



COOKING WITH GAS: 2018 UPDATE

Why women in developing countries
want LPG and how they can get it

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FOREWORD



In 2018, well over a third of people cannot cook cleanly.

The 2018 Tracking SDG7: Energy Progress Report shows many of them are still using firewood, charcoal and animal dung for cooking. Inhaling the smoke as they cook results in several million premature deaths worldwide every year. While this story plays out for families around the world, in Sub-Saharan Africa the situation is particularly acute, with the number of people without access to clean cooking rising. The most recent data from 2016 shows that 860 million people – 70 percent of Africans – cannot cook cleanly.

Women and girls suffer the most. In addition to the effects of air pollution, they lose precious hours every day, collecting firewood – time that could otherwise be spent studying or working productively. As this report documents, head loads of 20 kilograms are not uncommon as having to walk distances of up to 12 kilometers. And they may face perilous physical risks while collecting this firewood.

We must do better. More governments need to prioritize clean cooking by creating markets for clean fuels for cooking and cookstoves that are affordable and reliable. The international community needs to look hard at its level of support too.

Within bigger big markets for affordable, clean fuels LPG plays an important role. By focusing on market creation we should concentrate on affordability of fuels and their distribution. Putting purchasing power in the hands of women will help shape markets to their needs. Of course for the most vulnerable and the poorest, government support for access to clean fuels will be essential and may need to be stepped up.

Investing more in clean cooking solutions is central. The 2017 Energizing Finance report series by SEforALL showed that very little finance is flowing into clean cooking, and the little that does flow comes with many conditions and caveats. That needs to change.

It's time for the LPG industry to look hard again at this issue and what it would take to drive solutions at scale. Earlier this year, SEforALL brought together leaders from associations representing different fuel sources – including the Global LPG Partnership and the WLPGA – to form a basis for greater ongoing collaboration. When countries are committed politically to close clean cooking gaps collaboration should support fast action.

Progress to date has been promising when governments have committed to solutions for clean cooking. From Mexico and India, to Indonesia and Morocco, when governments commit at the highest level, it produces results. But much more can be done in partnerships between governments and the LPG industry – and where necessary, the international community – to ensure that LPG is available to low income households.

In 2018, no mother or father should have to choose between cooking a meal and the health of their children. But this is where more than a third of us stand today. There is much more that can be done. The LPG industry stands in the middle of this opportunity and has for some time. It is time to lead from the front. Let's do this together.

A handwritten signature in black ink, appearing to read "kyte".

Rachel Kyte

Special Representative of the UN Secretary-General
Chief Executive Officer
Sustainable Energy for All

Glossary

ALRI	Acute Lower Respiratory Infections
AREED	African Rural Energy Enterprise Development programme
COPD	Chronic Obstructive Pulmonary Disease
DEEP	The Developing Energy Enterprises Project
DfID	Department for International Development
DOSH	Department of Occupational Safety and Health
ENERGIA	International Network on Gender and Energy
EU	European Union
GACC	Global Alliance for Clean Cookstoves
GBD	Global Burden of Disease
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Agency for Development Cooperation)
GVEP	Global Village Energy Partnership
GLPGP	Global Liquefied Gas Partnership
HEP	Household Energy Programme
ICS	Improved Cook Stove
IAP	Indoor Air Pollution
IEA	International Energy Agency
LPG	Liquefied Petroleum Gas
MDGs	Millennium Development Goals
MJ-d	Mega Joules delivered
MT	Metric Tonnes
NCRB	National Crime Registration Bureau
NORAD	Norwegian Agency for Development Cooperation
PASASA	Petroleum Safety Association of South Africa
PLWHA	Persons Living with HIV and AIDS
PM	Particulate Matter
REEEP	Renewable Energy and Energy Efficiency programme
SDG	Sustainable Development Goals
SEforALL	Sustainable Energy for All
SEWA	Self-Employed Women's Association
TCS	Traditional Cook Stoves
UNDP	United Nations Development Programme
WDA	Women's Development Association
WHO	World Health Organisation
WLPGA	World Liquefied Petroleum Gas Association

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EXECUTIVE SUMMARY



CHAPTER 1: COOKING ENERGY IN DEVELOPING COUNTRIES: A KEY ISSUE FOR WOMEN AND GIRLS

1.1 Access to clean cooking energy is a gender issue

Empowering women and improving their status are essential to realizing the full potential of economic, political and social development. At the center of the Sustainable Development Goals for 2030 is Goal 5: Achieve gender equality and empower all women and girls. Goal 5 includes measures relevant to the energy sector, including to end all discrimination against women and girls, recognize and value unpaid care and domestic work through the provision of infrastructure, ensure women's effective participation and equal opportunities, and enhance the use of enabling technologies.

Gender equality matters if energy sector development is to contribute to economic growth and broader development goals. Access to clean cooking energy is a particularly gendered issue, because women are primarily responsible for cooking in virtually all cultures.

While roughly 1 billion people live without electricity, nearly 3 billion people – or more than 40 percent of the world's population – do not have access to clean fuels and technologies for cooking, mainly in South Asia but also in Africa, parts of Latin America and elsewhere. Cooking energy access will be a key contributor to meeting Goal 5 on gender equality and to reducing poverty.

1.2 LPG and energy poverty

Increasing household use of LPG is one of several pathways to meet the objective of universal access to clean cooking and heating solutions by 2030, one of the three targets of SDG7 (along with doubling the global rate of improvement in energy efficiency and doubling the share of renewable energy in the global energy mix). For the first time, access to cooking and heating energy, the most important energy need for poor women, is treated as a global and national target on an equal footing with access to electricity.

LPG is a clean-burning, efficient, versatile and portable fuel, produced as a by-product of natural gas extraction and crude oil refining. It can be up to five times more efficient (high



calorific value) than traditional fuels, produces less air pollutants than kerosene, wood or coal, and emits about 20% less CO₂ than heating oil and 50% less than coal; it also reduces black carbon emissions.

Historically the main obstacles to wider LPG use in developing countries have been affordability and availability. LPG is currently used predominantly by the upper half of the income groups, in low- and lower-middle-income countries, and especially urban and suburban households. However increasingly, LPG is penetrating to lower income households, especially in emerging market countries: governments and private companies in India, Bangladesh, Indonesia, Vietnam, Thailand, Brazil, Senegal, Peru, Ghana and Morocco have, through deliberate policy, promoted the establishment of LPG infrastructure, and pricing and equipment packages that make LPG accessible to middle and sometimes even lower income households in urban, suburban and even rural areas. It is clear that there are still many households, of the three billion households without access to clean cooking energy, who could afford to switch to LPG if other obstacles could be reduced.

Nonetheless many millions of household will continue to be dependent on wood fuels, and promotion of LPG does not mean that efforts to promote improved biomass cookstoves and other smoke reduction approaches are not needed. Electric cooking has a role to play as well, as electrification progresses. But LPG has probably the major role in this multi-pronged solution, as a preferred option for cooking for women in developing countries.

...Gender equality matters if energy sector development is to contribute to economic growth and broader development goals...

CHAPTER 2: WHY WOMEN WANT LPG

Women want LPG for cooking. Even with constraints such as fears of accidents, often higher fuel expenses, and supply issues, women often choose LPG when they have the option.

2.1 The energy crisis is women's time and drudgery

Lifting women's time constraints by improving infrastructure is one of the priorities for action on gender equality, identified by the World Development Report 2012. Modern stoves and fuels can save women's time and effort both in fuel collection and in cooking, and women perceive this as the major advantage of LPG. Norms about responsibilities for care and housework mean that women in nearly all countries work longer hours than men, with a "triple burden" of market work, housework, and family care. Even as women take up a bigger share of market work, they remain largely responsible for care and housework. These differences in gender roles reduce women's leisure, welfare, and well-being. Releasing women's time is a key necessity for women's ability to invest in education, their agency and life choices, and their ability to take up economic opportunities and to participate more broadly in economic, political, and social life.

Most attention to timesaving of women in the energy sector has focused on the burden of biomass fuel collection, which in fuel-scarce areas can range from one to more than eight hours per household per week. The majority of fuel collection and transport is carried out by women and girls, with head loads of 20 kg or more and distances of up to 12 km travelled not uncommon. In some cultures, men and boys also collect fuelwood, especially when distances and loads are greater. But cooking, almost exclusively women's task, can also take many hours per day, sometimes equal to or greater than the time spent in fuel collection.

Considerable timesavings are possible when switching to LPG for cooking, especially from biomass fuels but also from kerosene. Little comparative data is available on actual time saved in fuel collection and cooking, but studies from India suggest that savings in cooking time when switching to LPG can be greater than those for fuel collection, up to one to one and a half hours per day, compared with about 15 minutes daily for fuel collection. Field data is important because fuel stacking (continued use of biomass stoves together with LPG) can reduce the theoretical savings.

LPG itself may require time and effort in "collection," with travelling to towns, queuing in lines and having to visit distant depots for refills being very time-consuming in some countries. It may also include carrying heavy cylinders if a home delivery service is not in place or smaller LPG cylinder programmes are not available. This effort to obtain the fuel does illustrate how much women want to cook with LPG, but also highlights the need to make supplies easier to obtain.

Time saved and reduced drudgery due to fuel switching can enable women to take advantage of development and empowerment opportunities. Few studies exist for LPG but electrification (including electric cooking) has increased women's labor force participation by about 9% in South Africa. Some household energy studies do report women's increased participation by women in wage work; it is clear that other household chores, agricultural activities, and childcare are also important uses of freed-up time. Leisure (often combined with entertainment/information from media) and participation in community and social activities that build social capital are common. The opportunity cost of women's time and the availability of waged work have been identified as key drivers for the shift to LPG, though more evidence is needed. So long as there is no economic need perceived to save women's time, "free" biomass cooking

may not be abandoned for modern fuels. Essentially, saved time gives women the opportunity to choose how to best use their time, a chance that may allow them to better take advantage of development opportunities and empower themselves.

Finally, LPG, like electricity, is a modern fuel that seems to induce or correlate with more forward-looking investments and roles. Improved status is often reported by households as a benefit. There is evidence that households switching to LPG also start to cook with electricity. Gender roles may also change with adoption of LPG and other modern fuels, though this may need to be backed by institutional and legal support by the State for gender equality. Gender roles in the cooking energy system are unlikely to change however unless women get independent access to finance and income.

2.2 Health improvements for the family and women

Almost 3 billion people worldwide continue to depend on solid fuels, cooking and heating on open fires or traditional stoves, exposed to high levels of health-damaging pollutants, including small particulate matter and carbon monoxide, that can exceed accepted guideline values by a factor of 20. According to the WHO, household air pollution is responsible for 7.7% of global mortality or 4.3 million deaths, mostly in Asia and Sub-Saharan Africa. It can lead to acute lower respiratory infections in children under five, and ischemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer in adults. Globally, 93% of all children live in environments with air pollution levels above WHO guidelines. Both ambient and household air pollution contribute to respiratory tract infections that resulted in 543,000 deaths in children under 5 years in 2016. Women and children in developing countries are the most exposed to solid fuels smoke - though men bear a larger burden of disease than women due to larger underlying disease rates among men. As such,

men, women and children will all benefit from decreasing household air pollution.

LPG scores far better than traditional biomass fuels on virtually all indicators of health impacts: indoor air pollution, fuel collection health impacts, and fires. It significantly reduces indoor air pollution (IAP); and research on exposure-response with respect to child pneumonia shows that compared to fan stoves, chimney/rocket, simple improved stoves and open fires, LPG is the only stove whose emissions are below the critical level of 10µg per m³. In contrast to LPG, biomass burning typically releases 19 times more emissions per meal.

Better health outcomes have been associated with LPG in comparison with other solid fuels such as biomass and coal, in several India studies. In West Bengal, India, LPG users had consistently better health outcomes than biomass users even controlling for socioeconomic conditions. Also in India in the states of Jharkhand and Chhattisgarh, compared with LPG, biomass was associated with increased risk of preterm delivery, even controlling for socio-demographic differences.

Nonetheless, clean fuels such as LPG must be used consistently without stacking with “dirty” fuels in order to yield health benefits. Consistent and exclusive use of LPG can be problematic due to low incomes, unreliable supply of LPG, taste and cultural preferences and fears related to LPG use. Still, WHO suggests that a massive investment in clean fuels and clean stoves would repay itself many times over in reductions in ill-health and economic benefits. Time gains from reduced illness, fewer deaths, less fuel collection and shorter cooking times account for more than 95% of these benefits.

Beyond indoor air pollution, there is a substantial physical burden and drudgery in collecting, transporting and processing biomass, leading to health impacts and accidents. Women firewood collectors suffer

from neck aches, headaches, backaches, bruises and animal attacks; prolapsed uterus and degeneration of the cervical spines have also been reported. The limited evidence on the direct health impacts of firewood collection and use suggest that reducing or eliminating firewood collection could yield substantial health benefits, especially for women. The connection between health and fuel collection has received much less attention than that between biomass cooking and health.

Another health linkage with modern cooking fuels is that increased energy access can have a direct impact on reducing malnutrition, as fuel is needed for adequate cooking. Modern fuels can also improve the delivery of health services, by providing lighting and refrigeration in places where it is difficult to ensure reliable electricity and as an alternative to kerosene.

Finally, LPG often replaces paraffin (kerosene) in cooking. While LPG is implicated in some fire accidents, these are dwarfed in comparison with the enormous number of homes burned, injuries and deaths caused by paraffin (kerosene), at least as reported in South Africa. Poisoning as a result of children accidentally ingesting kerosene is also a major pediatric problem in Africa. Kerosene has also been implicated in dowry deaths in India. There are few statistics on the safety impacts of switching from kerosene to LPG, and more studies are needed to determine to what extent this is likely to reduce property damage, injuries and deaths related to kerosene use.

CHAPTER 3: HOW GOVERNMENTS AND COMPANIES ARE OVERCOMING CONSTRAINTS AND HOW WOMEN CAN BE INVOLVED IN INCREASING ACCESS TO LPG AS A COOKING FUEL

3.1 Empowering women with knowledge and control of LPG

Educating the public, especially women cooks, about the costs and benefits of

different fuels, is generally considered essential to promote a switch to LPG. Women's fears about LPG safety are not surprising, given the poor regulation and enforcement of LPG supply in many countries, and the unfamiliarity of the technology for many consumers. In India, with rising use, most victims of cooking gas explosions are women (82%) and most burns result from gas leaks (70%) and cooking negligence (25%). Illegal manufacturing and distribution practices, and unsafe environmental conditions, are mentioned as causes of accidents in Indonesia. The global industry does not have in place an international monitoring system for LPG fires and accidents and there is little data available on the types or causes of these events in most developing countries. Generally, two types of accidents are found: fires and explosions related to storage, transport, filling and maintenance of LPG equipment in the supply chain; and accidents related to consumer use, often due to defective cylinders and hoses but also due to improper use by cooks. Both are preventable and have been greatly reduced in developed countries, through regulation, enforcement, and consumer education. Involving women in consumer education and awareness, as well as in lobbying for better regulation and enforcement, can empower women with knowledge and control of LPG. Consumer education and awareness in LPG promotion must not only dispel the idea that LPG is a fuel that "burns houses down," but must also give women cooks the knowledge and tools to make sure that their own cooking facilities and cylinders are properly installed, regularly inspected, and correctly filled. Mistrust in the market due to perceptions and/or realities related to partial filling, contamination of fuel, and other deceptive practices by grey/black market players are limiting the sustained growth of markets in some countries, and women need to know how to deal with these concerns. With this knowledge, women can also promote and lobby their governments and LPG companies

to adopt regulations and enforce standards. While government agencies engage in the long-term process of strengthening monitoring and enforcement, women's organizations can work with industry associations and consumer groups to help with monitoring by raising public awareness about malpractice and even conducting and publicizing the results of spot-checks.

In addition, misconceptions about the expense of LPG are common, especially among less educated households, who are less likely to select LPG than more educated ones. Understanding the health and safety costs of using traditional biomass fuels and kerosene also needs to be part of a fuel-switching programme.

Further, technology innovations need to be pursued that make LPG stoves and the entire supply chain safer and more convenient for users. Women may need to take a more active role in LPG stove and, installation design, in order to ensure that these correspond to the type of cooking and foods prepared locally. Technical fixes that reduce deceptive practices and inconveniences (such as not knowing the amount of LPG left in a cylinder) need to be pursued, and pressure cookers or complementary household appliances could also be helpful to reduce fuel stacking and use of traditional biomass for cooking in parallel to LPG. Women's participation and input to designing and selecting appropriate technology innovations will be essential.

With good practices both in consumer education and awareness, and in the regulation of safety in the supply chain of LPG, it is possible to mitigate risks and greatly facilitate adoption of LPG as a safe modern fuel. Still, there is scope to improve the quality of consumer campaigns to make them more user-friendly, and to involve women as communicators and designers of programmes. Neighborhood associations have been especially effective. Men also need to be involved in safety programmes. Safety

campaigns and appliance standards can be lobbied for by companies, strengthened by the inclusion of women's organizations and consumer groupings in alliances.

3.2 Diversifying women's livelihoods with LPG Using LPG to improve profitability of women's enterprises

Improved technologies have been shown to create pathways for strengthening women's economic opportunities, leading to their economic advancement as well as expanding markets. Technologies that increase women's earning capacity are much more likely to increase women's status and decision-making powers within the household and community; this may also be the fastest route to encourage fuel-switching to modern fuels.

Many of women's traditional income activities are highly fuel intensive, and their viability and costs are affected by energy prices and availabilities. Fuel is often a significant cost factor in these enterprises and there is therefore a commercial motivation to improve the efficiency of the entire process. Such enterprises often play a primary role in ensuring family food security by providing an off-farm source of income. Modern fuels such as LPG can save time and improve productivity in many of these fuel and labor-intensive enterprises. They can save time for entrepreneurs, lower costs of process heat, and diversify their entrepreneurial opportunities. There are many types of LPG appliances available for small commercial and industrial enterprises. Tofu and tempeh industry in Indonesia, food kiosks and small restaurants in Kenya, fish smoking and street foods in Ghana, and sweet shops in India are examples of enterprises employing or owned by women that have improved their profitability by switching to LPG. LPG is the main source of energy used in the street food sector in many countries, preferred because it is easy to use, affordable, clean and "best for product." Constraints to adoption of LPG by enterprises are similar as for households, but availability

may be more a concern for businesses than is affordability. Both businesses and household may be concerned about taste and adaptability of LPG stoves to traditional cooking methods. Female entrepreneurs generally do face more obstacles than male businessmen, in terms of access to finance and inputs such as land and assets, skills, other family responsibilities, and access to networks. When they do engage in entrepreneurship, women tend to engage in businesses that are less profitable compared with men. More understanding and examples are needed of how women entrepreneurs benefit from using LPG, and how constraints have been successfully overcome.

Engaging women in the LPG supply chain. While women are the biggest users of LPG for cooking, they are generally not as involved in LPG distribution or other parts of the supply chain. Integrating them can help build LPG usage. The supply of LPG represents an important employment sector with growth potential in and of itself. But modern energy technology businesses have been viewed as “men’s work”, while women operate more traditional, and less profitable, biomass-based micro-enterprises. Some examples were found in the literature of women’s participation in the LPG supply chain. A number of barriers to women’s entrepreneurship need to be addressed in order for more women to become LPG energy entrepreneurs.

New approaches include at the individual level, business education and skill development, as well as training to foster personal agency and initiative; and at the business level, access to finance and capital and access to coaches, mentors and networks, while partnering with formal and informal women’s organizations. These strategies can help overcome the traditional constraints on women’s participation and take advantage of their strengths. Such approaches have been applied to produce and market improved biomass cookstoves, and briquettes, solar lighting and battery charging, and biogas. Similar approaches could be applied in LPG promotion.

With women being the main consumers, women can be successful and effective LPG energy entrepreneurs and providers of microfinance, involved in managing LPG business and in servicing clients. Opportunities for women include wholesale and retail sales of stoves and cylinder systems, their installation, and follow up inspections. Women could also be engaged in monitoring of safety of storage and transport facilities and of cylinder refill depots to ensure fair sale, as private certified inspectors. Consumer education on health benefits, correct use and maintenance, and safety procedures would be more effective from woman to woman. Women’s networks can support the advancement and success of women in business operations and professional development. WLPGA launched the Women in LPG Global Network (WINLPG) in 2015 with the goal of getting more women involved the global LPG supply chain, from operations to executive positions. Engaging women in the LPG supply chain is an effective strategy for gender equality as well as for LPG promotion. Investing in women’s economic empowerment sets a direct path towards gender equality, poverty eradication and inclusive economic growth. Women in the value chain can also be key agents for addressing universal energy access, including access to LPG for cooking.

3.3 Linking modern cooking fuels with women’s empowerment

Women’s organizations can influence household energy policy and discussions on the global energy mix and climate change. Women and their organizations are increasingly active in shaping policies and programmes in women’s interests in their countries, including in the energy sector. National networks on gender and energy have carried out gender audits of the energy sector in a number of countries in Africa and Asia, and helped ensure that women’s interests are represented in national energy plans in Botswana, Kenya, Uganda and Philippines among others. Women in developing countries are increasingly vocal about their need for

adequate household energy options, and lobby and protest about LPG pricing and availability. In India, women voters and their organizations have played a key role in ensuring that LPG subsidies would be accessible to women. Women's organizations and networks can also weigh in on the ongoing discussions at the national and international level on the role of LPG in the global energy mix and climate change. They can point out superior pollution and emissions performance of LPG, and the relatively low cost of providing household energy for all. At policy level, women in developing countries can advocate for modern, technology-neutral options that they can choose among, rather than relegating the poor and women to traditional biomass fuels or less convenient renewable options, or stereotyping that development for women should be limited to small, manual processes. They can claim their right to subsidies that will make their time more productive. Organized women, allied with household energy providers, can address the gender bias and absence of women's voice in energy policy, and demand more solutions that address women's cooking needs.

Financial inclusion is key to expanding access to modern cooking fuels. Reforms in energy policy have been successful in expanding LPG availability and reducing its price in a number of countries. Innovative financing measures have contributed to promotion. Barriers and constraints need distinct attention, on both the supply side and the demand side. Government actions such as establishing a regulatory environment and supporting subsidy and micro-finance schemes will be essential to further expansion in many countries. The potential to widen the reach of LPG beyond middle- and upper-income cooks depends crucially on the policies adopted.

