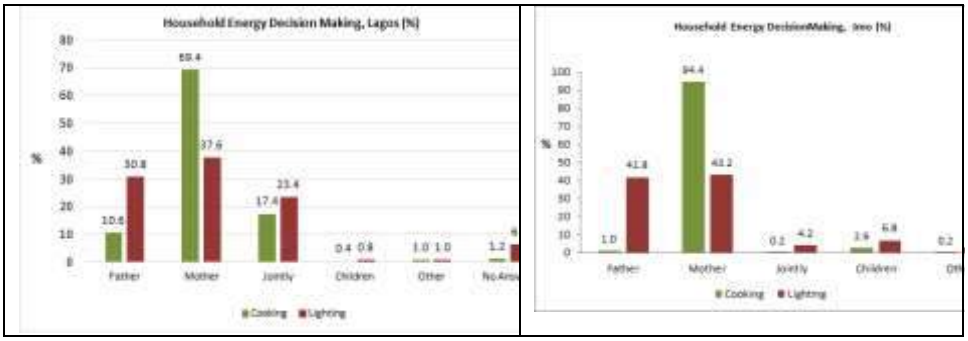


Source: Household surveys.

This partly confirms findings on household fuel choices in the literature. Udoffia (2015) finds that income is the major determinant for the choice of fuel type which determines the spending pattern on the selected fuel type, followed by availability of the fuel.

A large majority of the women surveyed reported being in charge of making decisions about which household energy source to use. In the Lagos and Imo surveys, 69% and 94% of the women who participated reported to be in charge of decision-making on cooking fuels. Also, for lighting, the survey found that women decided on which energy source to use in slightly more households than men (see Figure 32).

Figure 32. Decision making about cooking and lighting fuels by gender

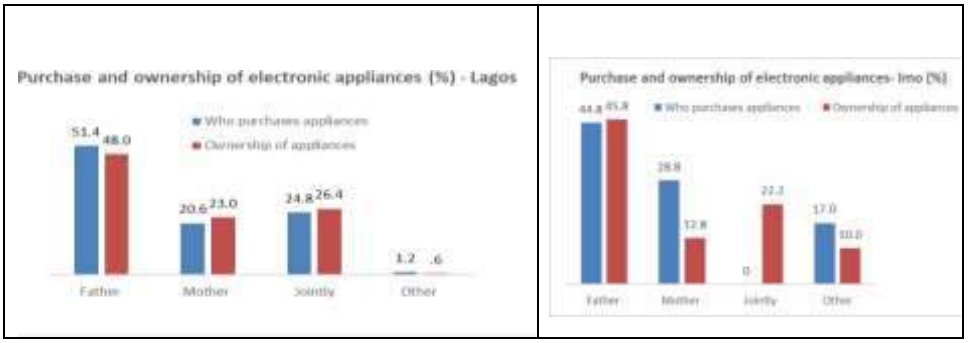


Source: Household surveys.

There seems to be a marked difference though, regarding the purchase and ownership of electronic appliances (see Figure 33). About half of households indicated that men

purchase and own electronic appliances, while only one fifth are owned and purchased by women. This means that men have an important role in choosing appliances that might have gendered implications for energy use. Focus group discussions found different decision-making patterns about changes in cooking and lighting fuels: In Lagos, respondents indicated that the decision to change the cooking and lighting fuel was mostly made by women, whereas women in Imo stated that it was primarily made by men.

Figure 33. Purchase and ownership of electronic appliances by gender. Source: household surveys



Key points

- Even though kerosene was subsidised, households used a wide variety of energy sources for their cooking and lighting needs. Biomass still accounted for 64% of cooking fuels, especially in rural areas.
- Households in urban areas expressed a preference for liquid fuels for cooking, with a range of factors hindering their uptake, among them affordability, safety concerns and availability.
- The vast majority of respondents would like to use electricity for lighting.
- While women claim to be in charge of decisions about cooking fuels, and in many households also about lighting fuels, men have an important role in deciding about purchases of electronic devices, as well as changes in energy sources.

Income Effect

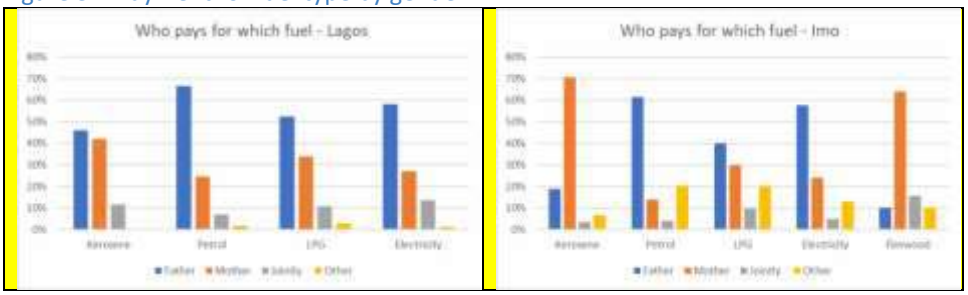
To understand the impacts of kerosene subsidies on income, it is important to understand the limitations of the previous system. The subsidy system in Nigeria did not ensure uniform low prices across the country. While there was an official government-approved price for kerosene of 50 Naira per litre until January 2016, average prices paid by consumers were significantly higher. There was no uniform distribution across the country. As a result, diversion to the black market and middlemen drove average retail prices up to 300% above the official retail price (Aramide et al., 2012). The household surveys conducted in 2017 investigated which prices households were paying before and after the price increases in 2016. Both in Lagos and in Imo area, none of the households reported paying the official sales price of 50 Naira per litre in 2015. In Lagos, households reported paying on average 287 Naira in 2015, almost six times the official price. In Imo, households reported paying 125 Naira per litre of kerosene, more than double the official sales price. Prices were found to be lower in the rural sampling areas in Imo than in the urban slums in Lagos. This is surprising given the constraints in the kerosene distribution chain and the difficulty of getting kerosene supply to rural communities (cf. Ehinomen & Adeleke, 2012).

The kerosene subsidy scheme was also inefficient in reaching the poor, even though kerosene is a 'poor people's fuel'. The subsidy was not targeted to poor households, or women, but to anyone who buys the fuel. Based on statistical consumption data, Soile & Mu (2015) found that the richest quintile receives a larger share (17.1%) of subsidies than the lowest quintile (14.7%).

The surveys also inquired whether women knew about the subsidy scheme. The awareness of government fuel subsidies in the sampling areas was limited. Two thirds of survey respondents claimed to have heard about fuel subsidies. Nevertheless, when asked to explain what a subsidy is, over 90% of respondents did not know what subsidy actually means, i.e., provided no answer or a wrong answer.

The survey found a gendered difference as to who pays for which fuel.[19] In both areas, mostly men pay for petrol, LPG and electricity (see Figure 34). Kerosene seems to be more the responsibility of women. In Lagos both men and women pay for it, whereas in Imo women pay for it in 71% of all cases. In rural areas, women are also clearly in charge of payments for firewood.

Figure 34. Payment for fuel type by gender



Price changes for kerosene can therefore be expected to affect women's income more than for other fuels. The Nigeria Demographic Health Survey in 2013 (NPC, 2014, p. 281) found that in 69.7% of urban households and 70.4% of rural households, decisions on household expenditure are mainly made by women. Most women surveyed in Lagos (71%) and Imo (78%) stated that they mostly decide how to spend their income. This is especially important, as energy expenditure already makes up a large share of household budgets in low-income households. Soile & Mu (2015) calculated household energy expenditures in Nigeria based on statistical consumption data and the official sales prices of fuels and found that the poorest quintile spends 8.7% of their budget on kerosene, compared to 2.9% for the richest quintile. Nevertheless, as the authors themselves point out, this might still underestimate the magnitude of energy expenditure, especially of poor households in remote areas, as most households paid much higher prices for kerosene than the official sales price which points to the challenges in the official distribution system and the relevance of the black market.