Can LPG meet lower-income and rural women's cooking energy needs, or is it only for middle and upper income households? LPG has usually been branded as a fuel for the middle and upper class, but much depends on government policy, as well as private sector company approaches. Where LPG is less expensive than

competing fuels such as charcoal, credit to purchase appliances can be a huge barrier. Innovative programmes such as Switch SA in Haiti and PayGo in Kenya are tackling the low-income market by offering credit for stoves and low-cost refills.

Targeting subsidies to women and poor households is critical in realizing benefits, as the case studies from India and Indonesia show. In India, subsidy reforms were initially ineffective in reaching poor rural women, subsidized LPG was illegally diverted, and the fiscal burden was great. Recent advances in the Aadhaar identity system, linking subsidy payments to bank accounts, and better targeting subsidies directly to women, has increased women's financial inclusion and LPG connections in the latest LPG scheme, PMUY, which aims to empower women and protect their health. But poor women still face access issues, and fuel stacking is still common. In Indonesia, the Kerosene-to-LPG Conversion programme launched in 2007 has resulted in lower mortality and morbidity rates, and time savings, with women the direct beneficiaries, but has had little impact on energy poverty or biomass use, and the government is also looking at how to better target to lower income households.

Global partnerships can be more effective in implementation by working with women's networks. The last decade has seen the emergence of several global partnerships around household energy. Sustainable Energy for All (SEforALL) has recognized access to energy for cooking and heating on an equal par with access to electricity, and ensured that this goal (which was absent in the MDGs) is included as SDG 7 on energy. The Global Alliance for Clean Cooking (GACC) – now the Clean Cooking Alliance (CCA), has established a public-private partnership that seeks to mobilize high-level national and donor commitments toward the goal of universal adoption of clean cookstoves and fuels. Its goal is to foster the adoption of clean cookstoves and fuels in 100 million households by 2020. LPG fuel and stoves are an integral part of this strategy.

The WLPGA Cooking For Life programme, and the Global LPG Partnership (GLPGP) complement the work that is being done by CCA and SEforALL, with the goal of transitioning 1 billion people from cooking on traditional fuels and other dirty and dangerous fuels such as kerosene to LPG by 2030.

In 2012, WLPGA had launched the “Cooking For Life” campaign to communicate the health benefits of switching communities from wood, charcoal, dung and other traditional fuels to LPG for cooking. In October 2013, SEforALL and the WLPGA announced the goal of transitioning 1 billion people from traditional fuels to LPG. A multi-stakeholder partnership has been created to build on best practices and sustainable business models in order to overcome the multitude of policy, market regulation, business environment and local financing bottlenecks inhibiting the ability of governments and the private sector to meet the need for LPG.

Partnerships with women’s organizations and other development actors can move this agenda forward faster. Multi-sectoral approaches can multiply benefits for women and their families. Few LPG programmes appear to have adopted an integrated approach to using energy for local development and poverty reduction, an approach fairly common in improved stoves initiatives and decentralized energy projects, and also used in rural electrification projects, to ensure development linkages. Coordination of LPG promotion with road improvements, school cooking programmes, and maternal and child health initiatives has been effective. Promotion of both electricity and cooking household energy access improvements simultaneously could have considerable synergies. Women’s organizations and networks can be powerful allies to work together with LPG companies and governments to advance these measures. They can share information and experiences, advocate for appropriate

policies and regulations, and assist in their implementation. They can help pilot and implement micro-finance schemes and other mechanisms that make it easier to adopt LPG. They can support entrepreneurship among their members. Women’s organizations have valuable perspectives and actions to contribute to these initiatives on household energy options, as described throughout this report. The Self-Employed Women’s Association (SEWA), an important self-help association of women workers in the informal sector in India, is already partnering with the GLPGP on initiatives that can help deliver energy inclusion and facilitate economic opportunities for women to address cooking energy needs. Women’s energy networks and other women’s organizations can be a powerful tool to increase women’s agency and voice, and can help create conditions where all women have the ability to demand, manage and use modern energy services.

CHAPTER 4: WAY FORWARD

4.1 Knowledge gaps

Few gender-perspective impact evaluations of LPG switching programmes and targeted subsidies have been carried out; fossil fuel subsidy reform in India is the first time that reforms have specifically targeted women, and initial research findings on impacts on gender inequality are promising. Most studies of LPG switching have not however used a gender lens; for example an otherwise excellent impact analysis of the Indonesia programme (Andadari, et al., 2014) shows poverty impacts but does not analyze specifically the effects on women versus men. Time savings and other impacts on women following electrification of households have been studied and have shown for example effects on women’s literacy and girls’ education. There are few studies on the development impacts of improvements in cooking, however and most of these are on biomass fuels. Synergistic effects of bundling of more than one type of infrastructure or development intervention have been studied

for electricity, e.g. electricity and water, electricity and education. But there is mainly only anecdotal evidence about the synergistic effects of providing modern cooking and heating fuels together with other development initiatives. The example of Vida Gas in Mozambique illustrates how removing the energy constraint by enabling access to LPG by health clinics could be essential to improving access to vaccines and maternal and child health. But we have been able to identify few such examples.

Time savings in cooking and fuel collection are nearly always the first advantage of LPG cited by women, including probably convenience and cleanliness, which also save time. One of the most important insights from gender analysis of time use is that there are synergies, and short-term trade-offs, between and within market-oriented and household-oriented activities. Data on time spent in fuel collection suggests that households could save ten hours a week or more by switching to modern fuels, but most field studies have focused on improved biomass stoves and there is little information on actual time savings when switching from biomass or other fuels to LPG, including cooking time savings, which could be significant.¹ More studies are needed specifically on time savings in cooking and fuel collection when switching to LPG. How time savings are used by women also deserves study, because it seems that faster cooking with LPG may be especially important for women who wish to use saved time to add to their workforce participation and increase their families' income earnings. Shifts in gender roles with adoption of LPG and a more modern outlook also need to be documented.

The fuel switching process and health outcomes. Lower emissions and hence lower exposures of women cooks to pollution when cooking with LPG have been well documented. However due to fuel stacking (continued use of multiple fuels), health outcomes can be ambiguous. Households with improved biomass stoves plus LPG will have lower emissions than those with traditional stoves plus LPG. A correlation has been found between electricity connection and adoption of LPG. More understanding is needed of the fuel switching

process and health outcomes in practice, and how to influence these. Is a "package" approach to fuel switching needed to ensure lower overall household air pollution? Possible behavioral "nudges" that governments could use to make clean fuels like LPG the "new normal" and avoid fuel stacking, need to be investigated.

Beyond household air pollution, other public health impacts of switching to LPG have been little examined. Carrying heavy loads in fuel collection can have impacts on maternal and child health. Statistics on accidents, fires and burns comparing LPG with kerosene and biomass cooking would be essential to provide cooks with accurate risk assessment. Some available data suggests that, due to house fires, accidents, and child poisonings, kerosene (paraffin) is a much more lethal fuel than LPG. Better stoves and fuels could even lead to reduced violence against women – burning food was the third highest justified reason for wife beatings, in the 2012 World Development Report on Gender. We do not know whether the growth of LPG use in India, replacing kerosene, is leading to fewer dowry deaths, in which kerosene is commonly implicated.

What role have women played in successful LPG fuel switching programmes in e.g. Brazil, India, Indonesia, and Thailand? Recent models of innovative distribution models with financial inclusion enabling lower-income women to access LPG, need to be documented and lessons learned need to be shared. Are there best practice examples of women's participation in consumer education, in advocating for standards, and in the LPG supply chain? Little is known about how women's businesses use LPG, and how they have benefited. The lack of studies on LPG and women's empowerment, and particularly its role in societal transformations, means the evidence is so far inconclusive. Cases such as Morocco where LPG is widespread with over 40,000 groceries selling it are likely to yield examples of women's involvement in supply chains and how and whether this (and other characteristics of LPG) changes gender roles and relations.

¹ Time spent searching for and waiting to buy LPG would also have to be factored in.

4.2 Knowledge gaps

1. **Gender-equitable financing at global and national level should be provided to meet both women's and men's energy needs. Subsidies targeted specifically at poor women are essential to make best use of national budgets and ensure benefits.** Policy makers can learn from recent innovations such as the Direct Benefit Transfer scheme or Give It Up campaign in India that seek to minimize leakage and ensure subsidies reach the intended recipients. **Investments need to be increased for improved cooking options, women's primary energy use. Universal energy access can be financed through international climate funds, national energy budgets, public-private partnerships, bank finance on multilateral, bilateral and local levels, microfinance, loans, targeted subsidies and innovative financing mechanisms. LPG for cooking should be an important part of this financing, along with other options such as improved biomass stoves, electricity, and energy efficiency.**
2. **The guidelines on household air pollution issued by WHO in 2014, alongside the ISO emissions standards for cook stoves (<https://www.iso.org/standard/61975.html>) have greatly facilitated the benchmarking of potential energy options for households. LPG is well positioned to provide early wins in addressing the guidelines. To achieve a community health benefit, a strategy working with public health agencies to develop health awareness and promotion of clean cooking is needed, especially when there is a project or marketing effort that is being planned in a community. Linking health promotion to local efforts would help strengthen the messaging and outreach.**
3. **The guidelines on household air pollution issued by WHO in 2014, alongside the ISO emissions standards for cook stoves (<https://www.iso.org/standard/61975.html>) have greatly facilitated the benchmarking of potential energy options for households. LPG is well positioned to provide early wins in addressing the guidelines. To achieve a community health benefit, a strategy working with public health agencies to develop health awareness and promotion of clean cooking is needed, especially when there is a project or marketing effort that is being planned in a community. Linking health promotion to local efforts would help strengthen the messaging and outreach.**
4. **Governments should ensure that women and their organizations are represented in the national household energy policy process and specifically in LPG policy and regulation, including in determining siting and monitoring compliance with safety regulations, commenting on programmes and policies, and having input into the appropriateness of regulations, markings, and other measures for strong monitoring and enforcement. Women's groups can advocate for appropriate regulation and participate in conducting and publicizing the results of spot-checks monitoring compliance and prices. Individual women could be employed in consumer education programmes and monitoring. Consultations should be two-way, gathering input from women's experiences as well as informing them about good practices.**

5. **Women can help identify innovative approaches, both technical and non-technical, to key issues, constraints and barriers to wider access, such as fuel stacking, safety, underfilling, and unreliable supply. It would be useful for example, to have comparisons, done by women themselves, of the different fuels. Cost comparisons could be developed together with women's groups on the basis of local prices of fuels and stoves. Women need to have comparative information about safety, health impacts, costs, and other characteristics of different cooking fuels, and to understand technical as well as social aspects of LPG safety, in order to feel in control of the process. Women's organizations can be involved, based on this knowledge, in raising public awareness and advocacy for LPG and other modern fuels. Gender norms and aspirational norms can be "nudged" by government policy. The private sector is already active, and women see LPG as an "aspirational fuel", so there is an alignment of interests.**

6. **Private LPG companies and entrepreneurs need to continue to develop and share innovative ways to expand markets to lower-income households and to engage with women's development.** This is an area where the LPG industry has been slow to recognize the potential for driving both market growth and for socio economic benefits. **Market assessments need to be undertaken that take into account not only income levels but also the potential of these innovative approaches. Women's organizations, governments and LPG companies are**

natural allies in ensuring maximum access to and safety of LPG for cooking. Women's participation in the industry and supply chain, and in monitoring safety practices, can be encouraged through industry groups, including professional women's networks.

One example of this is the Women in LPG (WINLPG) global network launched by WLPGA, which aspires to bring more women into the supply chain of LPG at all levels of the industry. **Women's ownership of LPG assets, creative microfinance and delivery options led by women, and women-to-women sales and consumer education are likely to be effective means of promotion. Opportunities for synergies between sustainable development goals and LPG promotion, as in the VidaGas case, need to be identified and moved forward, in cooperation with NGOs and governments. As with rural electrification programmes, productive use components that encourage use of LPG in businesses and social infrastructure (which increases load) can be included in fuel switching programmes.** WLPGA's suite of documents which promote industry guidelines and best practices such as the Guidelines for the Development of Sustainable LPG Markets **could be expanded beyond technical and regulatory issues, to consider the need to connect all the linkages that will be needed to achieve scaling of LPG as a clean cooking solution that contributes to gender equality and sustainable development programmes.**

COOKING ENERGY IN DEVELOPING COUNTRIES A KEY ISSUE FOR WOMEN AND GIRLS



Empowering women and improving their status are essential to realizing the full potential of economic, political and social development. Empowering women is also an important equity and human rights goal in itself. Access to clean cooking energy is a critical element in women's empowerment and gender equality.

1.1 Access to clean cooking energy is a gender issue

In the last two decades, the divide between men and women has narrowed, especially in primary education and health (World Bank, FY16-23). Improvements in women's education and health have been linked to better outcomes for their children in many countries. Women make up 40% of the global labor force (Pew Research Center, 2018), and 43% of the agricultural labor force in developing countries (World Bank, FY16-23), and globally are the majority of university graduates. Empowering women as economic and social actors has changed policy choices and made institutions more responsive (World Bank, 2012).

Yet despite progress, gender disparities continue to limit economic growth: women

lag behind men in most measures of economic opportunity. Globally, on average, women's incomes are 24% less than men's (UNWomen, 2015). They have access to a disproportionately lower share of land, credit and schooling and receive in general lower average wages than men. In education, only 23 percent of low-income countries have achieved gender parity at primary school level and 15 percent at secondary level. Women are more likely to work in the informal sector and spend at least twice as much time as men on unpaid domestic work and care activities. The credit gap for formal, women-owned small and medium-sized enterprises is estimated at about \$300 billion dollars globally. Globally women occupy only 23% of parliamentary seats, and women continue to face unequal treatment under the law as well as sexual violence and harassment in society and the workplace (World Bank, FY16-23).



The Sustainable Development Goals for 2030 emphasize inclusion not just as an end in and of itself, but also as critical to development. At the center of this agenda is the achievement of gender equality and empowerment of all women and girls (SDG 5). The private sector as well as governments are increasingly committed to reducing gaps between men and women, because not just because it is the right thing to do, but also because it makes business sense. Goal 5 includes many targets relevant to the energy sector, e.g.:

- ▶ end all forms of discrimination against all women and girls everywhere, including to eliminate violence against women;
- ▶ eliminate all harmful practices;
- ▶ recognise and value unpaid care and domestic work through the provision of infrastructure and the promotion of shared responsibility within the household;
- ▶ ensure women's effective participation and equal opportunities for leadership in political, economic and public life;
- ▶ reform to give women equal rights to economic resource, access to ownership and control over land, financial services and natural resources;
- ▶ enhance the use of enabling technologies; and
- ▶ strengthen sound policies and legislation.

Gender equality matters if energy sector development is to contribute to economic growth and broader development goals. Table 1.1 shows linkages between some SDGs, gender, and energy. Increased supply of time- and labor-saving energy services, including clean cooking, can enable women to participate in the workforce. Improved delivery of energy to social infrastructure can help close the gender gap in human capital, specifically maternal mortality and education.

Equal access to energy for both women-owned and men-owned businesses can create new jobs and private enterprises and reduce the gender gap in economic opportunities, earnings and productivity. Reducing gender differences in voice and agency in energy sector decision-making can improve governance and representation in the energy sector.

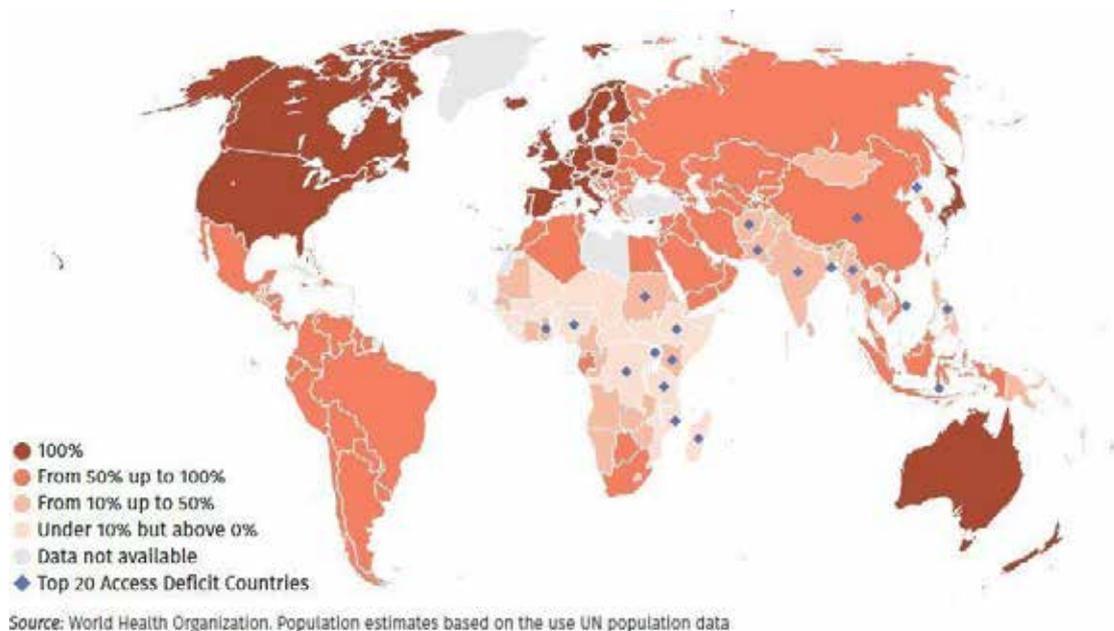
Table 1.1 Indicators of energy as a key variable from a gender perspective for the Sustainable Development Goals

Sustainable Development Goals	Gender & energy indicators relate energy access with impact on:
Goal 1. End poverty in all its forms	<ol style="list-style-type: none"> 1. Income generation (M/F): Direct applications in agriculture, home industry, extension in work hours through lighting, energy entrepreneurs 2. Reduction in household expenditures on energy 3. Improvement in social capital
Goal 2. End hunger, achieve food security and improved nutrition	<ol style="list-style-type: none"> 1. Time & effort spent (M/F, B/G) in cooking & fuel collection and in food processing; and use of time saved 2. Efficiency and volume of food production per labor unit (M/F, B/G)
Goal 3. Ensure healthy lives and promote well-being for all at all ages	<ol style="list-style-type: none"> 1. Indoor air pollution (IAP) exposures and acute respiratory diseases due to biomass fuel use (M/F, B/G) 2. Reduced under-5 mortality 3. Low birth weight due to IAP and maternal overwork 4. Quality of primary health care and vaccination 5. Women's workload and child care 6. Burns and kerosene poisoning 7. Fuel scarcity, water boiling and cooked foods
Goal 5. Empowering women and girls	<ol style="list-style-type: none"> 1. Literacy (M/F) 2. Leisure time (M/F) 3. Access to information through media & telecommunications 4. Transformation of gender roles in the household (M/F) 5. Control over & access to modern energy services (M/F) 6. Voice and participation of women 7. Violence against women in energy sector 8. Employment of women in the energy sector 9. Improved access to enabling technologies
Goal 7. Access to affordable, reliable, sustainable and modern energy for all	<ol style="list-style-type: none"> 1. Access to affordable, reliable modern energy 2. Reduced women's burden of care for PLWHA 3. Reduced drudgery for women LWHA 4. Risk of infection from violence in collecting fuel 5. Proportion of population (M/F) with primary reliance on clean fuels 6. Women's empowerment in energy infrastructure, technology upgrade and supply chain
Goal 13. Urgent action to combat climate change and its impacts	<ol style="list-style-type: none"> 1. Deforestation & fuel collection 2. Climate change & traditional biomass use 3. Access to clean water & sanitation 4. Access to cooking energy and electricity by slum dwellers (M/F)
Goal 15. Sustainably manage forests and halt land degradation	<ol style="list-style-type: none"> 1. Deforestation & fuel collection 2. Climate change & traditional biomass use 3. Reduction of land degradation and desertification Access to clean water & sanitation

*M/F denotes to Male/Female, B/G denotes to Boy/Girl
 Source: Adapted from (UN, 2015) & (World Bank et al., 2018)

Energy access will be a key contributor to meeting gender goals and reducing poverty (Dutta, Kooijman & Cecelski, 2017). 38% of the world's population, in both rural and urban areas still cooks daily with wood crop residues, dung and coal, as shown in Table 1.2. The health consequences of biomass combustion in terms of acute respiratory infections, chronic obstructive lung diseases, low birth weights, sinus headaches, lung cancer and eye problems are now well-documented. The World Health Organisation (WHO) estimates household air pollution was responsible for 7.7% of global mortality, or 4.3 million deaths, in 2016, 54% of them being women and children. These diseases have a significant impact on maternal and child health (WHO, 2016) (see also 2.2.2 below).

Map 1.1: Share of population with access to clean cooking in 2016 (%)



Source: (World Bank et al., 2018)

According to gender roles in traditional societies, rural women and girls are the primary collectors of wood and residue fuels, which account for 80% of household energy use in many developing countries. Time spent in wood collection by women in households without access to modern energy has been reported on average, 1.4 hours a day. (World Bank et al., 2018). But time spent in fuel collection can range from one to five hours per household per day or more (UN, 2015).

When fuel is monetized, households must work to pay for purchasing household energy. Cooking roles are even more gendered, with women responsible for cooking in nearly all cultures. Cooking and cleaning sooty pots can take just as much time daily as fuel collection, and often more.

The real rural energy crisis is rural women's time and drudgery, with women working longer work days than men in providing human energy for survival activities such as fuel gathering and water carrying, cooking, food processing, transport, and agriculture – often non-monetized work which is largely invisible in national energy accounts and labor force statistics. Collecting biomass and using inefficient cooking methods can take away from productive activities such as schooling, childcare and potential income generating activities. Energy access can alleviate many of these tasks and empower women to take part in education, employment, and political participation, as well as to improve their family welfare by spending more time on their families.

Many income activities of women in the informal sector – often critical to family economic survival – are extensions of women's cooking and home roles, are fuel-intensive and require thermal (heat) energy, e.g. cooking food for sale. The viability of these activities is affected by energy prices and availability. Energy scarcity also impinges on the provision of basic services key to women's empowerment, such as water, health, education, and grain milling.

In energy sector employment, women are increasingly represented but still less than men. Women account for 38% of the total workforce in major oil-producing nations, however, only about 22% are employed in their oil and gas sectors (Rick, et al., 2017). Research conducted by IRENA (2016) suggests that women are better represented in the renewable energy sector, making up thirty-five percent of the labor force compared with the overall energy industry, in which women are only represented by 20-25% (IRENA, 2018). Due to their under-representation, women in the energy sector can often feel isolated. In national and international energy policy, women's voices are only beginning to be heard. Networking has proven valuable to women in the energy sector, both in the North and South. Access to clean cooking energy is a particularly

gendered issue, because women are primarily responsible for cooking in virtually all cultures. Historically, energy access programmes and policies have focused mainly on providing electricity connections; traditional biomass energy was not even recognized in national energy accounts until the 1980s and later, and investment in cooking energy services has largely been neglected. SDG7 on energy for the first time includes targets on clean cooking energy as well as electrification. While roughly 1 billion people live without electricity, nearly 3 billion people – or more than 40 percent of the world's population – do not have access to clean fuels and technologies for cooking. Progress in access to clean cooking fuels and technologies has barely kept up with population growth, especially in Sub-Saharan Africa (World Bank et al, 2018). In contrast to electrification, access to clean cooking is actually falling in some countries. Despite dedicated policies being implemented in India, China and Indonesia, IEA projections (IEA, 2017) show that the world will still lag behind when it comes to achieving universal access to clean cooking by 2030. Under current policy scenarios, 2.3 billion people - 27% of the global population- will not benefit from access to clean cooking facilities in 2030.

Moreover, the costs of meeting global cooking energy needs are minor compared with those for electricity. "The costs associated with delivering universal clean cooking access, \$3 billion per year, represent only 10% of those associated with delivering universal access to electricity", according to the 2018 Energy Progress report tracking the SDGs (World Bank, 2018). Why are these investments not being made?

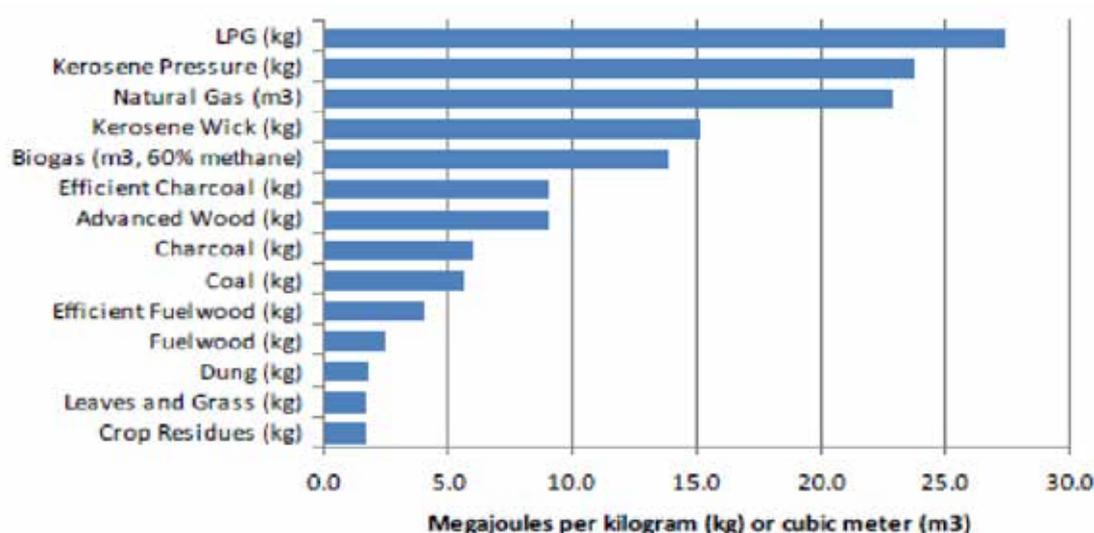
This neglect of cooking energy in energy investment is a gender issue. Gender bias has been suggested as one reason for lack of attention in the past to household energy, which is of particular importance to women (Parikh, et al., 1999; Cecelski, 1995)). Parikh and Laxmi (2000) were the first to argue that the low share of cooking fuels (19.3% in 1995-6) in the total consumption of petroleum products

in India, compared with transport fuels and the power sector, showed that far less priority was being placed on women's health, especially in rural areas. A World Bank report on its investments in energy access over the period 2000-2008 found that while physical investment in electricity access accounted for nearly half of energy access-related assistance, support for promoting the transition to modern cooking fuels was quite small - less than 5% of total lending (Barnes, et al., 2010). Only a small proportion of fossil-fuel subsidies go to households for cooking: in 2009, according to the IEA, only 15% in countries with low levels of modern energy access (IEA, 2012). Moreover, an IISD study for Indonesia found that fossil fuel subsidies are enjoyed by wealthier rather than poorer households. (IISD, 2017). Hence energy policies and subsidies have been biased away from the fuels and energy services that women use the most. This imbalance is currently being addressed under SDG 7, but targets are still not being met for cooking energy.

1.2 LPG, ENERGY POVERTY, AND CLIMATE CHANGE

The use of household solid fuels (wood, charcoal, dung, and agricultural residues) for cooking and heating is an indicator of energy poverty. Increasing household use of LPG is one of several pathways to meet the objective of universal access to clean cooking and heating solutions by 2030 - one of the three targets of SDG 7 and the Sustainable Energy for All (SEforALL) initiative (along with doubling the global rate of improvement in energy efficiency and doubling the share of renewable energy in the global energy mix). These three pillars are main targets to achieve the SDG 7: access to affordable and clean energy, to support other sustainable development goals and the elimination of poverty. For the first time, access to cooking and heating energy, the most important energy need for poor women, is treated on an equal footing with access to electricity.

Figure 1.1: The energy transition for cooking

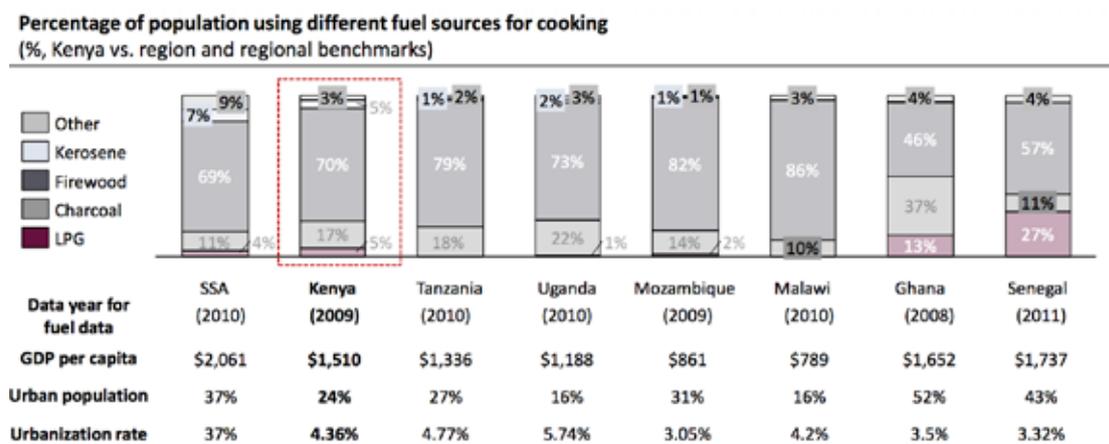


Source: O'Sullivan and Barnes, 2007 in (World Bank, 2011)

LPG is a clean-burning, efficient, versatile and portable fuel, produced as a by-product of natural gas extraction and crude oil refining – therefore either it is used or wasted. It is consistently among the most efficient heating options and can be up to five times more efficient (high calorific value) than traditional fuels (see Figure 1.1). LPG produces less air pollutants than kerosene, wood or coal and emits about 20% less CO₂ than heating oil and 50% less than coal; it also reduces black carbon emissions compared with these fuels. It can be transported in small or large quantities by sea, rail or land, including human portage, so it can be made available even in remote rural areas. While accidents are not common, LPG is highly flammable, and does require safety precautions and correct usage to avoid fires and explosions: “LPG is a good slave and a bad master” (Ramesh & Sakthivel, 2013).

Historically, the main obstacles to wider LPG use in developing countries have been affordability and availability (UN, 2015; Kojima, 2011). LPG is currently used predominantly by the upper half of the income groups in low- and lower-middle-income countries and especially urban and suburban households (Kojima, 2011), as shown in Figure 1.2, due to the need for a dense distribution system (i.e. high number of customers per square km) for maximum efficiency and lower cost. However, increasingly, LPG is penetrating to lower income households, especially in emerging market countries: Governments in India, Indonesia, Vietnam, Thailand, Brazil, Senegal, Ghana and Morocco have through deliberate policy promoted the establishment of LPG infrastructure, and pricing and equipment packages that make LPG accessible to middle and sometimes even lower income households in urban, suburban and even rural areas.

Figure 1.2: Percentage of population using different sources of cooking fuels in Sub-Saharan African countries, compared with Kenya



Source: (GLPGP, 2013)

LPG consumption for domestic use is increasing at a fast pace, although not evenly around the world. The LPG demand in the past years proves this trend. According to W--LPGA's Statistical Review of Global LPG 2017, 44% of LPG is used in the domestic sector, followed by the chemical sector (28%) and industry (10%) (WLPGA, 2017). Moreover, many countries, especially African and Asian ones, have been pushing to promote LPG usage to meet climate and energy-related SDGs (IEA, 2016b). Governmental support for kerosene to LPG mass household conversions in India or Indonesia have kept the demand for household use at high peaks.

In India, a country which has one of the highest LPG domestic consumption rates - 20 MT annually - demand increased by 6% between 2014 and 2017 and is expected to reach 38.8 MMT by 2021 (WLPGA, 2017a), as the government implements the new Ujjwala LPG scheme that aims to give access to LPG connections for 50 million poor households. Under this scheme, LPG coverage increased to 72% of all households and is projected to reach 85% by 2019 (WLPGA, 2017b). In Indonesia as well, as its fuel-switching programme reached maturity, Indonesia's LPG household consumption rose from 4.7 kg/capita in 2007 to 24.4 kg/capita in 2015, making up 8% of the country's overall energy mix (Thoday, 2018). Ghana's rural LPG programme scale up, launched in 2013, has also contributed to mainstreaming the domestic use of LPG. As of November 2017, almost 150,000 households had received cook stoves working on LPG under the Rural LPG (RLP) programme (Asante, 2018). Nonetheless, the high cost of subsidized LPG remains a problem for balancing these countries' national budgets.

It is clear that there are still many households, of the nearly three billion households without access to clean cooking energy, who could afford to switch to LPG if other obstacles could be reduced. Further, higher-income households can help build up the LPG infrastructure needed to reduce costs, and

provide awareness building, so that lower-income households may also eventually be able to consider the LPG cooking option.

LPG is sometimes a transitional fuel in urban areas and for higher income households on the way to piped natural gas and electricity for cooking. However piped gas does not always become an option for various reasons including lack of town planning, high costs of infrastructure, and vulnerability of pipelines to sabotage. Furthermore, rather than "fuel switching" to increasingly modern fuels, the concept of "fuel stacking" is now accepted as more descriptive of household fuel use: even at higher income levels, users continue to want to preserve access to multiple fuel options for different tasks, adding LPG and electricity services, without leaving wood and charcoal behind. This multiple fuel strategy is adopted because it maximizes household fuel security and exposure to price volatility in uncertain markets. While relative fuel prices and household income are important factors, they are not the only ones. The value of women's labor is also a factor in fuel choice (see 2.1 below). At lower income levels, LPG provides a valued option to working women for cooking fast and for short cooking tasks such as making tea or breakfast, even if biomass fuels are still the main source of cooking energy.

In addition, traditional biomass fuel use is related to climate change and agricultural production that affect women's work and livelihoods. Black carbon contributes almost 20% of temperature increases and is second only to CO₂ in its contribution to climate change (Ramanathan & Carmichael, 2008). Globally, about 25% of global black carbon emissions are attributed to residential solid fuel burning (cooking, heating and lighting) and about 84% of this black carbon is from households in developing countries (EPA, 2012). In many Asian and African countries, residential use can account for as much as 60-80% of black carbon emissions. In 2018, for the first time, the International Panel on Climate Change (IPCC, 2018) acknowledged the importance of simultaneously reducing

short-lived climate forcers (SLCFs), including black carbon and methane, in limiting warming to 1.5 degrees C. The IPCC report points out that many of the solutions and innovative technologies to combat climate change already exist, in the form of clean cook stoves, gas-based or electric cooking, but are not being deployed at scale, nor receiving the requisite financial investment or political support. A study commissioned by Clean Cooking Alliance pointed out that up to 25% of polluting black carbon emissions are caused by household solid-fuel use, emphasizing the central role of clean cooking solutions. In a survey conducted in Nepal, researchers found that PM2.5 emission factors of gas cooking events are 50 times lower than wood cooking events, and biogas and LPG cooking aerosol emissions are slightly climate cooling. However, wood still remains a dominating role in household energy source due to the incapability of clean gas stoves to meet all household energy needs (Clean Cooking Alliance, 2018). Citing Marc Jeuland's 2015 research on the economics of household air pollution in India, the authors argue that switching from biomass cookstoves to "cleaner gas stoves or to electric cooking stoves is technically and economically feasible in most areas, but faces barriers in user preferences, costs, and the organization of supply chains."

Clearly, many millions of households will continue to be dependent on wood fuels as their main or sole fuel, and promotion of LPG does not mean that efforts to promote improved biomass cookstoves and other smoke reduction approaches are not needed. Electric cooking as well has a role to play in the cook's arsenal of clean cooking choices – electric rice cookers are already popular even in rural areas of many Asian countries, and electric kettles, microwaves and other appliances can be expected to become popular as electrification progresses (Smith, 2014). But LPG has probably the major role to play in this multi-pronged solution to the cooking energy crisis, as a preferred option for cooking for women in developing countries.

The present report brings a gender perspective to contribute to the partnerships among the UN, governments and the private sector, to increase access to LPG for cooking. Following this introduction to the cooking energy challenge from a gender and poverty perspective in Chapter 1, it explains in Chapter 2 why women want LPG – both short and long-term benefits in terms of saving time and drudgery that can enable other development opportunities, and in terms of health improvements for women and their families - including but not limited to reducing household air pollution and climate warming. Chapter 3 then explores how governments and companies are overcoming constraints to access, and how women's full and effective participation and equal opportunities can contribute to expanding access to LPG as a cooking fuel. The way forward in terms of knowledge gaps and recommendations is proposed in Chapter 4.



WHY WOMEN WANT LPG



Women want LPG for cooking. It is the “aspirational” cooking fuel, even in developed countries. Even with constraints such as fears of accidents, often higher fuel expenses, and supply issues, women often choose LPG when they have the option. What are the benefits for women of switching to LPG?

With focus on the Sustainable Development Goals (SDGs), energy policy and practice has sought increasingly to document the tremendous impact that modern energy services can have on education, health and gender equality (Cabraal, et al., 2005, World Bank et al., 2018)). Fuel switching from traditional biomass fuels to modern fuels for cooking such as LPG can reduce women’s work and time burden and drudgery, and improve health and decrease deaths. Secondary benefits can come from how time saved is used by women to improve their and their families’ lives, whether through income generation, education or leisure. There are likely to be considerable safety benefits due to switching from kerosene to LPG. Modern energy in the form of LPG can also improve the delivery of health services. This chapter explores these short- and long-term benefits.

2.1 The energy crisis is women’s time and drudgery

2.1.1 Women’s triple burden

Lifting women’s time constraints by improving infrastructure is one of the priorities for action on gender equality, identified by the World Development Report 2012 and the 2017 HLPF Thematic Review of SDG 5. Modern stoves and fuels can save women’s time and effort both in fuel collection and in cooking, and women perceive this as the major advantage of LPG. Time savings are nearly always the first advantage of LPG cited by women (Bates, 2007; Budya & Arofat, 2011; Terrado & Eitel, 2005).

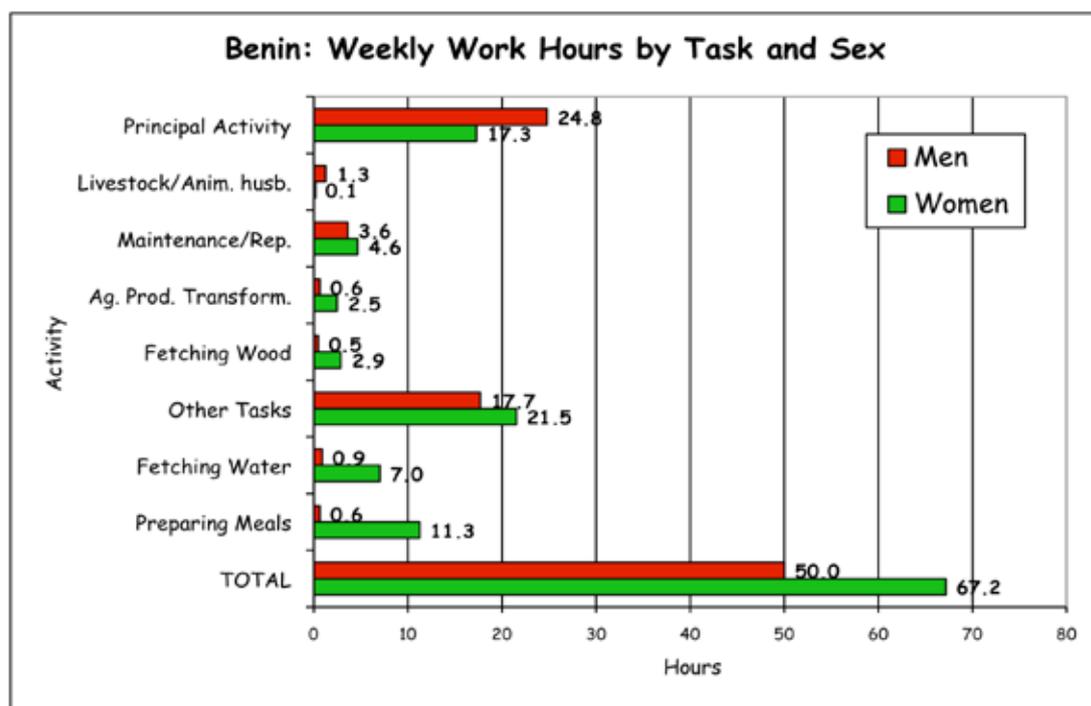
In the developing as well as developed world, women often play the major reproductive role in the family.



They are responsible for most of the domestic or household work while taking care of other market work, child caring work, etc. (Rewald, 2017), as shown in Figures 2.1 and 2.2 below. The differing amounts of time that men and women allocate to household work are one factor driving earnings gaps. Everywhere women devote more time each day to care and housework than men: from one to three hours more for housework, two to ten times the time for family care, and one to four hours less for market activities.

Even as women take up a bigger share of market work, they remain largely responsible for care and housework. These differences in gender roles reduce women's leisure, welfare, and well-being. Releasing women's time is a key necessity for women's ability to invest in education, their agency and life choices, and their ability to take up economic opportunities and to participate more broadly in economic, political, and social life (World Bank, 2012).

Figure 2.1: Weekly work hours by task and sex, Benin

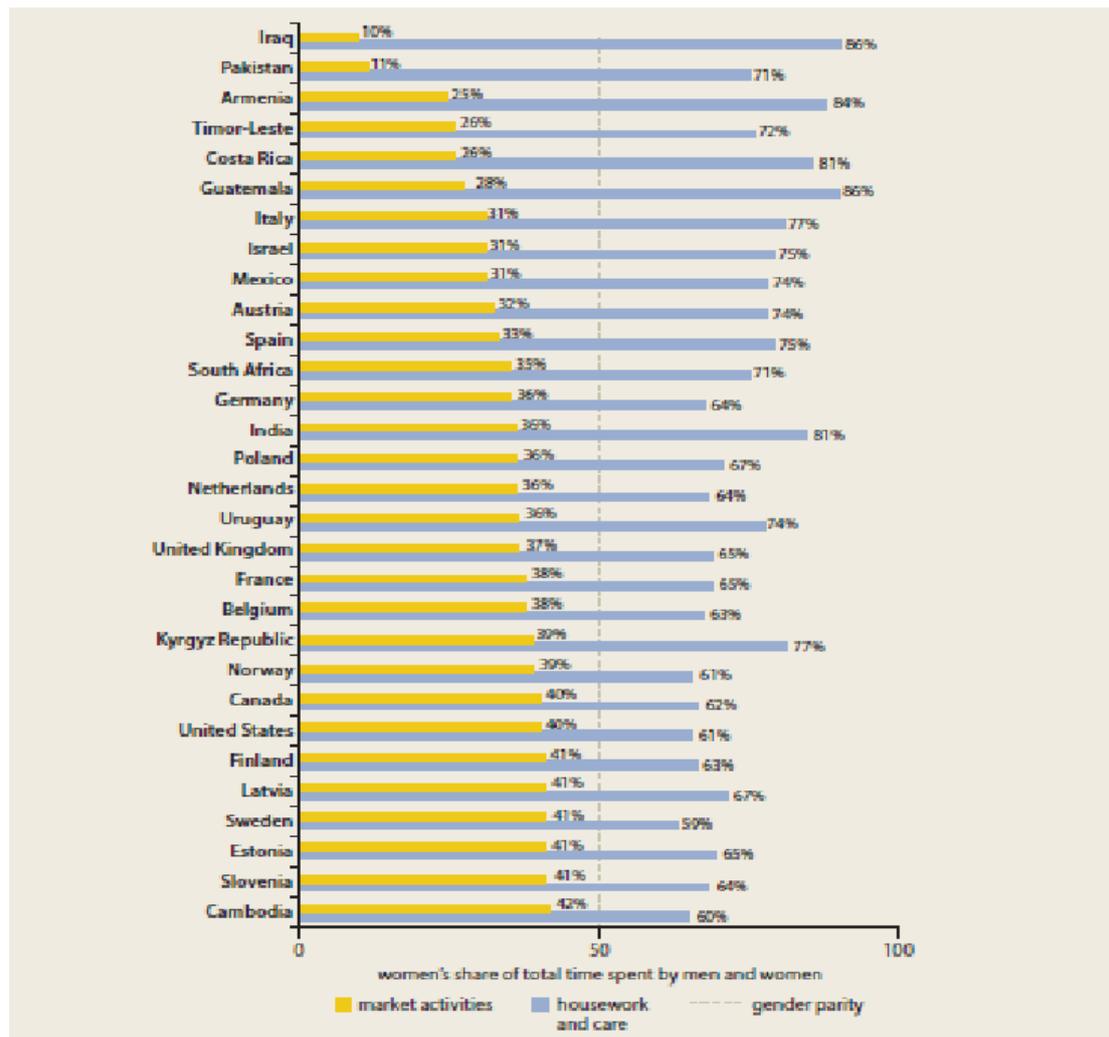


Source: Benin – Time Allocation Study, UNDP, 1998 in (Blackden, 2002)

Poverty is a function of time as well as money. Time poverty and income poverty may reinforce each other, with the sheer drudgery and low productivity of tasks such as fuel collection and cooking reducing women’s ability to take advantage of economic opportunities. One of the most important insights from gender analysis of time use is that there are synergies and short-term trade-offs between and within market-oriented and household-oriented activities - what has been called “household time overhead”. This includes preparing meals, gathering fuel for cooking and heating, and other household activities such as fetching water.