Key points

[19] The analysis for this paragraph is based on a smaller sample of survey questionnaires (250 each for Lagos and Imo).

- Even though kerosene was subsidised and an official price was fixed, none of the households surveyed reported paying the official sales price, but rather prices that were between two and six times the official sales price.
- Kerosene and firewood are the fuels paid for more by women, while men pay mostly for petrol, LPG and electricity. Higher prices for kerosene might therefore impact women's budgets and incomes more.

Energy Supply

As outlined above, prices paid by consumers were much higher than the official sales prices. Fuel distribution suffered from smuggling, inefficiencies in the system and corruption (Ehinomen & Adeleke, 2012; Naibbi & Healey, 2014; PWC 2015). High subsidies for kerosene also contributed to the problem and increased scarcity (Lawal, 2011). Kerosene scarcity was frequent, which resulted in long queues at filling stations. Distribution of petroleum products was very unequal across the six regions (NNPC, 2014). In rural areas, distribution points are further away from homes. In the surveys, households in rural areas were found to spend more time to reach sales points for kerosene or LPG. In Lagos, 62% live within 10 minutes' walk to a formal vendor, and 81% within 10 minutes' walk to an informal dealer. In rural areas, only 10% of households live within 10 minutes' walk from a formal dealer, and 18.5% from an informal dealer. More than a third of households in rural areas have to walk more than 30 minutes to a formal dealer (36%), or to an informal dealer (40%).

The informal sector plays an important role in kerosene distribution in Nigeria. The surveys found a preference of households for informal vendors. In Lagos, 57% of survey respondents indicated a preference for informal sellers, even though households reported paying higher prices there. Households named closer proximity, sales in smaller quantities and a variety of containers, as well as less queuing as reasons to prefer informal vendors to the formal filling stations. The survey also found that shortages were experienced more frequently with formal dealers.

During periods of scarcity, women mostly queue at the filling stations to buy cooking fuel (S4C, 2015). Women that participated in a focus group discussion in Imo reported that during periods of scarcity, they queue as much as two to four hours and sometimes all day. Reliance on the informal sector can also be seen as a coping strategy, with the possibility of buying in small quantities, with less queuing, and less kerosene scarcity. Nevertheless, this also comes with risks. Products sold on the informal market are poorly regulated and the risk of adulteration is high. Marketers may adulterate kerosene products to increase profits, which results in explosions and domestic accidents.

Key points

- The fuel distribution system was unable to ensure uniform prices, distribution across the country and reliable supply of fuel, and was characterised by smuggling, inefficiencies and corruption.
- During periods of scarcity, women queue for hours for kerosene.
- The informal sector played an important role in supplying kerosene to poor households.
- Relying on the informal sector can be seen as a coping strategy. Closer proximity, sales in smaller quantities and a variety of containers, as well as

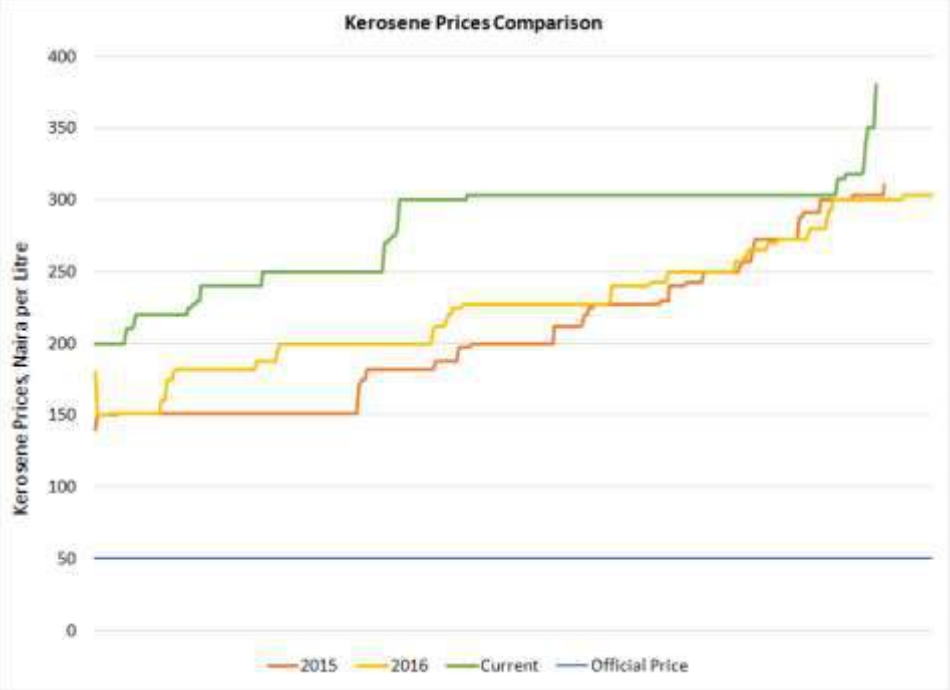
less queuing seemed to outweigh the higher prices at informal vendors compared to official sales points.

5.4. How did the reform of kerosene subsidies impact poor women?

Faced with volatile oil prices in the international market, the Government of Nigeria started to reform oil prices in 2012. In January 2016, Nigeria's petroleum pricing body revised the pricing templates for kerosene and increased the official price from 50 Naira to 83 Naira.[20] In August, NPPC depots confirmed that the price of kerosene at official NNPC deports and stations had been increased to 150 Naira per litre (Eboh, 2016). This means that the official price was tripled. At the same time, the mechanism for subsidy payments was changed and the government stopped the payments to oil marketers.

Nigeria experienced a foreign exchange scarcity during this period that also affected imports by independent companies. As the difficulty marketers faced in accessing foreign exchange worsened, the government-owned NNPC's subsidiary, the Pipelines and Products Marketing Company (PPMC), took over and monopolised fuel and kerosene imports and distribution (Ohaeri & Adeyinka). As the major importer of petroleum products, the government now incurs what it refers to as 'under-recoveries' when importing kerosene at prices that are too high to maintain the official sales price (Adetayo & Asu, 2018). Consequently, even after the changes in kerosene subsidy policy, kerosene subsidies still exist, while kerosene supply challenges remain.

Figure 35. Comparison of kerosene prices reported by households and official kerosene sales price



Source: Household surveys.

[20] PPPRA Press Statement, signed by Farouk Ahmed, Executive Secretary on 29th December 2015.

After the reforms, prices soared across major cities in Nigeria (Ohaeri & Adeyinka, 2016). Figure 35 visualises the comparison between prices reported by households (see Table 23) before and after the reform and the official sales prices of 50 Naira (until early 2016) and 150 Naira (from mid-2016). The table shows that kerosene prices that were reported rose by 52% in Lagos and even 145% in Imo State, even though already before the reforms households were paying several times more than the official sales price. As of May 2017, Nigeria's National Bureau of Statistics reports that the current average prices for kerosene is N312 per litre in Lagos and N320 in Imo State (NBS, 2017). This shows important product price differentials between states linked to distribution and logistical issues.