For example, there are interconnections between time spent in cooking, and respiratory disease, discussed in the next section. Several studies document that workload constraints limit the likelihood that children will be taken to health posts for vaccinations, or that sick children or family members will access health care (Blackden & Wodon, 2006). According to a study conducted by the Institute of Social Studies Trust (ISST) and Institute of Development Studies (IDS) in India, in Indian urban areas women spent 8.4 hours on household chores and in rural areas women spend 14.5 hours on chores. Women’s situation in economic empowerment is closely related to their unpaid care work, and the household workload limits their choices of employment (Sengupta et al., 2017).

Figure 2.2: Across the world, women spend more hours per day on care and housework than men



Source: (World Bank, 2012).

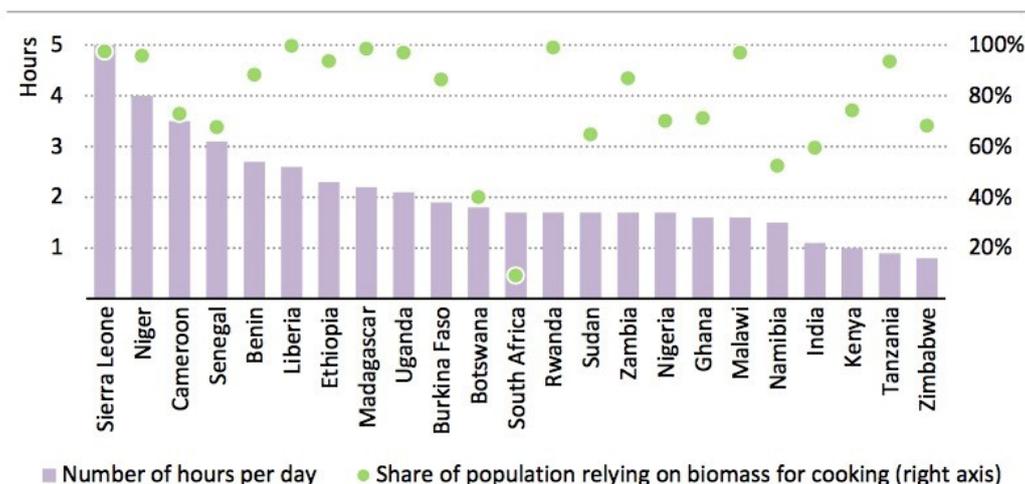
...Time poverty and income poverty may reinforce each other, with the sheer drudgery and low productivity of tasks such as fuel collection and cooking reducing women's ability to take advantage of economic opportunities...

2.1.2 Time spent in fuel collection and cooking

Most attention to time-saving of women in the energy sector has focused on the burden of biomass fuel collection, which in fuel-scarce areas can range from one to more than eight hours per household per week. A WHO report indicated that women not only spend three

times as many hours as men in fuel collection, but are also suffering from injuries and chronic discomfort caused by years and years of heavy burdens on their back (WHO, 2016). The World Energy Outlook Special Report (2017) conducted by IEA has collected data on the average number of hours spent collecting fuel in some African countries, as shown in Figure 2.3 (IEA, 2017).

Figure 2.3: Average number of hours spent collecting fuel per day per household



A high reliance on biomass for cooking in many countries means that women and children without clean cooking access spend an average of 1.4 hours/day collecting fuel

Source: (IEA, 2017)

In some places and households, however, the fuel collection burden is much higher. SEWA for example reported findings from quantitative and qualitative studies in rural Gujarat, that women can spend up to 40% of their waking time on collecting fuel or in cooking (SEWA, 2014). Clearly, local conditions can vary considerably.

In some cultures, men and boys also collect fuelwood, especially when distances and loads are greater (Concern Universal, 2012; Clancy, et al., 2013), indicating some flexibility in gender roles. A study in Haiti showed that boys spend more time in fuel gathering than girls, probably out of safety concerns. In general though, girls take more responsibility in fuel collection, and people in clean-fuel-using households spend less time in gathering wood and water, than in households using traditional fuels (WHO, 2016).

Cooking, and preparing fuels - which tend to be exclusively women's tasks - can sometimes take even more time than collecting the

fuel. This is demonstrated in the 2016 Poor People's Energy Outlook (Practical Action, 2016), which emphasizes that, in four rural communities in Kenya, cooking and preparing the fuel can take up to 41.4 hours per week. Interestingly enough, in this case, both men and women do fuel collection. Nonetheless, on average, men spend less time on this task than women.

Most life cycle cost comparisons of cooking fuels measure time saved in fuel collection but not time saved in cooking e.g. Sánchez-Triana (2007). The valuation of labor time is a key factor in cost comparisons. The health impacts of energy collection have been a "blind spot" for policy researchers (WHO, 2016), for the value and the opportunity cost of those domestic work done by women are difficult to measure. Women's unpaid time in both fuel collection and cooking is not always economically valued and can be "invisible" in household as well as in energy policy decision making about fuel switching.

Table 2.1: Stove type and women's time spent cooking and collecting fuel, rural India 1996

Stove type	Mean time spent (hours per day)*					
	All users			Only users who collect fuel		
	N	Cooking (Hours)	Collect fuel (Hours)	N	Collect fuel (Hours)	Cooking (Hours)
Traditional chulha	4,654	2.73	.69	1,433	2.44	2.11
Kerosene stove	757	2.79	.37	134	2.24	2.07
LPG stove	518	2.30	.52	200	2.37	1.33

* Time saved was calculated by subtracting the average times taken to collect firewood or cook in households that use biomass, minus the average time taken to collect fuel or cook in households using LPG.

Source: (Barnes & Sen, 2004)

2.1.3 Time and effort saved with modern fuels

Considerable timesavings are possible when switching to LPG for cooking, especially from biomass fuels but also from kerosene. Savings of 12% in cooking time in lab tests have been found for switching from traditional cooking to LPG stoves (Berkeley Air Monitoring Group, 2012). Available survey data from 13 countries showed that girls in sub-Saharan African homes with polluting cookstoves spent about 18 hours weekly collecting fuel or water, while boys spent 15 hours. In homes mainly using cleaner stoves and fuels, however, girls spent only 5 hours weekly collecting fuel or water, and boys just 2 hours (WHO, 2016). The value of these time savings may be great at busy times, e.g. for example preparing breakfast, or tea for guests, when time is at a premium. Indeed, the time savings in cooking may be as or more valued than those in fuel collection.

The cooks are happy with the fast cooking especially during the morning periods, as they are often very busy with lots of tasks such as preparing food, preparing their children to attend school, preparing livestock feed, manage water, etc.

- Cooks in Karnataka, Himachal Pradesh and Odisha States of India, in Practical Action, 2014

Convenience and cleanliness are also important factors that influence consumers making cooking choices, as are ease of use and speed. In Guatemala, women biomass users piloting LPG value not having to blow on the cooking fire and tend it constantly (Espinosa, 2014). Soot is time-consuming to clean from pots and the kitchen environment. In Indonesia, “clean” was even ranked above “fast” and “cost-effective” in one household survey of LPG adopters (Andadari, et al., 2014). Inconveniences of LPG have been reported as well though - cylinders can run out of gas while in the middle of cooking or showering, and there is not always a backup cylinder on hand. Comparative data is gradually becoming available on actual time saved by women in fuel collection and cooking by switching to LPG. Some studies from India are shown in Table 2.2, suggesting that time savings could be substantial. Timesavings in cooking could be even greater than those for fuel collection, up to 1 to 1.5 hours per day, compared with about 15 minutes daily for fuel collection.

Table 2.2: Time saved as a result of switching to LPG in India

Stove type	Original fuel/stove	Time savings with LPG	
		Fuel collection	Cooking
Maharashtra, Andra Pradesh, W. Bengal, Punjab, Himachal Pradesh, Rajasthan ¹	Traditional biomass Chulha	17 min/day	43 min/day
	Kerosene	15 min/day	49 min/day
Karnataka, Himachal Pradesh and Odisha ²	Traditional stove	Not provided*	1 hour 10 minutes (70 mins)/day
Lag Valley in Kullu Himachal Pradesh ³	Traditional fireplace	As much as 6 hours a day	1-1.5 hours/day

The time saved were calculated by subtracting the average times taken to collect firewood or cook in households that use biomass, minus the average time taken to collect fuel or cook in households using LPG.

*Traditional cookstoves were replaced by Biogas, LPG, Electricity and/or Natural Gas (BLEN) cookstoves. Thus this figure includes but is not limited to LPG use

¹(Barnes & Sen, 2004),²(Practical Action, 2014),³(UNDP, 2011)

Shifting away from traditional cooking stoves allows a significant saving in women's time. A more recent study of Practical Action (Practical Action, 2017) showed that 47% of the Togolese population would ideally like to switch to LPG and 28% would choose an improved charcoal stove. Changing from traditional cooking fuels to LPG or improved biomass cook stoves would reduce the time spent by women cooking, collecting and preparing fuel by more than 51% in Togo, from 6 hours and 43 minutes per day to 3 hours and 15 minutes. Matching results were also registered in Bangladesh. The analysis concluded that for women in Bangladesh, the time spent on cooking, collecting and preparing fuel per week reduced by 47% after switching to clean cooking solutions, from 5 hours and 40 minutes to 2 hours and 45 minutes.

Another study from India reported substantial time savings for women after introduction of LPG in regions of Himalaya. Women spent 0.2 hours per day for fuel collection, compared to 2.2 hours before the introduction of LPG. In addition, time savings of about 30 minutes were registered from utensils requiring less time cleaning and washing (Bruce, et al., 2017). Another study from Kenya suggests that cooking with wood or charcoal results in 0.8-1.3 or 0.3-0.4 hours of time opportunity cost per day, compared with cooking with modern fuels (Dalberg, 2018).

Before the gas came, women could spend more than two hours on cooking. But with the gas, time spent for cooking is reduced drastically because when you turn on the LPG stove, the fire doesn't go down. (FGD, men of LPG beneficiaries' household, Asante, et al, 2018).

Timesavings are larger of course if fuel switching is directly from collected biomass fuel to gas cooking. In many cases however, LPG adopters are already purchasing cooking fuels to some extent, so the switch may be from partly collected, partly purchased wood, charcoal or kerosene cooking fuel, to the more convenient LPG.

Any savings in fuel collection time would in any event be dispersed among all the members of the household who collect fuel. And fuel stacking, as discussed in 1.2, means that biomass fuels may continue to be used in parallel with LPG, limiting the time savings and health benefits. In Jaracuaro, Mexico, fuelwood savings from partial switching to LPG were on the order of 35%, instead of 66% with total switching, because households continued using fuelwood for tortilla making (Masera, et al., 2005). Masera even found that the new kitchens built with adoption of LPG could make smoke worse, with less ventilation yet continued parallel use of traditional fuels.

Clean fuels and stoves may also not be able to meet all the demands and preferences of users, when pots or other cooking equipment do not fit with the new stove. In Cameroon, surveys have found that only 9.5% of LPG users in peri-urban areas and 1.2% in rural areas reported exclusive use of LPG, while traditional biomass continued to be used by most households (Pope et al., 2018.) In China, open fires and traditional stoves are still used widely to prepare feed for animals, even though people may use improved stoves to cook meals for themselves (WHO, 2016).

Furthermore, LPG itself may require time and effort in "collection", with travelling to towns, queuing in lines and having to visit distant depots for refills being very time-consuming in some countries. This can include carrying heavy cylinders if a home delivery service is not in place or smaller LPG cylinder programmes are not available (Kooijman-van Dijk, 2008; Masera, et al., 2000). Men missing work and children missing school to queue for LPG are also reported in Egypt (World Bank, 2014). In Ghana, consumers can queue for as many as 2-3 days to get LPG (Matthews & Zeissig, 2011). Women in Sri Lanka cited the time saved in obtaining LPG as a benefit of electrification (Ramani & Heijndermans, 2003). This effort to obtain the fuel does illustrate how much women want to cook with LPG, but also highlights the need to make supplies easier to obtain.

2.1.4 Using saved time and reduced drudgery for development opportunities and empowerment

Improvements in infrastructure services, including energy provision and use, have been shown to help free up women's time spent on domestic and care work and promote women's market labor opportunities. Electrification (including electric cooking) in rural South Africa is reported to have increased women's labor force participation by about 9%; in Bangladesh, it has led to more leisure time for women. Water sources closer to the home have led to increased time for market work in Pakistan (World Bank, 2012).

In Himachal Pradesh, a study found that women's participation in wage work increased noticeably as a result of an LPG adoption programme: of the 53 women who bought LPG stoves, 41 (i.e. 77%) were engaged in activities such as weaving and working with oil-production units, farms and orchards (UNDP, 2011). In Pakistan, local women used 24% of the saved time from switching to clean fuels for operating home-based micro-enterprises, and 12% on livestock-related enterprises (Jan & Pervez, 2015). With the saved time, girls have more opportunities to go to school and receive education, which helps to increase women's literacy and strengthen their presence in income-generating activities (Rewald, 2017).

Other studies show no impact on market work but noticeable impacts on leisure and socializing time, which increase women's and often family welfare (World Bank, 2012). An ESMAP study in India found that in households with access to either LPG or electricity, women enjoyed a more balanced life between arduous tasks and leisure compared to women who use biomass. Leisure is often combined with entertainment, as in listening to the radio or watching TV. Recreation and social activities are a chance to build social capital and participate in community organizations and political life. The time 'saved' as a result of switching to modern fuels is often used for more household chores, agricultural activities, and child care, watching TV, listening

to the radio, leisure time, reading, and more balanced (between arduous tasks and leisure activities) life for women compared to women who use biomass (Barnes & Sen, 2004; Practical Action, 2014; UNDP, 2011).

The opportunity cost of women's time is a key factor in how timesavings are used and whether more expensive but time-saving technologies are adopted. Existing gender relations strongly influence the type of energy and its use, due to the gender division of labor. When women have an alternative path of diversifying work activities, the additional cost of modern fuels like LPG becomes more attractive, as women's time becomes more valuable (Cecelski, 2005). Nathan and Kelkar (1997) argue that a key factor in the success of dissemination of improved stoves in China and India in the 1990s was the higher extent of rural commercialization and hence economic opportunities for women in China. In an indigenous village in Yunnan, China, for example, the increase in productivity of women's income-earning labor with rising tourism led to a complete rural fuel transition. Once women's labor became a constraint to their employment in the tourism sector, there was a switch to LPG for domestic cooking to save women's labor time (Kelkar & Nathan, 2005). A similar increase in household income through higher productivity and income of men only is not likely to bring about a fuel transition, so long as women's unpaid time is "available". Cleaner stoves and fuels, which are typically more expensive, are more likely to be adopted when there is higher economic value placed on women's currently unpaid labor. Users will find it hard to give up a "free" biomass stove and fuel, unless alternate economic opportunities exist to justify using a more costly cooking system.

Indeed, a Practical Action (2014) study in South Asia identified the availability of daily waged work as one of the principle drivers for the shift to LPG. One of the few studies to examine time savings from improved stoves and their use, it found that saved time in cooking and fuel collection is contributing to increased women's involvement in social and family activities, including giving more time to their children; giving more time to agricultural activities; attending community meetings and meeting friends and relatives, and watching TV while doing knitting, etc. (Table 2.3). Mothers who used improved cook stoves (ICS) are able to give more time to prepare their children to go to school and monitor their studies. Likewise, due to the reduced drudgery and time saving, they need much less support from their children for household chores and fuel collection. The survey also showed higher children's school enrolment percentage among ICS user households compared with traditional cookstove (TCS) users.

**Table 2.3: Use of saved time due to switching to modern fuels in three Indian states
(% of women respondents)**

Activities	Karnataka	H.P.	Odisha	Total
Give more time to children's care	30.4	27.9	45.2	34.7
Give more time to agricultural activities	34.8	15.6	16.9	20.0
Able to attend community meetings	15.9	0.0	25.0	12.4
Meet other friends and relatives	17.4	4.1	10.5	9.1
More time to household chores	0.0	42.2	2.4	19.1
Have a rest	1.4	10.2	0.0	4.7

H.P refers to Himachal Pradesh

Source: (Practical Action, 2014)

In Colombia, Sanchez-Triana et. al (2007) in a life cycle cost comparison of cooking fuels, notes that the valuation of time savings can raise the benefit-cost ratio of LPG considerably relative to other improved stoves, and is very much influenced by the value that households place on their time, in relation to the average rural wage. In poorer households, this value may be very low; but households that have good income opportunities for women and thus high opportunity cost of time may value their time highly and therefore invest in LPG.

Essentially, saved time gives women the opportunity to choose how to best use their time, a chance that may allow them to better take advantage of development opportunities and empower themselves.

...Mothers who used improved cook stoves (ICS) are able to give more time to prepare their children to go to school and monitor their studies....

2.1.5 Modernity, status and changing gender roles

LPG, like electricity, is a modern fuel that seems to induce or correlate with more forward-looking investments and roles. Increased status is often reported by households as a benefit of LPG adoption (Bates, 2007; Pertamina PT & WLPGA, 2011).

There is evidence from Indonesia that households switching to LPG also start to cook with electricity as well (Andadari, et al., 2014). In Masera et al (2000) study in Mexico, most of the gas stoves purchased corresponded to a relatively expensive model, four burners with a cabinet beneath; some even had ovens, used only for storage. In Kenya, the Upesi Cook Stoves Project has helped the women's groups to learn skills related to marketing, drawing up business plans and managing production activities. The improvements on the stove and clean energy sources give women the idea of modernity and raise their awareness on well-being (Malonza, 2015). Many of these gas stoves were gifts of migrants to their mothers or wives, intending to show the progress the household is making in their living conditions. The gas stove status symbol is associated with larger changes within the home. An additional kitchen is usually built, with the more typical Western style structure and a large table and chairs. New cookware is purchased, and traditional ceramic pots are replaced by porcelain glazed ones. The notion of "modernization" accompanies the adoption of LPG cooking. There is also variation by age regarding adoption of LPG, such that even if all ages view LPG as "modern" and with resources permitting, young persons are more likely to adopt LPG compared to older persons.

Gender roles may also change with adoption of LPG and other modern fuels. Annecke (2005) found that access to modern energy services could facilitate shifts in gender roles and responsibilities in the domestic sphere – if however backed by serious institutional and legal support by the State for gender equality. In Lag Valley in India, men and children started helping with cooking duties after the introduction of LPG (Chandar & Tandon, 2004). However men's dominance in decisions regarding expenditures remained after switching to LPG, and men were said to keep a strict watch over LPG expenses and any waste. Also in Himachal Pradesh (Parikh, 2010), "a clear pattern can be seen that

as the fuel quality becomes superior, the role of women declines and that of men increases. The procurement of kerosene and LPG was largely the responsibility of young men, with no involvement of women in procuring LPG. The picture is the same in both the districts surveyed showing a higher role of women for inferior fuels."

...Before the LPG cookstoves I had the perception that cooking is for women because going to set fire to cook as a man means you don't have a wife. For now, this perception has reduced because of the LPG cook stove...

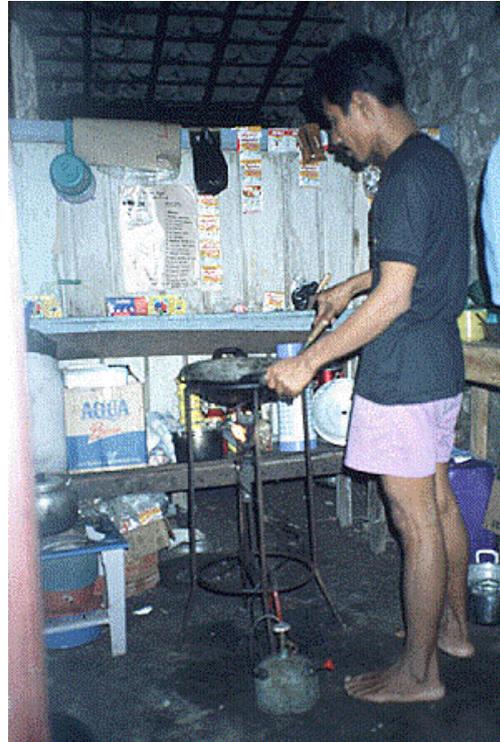
(FGD, men of LPG beneficiaries' household, Asante, et al, 2018)

In South Africa and Zanzibar, men sometimes cooked with electricity but not with LPG. In Zanzibar, men appear to take on the tasks which did not infringe on their ideas of masculinity (Winther, 2008), as well as those that serve their needs in a timely manner – without recourse to involving women in the household and reducing the possibility for creating, or further exacerbating, intra-household tensions (Annecke, 2005). Women may also fear a loss of cultural identity, for example by being judged lazy if they switch from traditional wood stoves to modern LPG (Matinga, et al., 2013). The switch would require a transgression of women's gender roles. To do this requires considerable empowerment in the sense of power from within.

Gender roles in the cooking energy system are unlikely to change however unless women get independent access to finance and income. In the Practical Action LPG project in Sudan, many of the women in the society where the project was conducted relied exclusively on their husbands for their finance. Those who worked were often engaged in seasonal activities, and in the off-season, their husbands were reluctant to provide additional money for the family for clean fuel and appliances. Once bought, though, LPG provided a pathway towards more savings for the women, as it is cheaper than other fuels in the market place in Sudan (Bates, 2007).

In India, women having some decision-making power within the household had a positive effect on fuel switching from biomass to LPG. However while there was a reduction in the time required for cooking, little redistribution of household work was found between men and women (RA3, 2018).

In Himachal Pradesh, the introduction of LPG was made through community organizations, focusing on organizing women in savings and credit groups to access LPG connections. As a result of this approach, women gained confidence and their participation in gram sabhas (village assemblies aimed at ensuring participation in village-level decision making), their ability to articulate needs and issues in village meetings, and their visibility as a group increased. On an individual basis, women reported increased self-esteem, increased networking and interactions with government officials and greater mobility (UNDP, 2011).



Can modern fuels change gender roles in cooking?
Source: (Bounds & Gallo, 2012)

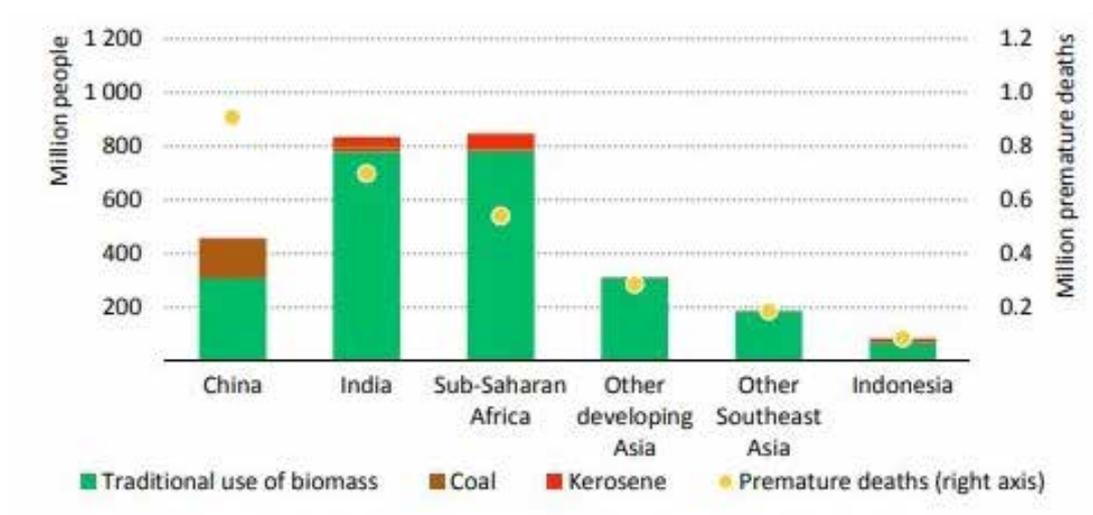
2.2 Health improvements for the family and women

2.2.1 Traditional fuels and health

For the almost 3 billion people worldwide who continue to depend on solid fuels (biomass fuels such as wood, dung, agricultural residues, and coal), cooking and heating on open fires or traditional stoves results in high levels of household air pollution. Indoor smoke contains a range of health-damaging pollutants, such as small particles and carbon monoxide, and particulate pollution levels may be 20 times higher than accepted guideline values (WHO, 2016).

In 2016, according to the WHO, household air pollution was responsible for 7.7% of global mortality or 4.3 million deaths (WHO, 2016a).² The largest numbers of premature deaths from household air pollution are in Asia, dominated by China and India, followed by Sub-Saharan Africa, as shown in Figure 2.4. On a per capita basis, the burden in Africa and other regions outside Asia is relatively high, however.

Table 2.4: Population without access to clean cooking by fuel and region, and premature deaths from household air pollution, 2015



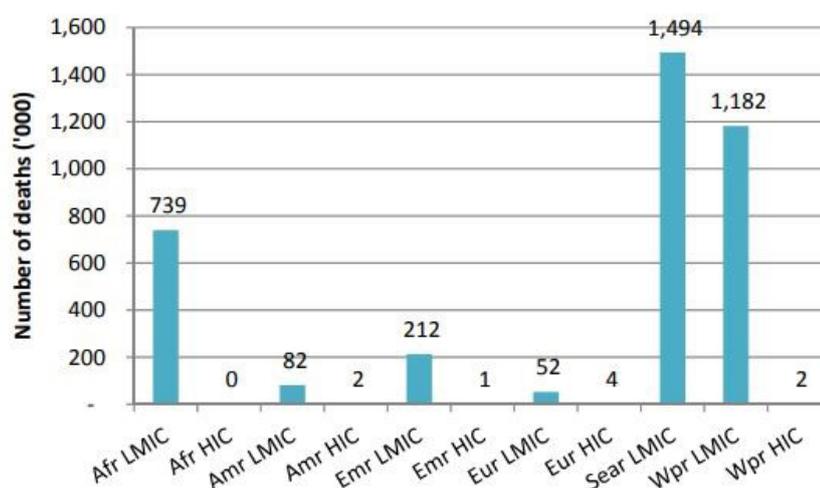
Source: IEA, 2017; International Institute for Applied Systems Analysis (IIASA)

²This is considerably higher than the previous estimate of two million deaths from household air pollution made by WHO in 2004. According to WHO, the higher estimate is mainly due to 1) additional health outcomes such as cerebrovascular diseases and ischaemic heart disease included in the analysis; 2) additional evidence that has become available on the relationship between exposure and health outcomes and the use of integrated exposure-response functions; and 3) an increase in non-communicable diseases (WHO, 2016).

There is consistent evidence that exposure to household air pollution can lead to acute lower respiratory infections in children under five, and ischemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer in adults (WHO, 2013). According to the WHO, household air pollution was the cause of 18% of all ischemic heart disease and 33% of lower respiratory infections globally in 2015 (WHO, 2016c). Household smoke is a significant risk factor for three important diseases: Acute lower respiratory infections (ALRI) in children, chronic obstructive pulmonary disease (COPD) in adult women, and lung cancer (where coal is used as a fuel).

There is growing evidence that household solid fuels smoke is a risk factor for low birth weight, perinatal mortality, asthma, cataracts, tuberculosis, asthma, and adverse pregnancy outcomes, (Ekouevi & Tuntivate, 2012; Smith, et al., 2005), as well as cardiovascular and circulatory diseases, diarrheal diseases and other common infectious diseases (GBD 2015 Risk Factors Collaborators, 2016). In recent research, solid fuel use is linked to reduced height-for-age, and to an increased probability of severe stunting in Indian children under three years (Balietti & Datta, 2017). Balietti and Datta also point out that the impact of using solid fuels is greater on Indian children due to their mothers' tendency to carry them while cooking.

Table 2.5: Deaths attributable to Household Air Pollution (HAP) in 2016 by region



HAP: Household air pollution; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income; HIC: High-income.

Source: (WHO, 2016e)

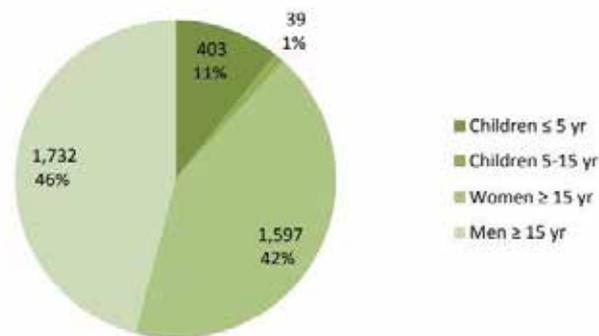
Globally, 93% of all children live in environments with air pollution levels above the WHO guidelines (see Annex 2). More than one in every four deaths of children under 5 years is directly or indirectly related to environmental risks (4). Both ambient air pollution (AAP) and household air pollution (HAP) contribute to respiratory tract infections that resulted in 543,000 deaths in children under 5 years in 2016 (WHO, 2018).

Women and children in developing countries are most exposed to indoor air pollution and suffer from the ill health effects, because women are responsible for cooking, and take care of children at the same time. For example, in a survey conducted in Central America in year 2010, Pachauri, D. Rao & Cameron (2018) found that women and children were the main bearers of the 12,000 deaths attributed to solid fuel combustion. Parikh (2011) found both gender- and age-differentiated impacts in Himachal Pradesh: Girls below the age of five and females in the 30-60 age groups, who are usually the chief cooks in a family, were at higher risk than males in the same age-groups. While women have higher personal exposure levels to indoor air pollution and higher relative risk to develop adverse health outcomes than men, the absolute burden of disease due to indoor air pollution is larger among men than women because of larger

underlying disease rates in men (WHO, 2013). Hence men, women and children all benefit from decreasing household air pollution.

In India, air pollution, including both household and outdoor pollution, is the second most important health risk factor, only exceeded by child and maternal malnutrition. Household solid fuel is responsible for about 4.8% of total DALYs% in 2016 (ICMR et al., 2017). Despite the severe health-risks related to traditional cooking, most households continue using solid fuels due to the lack of information and health awareness. In Rajasthan, India, only 13% of all respondents in a survey claimed awareness of any relevant health effects (Zahno et al., 2018). Childhood underweight and unsafe sex are primary drivers of early death and disability in much of sub-Saharan Africa (GBD 2015 Risk Factors Collaborators, 2016). But in 2015, household air pollution from solid fuels was the fifth leading risk factor for global disease burden for both sexes after dietary risks, high blood pressure, malnutrition, tobacco smoking including second-hand smoke. However, attributable deaths due to household air pollution decreased in 2015 by 13.0% (9.3–17.0) to 2.9 million deaths (2.2 million to 3.6 million) in 2015, and disease burden decreased by 20.3% (GBD 2015 Risk Factors Collaborators, 2016).

Table 2.6: Global deaths (000's) attributable to HAP by age and sex, 2016



Percentage represents percent of total HAP burden (add up to 100%).
HAP: Household air pollution; yr: year.

Source: (WHO, 2016e).

WHO's Burning Opportunities study (WHO, 2016), found that even though progress has been made nationally - driven primarily by dissemination of clean cooking solution in large countries like India, Indonesia or Pakistan - the number of people cooking with polluting energy systems in 2030 will remain mostly the same as today if current trends continue, Roughly the same number of people cook with polluting energy systems today as did 30 years ago. And traditional fuels will remain a severe health risk for hundreds of millions of people globally in the "business-as-usual" scenario.

The WHO study's conclusions have recently been confirmed by the Energy Progress Report 2018 (IEA, et al., 2018). The target for universal access to clean cooking facilities is far from being reached, as the study projects that, by 2030, 2.3 billion people will still remain without access to these basic facilities, mainly because clean cooking efforts do not outpace strong population growth (IEA, et al., 2018).

2.2.2 LPG: Better emissions and health outcomes

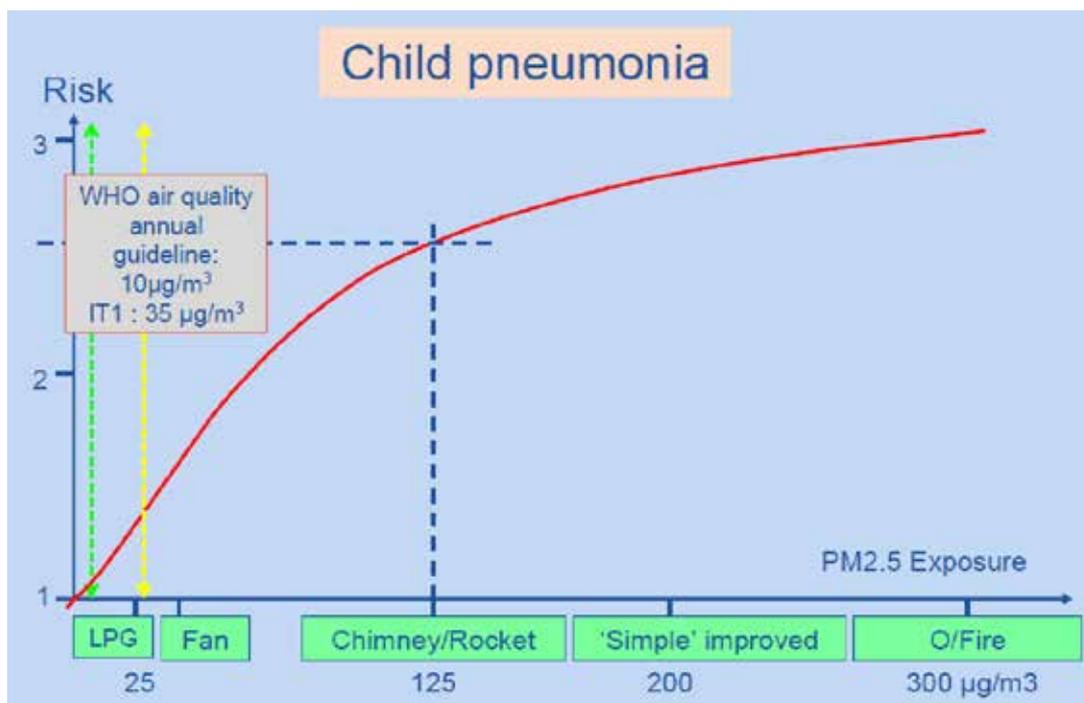
LPG scores far better than traditional biomass fuels on virtually all indicators of health impacts: indoor air pollution, fuel collection health impacts, and fires. Research has shown that having a cleaner stove such as an LPG or kerosene as the primary stove significantly reduces indoor air pollution (IAP) concentrations (Ekouevi & Tuntivate, 2012). Kerosene however has high risks of burns (Lloyd, 2002) and has been associated with increased susceptibility to tuberculosis (TB) (Pokhrel, et al., F). Studies show that not only does LPG have much lower emissions than biomass and coal burnt in open fires, but also lower emissions compared with improved biomass cookstoves.³

The reductions in emissions and particulate matter with LPG use have been associated with decreases in respiratory and other infections. Investigation on exposure-response, assessing LPG, fan stoves, chimney/rocket, simple improved stoves and open fires, showed that LPG was the only fuel whose emissions were below the critical level of 10µg per m³ (Smith, 2012), as shown for child pneumonia in Figure 2.7. A study comparing PM_{2.5}, PM₁₀ and Carbon Monoxide from open fires, plancha (biomass) stoves and LPG stoves showed that LPG stove has lowest emissions of all three pollutants (Naeher, et al., 2000). A study on the household air pollution from biomass burning in Paraguay showed that the PM_{2.5} concentrations in kitchens using LPG is 52.3µg/m³ on average, the lowest when compared with enclosed firewood (850.5µg/m³ on average) and enclosed charcoal (109.1µg/m³ on average) (Tagle, Smith & Pillarisetti et al., 2018). The exposure response curve emerging from these studies means that health impacts are not directly proportional to the reductions in the various pollutants, and may only appear once emissions are very low, e.g. with LPG stoves.

...And traditional fuels will remain a severe health risk for hundreds of millions of people globally in the "business-as-usual" scenario...

³ Grieshop et al 2011 point out that health benefits involve both reducing emissions and exposure. Stoves with chimneys and improved but unvented stoves can provide roughly an order of magnitude reduction in exposure relative to traditional options; these exposures are in turn an order of magnitude higher than for modern fuels (LPG, kerosene). None of the solid-fuel stoves investigated exhibit emission performance on par with modern fuels such as LPG.

Table 2.7: Exposure-response relationship for child pneumonia



Source: (Smith, 2012)

Guidelines on household air pollution issued by WHO in 2014, alongside the ISO emissions standards for cookstoves (<https://www.iso.org/standard/61975.html>) have greatly facilitated the benchmarking of potential energy options for households. Taking both availability, practicability and cost into account, LPG is regarded as the clean fuel alternative, which is most widely available for replacing solid fuels and/or kerosene (WHO, 2014). The WHO 2014 indoor air quality guidelines discourage the use of kerosene and biomass as household fuel; neither is considered a “clean” fuel (WHO, 2016d).

Recent studies indicate that many improved biomass stoves yield minimal health benefits and typically have a modest effect on air quality and climate change mitigation (Goldemberg, et al., 2017; Rosenthal, et al., 2018).

Rosenthal's framework suggests that cooking with cleaner fuels, such as LPG or ethanol, will result not only in improved health outcomes, but can also contribute to addressing five of the SDGs⁴. The author notes that much of the climate impact of traditional and improved cook stoves comes from non-CO emission, like methane or black carbon. Goldemberg et al. (Goldemberg, et al., 2017) point to the failure of improved biomass stoves to provide promised reductions in air pollution and the health benefits. These authors advocate LPG as a transition fuel from traditional biomass to cleaner solutions for household cooking, with both social and health benefits, pointing to LPG's success in Brazil - where only 5% of the population used traditional biomass for cooking in 2014 - and India's PMUY program, as examples of successful clean energy strategies for households in developing countries.

⁴SDG3: Health and well-being; SDG5: Empowering women and girls; SDG7: Access to reliable, efficient modern energy; SDG13: Combat climate change; SDG15: Sustainably manage forests and halt land degradation

Better health outcomes have been associated with LPG in comparison with other solid fuels such as biomass and coal. In a study of 1,260 women from the same neighborhood in West Bengal, Lahiri and Ray (2010) found that LPG users had consistently better health outcomes than biomass users. Biomass users were more likely than LPG users to suffer from a variety of pulmonary, cardiological, and other diseases and ailments, even controlling for socioeconomic conditions. Wylie et al. (2014) found that use of biomass compared with LPG was associated with increase in the risk of preterm delivery, even controlling for socio-demographic differences. According to Grieshop et. al (2011), LPG (and kerosene) offer unrivalled air combustion performance and air quality benefits, and unmatched PM2.5 exposure reductions. These authors make the case to leapfrog improved biomass use where possible, and move towards direct use of petroleum-based cooking fuels, on the basis of both health and climate benefits. Biomass burning typically releases 19 g/MJ-d CO per meal, 19 times the emissions of LPG, which releases only 1.0 g/MJ-d CO.

Nonetheless, ventilation conditions play a significant role in indoor air pollution (IAP) levels. A number of studies have found smaller differences in IAP benefits from LPG where cooking is well ventilated. A study in Uttar Pradesh, India (Jaiswal, 2013) found no difference in lung function in healthy non-smoking women who used either biomass or LPG as their sole cooking fuel. The researcher felt that the reason for this finding was due to good ventilation and outdoor cooking among the biomass users. A recent study by researchers at the University of North Carolina showed, based on the analysis of 529 households in Rwanda, that children who live in households with ventilation holes and cemented floors in the cooking area are less likely to have symptoms of respiratory infection or difficulty in breathing compared to children residing in households that cook indoors (Das, 2018). In addition, setting the cooking location outdoors is considered to be a positive behavioral change in reducing the health effects of cooking with solid fuels. Langbein (2017) found for the 30 developing countries in his

study, that the percentage of respiratory diseases among young children aged 0-4 is reduced by 9% when cooking outdoors. Still, outdoor cooking is not always a viable option: unfavorable seasonal conditions often prevent women from cooking outside all year long; and in many countries such as Uganda or Ethiopia, built-in stoves are more popular than portable ones, which gives women no option but to cook indoors.

Fuel stacking, which is a common household fuel strategy, also influences the extent to which LPG can improve health. A World Bank study (Ekouevi & Tuntivate, 2012) states that having a clean stove, as the secondary stove does not necessarily reduce IAP levels. If households use clean fuels only occasionally, for example for making tea, and continue using traditional biomass for primary cooking, the household IAP level does not change much. This is a common pattern of use for LPG, especially among lower-income households, as a complementary fuel for fast cooking. A study in Guatemala (Abalak, et al., 2001) found that an improved biomass cookstove offered the most reductions in PM concentrations (up to 85%), though LPG stove users had 45% reduction. This is because those using LPG did so together with open fires - most likely due to affordability and/or supply constraints - compared to those that transition to improved biomass. Hence LPG users may still be exposed to high pollution levels from stacking LPG with biomass. Fuel stacking is a rational response by women cooks to the often unreliable supply of LPG. It also helps manage their costs (for modern fuels) and their time (to collect biomass). The importance of fuel stacking and ventilation in exposures points to the need for not only cleaner fuels, but for integrated solutions that include incentives for behavioral change and to widen cooks' options and choices.

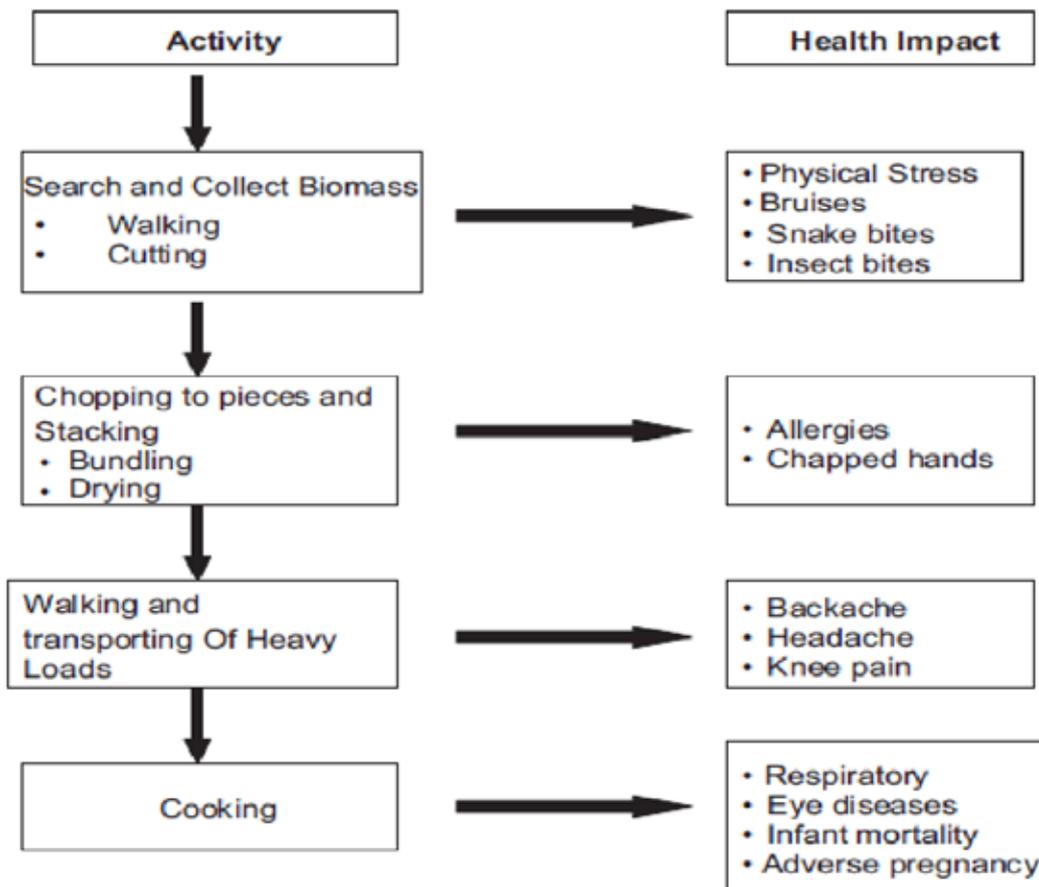
Still, the WHO (2006) suggests that a massive investment in either clean fuels or clean stoves would repay itself many times over in reductions in ill-health and economic benefits. Time gains from reduced illness, fewer deaths, less fuel collection and shorter cooking times account for more than 95% of these calculated benefits.