Table 23. Average kerosene prices reported in household surveys. Source: household surveys

	Price of kerosene in Naira per litre	
	Lagos	Imo
2015	287	125
2016	356	230
2017	435	307

Energy Use

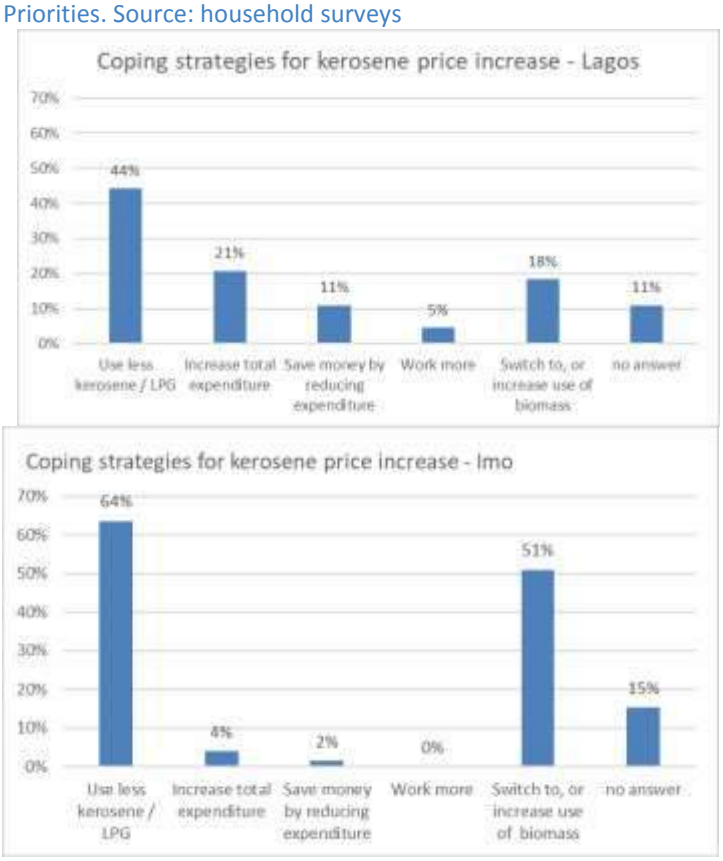
Faced with the increase in the price of kerosene, households adopted a variety of strategies (Figure 30). The household surveys showed a marked difference between urban and rural areas, and income groups. In Lagos, most households reduced their kerosene consumption or increased their total expenditure, but 18% also mentioned that they would switch to or use more biomass.

In rural areas, households seem to not be able or willing to increase their financial expenditure on fuel. They would reduce their kerosene consumption, or switch to other fuels, most likely firewood. These findings are in line with findings in the literature. Akujobi (2015) found that after the removal of kerosene subsidy and subsequent increase in price, the number of households using firewood in Owerri (Imo State) increased by 5.6% and in Ibadan (Oyo State) by 6.3%.

Income seems to have a large influence on strategies for coping with price increases in urban areas; this effect was not observed in rural areas. Over 85% of respondents in Lagos who earn below 10,000 Naira (28 USD)[21] monthly will use less cooking fuel and reduce their expenditure on other things if the prices of fuel increase. Just over 60% of respondents who earn above 45,000 Naira (125 USD) monthly use less cooking fuel and reduce their expenditure on other things if the prices of fuel increase, while none of the respondents who earn above 80,000 Naira (222 USD) monthly reduce other household expenditure if the prices of fuel increase.

[21] Conversion rate used for data collected in the survey results: 360 Naira to 1 USD; http://thenationonlineng.net/banks-to-adopt-n360-rate-for-2018-results/

Figure 36. Coping strategies for kerosene price increases reported by households Priorities. Source: household surveys



Key points

- When faced with price increases for kerosene of between 52% (Lagos) and 145% (Imo State), households adopted a variety of coping strategies.
- While only 18% of households in Lagos would switch to or use more biomass, over 50% of rural households would employ this strategy.
- Income also has a large influence on coping strategies and energy use. Households that were comparatively better off were more likely to spend more or reduce other expenditure.

Income

Even though households reported paying considerably more than the official sales price even before 2016, prices rose dramatically starting in 2016. This was due to both reforms and supply challenges. Even though the surveys did not collect data on household income and expenditure before and after reforms, the following can be deduced. Given the responsibility of women for both household energy expenditure in general, and kerosene in particular (Figure 34), it can be expected that an increase in spending on kerosene will have a significant impact on women's disposable income.

The financial impact is likely larger for women in urban areas, where it is not possible to resort to 'free' collected firewood. A significant number of respondents in Lagos reported that they would use less kerosene, increase their total expenditure or save on other items. In rural areas, where biomass is more available, many households reported to use less kerosene, and to increase the use of biomass. While this does not imply a financial cost

to women, it has a large opportunity cost given the time spent on firewood collection. An interesting finding that was reported from a focus group discussion in Imo stated that during a fuel price increases, women will support men financially to pay for fuel.

Key points

- High prices associated with reforms place high demands on household income, especially women's income.
- In Lagos, women cope with price increases mostly by saving fuel, or shifting expenditures within their budgets. In rural areas, women seem to have less access to financial strategies and resort more to less clean fuels, especially firewood.

Energy Supply Effect

The reforms did not improve the supply of kerosene, as shortages persist. The Nigerian National Petroleum Corporation (NNPC) is currently the major importer of petroleum products. In its January 2018 monthly operations report, NNPC showed that the total imports of petroleum products increased (NNPC, 2018, p. 20). Marginal increases in product supplied remains insufficient to meet the energy needs of the ever-growing population. Declining local refining capacities further compound efforts to achieve product supply sufficiency, especially for kerosene (NNPC, 2018, p. 20). The petroleum products (gasoline and dual purpose kerosene) production by the domestic refineries in January 2018 amounted to 111.88 million litres compared to 232.56million litres in December 2017. A combination of these factors contributed to product scarcity. Profiteering by cartels has been observed as a result of this kerosene scarcity (Bayagbon, 2018).

Respondents in household surveys conducted in 2017 reported that they experience scarcity of fuels, especially the scarcity of kerosene and petrol. Over 60% of respondents in Lagos who use kerosene and petrol say they experience scarcity often or very often. This seems to be less the case in Imo State.

Key points

- Kerosene scarcity persisted or was even worsened after reforms, with over 60% of households in Lagos reporting that they experience scarcity often or very often.

The previous subsidy system in Nigeria was not effective in ensuring uniform prices, did not lead to a transition to liquid cooking fuels in rural areas, and might even have contributed to fuel scarcity. Nevertheless, the survey results indicate that the price hike for kerosene has pushed a significant share of the poorest women to reduce their kerosene consumption or spend more on it, or to resort to biomass for cooking. This section will analyse how the observed changes in energy use, income and energy supply resulting from reforms might have impacted the welfare, productivity and empowerment of women.

Welfare

18% of households in Lagos and 51% of households in Imo State stated that they would use more biomass to cope with price increases. The use of biomass has negative impacts on women's health. Merem et al. (2018; cf. Ozoh et al., 2018) cite fire hazards from kerosene explosions, destruction of properties, burns, compromised vision, indoor air pollution, asthma that affects particularly women and children. It is estimated that

household air pollution causes more than 64,600 deaths in Nigeria (GACC, n.d.). Air pollution is aggravated if cooking takes place inside with insufficient ventilation. The survey indicated that in Lagos most of the cooking takes place indoors (69.6%) and some outside the house (28.4%). In rural areas, 46% of households cook outside, while 22% cook inside the house and 31% in a separate building. The use of firewood also results in considerable hardship to collect or buy it. In Nigeria, women were found to walk more than 4 km to collect firewood in an open access area because of their restricted access to the trees on communal land or family land. The unauthorised collection of wood might lead to demands for bribes, verbal or sexual abuse, rape, even death by forest guards or other forest owners (Wan, Colfer, & Powell, 2011).

At the same time, the use of kerosene, often adulterated by informal marketers driven by profiteering, has also led to considerable hazards, including in the form of fatalities through household explosions as well as health and environmental risks (Merem et al., 2018; Lawal, 2011). Three multi-year reviews of admissions to Nigerian hospitals attributed about 30% of all burn cases to kerosene (Mills, 2012). Women also make up the majority of affected casualties of domestic accidents caused by adulterated kerosene explosions.[22] According to the survey, kerosene is used as a lighting fuel in bedrooms, living rooms and kitchens. This can affect the whole family, but especially family members like women and children, who spend more time at home.

To positively influence the health of women, it is therefore necessary to not only reduce the use of biomass, but also fight the use of especially adulterated kerosene, and promote the use of LPG and electricity for cooking. LPG uptake would require well-regulated distribution networks and safety awareness campaigns.

Productivity

Energy is essential for women's productivity, both as an input into economic activities, and in terms of saving time that can be used for other economic activities. Most low-income women in Lagos and Imo are self-employed and are involved in catering, hairdressing, tailoring, beadmaking, fashion designing and sales of Ankara accessories. All these business activities are heavily dependent on energy supply. Kerosene is, for example, used for lighting businesses at night, and higher prices can increase the operating costs of these businesses. Nevertheless, this only holds if electricity is not available. Electricity not only provides a better service in terms of lighting output, it also provides interesting economic opportunities. There is therefore an important case for redirecting kerosene subsidies towards access to on- or off-grid electricity (Gill, Shardul, Sharma, & Bridle, 2018).

The use of firewood for cooking is extremely time-consuming, especially if it has to be collected and is not available in close proximity. The survey found that women are in charge of cooking in 85% of households in Lagos, and 88% of households in Imo. This means that women bear the burden of both acquiring the fuel and cooking itself. In rural areas, a third of respondents need over 30 minutes to collect the firewood, while a third of respondents says that it takes less than 10 minutes. Firewood collection happens

[22] Mills, E (2014) found that in individual events of kerosene disasters that occurred in Lagos in 2001, the female-to-male ratio of the number of people killed/injured was 59:35, and 2500:358 in Edo State as of 2004 respectively.

several times per month, with 75% of respondents collecting it more than three times per month. This confirms findings in the literature. One study found that women spent about 1.7 hours per day gathering firewood for cooking (Lambe, Jürisoo, Wanjiru, & Senyagwa, 2015). Another study found that farmers spent 17 hours over the course of a week, walking 11 kilometres (Madukwe, 2014). A study of 300 female farmers in Gombe State of Nigeria found that the gender roles for energy management and particularly wood collection profoundly impacted the time available for both productive and reproductive tasks (Yahaya, Nabinta, & Olajide, 2007).

In both Lagos and Imo, most women in focus group discussions stated that switching to a preferred cooking fuel would enable them to save time spent on cooking. The surveys found in Lagos that electrical and LPG stoves were faster to prepare, while in Imo biomass stoves were identified as the fastest to prepare. An important issue to take into account though, is that women were also found to spend a considerable amount of time queuing for kerosene during periods of scarcity. To improve the productivity of women, it is necessary to continue efforts to reduce the use of biomass, but also to introduce the availability and uptake of modern fuels, especially electricity and LPG. Efficient distribution systems are essential for this.

Empowerment

It is difficult to establish whether or how the change in the subsidy regime has impacted the empowerment of women. The subsidy did not target women specifically, for example through cash transfers. Nevertheless, the fact that women's incomes might be more affected by higher kerosene prices than men's could translate into negative impacts on empowerment. Having more time might benefit women's economic empowerment, but this depends very much on the context. Most women in a focus group discussion in Lagos said they would spend the extra time (from fuel switching) on their place of work or business, while women in Imo stated that they would use this time to do more cooking or spend more time with their family and children.

Education also seems to have an important role in the preference for modern fuels. Overall, it seems that fuel subsidies are an extremely inefficient tool to support the empowerment of poor women. Investing directly into women's education, providing business opportunities or financial empowerment through cash transfers can be expected to have better results.

Key points

- Women's welfare is impacted by reforms if users switch back to biomass use.
- To positively influence the welfare of women, it is necessary to not only reduce the use of biomass, but also fight the use of especially adulterated kerosene, and promote the use of LPG and electricity for cooking.
- For women who switched back to biomass, the reforms might have impacted their economic opportunities.
- To improve the productivity of women, it is necessary to continue efforts to reduce the use of biomass, and to increase the availability and uptake of modern fuels, especially electricity and LPG and increase the safety of using these fuels.
- Women's incomes might be more affected by higher kerosene prices than men's, which could translate into negative impacts on empowerment. Nevertheless, fuel subsidies in Nigeria seem to be an extremely inefficient tool to support the empowerment of poor women.

- Investing directly into women's education, providing business opportunities or financial empowerment through cash transfers can be expected to have better results.

5.5. What subsidies and government support do poor women prefer?

Fuel subsidies are not the only way to support the affordability of modern energy. Affordability depends both on the income available and the relative price of fuels or electricity and equipment. This means that affordability can also be influenced by an increase in the amount of income available, for example through social protection programs or cash transfers. In addition, other fuels or technologies might be able to provide similar or even better energy services. The surveys therefore explored women's preferences and possible alternatives to fuel subsidies.

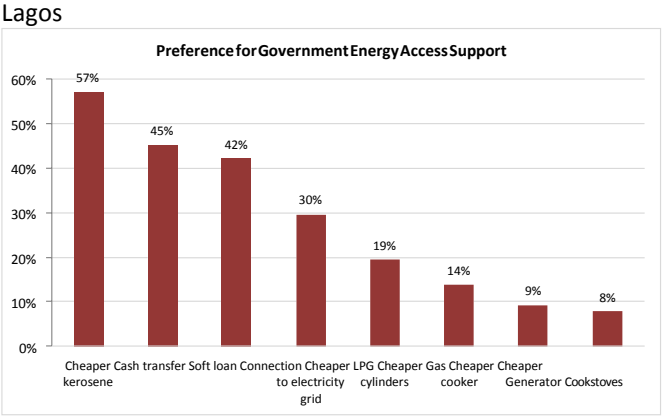
The research aimed to explore how alternative policy reforms might support the empowerment and welfare of women in poor income households. The research team in Nigeria broadened the initial research question to go beyond LPG and renewable energy and included support through social programmes.

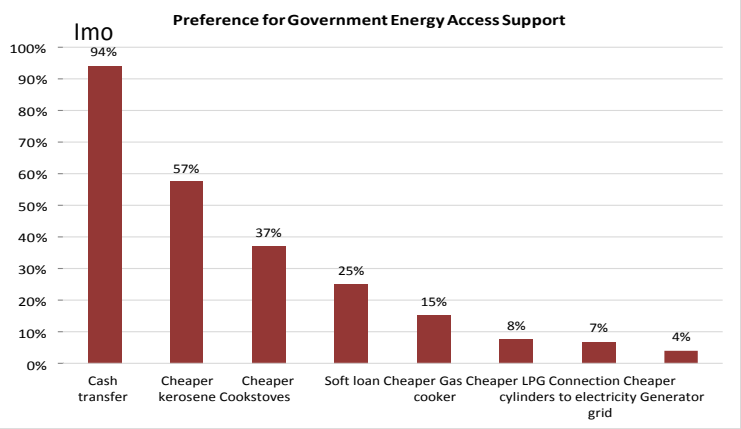
Support for Energy Access

When asked for their top three preferences for government support for energy access, in Lagos 57% of households picked cheaper kerosene, 45% cash transfers and 42% soft loans. In Imo, 94% of respondents would prefer cash transfers, with 57% opting for cheaper kerosene and 37% cheaper cookstoves (Figure 37).