2.2.3 Health and fuel collection

Beyond indoor air pollution, there is a substantial physical burden and drudgery in collecting, transporting and processing biomass, leading to health impacts and accidents. Parikh (2011) findings in Himachal Pradesh, India indicate that more than 50% of women firewood collectors suffer from neck aches, headaches, back aches, bruises and animal attacks, and that these are more frequent than coughing (Figures 2.8 and 2.9). This suggests that the hardships and health impacts of fuel wood

collection, transportation and processing may be as serious, if not more serious, than the health impacts of smoky kitchens. Prolapsed uterus is reported in Nepal from carrying heavy loads, and similar hardships have been reported in other countries (Matinga, 2010; Clancy, et al., 2013; Wickramasinghe, 2003; UN, 2015). Echarri and Forriol, (2002; 2005) found degeneration of the cervical spines of women who carry firewood on their heads against a control group. IEA and UNEP have found that in Africa, women had to carry loads of fuel weigh as much as 25 Kg (IEA & UNEP, 2017).

Table 2.8: Bio-fuel chain and health impacts



Source: (Parikh, 2011)

Table 2.9: Health impacts of collection of fuels in Himachal Pradesh, India

■ Results in backache (50%), neck ache, headache and bruises every week (80 %)



-19% persons in HP have some symptoms

Source: (Parikh, 2011)

This evidence on the health impacts of firewood collection suggests that reducing or eliminating firewood collection could yield substantial health benefits, especially for women. However the connection between health and fuel collection has received much less attention than that between biomass cooking and health.

Physical, sexual and psychological violence against women is endemic across the world and is also present in the biomass energy system. Women deal with risky and hazardous environments as gatherers and move through difficult terrain as porters. Occupational hazards of fuel collection include bone fractures, repetitive strain injuries, sprains, back disorders, miscarriages, and prolapsed uterus due to load carrying. Physical violence against women has been reported: rapes while gathering fuelwood around refugee camps in Somalia, undergoing sniper fire to gather fuel in Sarejevo, and even bride suicides related to women's inability to meet their family's wood fuel needs in India (UN, 2015). In Chad, 42% of households reported incidents of gender-based violence during firewood collection over a six-month span (Clean Cooking Alliance, 2015).

In a refugee camp in Kenya, a 50% decrease in the number of rape was observed after sufficient energy was supplied to most of the families (Van Leeuwen, 2018).

In cooking, an easy-to-use cookstove could even be a matter of avoiding domestic violence: On average, 21% of women in the 41 countries with data surveyed by the World Bank concurred that wife beating was justified for burning food, the third highest reason (after refusing to have sex and arguing with the husband). In some countries, 40-60% of women agreed with this statement (World Bank, 2012).

Another health linkage is that increased cooking energy access can have a direct impact on reducing malnutrition. About 95% of staple foods need cooking before they can be eaten. Lack of energy access may affect the ability to choose nutritious staple foods. Malnutrition plays a role in more than half of all child deaths and affects women's capacity to meet their physical demands. Maintaining good nutrition is also difficult for women when they spend several hours in far-away forests.

Modern fuels can also improve the delivery of health services, of special importance to women and children. In northern Mozambique’s health clinics, one challenge is the lack of reliable fuel to provide lighting for surgery and routine operations and to guarantee regular refrigeration for the storage of vaccines. LPG was used in the province of Cabo Delgado to introduce an improved cold chain and replace decrepit kerosene refrigerators in remote health facilities with LPG-powered refrigerators in 88 health clinics serving 1.5 million people, later expanded to 163 clinics in Nampula, for a total population served of 4.5 million. LPG was also used for lighting and for sterilisation of instruments in autoclaves. A for-profit company, VidaGas, owned by two NGOs, worked to develop a viable business model that would also supply LPG for households, thus addressing indoor air pollution problems, and large scale consumers. These activities contributed to a 36% increase in the number of children immunized in participating districts, and to Mozambique’s national targets for maternal and child health (Sprague, 2007).

2.2.4 Paraffin (kerosene) poisoning, burns and deaths

LPG often replaces paraffin (kerosene) in cooking. While LPG has been implicated in some fire accidents, these are dwarfed in comparison with the enormous number of homes burned, injuries and deaths caused by paraffin (kerosene), at least as reported in South Africa (Lloyd, 2002).

A more recent injury surveillance study conducted in South Africa among 12,000 households in low-income areas between 2007 and 2012 indicates that 57% of households surveyed used paraffin for cooking. According to this data, 24% of households suffered from fires, burns, or poisonings, out of which 73% were caused by kerosene (paraffin) and electricity (WHO, 2014). Flame burns accounted for 18% of injuries and out of these, 53% were the consequence of kerosene stoves explosions.

Table 2.4: Relative incidence rate of fires due to paraffin and LPG per 100 000t sold domestically each year in South Africa, 2000

	Homes	Injuries	Deaths
Paraffin	16700	1700	1000
LPG	9	9	5

Source: Lloyd, 2002

A more recent injury surveillance study conducted in South Africa among 12,000 households in low-income areas between 2007 and 2012 indicates that 57% of households surveyed used paraffin for cooking. According to this data, 24% of households suffered from fires, burns, or poisonings, out of which 73% were caused by kerosene (paraffin) and electricity (WHO, 2014). Flame burns accounted for 18% of injuries and out of these, 53% were the consequence of kerosene stoves explosions.

Child poisoning is a major pediatric problem in some African countries. Paraffin poses two major risks of injury, especially to children. Firstly, paraffin ingestion one of the most common causes of children poisoning. Over 20% of all poisoning cases in a hospital in Cape Town were attributed to paraffin ingestion between 2003 and 2015 (Balme & Stephen, 2017). This is due to paraffin's resemblance to water and storage in similar bottles. Secondly, paraffin is highly flammable and poses fire risk when contaminated by water or other fuels, used in a malfunctioning appliance, or used carelessly by intoxicated individuals or children. Once a fire starts, children are at particular risk.

Burns and deaths from burns are a serious problem with paraffin, both accidental and intentional, especially for women and children. A study of the National Crime Records Bureau in India estimated that 17% of deaths due to fire accidents were caused by burst of malfunctioning stoves and cylinders between 2010 and 2014, 60% of these accidents having women as victims (NCRB, 2015).

An article in the British medical journal Lancet in 2001 (Sanghavi, et al., 2009) estimated that more than 100,000 women, mostly between the ages of 15 and 34, were killed by fires in India in a single year, more than six times the number reported by police. Young women were three times as likely to be killed by fires as their male peers. These deaths shared common causes, including kitchen accidents, self-immolation, and different forms of domestic abuse. Paraffin has been implicated in dowry deaths in India. A dowry death is the killing of a young woman by members of her conjugal family for bringing insufficient dowry, and is commonly executed by first dousing the woman with kerosene and then setting her alight. Bride burning has been recognized as an important public health problem in India. Police in India registered 7,621 murders of women as dowry deaths in 2016 according to national statistics (NCRB, 2016). While removal of the easy availability of large quantities kerosene for cooking may not stop bride abuse, it could potentially go some way in removing the excuse often given when brides are burnt: that it was an accidental kerosene death during cooking.

There are few statistics on the safety impacts of switching from kerosene to LPG, and more studies are needed to determine to what extent this is likely to reduce property damage, injuries and deaths related to kerosene use - particularly in countries such as India where safety impacts of kerosene use have been considerable, and a major shift from kerosene to LPG has been taking place.



GOVERNMENTS AND COMPANIES ARE OVERCOMING CONSTRAINTS AND HOW WOMEN CAN BE INVOLVED IN INCREASING ACCESS TO LPG AS A COOKING FUEL



This chapter explores how governments and companies are involving women in overcoming constraints to increase access to LPG as a cooking fuel. Women are being empowered with knowledge and control of LPG, through awareness campaigns and by better regulation and enforcement of safety in the industry. LPG is being used to help diversify women's livelihoods and improve the profitability of women's enterprises. Women are increasingly engaged in the supply chain for LPG, from running retail businesses to working in international LPG companies. Women are also influencing international and national debates on LPG supply, regulation, pricing and subsidies, through their advocacy in women's organizations, voting, and protests, and by participating in global partnerships on household energy, energy access, and climate change.

3.1 Empowering women with knowledge and control of LPG

Educating the public, especially women, about the costs and benefits of different fuels, is essential to promote a switch to LPG. Women's fears about LPG safety are not surprising, given the poor regulation and enforcement of LPG supply in many countries, and the unfamiliarity of the technology for many consumers. Involving women in consumer education and awareness, as

well as in lobbying for better regulation and enforcement, can empower women with knowledge and control of LPG.

Beyond consumer education, women cooks may need to take a more active role in design of LPG stoves, training programmes, and regulations, in order to ensure that these meet their needs. Women can be both sources of accurate information, and agents for development of both technical and non-technical solutions to constraints identified.



3.1.1 Women's fears about LPG safety

A major barrier to increased LPG use is fear that it is not safe - particularly that cylinders may explode - which ironically keeps many households continuing to use paraffin (kerosene), a fuel with comparatively greater safety risks. In focus groups in South Africa, LPG was widely disliked and there are deeply entrenched fears about the risks of cylinders exploding (Tait, et al., 2013) - even though as Table 2.4 above showed, paraffin causes many more fires and deaths in the country. In a market survey of 400 households in Pemba, Mozambique, 79% believed LPG to be toxic, explosive or dangerous (Sprague, 2007). In a survey in Puno, Peru, many participants perceived LPG stoves as dangerous and risky, and there were fears about the "possibility" of explosion, even though none of them had ever experienced any LPG incident (Hollada, et al., 2017). The dramatic and devastating nature of some LPG accidents has led to sensationalist reporting and public fears about LPG. If women only hear about LPG in this way, it is not surprising that they think of it "as a very dangerous fuel capable of burning down houses", as cited in Togo (Kojima, et al., 2011).

Indeed, LPG is potentially hazardous, and uncontrolled releases of LPG can have serious consequences in fire and explosion. However the technology for safe use of LPG is well known, and risks can be controlled through proper regulation and use - as is widely the case in developed countries. Unfortunately such regulation is often lacking in many developing countries (WLPGA, 2013).

There are relatively few studies examining the safety risks of LPG in developing countries (WHO, 2016). The global industry association, WLPGA, has not been successful in setting up

an international monitoring system for LPG fires and accidents, due to industry worries about the negative image. So there is little data available on the types or causes of these events in most developing countries. Generally two types of accidents are found (WLPGA, 2013):

- ▶ Fires and explosions related to storage, transport, filling and maintenance of LPG and equipment in the supply chain. The risks associated with these accidents can be much reduced through regulations and enforcement following international guidelines on safety procedures.
- ▶ Accidents related to consumer use, often due to defective cylinders, regulators and hoses, but also due to improper use by cooks. These risks can be much reduced through consumer education as well as proper regulation and inspection of cylinders.

...Women can be both sources of accurate information, and agents for development of both technical and non-technical solutions to constraints identified...

Improper filling and storage of LPG cylinders can cause serious accidents in depots and storage facilities that need to be sited away from homes. In Ghana, there is a growing public concern over the siting of LPG and fuel stations in residential areas in Accra, in the wake of a gas tanker crash. Some stations are built very close to homes, shops, churches and offices (Bokpe, 2014). The Malaysian Department of Occupational Health has posted on its web site photos of severe property damage due to cylinders being decanted by arranging a row of 12kg cylinders upside down on top of a row connected by tubes, a practice banned in the country (DOSH, undated).

Assuring safety through a proper regulation and enforcement will be essential to expanded use of LPG. The threat brought by improper use of LPG is a big challenge for ongoing projects promoting LPG. Evidence is beginning to emerge from India, in the wake of initiatives to expand LPG use on a large scale in the country. A suspected gas-leak accident in 2016 aroused public fear and doubt towards the recently launched PMUY project, which aimed at replacing polluting cooking fuels with clean fuels (Sharma, 2016). With increasing use of LPG in India, in 2017-18, LPG blasts caused at least 260 deaths and the number of accidents doubled from around 710 in year 2015 to around 1500 (Shine, 2018).

The study attributes the sharp increase in LPG accidents to lack of safety awareness among consumers as the application of LPG expanded rapidly throughout the country, despite the fact that improvements in safety measures had been achieved. Historically, 82% of the victims of cooking gas explosions are women (Philip, 2012). A study of the rising incidence of LPG burns (as use of LPG has increased recently in the country) found that most burns (70%) resulted from a gas leak, and 25% were due to cooking negligence. A major risk factor was constrained living conditions of a single room dwelling of low-middle income households. Almost all burns from LPG mishaps were potentially preventable, with the cause either ill-fitting or cracked rubber tube or stove valve, or floor level cooking (Ahuja, et al., 2011).

A study conducted in a burn clinic in Zhejiang, China examined the causes of burns from 2011 to 2015 and found that around 15% of burn patients suffered from LPG-related accidents. Gas leaks accounted for 81% of all burns, followed by inappropriate operation and cooking negligence (Jin et al., 2017). Similar findings of preventable burn accidents come from Turkey (Tarim, 2014). Sub-standard cylinders, old valves, worn-out regulators are also identified as causes.

Cylinder ownership and refill arrangements have significant effects on LPG safety and the incentives for any given company to repair and replace cylinders (Kojima, 2011). The Philippine Star quoted the Bureau of Fire Protection and the LPG Industry Association in 2011, that five out of ten tanks of LPG in the market were defective and substandard, due to “brandless” tanks (Suerte-Felipe, 2011). The most common causes of LPG fires in homes and businesses were identified as defective hoses, incorrect installation of pressure regulators and cylinder valves left open. These defects and improper installation can cause leakage of LPG vapor, which can accumulate in enclosed and low-lying areas and explode if a spark is present.



Cooking with LPG at floor level in single-room dwellings has been found to be a risk factor for burn incidence in India

Cylinders have a lifespan of around twenty years if they are correctly maintained (Bruce, et al., 2017). However, many LPG consumers are unaware of the need for safety checks of cylinders, and the alphanumeric code showing the 'check by' date. Oil companies also cite illegal fillings of cylinders and the need to replace the rubber tube of the connection every three years (Philip, 2012). The existence of unregulated "black markets" in cylinders can result in improper operation or overfilling of cylinders, which can cause gas explosions. This is why countries such as Ivory Coast, Cameroon, India and Morocco have enforced a 'cylinder recirculation model' in order to ensure high levels of safety. In this model, which is endorsed by the WLPGA, fuel suppliers own the cylinder and are responsible for filling and maintaining it (Bruce, et al., 2017). Nonetheless, in many countries, as the clients buy and own the cylinder, inspection and filling are not always done properly.

In Indonesia, too, it appears that accidents have been primarily caused by lack of understanding in using the equipment, illegal manufacturing and distribution practices, and unsafe environmental conditions. Given the number of LPG conversion packages distributed, the number of accidents is relatively very small, but their impact on public opinion is considerable because of the media coverage (Budya & Arofah, 2011).

Safety concerns, as an obstacle should not be over-played however. An assessment of attitudes and preferences about traditional versus LPG stoves in rural Puno, Peru (conducting interviews with primary cooks, community leaders or stove contractors) found that safety was only the fourth major barrier to using clean stoves - after perceived differences in food taste, cooking niches filled by different stoves and social norms related to cooking. Hollada et al. (2017) conclude that there is a great need for more behavioral-focused tests to foresee the impact of behavior change interventions on adopting clean stoves, for example conducting cooking demonstrations, targeting younger generations or using early adopters to promote these clean stoves.

3.1.2 Consumer education and awareness

Women's fears about using LPG are not always misplaced, given the lack of regulation and absence of enforcement of safety standards in many countries. Hence consumer education and awareness in LPG promotion must be complemented by concrete safety measures. These must not only dispel the idea that LPG is a fuel that "burns houses down," but must also give women cooks the knowledge and tools to make sure that their own cooking facilities and cylinders are properly installed, regularly inspected, and correctly filled.

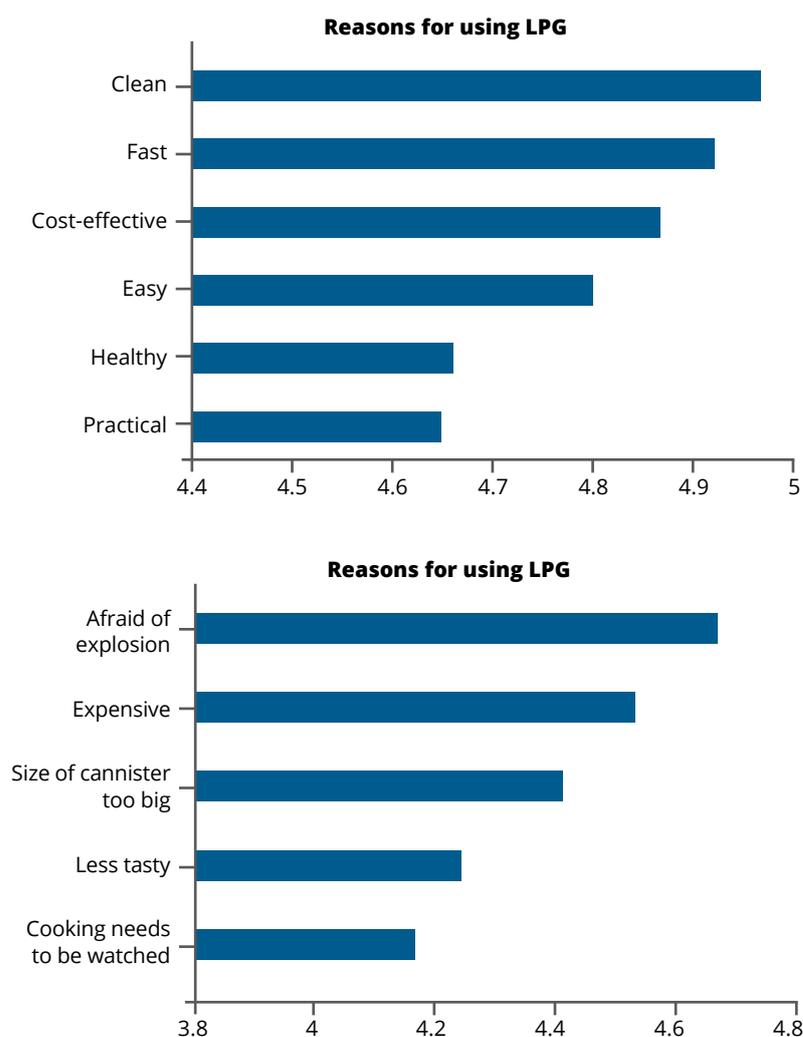
Mistrust in the market due to perceptions/realities related to partial filling, contamination of fuel, and other deceptive practices by grey/black market players are limiting the sustained growth of markets in some countries (GLPGP, 2013), and women need to know how to deal with these concerns. Underfilling is a common concern. In Guatemala for example, LPG dispensaries have no type of regulation and no check that they are selling LPG at the required levels (short-selling). So frequently, the dispensaries will use gas from a tank for a few days or week, and then sell the tank to the consumer. The market has become very untrustworthy between the LPG companies and the LPG dispensaries, which are often independent. This can be an opportunity for women who are engaged in the supply chain to increase consumer knowledge about the negative market practices and lobby for regulation to protect consumers (Espinosa, 2014).

...Safety concerns, as an obstacle should not be over-played however...

With this knowledge, women can also promote and lobby their governments and LPG companies to adopt regulations, and then enforce standards. They need to understand the difference between cheaper, low quality and potentially dangerous cylinders, and safe, branded ones that a reputable company will stand behind and inspect regularly. As pointed out by Kojima (2011), “Well-informed consumers can help efficient and responsible firms to expand their market share at the expense of those engaged in commercial malpractice, and exert pressure on firms to minimize costs.” While government agencies engage in the long-term process of strengthening monitoring and enforcement, women’s organizations can work with industry associations and consumer groups to help with monitoring by raising public awareness about malpractice, and even conducting and publicizing the results of spot-checks.

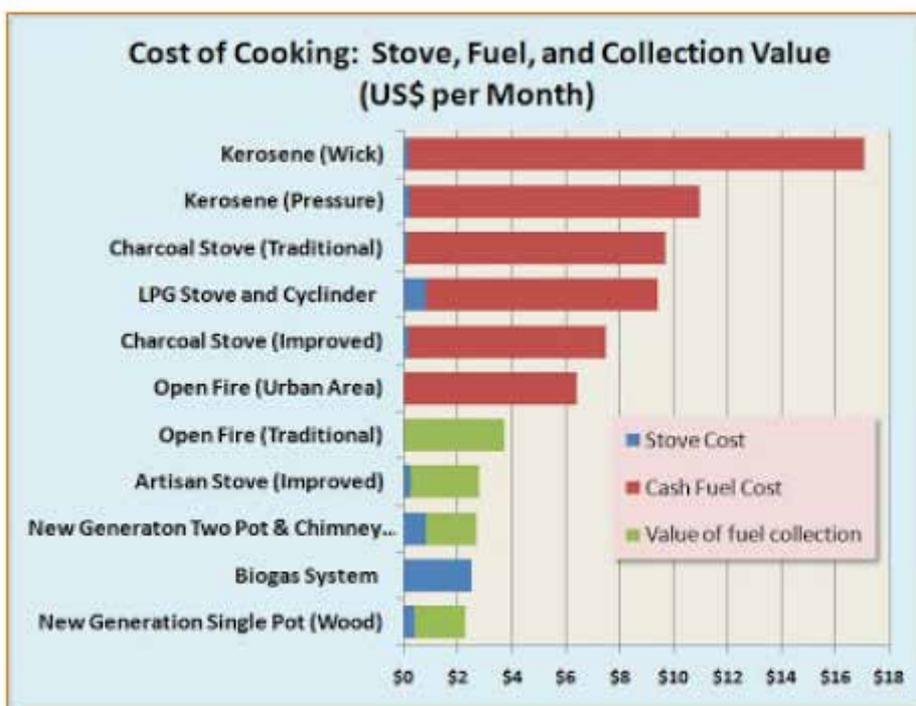
Women’s reasons for using LPG – and for not using LPG – in the Indonesian switching programme range from the cleanliness and speed of cooking, to the fear of explosion and expense as well as the size of canisters (see Figure 3.1). These are matters both of consumer education and of government policy.

Table 3.1: Main reasons for /not using LPG by households in Indonesia



Source: (Andadari , et al., 2014)

Table 3.2: Typical cost of cooking with different fuels and stoves in developing countries, 2010



Source: (Barnes & Openshaw, 2010)

In addition, misconceptions about the expense of LPG are common, especially among less educated households, who are less likely to select LPG than more educated ones. Due to varied pricing and subsidies, the cost of LPG cooking varies considerably among countries. In some countries, LPG is indeed more expensive than other cooking fuels. But in many, it is competitive with charcoal and paraffin (kerosene), though still more expensive than biomass (Kojima 2011). Women are not always aware of these cost differences and would benefit from being able to compare the actual cost of different cooking fuels. In South Africa, for example, there is a firm belief that paraffin is cheaper than both LPG and electricity, even though this is not the case; researchers speculate that this is for historical reasons (Tait, et al., 2013).