Figure 37. Preference for government support for energy access

Lagos





Source: Household surveys.

LPG and renewable energy as alternatives

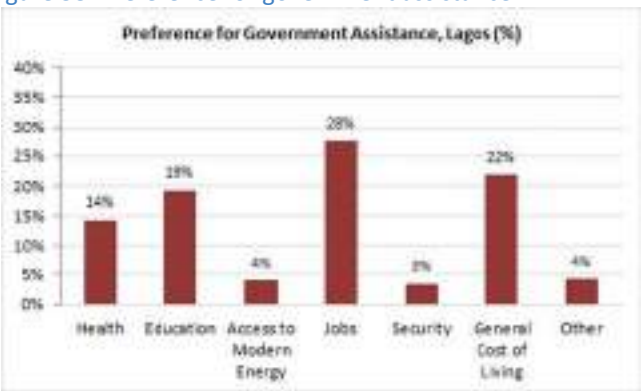
The surveys explored how alternative energy sources could support the empowerment of women, especially solar energy and LPG. Survey respondents stated a clear preference for electricity as a lighting fuel. 54% of respondents in Lagos and 63% of respondents in Imo say they would use renewable energy appliances if subsidised by the government.

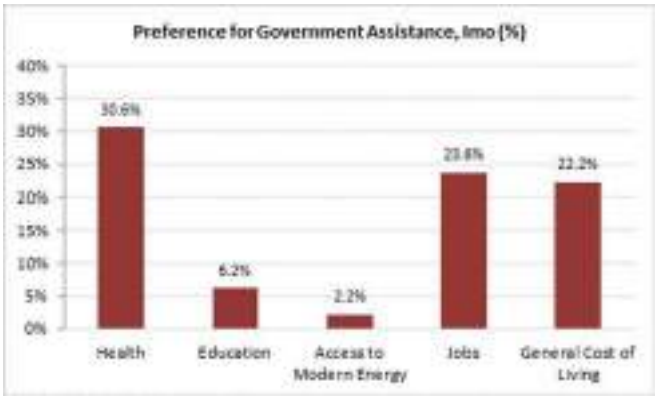
Households in urban areas expressed a preference for liquid fuels such as LPG and kerosene, while households in rural areas opted for wood (see Table 21). 59% of respondents in Lagos and Imo say they would use LPG stoves if there was government subsidy on LPG and cylinders. Preference for a clean cooking fuel (LPG) increases as the level of income and education increases. This was observed in both Lagos and Imo area.

Social protection as an alternative to fuel subsidies

When asked what kind of government support households preferred, jobs (28%/24%), health (14%/31%), financial support (22%/22%) and education (19%/6%) ranked highly in Lagos and Imo respectively. Access to modern energy only received 4% and 2%. While households might undervalue the benefits of modern energy, this nevertheless raises the question whether the billions spent on a fairly inefficient subsidy system might not be better spent on social protection programmes (Adeoti, Chete, Beaton, & Clarke, 2016).

Figure 38. Preference for government assistance





Source: Household surveys.

A challenge with regard to strengthening social protection is the low reach of current programmes. The implementation of programmes to support low-income households has been mixed. Previous interventions, like the SURE-P programmes, initiated to mitigate effects of high energy prices and to reallocate subsidy savings to women empowerment have been scrapped. The awareness of government support programmes in the household surveys was extremely low. Only 10.6% of women in Lagos and 9.2% in the rural areas claimed to be aware of the existence of government welfare programmes.

6. SUMMARY OF FINDINGS

The research across the three countries made gender-specific findings that were often very contextualised, except for some, such as the dominance of women as cooks within households. The fact that the responsibility of cooking within the household is so gendered across all three countries underscores the importance of findings and recommendations linked to cooking fuel subsidies and policies in general. Particularly important are the findings and subsequent recommendations around kerosene or a shift away from kerosene for cooking in Nigeria, and around LPG in India, because there will be direct impacts for women (as cooks) from changes in the price or supply of such fuels. Therefore, policies such as PMUY focused on targeting LPG subsidies toward poorer women have benefits linked to time savings and increased access to cleaner fuels for women. At the same time, aligning policies such as PMUY so closely with both a specific cooking fuel (LPG) and a specific gender (females) could further reinforce existing gender roles within the household, particularly around cooking. Overall gender findings from the research are outlined in the box below, following by findings and recommendations linked to our research questions around the impact of government subsidies, their reform and mitigation measures for gender and in summary form in Table 24.

Box 2. **Overall gender findings**

Cooking is a gendered role and women still do most of the cooking in the areas surveyed. In Nigeria, in both urban and rural areas, women are primarily responsible for cooking with kerosene and a host of other cooking fuels. Women are in charge of cooking in 85% of households in Lagos and in 88% of households in Imo. In Bangladesh, the survey found it is almost only women who undertake the task of cooking and women reported spending eighty minutes every day cooking at night. Only nine men reported to be engaged in cooking in the survey of 680 households in Bangladesh. Additionally, in Bangladesh the survey found that female students study 37 minutes per day less on average, and females access 17 minutes per day less of leisure time, than their male counterparts.

Different genders are in charge of decision making around fuel and lighting choices in different countries, and these choices are therefore context specific. In Bangladesh, our survey found that it was overwhelmingly men (the husband or father only) who take decisions on energy sources for lighting (46.2%) and cooking (39.4%) decisions. In Nigeria, a large majority of the women surveyed reported being in charge of making decisions about which household energy source to use for cooking. In the Lagos and Imo surveys, 69% and 94% of the women who participated reported to be in charge of decision-making on cooking fuels. In Nigeria, our survey found that for lighting women decided on which energy source to use in slightly more households than men. In Nigeria, about half of households indicated that men purchase and own electronic appliances, while only one fifth are purchased and owned by women. This implies that men have an important role in choosing appliances that might have gendered implications for energy use. In India, our survey found that in 74% of households surveyed, women made decisions on cooking energy sources. Since the PMUY scheme provides only female beneficiaries with subsidies for an LPG connection, it is reasonable to infer that it has placed more decision-making power in the hands of women.

Women want to access and use electricity. In Bangladesh, 69% of households reported that electricity access would provide the most beneficial services for women, well above support for other services including clean cooking and cash. Women in households in Bangladesh were also asked about what changes they might expect for income-generating activities with access to electricity either via the grid or via solar. Most women (54%) explained that they would continue with their current activity, but 45% (where women are not involved in IGA at present) indicated that they would get involved in income-generating activities given access to electricity. Our survey with households in Bangladesh overwhelmingly (99%) demonstrated the desire to shift away from kerosene and towards electricity. In Nigeria, while households continue to use a wide range of fuels including biomass, the surveys found an almost uniform preference for electricity.

Different genders pay for different fuels in different countries and settings, and therefore this is very context specific. Price changes in fuels could affect the person purchasing or utilising the fuel directly, with gendered impacts. From the survey in Bangladesh, men are responsible for buying kerosene for more than 94% of households and reported purchasing kerosene on average about once a week. Any government policies to encourage the shift away from kerosene for lighting or towards non-solid fuels for cooking in Bangladesh will need to significantly involve men. In Lagos and Imo, Nigeria, our survey found that women pay mostly for kerosene and firewood, while men pay mostly for petrol, LPG and electricity. Higher prices for kerosene might therefore impact women's budgets and incomes more. In India, our survey revealed that more women are responsible for collection and preparation of fuels like dung cake and fuelwood; and while women were still predominantly responsible for LPG collection, a larger share of men were involved compared to other fuels. The main exception to this was in rural areas, where LPG collection was predominantly the responsibility of men.

Women spend time fetching fuel and save time when there is fuel switching. In Nigeria, during periods of scarcity women mostly queue at the filling stations to buy kerosene cooking fuel. In Nigeria, most women surveyed in rural Imo were responsible for purchasing kerosene where it took more than 30 minutes to get to a formal or informal kerosene dealer (36% and 40%) for more than a third of households, implying time spent by women to fetch kerosene. In rural Imo, a third of respondents need over 30 minutes to collect the firewood, while a third of respondents said that it takes only up to 10 minutes. In Nigeria, both in Lagos and Imo, most women in focus group discussions stated that switching to a preferred cooking fuel would enable them to save time spent on cooking. Most women in a focus group discussion in Lagos said they would spend the extra time (from fuel switching to a cleaner fuel) on their place of work or business, while women in Imo stated that they would use this time to do more cooking or spend more time with their family and children. In India, women saved on average about one hour per day due to reduced cooking and cleaning times on LPG compared to cooking on biomass.

A fuel price increase in cooking fuels such as kerosene or LPG can lead to reduced use of the fuel and switching, especially with some households reverting to biomass. This **could impact women adversely** in terms of lost time or health benefits gained from the use of either kerosene or LPG. This effect seems stronger in rural areas where households have access to 'free energy' like biomass. For example, 18% of households

in Lagos, Nigeria, and 51% of households in Imo State, Nigeria, stated that they would use more biomass to cope with price increases.

Overall findings from the research are as follows:

1. **Overall, fuel subsidies are not working well for poor women:**
    i. **A large share of subsidies accrues to wealthier segments of the population** given their higher consumption and access to energy. This effect is particularly strong for LPG, but also for a 'poor people's fuel' like kerosene, and was found in Bangladesh, Nigeria, and India.
    ii. **Subsidies do not guarantee lower fuel prices—and may even create price premiums.** Even in systems with official registered prices, households were found to be paying significantly more than the regulated price. In Nigeria, low-income women reported paying between two to six times more than the official price for kerosene, and in Bangladesh 14% more for kerosene. This is likely due to many factors, among them challenges in distribution systems, fuel scarcity, smuggling, diversion and governance issues. These findings imply that even for kerosene, used by the poor, any benefits from subsidies are even lower than previously estimated. In India, the PAHAL (DBTL) system appears to have been successful in preventing large-scale illegal diversion of fuel, with very low rates of shortages or price premiums. But it may have created new access challenges by requiring households to register through bank accounts, identification and mobile phones under one member's name. Evidence suggests that it may also bias registration towards male household members, as fewer women than men tend to have the required documentation, despite recent progress on financial inclusion.
    iii. **Subsidies can increase fuel scarcity that can lead to long queuing for fuels** and this burden often falls on women (e.g. Nigeria). The informal sector in Bangladesh and Nigeria is key to accessing kerosene in small, but more expensive, amounts than via official channels, and reforms need to plan for impacts in the informal sector. In India, the PAHAL (DBTL) system has not created fuel shortages, but it does require someone to be available to accept home delivery. In rural areas, where home delivery is not available, households report that men are predominantly responsible for LPG collection, often at the expense of daily earnings.
    iv. **Many low-income women cannot access fuels that are currently subsidised** (e.g. LPG in India) **and many are not aware of those subsidies that exist** (e.g. in Bangladesh and Nigeria).
    v. **Fuel consumption subsidies alone are not effective at promoting the transition to cleaner cooking or lighting fuels,** especially where 'freely' collected biomass is available or where there are no alternative lighting systems to switch to such as solar or grid electricity e.g. in Bangladesh, Nigeria, and India.
2. **Better targeting of support for energy access is needed and possible:**

i. **Targeting subsidies to those that need them most** can counteract some of the problems outlined above.

ii. **A focus on connection over consumption subsidies** can encourage gender empowerment around decisions to purchase new cooking equipment for LPG and overcome upfront connection costs. For example, in India, the new LPG PMUY scheme aims to help women in low-income households afford the costs of using LPG for the first time. Such connection subsidies, however, also require good targeting. India's policy is reliant on a poverty card identification system that is well known for having major errors of exclusion and inclusion.

iii. **A gender focus can improve targeting and contribute to empowerment via clustering benefits towards women for multiple outcomes**. For example, India's PMUY scheme in India can only be used by female beneficiaries. As a result, women may not always be able to register easily—like PAHAL (DBTL), the policy requires beneficiaries to have bank accounts, for example—and the policy can reinforce gender norms that make cooking identified as the role solely of women. At the same time, such policy structures can play a positive role in encouraging women to pursue financial inclusion and in bolstering their voice and agency on household energy choices.

3. **Subsidy reform needs to be undertaken with care, and mitigation measures are needed to protect poor women:**

    i. Price increases to subsidised fuels without any support measures could hurt poor women, especially where they are using subsidised cooking fuels. The study found the following impacts on women's energy use and income, given price increases:

        a. Many higher-income households report the ability to absorb price increases which implies there is still scope for better targeting (e.g. India);

        b. However, some households may absorb costs from increased fuel prices by reducing expenditure on other goods (e.g. food, as in Bangladesh);

        c. Other households also reported reduced use and some fuel switching back to biomass for cooking when prices increase, with time and health implications for women (e.g. in India linked to LPG, or in rural Nigeria linked to kerosene);

        d. Some households reported secondary impacts such as a reduced ability for members to undertake activities that require lighting, such as studying and leisure time (e.g. in Bangladesh linked to kerosene).

4. **Other factors could be significant for fuel switching and better access to cleaner fuels for women:**

    i. Education and awareness are key (better-educated women are more likely to choose LPG as in Nigeria);

ii. Existing patterns of decision making and purchasing power over energy choices within the household need to be considered (educating men, as well as women, around energy choices, for example in Bangladesh);

iii. Improving the distribution system or electricity system, especially to rural areas and to the poor, in order to have alternatives to switch to (e.g. in India large drives to expand LPG distribution have played an important role in enabling greater access); and

iv. Culture (tastes and preferences) may still matter more (e.g. in Nigeria).

5. **Investing in subsidy alternatives could empower women more directly:**

i. More diverse, technology-neutral, and subsidies conditional on outcomes may be more effective in terms of achieving access, avoiding technology lock-in and fostering affordable solutions adapted to context;

ii. Via solar or grid electrification (to replace kerosene subsidies); and

iii. Into social safety nets, health care, education or business loans for women.

In terms of broad policy recommendations to governments, this research suggests that governments could

- Continue to phase out fossil fuel subsidies that do not support energy access for poor women or the target population. In particular, there is a need to phase out subsidies for kerosene, which is prone to large-scale diversion, is more costly than other lighting alternatives and is not clean-burning, whilst also ensuring there is a clean alternative to switch to;
- Work to better target subsidies for fuels that are currently deemed necessary for sustainable energy access so more resources are available to efficiently help achieve SDG7 on energy access and to fund programmes that support women and promote gender empowerment;
- Make energy access support more technology-neutral, to achieve better outcomes and avoid technology lock-in by fostering solutions adapted to the context. This should include not only focusing access policies on transitional fossil fuels but also on ensuring that the right market incentives and structures are in place to cultivate new and renewable lighting and cooking technologies;
- Recognise that subsidy reform needs to be undertaken extremely carefully, based on an impact analysis that analyses the effects on women and alongside robust package of measures to mitigate against the negative impacts of price increases;
- Use comprehensive strategies for energy access that recognise the importance of gender and incorporate it into policy design.