This perception among households that LPG is a high cost fuel might be caused by the fact that solid fuels and kerosene can be bought in small amounts, whereas LPG cylinders need to be refilled more rarely but at a higher one-time cost. Most are between 11-15 kg.

In order to tackle this issue, some countries have introduced smaller sized cylinders or smart metering pay-as-you-go systems, for example PAYGO Energy (www.paygoenergy.co) in Kenya (Bruce, et al., 2017).

Consumer understanding of the health and safety costs of using traditional biomass fuels and kerosene, as well as the potential benefits of LPG, as described above in Chapter 2, needs to be part of a fuel switching programme. Many studies have shown that women are not fully conscious of the health effects of burning smoky fuels and indoor air pollution, on themselves and on their children. When they learn more about these negative health effects, women often become more interested in adopting cleaner stoves and fuels (Bates, 2007; Annecke, et al., 2007). Very likely, kerosene users are not aware of how much more dangerous kerosene is in terms of fires and burn, than LPG. Parikh (2011), Matinga et al. (2013) and others suggest that health centers should be sensitized to the issues associated with household air pollution as well as diseases from hardships found in fuel transporting and collection.

Technology innovations also need to be pursued that make LPG stoves and the entire supply chain in fact safer and more convenient for users, not just changing their opinions. Women may need to take a more active role in LPG stove and, installation design, in order to ensure that these correspond to the type of cooking and foods prepared locally. In some cases, LPG stoves may be ill suited for local households and their cooking habits. Moreover, upstream emissions from the LPG fuel cycle, such as LPG leaks in distribution and storage systems should also be taken into account (Shen et al., 2017). Technical fixes that reduce inconveniences need to be pursued, such as an innovation in Kenya where the cylinder is translucent, allowing the users to know the level of LPG left and plan for replacement (Kenya London News, 2014). Technology fixes such as pressure cookers or complementary household appliances could also be helpful to reduce fuel stacking and use of biomass fuels for cooking in parallel to LPG. Women's participation and input to designing and selecting appropriate technology innovations will be essential.

3.1.3 Good practices in consumer education and awareness

With good practices both in consumer education and awareness, and in the regulation of safety in the supply chain of LPG, it is possible to mitigate risks and greatly facilitate adoption of LPG as a safe modern fuel. In India, for example the LPG Panchayat Programme has been launched to increase LPG safety awareness, quality of service provided by LPG distributors and the availability of refill cylinders. Founded and organized by the Minister for Petroleum and Natural Gas of India, the LPG Panchayat Programme is an interactive platform, which encourages mutual learning on the benefits and safe use of LPG among consumers. The platform aims to bring more communications and discussions as a bridge in the future between oil companies and potential users of LPG in rural India (PTI, 2017).

The Indonesian petroleum company has successfully pursued an intensive safety campaign to reduce accidents in its LPG supply and use chain (see Box 3.1). A number of other good practices in consumer education on LPG are identified by Kojima (2011):

- ▶ Pictorial guides on safety in several local languages, published by the LPG Safety Association of Southern Africa
- ▶ Newspaper advertisements sponsored by government agencies in Ghana to alert consumers to the risks associated with LPG cylinders
- ▶ A calculator for estimating the amount of LPG consumed by different appliances on the web site of the Mexican energy ministry
- ▶ Prices of LPG by location, company, and cylinder size posted on the web site of the regulatory agencies in Peru and Turkey
- ▶ Frequently asked questions on the web site of an LPG marketing company in Brazil

...Women may need to take a more active role in LPG stove and, installation design, in order to ensure that these correspond to the type of cooking and foods prepared locally...

Box 3.1: An intensive safety campaign reduced accidents in the Indonesia fuel switching programme

The Indonesian petroleum company PT Pertamina, in response to the rising number of fire accidents after its massive government-backed initiative switching from kerosene to LPG, launched a major safety programme in 2010. The campaign was successful in reducing accidents significantly by 2011. Although the percentage of accidents recorded was relatively small the impact of those incidents was potentially huge and could have eroded the success of the programme. Pertamina and WLPGA worked together to address this and held a Best Practice workshop with all stakeholders to identify issues and draw up an action plan:

- ▶ To address the media “spin” the government established an integrated team to determine the root of the problem and to formulate a solution. Pertamina executed a Crisis Centre monitoring 24 hours a day
- ▶ To address exaggerations by the media and provide quick response to all accident reports within two hours. Victims were compensated.
- ▶ To address the causes of household accidents, several product quality improvements were taken especially improving quality inspection in the distribution channel.
- ▶ To educate consumers about the LPG system, an intensive and continuous socialisation on safe LPG usage was undertaken with more than 5000 events in hundreds of cities and villages and advertisements in TV radio and newspapers.
- ▶ To reduce supply chain accidents, product specifications were ensured throughout the value chain, and safety improved in all LPG storage filling stations and distribution operations to eliminate extreme risks. An audit was implemented on good safety practice inspections in all distribution nodes, with periodic renewals.

Table 3.1: Reported LPG incidents in Indonesia, 2007-2010

Region	2007		2008		2009		2010 as per June	
	Cumulative distribution	# Incidents						
Sumatra	50,000	N/A	776,051	5	4,419,903	2	4,720,351	3
West Java	2,722,862	N/A	12,063,751	32	17,128,323	16	17,307,730	26
Central Java	445,247	N/A	2,970,016	7	10,318,294	8	10,318,294	8
East Java	758,341	N/A	3,244,326	17	9,929,525	23	10,242,420	27
Sulawesi, Kalimantan	0	N/A	0	-	1,613,454	1	1,875,713	6
Total	3,976,450	-	19,054,144	61	43,409,499	50	44,464,508	70

Source: (Budya & Arofat, 2011), based on Pertamina analysis

Kojima (2011) considers that there is considerable scope for improving the quality of information provided by companies to make it more user-friendly. Her study provides evidence that disseminating information to women can be particularly effective. Documentation of campaigns involving women would be useful for learning. It would be interesting to know whether these campaigns have involved women and their organizations in developing and testing materials, or in direct promotion. Campaigns seem usually to be limited to promotion of correct use, and do not compare different fuels and their financial and health costs. Focus group participants in a South Africa study who had taken up LPG often had had some exposure to it elsewhere, for example at a place of work, which had served to familiarize them with its ease and safety (Tait, et al., 2013). This suggests that women-to-women promotion and education on LPG may be most effective. Indeed, experience shows that women are extremely good at sharing new knowledge with each other (Carr & Hartl, 2010), and neighborhood demonstrations have been effective in LPG promotions (See Box 3.2).

Although women may be more effective communicators with other women, men also need to be involved. Participants in focus groups in South Africa were concerned about the fact that none of them had fire safety knowledge, and that no one in the community had been able to save a woman who died from exploding paraffin stove. They also worried about the fact that there was so little information available to them about which stoves to use. One of the men in the Imizamo Yethu focus group noted that the burden of energy issues mainly falls on

women, who generally have more exposure to cooking, and that safety programmes are generally targeted at them. But many men live alone and cook for themselves and are responsible for energy usage in their household. He felt that men also do not know how to use energy safely and often engage in risky behavior. He felt it important that energy safety programmes needed to target both men and women (Tait, et al., 2013).

In South Africa, the principal actors in paraffin safety have been petroleum companies, through the funding of the Paraffin Safety Association of South Africa (PASASA). PASASA has lobbied the government for safety campaigns and appliance standards (Tait, et al., 2013). Similar initiatives could be undertaken by LPG companies, and could be strengthened by the inclusion of women's organizations and consumer groupings in alliances. The Clean Cookstoves in Ghana provided capacity-building training to around 200 retailers selling cooking utensils and LPG stoves, among whom 183 were women (Practical Action, 2018).

**...This suggests
that women-to-
women promotion
and education on
LPG may be most
effective...**

Box 3.2: Demonstrating LPG safety in neighbourhoods in Peru



Fundación Repsol⁴ is working with the Asociación Cultural Teatrovivo to run the project *Formación en el buen uso del GLP* ('Training in proper use of LPG'), to help low-income Peruvian families to live more healthily. Part of this involves providing training through workshops and fairs to raise awareness and educate families about the impact that the type of cooking fuel they use can have on their quality of life. Information is given about how use of cleaner fuels, such as LPG (liquefied petroleum gas), can have

a positive impact on their health, safety and family economics. Educational sessions provide families and community representatives such as teachers and health workers with training in a fun and, above all, participatory format. The fairs, meanwhile, are designed to be festive events in which theatre, games and parades are used to teach people about having a healthier and more environmentally-friendly relationship with the environment.

Source: (Repsol, undated)

⁴ Repsol is one of the main LPG retail distribution companies in the world (Repsol, undated).

3.2 Diversifying women's livelihoods with LPG

Improved technologies have been shown to create pathways for strengthening women's economic opportunities. Specifically, integrating the needs of women in the technology development lifecycle can trigger a chain of events that leads to economic advancement and, eventually, to wider social and economic benefits. Women's use of technology and their involvement in its development and distribution can not only advance women economically, but also can benefit enterprise-based technology initiatives by expanding their markets and helping them to generate greater financial returns (Gill, et al., 2012).

Many of women's traditional income-generating activities in developing countries, such as food processing, depend on their labour and thermal energy. LPG is a welcome alternative to biomass fuels in these informal sector activities as well as in non-traditional sectors. Further, women's ability to close the earnings gap with men depends on moving into wage employment in the formal sector, and the LPG supply chain can offer such opportunities.

Technologies that lead to an increase in women's earning capacity are much more likely to increase women's status and decision-making powers within the household and community (Carr & Hartl, 2010). Furthermore, increasing women's income opportunities may be the fastest route to encourage fuel switching to modern fuels. As seen in Chapter 2 above, households are more likely to choose modern fuels like LPG with shorter cooking times, when there are alternative employment opportunities for women and their time is thus more valued.

Data from field programs suggests that women engage in energy-related entrepreneurship in a variety of roles, from informal women's groups, micro and small businesses, high potential entrepreneurial endeavours as well as independent sales agents and employees. Women's participation in income-generation, and as ambassadors of new energy technology products or services can contribute to: increasing decent work and economic growth (SDG8) by providing women with a sustainable income generation opportunity, reducing poverty through women's increased incomes (SDG1), and improving gender equality (SDG5) as women are able to not only financially contribute to the family, but are also able to communicate, negotiate, and participate in household and community level decision making. (RA7, 2019).

In its review of case studies, UNDP (Misana & Karlsson, 2001) found that the most successful projects on women and energy were those that stimulated income directly through engaging local people in the manufacturing and selling of energy technologies. Indirectly, in some projects, incomes were also increased through gains in productivity or expanded economic activity resulting from new energy inputs. The UNDP report recommended national and local energy policies that seek to expand the availability of energy services for value-added productive activities that are typically under-taken by women, to support economic growth, the well-being of families and the advancement of women, and for sustainability over time. ENERGIJA's multi-stakeholder consultations and regional reports as contribution to the energy policy discussions at CSD 14 and 15 reinforce that "energy is women's business" in all regions throughout the globe (ENERGIJA, 2006).

3.2.1 Using LPG to improve profitability of women's enterprises

Many of women's informal sector income activities are highly fuel-intensive, and their viability and costs are affected by energy prices and availabilities.

Fuel is often a significant cost factor in these enterprises and there is therefore a commercial motivation to improve the efficiency of the entire process. Such enterprises often play a primary role in ensuring family food security by providing an off-farm source of income (Cecelski, 1995).

Enterprise	Comments
Beer brewing	25% of fuelwood used in Ouagadougou; main source of income for 54% of women in surveyed Tanzanian village; 1kg wood/litre beer
Rice parboiling	15%-20% of firewood in some districts of Bangladesh
Tortilla making	1 kg wood/0.4 kg tortillas
Bakeries	Wood is 25% of bread production costs in Kenya; 30% in Peru; 0.8-1.5 kg wood/1kg bread
Shea butter production	60% of cash income for women in parts of Sahel
Fish smoking	40.000 tones wood/year in Mopti, Mali; 1.5-12 kg wood/kg smoked fish; fuel is 40% of processing costs
Palm oil processing	Extremely arduous, requiring lifting and moving heavy containers of liquid; 0.43 kg wood/1 litre oil; 55% of income of female-headed households in Camerouns study
Gari (cassava) processing	Women in 2 Nigerian districts earned \$17/year each; 1kg wood/4 kg gari
Hotels, restaurants, guest houses, tea shops	816,865 Mt (million tonnes) wood annually in Nepal
Food preparation and processing	13% of total household income in Nepal; 48% of mothers in Dangbe district in Ghana engaged; 49% of women in one village in Burkina Faso
Pottery making	Men and women both have distinctive roles in different processes
Soap-making costs in Bangladesh	Fuel is high percentage of production

Source: (Cecelski, 1995)

Modern fuels such as LPG can save time and improve productivity in many fuel and labor-intensive women's enterprises. They can save time for entrepreneurs, lower costs of process heat, and diversify their entrepreneurial opportunities. Since many of women's informal sector activities depend on thermal energy and involve cooking and food processing, women entrepreneurs could benefit disproportionately from switching to LPG. LPG is also likely to be attractive for women's businesses because entrepreneurs' time may have a higher value than household cooking time. In Senegal and South Africa, a study of the street food sector supported by ENERGIA's Gender & Energy research program found LPG to be the main source of energy used by both informal and formal enterprises, preferred by women because it is easy to use, affordable, clean and "best for product." Gas cookers are among the top desired appliances across the study in Rwanda as well, with the main reason being to simplify and accelerate cooking tasks for street food (RA2, 2018).

There are many types of LPG appliances available for small commercial and industrial enterprises. Common applications of LPG in industries where women are well represented include ceramic kilns, textile and paper processing, brick making, drying and curing, and shea butter processing. For food preparation and processing, LPG appliances provide instant heat and precise temperature control, and eliminate the need to wait for wood or charcoal fires to get hot or to carry wood over long distances. Roasting ovens provide reliable heat for roasting, eliminate smoke contamination from open fires, and prevent spoilage with sun baking. LPG water heating can provide large quantities of hot water for restaurants and bathing facilities. Smoke ovens fueled with LPG are used to preserve fish while adding flavor (UNDP, 2003).

Both women and men have used LPG to improve their businesses in the informal sector. In Kenya, LPG use by women in food kiosks, small restaurants and bars is common, while men use LPG in vehicle repair and metal works businesses (Practical Action, 2014). In Accra, Ghana, women entrepreneurs engaged in traditional fish smoking were faced with dwindling wood supplies, low returns from the sale of low-quality smoked fish, and environmental as well as health hazards. A local NGO followed an integrated approach of providing credit for equipment and raw materials, and a training scheme on operation, repairs, business management, packaging for international markets, and credit, as well as LPG handling, purchase, valves and hoses (Mensah, 2001).

In Himachal Pradesh, India, the use of LPG in chai dhaba and sweet shops is related to the perceived benefits in comfort and costs of use in comparison with the alternatives of fuelwood, kerosene, and in some cases coal. The use of LPG reduces indoor smoke and blackening of cooking utensils and walls, which makes the environment more pleasant for customers. One female entrepreneur stated that faster cooking with LPG, and the fire not requiring the regular attention of fuelwood, allowed her to increase turnover and reduce costs of helpers to tend the fire. Kerosene stoves needed more effort to start up and to keep operating, so comfort is a benefit (Kooijman-van Dijk, 2008).

Box 3.2: Switching from firewood to LPG in the tofu and tempeh industry in Indonesia: Women workers

Tofu and tempeh are staples of the Indonesia diet and an important source of protein, especially for low-income households. More than 285,000 workers, of which 40-50% are women, are employed in some 85,000 businesses, generating some 57 million Euros annually. Traditionally, firewood is used to heat soybeans in the production process. Since 2009, some 1,000 tofu and tempeh producers in the Jakarta region have been supported by the Renewable Energy and Energy Efficiency programme (REEEP) and EU funding, to switch from firewood to LPG. Mercy Corps, a humanitarian agency, leveraged its links to producer associations, ministries and the National Standards agency to develop a lease-to-own financing scheme where equipment also

serves as a guarantee, enabling small producers to purchase equipment. Timesavings of one and a half to two hours per day were reported by the businesses; interestingly, however, the top advantage perceived by businesses was reputational benefits based on the cleaner kitchen and end products. Hygienic production also allows producers to obtain a government certification, which opens markets to new clients, such as restaurants, hotels, supermarkets, etc. The project expects to achieve a 75% reduction in emissions equivalent to 25,000 tons CO₂ per year and to increase profitability of producers by an average of 500 Euro per year.

Top 5 reasons for using LPG over firewood in tofu & tempeh production in Indonesia, according to producers:



Cleanliness of the factory



More hygienic



Less labor intensive than firewood



Less storage space needed than firewood



Time efficiency

Source: (WLPGA, 2013? citing Mercy Corps)

Constraints to adoption of LPG by enterprises are similar as for households, but availability may be more a concern for businesses than is affordability. In Ghana, sporadic shortages of LPG affect food vendors (mainly women) and welders (typically men), reducing productivity, creating anxiety and inconvenience as users are forced to switch back to traditional fuels, especially charcoal. The most common strategy adopted to curtail the effects of shortages is the use of two or more cylinders, increasing cost (Broni-Bediako & Kakra Dankwa, 2013). A recent study found that the transition from traditional fuels to LPG plays an important role through the use of portable cylinders in responding to the growing consumer needs and the growing flexibility of the enterprises (de Groot et al., 2017). Female-owned businesses in rural Himachal Pradesh, India reported a dependency

relationship with distributors, who were often not available after entrepreneurs had trekked for hours to roadsides to refill cylinders; and having to still collect wood after having failed to secure LPG. Distributors were also suspected of underfilling cylinders (Kooijman, 2014). Underfilling seems to be a problem in other parts of India as well, and in the Philippines (Suerte-Felipe, 2011).

Both businesses and households may be concerned about taste and adaptability of LPG stoves to traditional cooking methods. In Guatemala, GenteGas noted that there is more interest to switch to LPG for families that do not have a business selling food. Businesses cooking with wood fear their customers will taste a difference in the food cooked with LPG (Espinosa, 2014).

Takoradi, Ghana. This woman selling kelewele (a Ghanaian snack of fried plantains mixed with roasted peanuts) switched to LPG from charcoal because of the lesser heat on her legs, and the lower price of LPG.



Source: <https://uenergy.wordpress.com/2010/10/21/lpg-vs-charcoal/>

...If I could, I would increase the size of my business as soon as possible. I have the ambition but the financial means are lacking...An LPG stove cooker would make it easier for me because I could prepare several dishes at one moment but I can't afford it not can I afford to bear the cost of gas...

Viviane, Senegalese married women, informal enterprise (RA2, 2018)

Female entrepreneurs generally do face more obstacles than male businessmen, in terms of access to finance and inputs such as land and assets, skills, other family responsibilities, and access to networks. When they do engage in entrepreneurship, women tend to engage in businesses that are less profitable compared with men (World Bank, 2012). Additional key issues identified in providing energy services for women's informal sector enterprises by Clancy and Dutta (2005) include: the informal and unorganized nature of enterprises; heavy reliance on process heat; high use of women's metabolic energy; energy as a cost factor in sustainability of rural enterprises; and the role of complementary inputs. Further, an ENERGIA-supported study in 2018 (RA6, 2018) found that men are more likely to be targeted by productive use interventions, at least in the electricity sector; similar outcomes need to be avoided in promotion of LPG to enterprises.

It is important that women's retail businesses have access to sufficient training and support to function as sustainable businesses. In Sudan, for example, loans for acquisition of LPG equipment were serviced through branches of the Women

Development Association (WDA), but initially not all WDA members showed themselves to be very suited to the business environment. Demand for LPG was higher than anticipated, and the NGO staff could not monitor and follow up on repayment (Bates, 2007).

More understanding and examples are needed of how women entrepreneurs benefit from using LPG, and how constraints have been successfully overcome.

3.2.2 Engaging women in the LPG supply chain

There is a huge global market opportunity for the private sector in energy access, with an untapped market in many countries. Looking at current market barriers, it is clear that new approaches and business models are needed to overcome these and create viable investment opportunities. Engaging women in the LPG supply chain could be one such new approach. While women are the biggest users of LPG for cooking, they have been less involved in LPG distribution or other parts of the supply chain. Integrating women in the LPG supply chain can help build LPG usage. A Johns Hopkins Bloomberg School of Public Health

randomized control trial (RCT) study in Kenya showed that women cookstove entrepreneurs outsold their male counterparts by nearly three-to-one (Global Alliance, 2016); similar success might be anticipated with LPG connections. The supply of LPG represents an important employment sector with growth potential in and of itself. Increasing the number of suppliers and distributors is critical to the expansion of LPG use. In Indonesia, for example, the LPG switching programme involved eight LPG terminals, ten LPG Depots, 67 LPG cylinder factories, 27 stove factories, 16 regulator producers, and 360 filling stations. It was predicted that by 2013, 2.5 billion US\$ of investment and 38,000 new employees would be hired as a result of the construction of new refrigerated terminals and filling stations (Budya & Arofat, 2011).

Modern energy technology businesses have been viewed as “men’s work”, while women operate more traditional, and less profitable, biomass-based micro-enterprises. GVEP’s DEEP programme⁵, working with very small micro enterprises, found that even though the programme set out to involve equal numbers of women, female entrepreneurs were generally less mobile than male entrepreneurs; they tended to be engaged in businesses that do not need a high level of capital, use low technology and deal in products that can sell to immediate markets. Disparity in accessing credit was found to be a particular obstacle for female sustainable clean energy entrepreneurs, and average loan size was smaller. The female entrepreneurs were often constrained by their household responsibilities and marital status (for example, having to obtain permission from their husbands to travel out of town for training or trade fairs) - though some husbands were supportive and indirectly or directly involved in the enterprise. Women tended to engage in improved cook stoves and briquette production, while men engaged more in solar, biogas and battery charging businesses, which require more capital or skill (Kariuki & Balla, 2012).

Approaches that include training and microcredit, and partnering with formal and informal women’s organizations, can help overcome the traditional

constraints on women’s participation and take advantage of their strengths (Karlsson, 2012). The GVEP DEEP programme above provided both financial and non-financial services, including business mentorship (Kariuki & Balla, 2012). Solar Sisters in East Africa uses a “micro-consignment” model and partners with formal and informal women’s organizations to market off-grid lighting, and combines sales with promoting mobile phone charging as a women’s business, and using mobile banking and text messaging to communicate with the entrepreneurs and to streamline funds. In Bangladesh, an NGO providing energy microfinance has bundled projects that involve training women and employing them as engineers to install solar panels for CDM financing.