Table 24. Summarised findings from the impacts of fossil fuel subsidies, their reform and mitigation on poor women across Bangladesh, India and Nigeria

INCOME EFFECT	ENERGY USE EFFECT	ENERGY SUPPLY EFFECT
Impacts of fossil fuel subsidies on poor women		
In Bangladesh, households (HHs) had not experienced a decrease in the price of kerosene via a passthrough to the consumer from an official price cut from BDT 68 to BDT 65 per litre of kerosene in 2016. In fact, prices of kerosene were higher than the official price by 14%, at an average of BDT 77 per litre, and in some places as high as 17% higher.	In Bangladesh, key energy decisions around lighting (46.2%) and cooking energy (39.4%) sources are mostly taken by the husband or father only. HHs overwhelmingly (99%) demonstrated a desire to shift away from kerosene and towards electricity. Lack of adequate lighting (92%) and the high price of kerosene (85%) were given as the main reasons. 48% of female respondents are engaged in cooking at night using kerosene for lighting: only nine men were engaged in cooking.	In Bangladesh, there was little awareness of the subsidies from the government: 80% of HHs did not know about the subsidised price of kerosene and 95% of HHs were not aware of the subsidy. Currently retail sellers have the highest profit margin, whilst depots had the lowest, transport costs were identified as a major factor in the price differential. 21% of households purchasing from local stores had faced unavailability of kerosene in the last six months
In India, many poor HHs did not benefit from the LPG consumption subsidies (DBTL) because upfront costs of connection were too high (95% of HHs: Jain et al., 2015). In 2012-13, only 13% of the cost of acquiring LPG went for fuel consumption, with 87% on set up costs (IRADe, 2014). Inefficient and large DBTL consumption subsidies were an opportunity cost that could have been better focused on low-income HHs.	In India, in a 2014 survey 90% of HHs were eligible for DBTL, but only 65% of them could access it (IRADe, 2016). A lack of support for upfront connection costs in 2014 limited the impact of connection subsidies on LPG usage.	In India, a 2015 survey found LPG increased marginally in Jharkhand (Jain et al., 2015). In 2011 the bottom 50% of the population were using biomass for cooking (NSSO, 2015).
In Nigeria even though kerosene was subsidised and an official price fixed, none or the HHs surveyed reported paying the officials sales prices, but rather prices between two and six times higher. In Nigeria kerosene and firewood are the fuels paid for more by women,	In Nigeria even though kerosene was subsidised households used a wide variety of energy sources for their cooking and lighting needs (biomass still accounted for 64% of cooking fuels especially in rural areas). HHs in urban areas expressed a preference for liquid fuels for cooking. Most respondents	In Nigeria the fuel distribution system was unable to ensure uniform prices, distribution across the country and a reliable supply of fuel, and was characterised by smuggling, inefficiency and corruption. During periods of scarcity women queue for hours for kerosene. The informal sector played an

while men pay mostly for petrol, LPG and electricity.	would like to use electricity for lighting. Whilst women claim to be in charge of decisions about cooking fuels, and in many HHs about lighting fuels, men have an important role in deciding about purchases or electronic devices, as well as changes in energy sources.	important role in the supply of kerosene and the closer proximity, smaller quantities, and reduced queuing outweighed the higher prices.
Impacts on poor women of higher energy prices caused by reforms		
In Bangladesh, any increase in the price of kerosene needs to be handled with care, especially if HHs have no opportunity to switch. In Bangladesh, men purchase kerosene (94%), and a price increase may affect men's incomes more than women's. In case of a price shock, overall it seems that women do not seem to be more vulnerable than men, with 74% of HHs reporting that all members will be equally affected.	In Bangladesh, with a hypothetical 20% price increase most HHs said they would absorb the cost via an increase in income-generating activities (IGAs), but overall 47% of HHs would reduce the use of kerosene (alone or in conjunction with other strategies). Given a doubling of the price of kerosene more HHs used multiple coping mechanisms, 67% of HHs reducing the use of kerosene as well as including other elements, such as reducing expenditure on other goods (e.g. food) and increasing IGAs.	
In India, inclusion and exclusion errors of the Below Poverty Line (BPL) targeting system has reduced the income effect of PMUY. Only 48% of PMUY beneficiaries were among the poorest 40% of surveyed HHs. Improving the targeting of BPL and by extension PMUY could increase the positive income effect for poor HHs. For higher-income groups, where affordability is not a constraint, LPG is still not used for 100% of the cooking fuel mix. Affordability is not the only issue for adoption.	In India, in 2017 50% of HHs surveyed were not using LPG and not benefiting from subsidies. 26% of HHs surveyed were identified as poor and using LPG, and a third of these were using LPG as the primary fuel. In India, in 2005-2006 53% of women were least likely to participate in decisions about large HH purchases (NFHS, 2006). In this survey 74% of HHs women made the decision on cooking sources. The PMUY scheme subsidises the upfront cost of LPG and seems to have enabled increased decision making by	HHs are paying between INR 800 to INR 840 per 14.2kg cylinder to the official LPG distributors, and this was the range of the official price in the two districts. Shortage of cylinders was found to be rare—only 6% reported a shortage in the last six months. There has been an increase in rural distributors for LPG (PPAC, 2018). Diversion of subsidised LPG cylinders in India is now harder since there exists a digitised registry of beneficiaries, an official price

HHs not using LPG (50%) are unlikely to be affected by a price increase in LPG equivalent to a removal of the subsidy. Of HHs using LPG 86% would absorb the higher cost and continue using LPG although 39% would reduce consumption. 14% would stop using LPG and likely revert to biomass. For PMUY HHs alone (16% of sample), just under a quarter would stop using LPG as a result of a removal of the subsidy and increased price. Large and inefficient PAHAL (DBTL) subsidies continue to represent a significant opportunity cost that could be better focused on supplementing energy access needs of poor households. In 2018, PAHAL (DBTL) subsidies were more than eight times the value of PMUY subsidies.	women on cooking fuels (including LPG.) In India, in rural areas, fuel management responsibility transitions from women to men with LPG adoption. Women saved, on average about one hour per day due to reduced cooking and cleaning times on LPG compared to cooking on biomass.	and the subsidy transfer is linked to beneficiary fuel purchase.
In Nigeria high prices associated with reforms place high demands on HH income, especially women's income. In Lagos, women cope with price increases, mostly by saving fuel or shifting expenditures within their budgets. In rural areas, women seem to have less access to financial strategies and resort more to less clean fuels, especially firewood. The income effect seems stronger in urban areas.	In Nigeria, when faced with price increases of between 52% (Lagos) and 145% (Imo) there were a number of coping strategies. Most HHs explained that they would use less kerosene (Lagos, 44%; Imo, 64%). In urban Lagos 18% of HHs would switch to or use more biomass: in rural Imo this was 51%. The energy use effect is stronger in rural areas.	In Nigeria the supply of kerosene has not improved since the 2017 reforms. The survey found persistent scarcity of kerosene and petrol e.g. 60% of HHs in Lagos reporting that they experience scarcity often or very often.
Impacts of mitigation measures or reallocated expenditure caused by reforms		
In Bangladesh, 69% of HHs reported electricity access would provide the most beneficial service to women well above other kinds of support (e.g. food or clean cooking). If women had access to electricity most explained they would continue with current activities (54%), but 45% indicated they would get involved with IGAs. At the same time, when asked about changes in women's activity based on reduced fuel collection or access to light most indicated this would mean more time with HH chores (87%) and children (73%) and a lot less paid work (22.7%).		

However, HHs perceive the additional cost of accessing either grid or solar electricity as high (around BDT 3,000 per month); this is 15 times higher than current average costs of kerosene to the HH (BDT 210).
In Nigeria, when asked what kind of government support HHs preferred, jobs (28%/24%), health (14%/31%) financial support (22%/22%) and education (19%/6%) ranked highly in Lagos and Imo respectively. Access to modern energy received only 4% and 2%.
In India, 86% of HHs desired LPG cooking compared to other fuels.

Source: This research, unless otherwise sourced.

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ANNEX 1 VALUE CHAIN OF KEROSENE PRICE (BANGLADESH)

As discussed previously (chapter 3), the value chain of kerosene involves a number of stages. Government monitoring occurs up until the dealer level. Therefore, the research investigated from the build-up of price from the dealer level to final consumption, to fully understand the whole kerosene value chain. This was achieved via key informant interviews (KIIs) with each of the agents of value chain based on a sample of 30 targeted households from eight districts across three divisions (Barisal, Rangpur and Chittagong) that were found to face a high price differential between that of the official and retail price of kerosene from the main survey. Specific households with both the highest and the lowest price differential, compared to the average price differential, in each of the districts were selected for the value chain survey. These included, for example, households registered price differentials of between 7.7% to 23.1%.

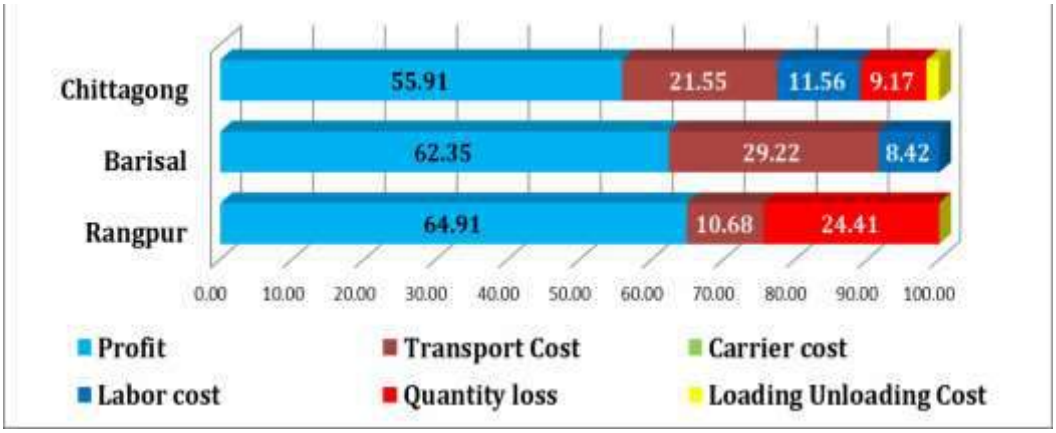
The households were asked to report details of the source of kerosene purchased: enumerators then visited these outlets and interviewed sellers regarding the buying and selling price, and cost composition of kerosene. To establish a full depiction of the value chain, the enumerators then visited each of the purchase (sale) points of kerosene within the full chain back to the depot, one by one. The depot is the selling point of the registered dealer. Hence, the survey established 30 distinct value chains starting from each of the households. The survey traced up to a maximum of six points of purchase (sale) from households' source of purchase back to the depot and official government level, but the majority of points in the kerosene value chain covered between two to three points of sale before purchase.

Because all of the points serve as both buyers and sellers of kerosene, the difference between the buying and selling price of these points is one of the primary indicators to understand the cost structure, as well as profit margin, at each one.

Out of the 30 value chains in the survey, 25 identified Point 1 as the highest proportion of profit earned in the respective value chain i.e., the point in the value chain that is furthest from the depot and the official price. Depots, on the other hand received the lowest proportion of profit across twenty-eight value chains. All the sellers in Point 1 are retail sellers, and almost all the sellers in Point 2 & 3 are wholesalers.

Profit comprises more than 55% of price difference of Point 1 (i.e., the retailer where the household makes purchase) in Chittagong and more than 60% in Barisal and Rangpur (Figure A1.1) Transport follows in Chittagong (22%) and Barisal (29%). However, for Rangpur, quantity loss comes next in this regard (24%) whereas transport cost comprises 11%.

Figure A1.1. Profit & cost of Point 1 (from where HHs purchase) as % of price difference

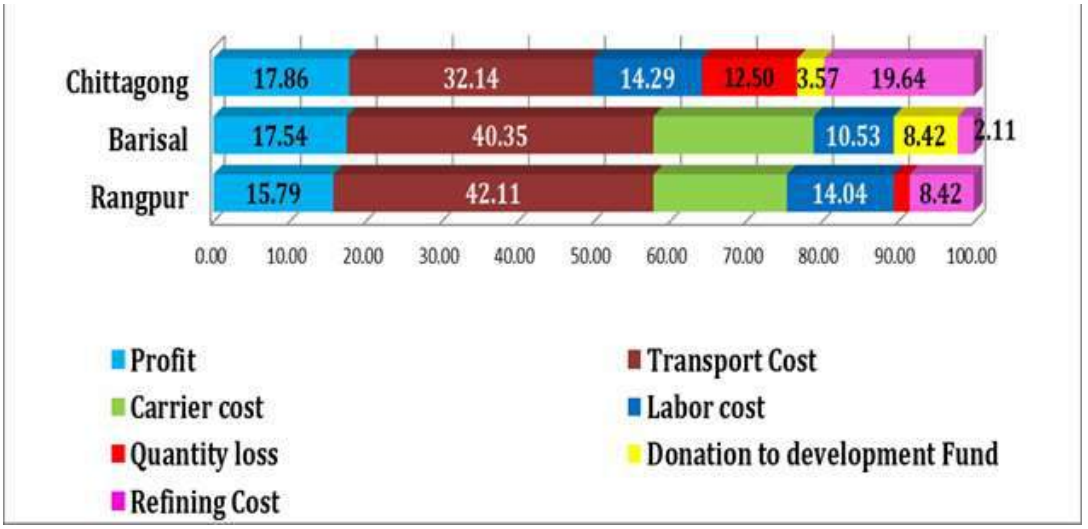


The share of profit of Point 2 (wholesaler) to total price difference is lower than the share of Point 1 for Chittagong (32%) and Barisal (33%) (Figure A1.2). However, the share is almost same to Point 1 in case of Rangpur (65%). Transport cost comes next in the composition across all the three districts. Quantity loss holds a share of around 9% for Chittagong whereas the share is very minimum for Barisal and Rangpur. On the other hand, Barisal holds a share with 'commission to middlemen' (10%).

Figure A1.2. Profit & cost of Point 2 (from where HH purchase) as % of price difference

Transport cost represents the major share of price difference for depots across all the three districts (Figure A1.3). Refining cost, the cost incurred by depots comprises only around 20% for Chittagong, whereas the share comes to 8% for Rangpur and very low for Barisal (only 2%). The share of profit is the same for Chittagong and Barisal (around 18%) whereas depots of Rangpur enjoy a profit share of 16%.

Figure A1.3. Depot's profit and costs as % of price difference


Chittagong
Barisal
Rangpur
17.86
32.14
14.29
12.50
3.57
19.64
17.54
40.35
10.53
8.42
2.11
15.79
42.11
14.04
8.42
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Profit
Transport Cost
Carrier cost
Labor cost
Quantity loss
Donation to development Fund
Refining Cost

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iRADe Action for Development
BIDS