Traditional biomass can also be modernized and provide employment opportunities. In Senegal, an improved stoves production in two regions provided employment for 43 male metalworkers, 50 female potters and 27 male and female re-sellers. More efficient production and sale of charcoal and minor forest products in the same project resulted in the employment of 214 women and 237 men through enterprise groups. In Nepal, women are encouraged to participate in technical training as micro-hydro operators, bio-digester masons and solar technicians, with incentives given to women for childcare plus a 50% quota to encourage women to participate in technical training (NORAD, 2011).

Recent studies confirm these findings. (RA7, 2019) identifies four types of supports needed to enhance women’s economic growth, including energy-related businesses: at the individual level, business education and skill development, as well as training to foster personal agency and initiative; and at the business level, access to finance and capital and access to coaches, mentors and networks. The importance of engaging men is also emphasized. ENERGIA’s women’s energy entrepreneurship program, described in Box 3.3, while focusing mainly on renewable energy, offers many lessons that could be applied to women’s entrepreneurship in LPG as well.

⁵ GVEP (Global Village Energy Partnership), now known as Energy4Impact, is a partnership that supports local businesses in developing countries to increase access to modern energy. The Developing Energy Enterprises Project (DEEP) was one of its projects, run between 2008 and 2013. It aimed to develop sustainable micro and small energy enterprises.

Box 3.3: Women's Economic Empowerment (WEE): Scaling up Energy Access Through Women-Led Business

Together with its five partners, ENERGIA has supported more than 4,000 women to launch and grow clean energy businesses in seven countries since 2014. These women-led enterprises – largely on the micro-level – have delivered clean energy products and services to more than 2.6 million consumers, mostly in rural areas and in low-income communities.

The WEE programme design is centered on ENERGIA's belief that, because the factors limiting women's entrepreneurship are manifold and intertwined, integrated measures are needed to realize women entrepreneurs' potential. In line with this belief, the programme's strategy encompasses a comprehensive entrepreneurship development process that entails a careful identification of the barriers women face in starting a business and then systematically addresses them. Women entrepreneurs are trained in technical, managerial, leadership and empowerment aspects of energy businesses. Each receives customized support from designated mentors, trained by the partner organization. The mentors help them on an ongoing basis to identify new market opportunities, develop marketing strategies, identify and transact with suppliers, interact with local government authorities, prepare business plans, and approach and negotiate with financial institutions. The mentors take the support package right to the entrepreneur's place of work and demystify 'business' for them. In addition, the project supports the partner organizations to set up and strengthen product supply chains through the private sector. And it builds partnerships with the private sector and financing institutions, as well as with local government.

An enabling environment is as important as direct support to the entrepreneurs. Together with addressing the 'immediate' challenges that women face in starting and expanding a business, the enabling environment - including policies and

resources available – must ensure that structural barriers that create bias against women within policy are overcome, and that markets and institutional environments in which governments, financiers, energy companies and consumers operate, support such initiatives. A conducive, enabling environment that supports women's enterprise development in renewable energy technologies and products includes (a) enabling fiscal policies for off-grid clean energy products, (b) industry standards and certification of quality assured market products and (c) ease in doing business for women, including streamlined processes for business registration and licensing, easy access to information, guidance, application submission and follow up.

An ecosystems approach is central to women's enterprise development. In promoting women's enterprise development, practitioners must convene together a number of stakeholders, who need to operate in tandem: entrepreneurs; specialized support organizations, financial institutions, civil society organizations (i.e. women support groups) and the public sector. Together, they need to perform multiple functions: to provide a conducive policy and regulatory environment; to facilitate access to funding; to provide business development support and mentoring; to link entrepreneurs to markets and to strengthen the value chains as a whole.

Access to capital is critical, but must be accompanied by a combination of other measures. Availability of capital for entrepreneurs has been identified as a major bottleneck. But in our experience, access to capital must necessarily be accompanied with a host of complementary services, such as leadership and agency development, investments in financial literacy and the ability to manage cash flows, and continued mentor support - all of which increase women's direct control over resources and increase their self-confidence.

Source: (Respol, undated)

Employment as energy entrepreneurs has been shown to have positive effects on education of children and simple quotas for women has been shown in recent randomized control trials in Rwanda to be an effective strategy for realizing benefits, both for female entrepreneurs and for profitability (RA5, 2018)

Similar approaches could be applied in LPG promotion. With women being the main consumers, women might logically be successful and effective LPG energy entrepreneurs and

providers of microfinance, involved in managing LPG business and in servicing clients. Opportunities for women could include wholesale and retail sales of stoves and cylinder systems, their installation, and follow up inspections. Women could be engaged in monitoring of safety of storage and transport facilities and of cylinder refill depots to ensure fair sale, as private certified inspectors. Consumer education on health benefits, correct use and maintenance, and safety procedures would be more effective from woman to woman.

Box 3.4: Women running LPG retail businesses in Ghana

Lambark Gas is currently one of the market leaders in LPG distribution for automobiles and for domestic and commercial heating purposes, in the Kumasi Metropolis. Employing 17 staff, the company sells over 2.5 million kg of LPG each year, equivalent to 12,500 tones of charcoal. Ms. Mallam Abukari Amadu is the entrepreneur behind Lambark, who received enterprise development services (EDS) from Kumasi Institute of Technology and Environment (KITE), a Ghanaian research institution focusing on energy and environment, to help her refine the company's business plan. AREED invested a total of US\$ 359,746 in Lambark Gas between 2004 (US\$ 109,746) and 2007 (US\$ 250,000). As of 2012 the company was on track to make a full loan repayment to African Rural Energy Enterprise Development (AREED).

M38 is an LPG retail business based in western Accra, set up by Mrs. Clara Koranteng in 2003 (though her maiden name was Mankata and she was 38 when the business started, hence M38). Mrs. Koranteng was working as a secretary when she got the idea of setting up her own LPG retail business, motivated by the long queues in her neighbourhood for refilling at that time. She was also encouraged by a friend involved in

LPG retailing who advised her it was a lucrative business to get into. She first worked to secure all relevant permits and approval, i.e., from the Environmental Protection Agency (EPA), fire service and construction authorities. She first tried to secure a bank loan but they didn't want to lend, then she saw the AREED project advertised in the Daily Graphic and contacted KITE. She was later told that she was the only female applicant to express interest in AREED from a total of 1,441 across the five African countries. The EDS process provided by KITE helped her when it came to sourcing the two gas tanks, which were imported from Germany. The tanks, once delivered, had to be tested by local authorities and the Oil Marketing Company (OMC) trained their workers in safe re-filling. M38 was approved a US\$ 59,000 start-up loan in 2004, backed by AREED with variable interest of between 5-8%, which was paid off within 18 months. M38 sells approximately 0.45 million kg of LPG per year, equivalent to about 2,250 tones of charcoal. The company's refueling station employs four staff and the company is now (as of 2012) planning to set up another LPG filling station, using its own finance. However M38 is not the only job for Mrs. Koranteng; she also works for the Agricultural Development Bank.

Source: (Haselip, et al., 2013)



A few examples were found in the literature of women's participation in the LPG supply chain, though in general LPG entrepreneurship appears to be mostly dominated by men. Of the Ghana case studies of LPG enterprises by REEEP, only two were female-owned, though these were very successful ones (See Box 3.4). In Morocco, an LPG and microfinance programme supported by WLPGA and the UNDP provided loans for stimulating LPG entrepreneurship. 27% of the loans did go to women-owned rural tourism businesses; but this is less impressive when one considers that the NGO involved, Zakoura Foundation, in its regular financial and non-financial services mostly targets women and normally provides 84% of its loans to women (Elgarah, 2011). In India, the Minister of Petroleum and Natural Gas originally announced that the 2,000 dealers under the Rajiv Gandhi Gramin LPG Vitruk Yojana would be appointed on the condition that their wives would be made partners in business, so 50% of distributors would be women; this was later changed to spouses (The Hindu, 2010). Nonetheless, reportedly these quotas were mostly used by men, to get dealerships in women's names (Dutta, 2014).

In the Philippines, a positive example is that 81% of women graduates from a pilot capacity building course for women technicians on the conversion of vehicles to Autogas were hired by multinational automotive companies within two years (DOE, 2012).

A number of barriers to women's entrepreneurship in general need to be addressed in order for women to become energy entrepreneurs: Supporting women's enterprises through appropriate training and skill building; promoting alternative institutional models; and addressing credit needs (Clancy & Dutta, 2005). Best practices exist from initiatives that have had some success in promoting women's entrepreneurship in the energy sector, and these could be applied in LPG promotion engaging women (Gill, et al., 2012; Misana & Karlsson, 2001). Further, some nascent initiatives exist in the promotion of LPG as well that have the potential to unleash women's entrepreneurship for the benefit of other women.

Box 3.5: Converting Families to LPG Stoves in Guatemala: The Trials and Tribulations of a Social Enterprise

Social enterprises tackle clean cooking with business principles combined with a social mission. GenteGas, dedicated to improving the quality of life of families in Guatemala by converting them to LPG, is experimenting and constantly evolving to meet the challenges faced as a start-up business in a complex LPG sector.

Impact on health was and is the primary goal of GenteGas. The initial market study identified a high interest of wood fuel users to switch to LPG, as well as key barriers: the up-front cost of the stoves, the low access of the households to credit, the lack of knowledge on LPG, and safety issues. GenteGas founded its original business model on independent women entrepreneurs selling stoves, with credit facilitated through a local bank for stove purchase and women entrepreneurs responsible for facilitating community education regarding safety and usage directly to households. Several difficulties appeared: Inventory control and logistic distribution for women entrepreneurs, labor and fiscal constraints, gender issues, difficulty to access to bank credit, and lack of control on the training provided to customers. The internalization of the services became the only viable solution: hiring full-time salaried employees, managing stove and fuel distribution in a centralized manner, and offering in-house credit options to customers. It allowed for a more refined level of customer service to new customers, which is key to the success of LPG adoption, especially in Guatemala where consumers usually have a poor impression of the LPG industry.

GenteGas currently centers their sales strategy on two programs relying on educational activities. The Smokeless Schools program works to install industrial LPG stoves in schools and provide educational sessions to parents about health impacts of cooking smoke and the safe use of LPG.

The One Week with Gas program is a free stove trial program offered to wood user families who have participated in the training sessions. The key to higher sales and adoption rates proved to be the creation of a strong relationship with potential customers. This offers the opportunity to promote the GenteGas brand and educate community members on the health impact of cooking with wood as well as safe cooking with LPG; and also increases customer referrals. After negative experience with more economical stove options (increase in technical service calls, irregular monthly payments), GenteGas excluded from their product low quality stoves and included numerous options for consumer preference (color, cabinets, ovens, etc.). This contributes to maintain uptake of LPG usage and a high consumer perception about the quality of stoves and services offered by GenteGas. Also, GenteGas tested a series of marketing and sales strategies: door-to-door sales, community training, flyers, social media advertisements, street promotion activities, health fairs, product fairs, and employer programs. These were ineffective however until GenteGas fixed the other working pieces of the business model (financing, logistical operations, employment structures, etc.). GenteGas was able to return to some of the earlier tested marketing and sales strategies that later produced better results.

Last but not least, GenteGas has had to take into account the characteristics of the LPG sector in Guatemala - LPG price volatility, the poor reputation of the sector, the centralized filling system and the weak enforcement of regulations by the Ministry of Energy. Understanding the overall ecosystem and its impacts on the business activities makes a difference. The focus of GenteGas on a high quality service to customers, including training, education and good quality cylinders, is essential to the success of GenteGas business model.

Source: Christina Espinosa, Co-Founder & CEO of GenteGas (GenteGas, 2017)

3.2.3 Opening opportunities for professional women in the LPG industry

Figures commonly cited throughout the industry are that women are under-represented at the top of the industry, with 95% of executives being men, while women are 80% of the consumers of LPG (WLPGA, 2013). A US-based network, the Women in Propane Council, is working through the National Propane Gas Association to provide positive opportunities to support the advancement

and success of women in business operations and professional development; it currently has more than 500 members and is seeking to expand the organization's concept globally. It encourages membership by both women and men who support the concept. Recognizing an opportunity for the LPG industry to take actions that can address the issue of improving diversity in the workforce, the WLPGA has built on such existing national programmes, to develop and implement an international network, WINLPG (see Box 3.6).



Box 3.6: Women in LPG Global Network (WINLPG):

Women in LPG Global Network (WINLPG) is a network managed by the WLPGA, launched in 2015 with the mission to support and help empower women in the LPG Industry through leadership, coaching, mentoring, promoting role models and Ambassadors, and developing national chapters. The idea of establishing an initiative for women in LPG sector was brought up on the first Global World Women in Propane session during WLPGA's World Forum in Miami, 2014, which included senior professional women from LPG companies and was chaired by Nikki Brown from Cavagna Group. The primary goal since the network's launch has been to promote diversity in LPG businesses. During the period the activities of WINLPG will lead to an increase of 5% from the current 16.5% of women employed in the industry to 21.5% during the period 2017 – 2019. In addition, the network will have a membership of at least 1,000 individuals by the end of the period. Other areas of diversity in the business e.g. involvement of youth will be investigated.

WINLPG currently has five national chapters in South Africa, Nigeria, Colombia, India and the USA. National chapters enable a wider reach to members' in country and also enable discussions around specific issues related to particular geographies. Further national chapters are being considered with Turkey and Myanmar set to launch in 2019.

WINLPG has three objectives:

1/ Support and Retain: Set up the global network, develop a social media presence, develop case studies and role model profiles, and hold knowledge exchange workshops.

2/ Promotion and Advocacy: Gain visibility for the network through continued partnerships, promoting case studies, role models and advocates, via the media.

3/ Educate and Attract: Educate and attract, in the longer term, via global events (not necessarily LPG events), external education at universities and schools and educating the industry itself.

WINLPG engages in a number of different activities with a focus on communications both inside and beyond the LPG industry. In 2016, WINLPG held its first Knowledge Exchange workshop in Bogota, Colombia during the Latin American LPG Association's annual conference. Female leaders in Latin American industry were brought together to discuss leadership learning skills and exchange ideas on career challenges. In 2017, WINLPG launched the National Chapter in India. With more than 425 participants being involved, the launch was filled with interactive discussions. Mr Dharmendra Pradhan, Minister for Petroleum & Natural Gas for India and Mr. Sanjiv Singh, Chairman of Indian Oil Corporation were invited to deliver a keynote speech to address the importance of women's empowerment in LPG sector.

These events hope to unite women in the industry to enable them to share their histories and also benefit from some kind of training (negotiation skills, leadership tactics, presentation skills etc.).



Inauguration of WINLPG National Chapter in India, 2017

Source: Christina Espinosa, Co-Founder & CEO of GenteGas (GenteGas, 2017)

Engaging women in the LPG supply chain is an effective strategy for gender equality as well as for LPG promotion. Investing in women's economic empowerment sets a direct path towards gender equality, poverty eradication and inclusive economic growth. Women in the value chain can also be key agents for addressing universal energy access, including access to LPG for cooking.

The Global LPG Partnership (GLPGP)'s leadership includes four women out of ten members in its leadership team, a model in encouraging professional women's empowerment in the LPG sector. As a Sales and Marketing Manager with Kosan Crisplant, Bessem Enonchong (above) successfully directed the launch of GLOCALGAX, a subsidiary focused on safe residential LPG cylinder distribution, in the Cameroon market in 2006. She subsequently took on an LPG equipment sales role, covering all of Sub-Saharan Africa. In 2015, she was honored by WLPGA as Women in LPG Global Network (WINLPG) Role Model. Another team member, Elizabeth Muchiri (below), was the first ever LPG Manager at the National Oil Corporation of Kenya, where she was instrumental role in launching the Supa Gas brand. She has been engaged by several LPG start-up companies to advise on cylinder requirements, management and distribution strategies (GLPGP, 2018).



3.3 Linking modern cooking fuels with women's empowerment

3.3.1 Women's organisations can influence household energy policy and discussions on the global energy mix and climate change

Women and their organizations are increasingly active in shaping policies and programmes to support women's interests in their countries, including in the energy sector. National networks on gender and energy have carried out gender audits of the energy sector in a number of countries in Africa and Asia, and have helped ensure that women's interests are represented in national energy plans in Botswana, Kenya, Uganda and Philippines among others. Women in developing countries are increasingly vocal about their need for adequate household energy options.

Women's organizations and NGOs have started to focus on LPG. In the Philippines, women have lobbied for lower LPG prices and sought to include LPG and kerosene in the list of basic necessities for price controls (Gabriela Women's Party, 2007). The Ghana Girl Guides Association provides a platform to educate women on the benefits of LPG and empowers them to be the agents of the transition towards clean cooking fuels. With Mrs. Hadjia Samira Bawumia, the second lady of Ghana as the ambassador, the Global Alliance for Clean Cookstove stands for building the capacity of local stove manufacturers, educating future generation and developing better local policies for the clean cooking industry (WHO, 2018).

Women's organizations also play an important lobbying role in legislation. In Nigeria, the Women in LPG Global Network (WINLPG) appealed to the government to enact a law on safety in cooking (TechnoOil, 2017).

Box 3.7: A gendered political economy analysis of clean cooking in India

Until recently, India and Nepal had targets for rural electrification but not for clean cooking energy. There was a failure to recognize unpaid household work and cooking energy as claimants in the use of the rents space. However a broadening of the political settlement to include not just the elite and the middle classes but also poor rural women – a change driven by universal, adult suffrage – has led to targets for access to clean cooking energy. Rural poor women as voters have made a difference to

the political settlement, and this has led to a change in the use (in a clientelist manner) of the rents space to accommodate women's strategic need for clean cooking energy and modern energy in agriculture. Women's movements have also raised demands for women's access to energy for production, forcing governments to respond with policies to provide women access to modern energy services.

- RA3, 2018

In India, women voters and their organizations have played a key role in ensuring that LPG subsidies would be accessible to women. During the 2013/14 elections in various states in India, women protested LPG price hikes. LPG policy provisions became an issue during election campaigns, and subsidies were kept in place in response to these protests. Women activists met with ministers and lobbied for increasing the cap on subsidized LPG cylinders from 9 to 12 per year (Thorat, et al., 2014), and this demand was included in the Women's Charter for the 2014 Lok Sabha Elections (Thorat, et al., 2014). Not only middle and upper income women from the national women's movement, but also women laborers organized protests under the banner 'Penkoottu,' an organisation of women laborers (The Hindu, 2014).



Women in New Delhi demanding lower prices for cooking fuel

Source:

...For working women, quick and smokeless cooking using LPG is a blessing. With such steep increase in the price of cooking gas, we will not be able to afford it anymore." She said the government was pushing the country's women back into 'the hell of smoke...

P.Viji in The Hindu, 2014

In Senegal in 1974, the government launched the “Butanisation” programme to increase the share of LPG in energy consumption and decrease reliance on biomass. In 1985, LPG subsidies were withdrawn due to IMF loan requirements, but were soon reintroduced into the country due to the continuous opposition from women’s groups protesting against the high cost of LPG.

Women’s organizations and networks can also weigh in on the ongoing discussions at the national and international level on the role of LPG in the global energy mix and climate change. Emissions from cooking in developing countries are hardly significant in the total. Smith has estimated that even if all two billion people using solid fuels for cooking shifted to LPG for household fuel, it would add less than 2% to global greenhouse gas emissions from fossil fuels. This can be weighed against the enormous health and other benefits described in Chapter 2 above. Further, in many cases LPG, a low-emissions fuel, is replacing kerosene, a high-emissions fuel. An environmental life cycle assessment of ten fuel sources used in Indian households found that the environmental impacts of LPG are one of the lowest, and 15-18% lower than kerosene (Singh & Gundimeda, 2013). The Peruvian Ministry of Energy and Mines and UNDP have calculated that in Peru, each LPG cook stove distributed in that country actually reduces approximately 1.15 tonnes of CO₂ e/year (UNFCCC, 2006).

A recent study of 40 countries suggested that an average country could avert over 100,000 more tons of CO₂ equivalents by instituting a 25,000-household LPG intervention compared with a basic improved biomass stove (Rosenthal, 2017).

Organized women, allied with household energy providers, can address the gender bias and absence of women’s voice in energy policy, and demand more solutions that address women’s cooking needs. As Nathan and Kelkar (2005) point out, energy policies should address gender asymmetries in capabilities, control and ownership of assets, and participation in community governance. For this, women need knowledge not just about how to use LPG safely in the kitchen, but how LPG and household energy policy and programmes work, how their choices will affect climate change, how they can participate in energy supply chains as workers and entrepreneurs, and a whole range of issues.

At policy level, women in developing countries can advocate for modern, technology-neutral options that they can choose among, rather than relegating the poor and women to traditional biomass fuels or less convenient renewable options, or stereotyping that energy development for women should be limited to small, manual processes. They can also claim their right to subsidies that will make their time more productive.



3.3.2 Financial inclusion is key to expanding access to modern cooking fuels

Reforms in energy policy have been successful in expanding LPG availability and reducing its price in a number of countries, as shown in Figure 3.3 below. Innovative financing measures have contributed to success in promotion.

Table 3.3: Range of possible outcomes: different countries have achieved low, medium and high LPG use growth rates over the years

	Growth rate/year	Y10 LPG penetration	Country examples	Typical reforms
Low	• 1%	• 10-15%	• Senegal, Morocco	<ul style="list-style-type: none"> • Governmental subsidies for LPG; micro-credit channels developed for equipment • High quality and well-regulated distribution system • Facilitated private sector collaboration and development of local industry
Medium	• 2%	• 18%	• India	<ul style="list-style-type: none"> • Subsidies (directly deposited into users' bank accounts) • Strict regulatory environment to prevent the misuse of cylinders (e.g., for commercial purposes)
High	<ul style="list-style-type: none"> • 3-5% • 18% 	<ul style="list-style-type: none"> • 50% • 84% (Y4) 	<ul style="list-style-type: none"> • Peru, Vietnam • Indonesia 	<ul style="list-style-type: none"> • Major and rapid policy interventions, including decreasing VAT/import tax of LPG, instituting LPG retail price ceiling, taxing biomass consumption • Conversion of existing infrastructure; establishing LPG conversion PPPs • Heavy investment in infrastructure, education, and promotion of LPG

Source: (World Bank, 2012)

Barriers and constraints need distinct attention. On the supply side, establishing a commercially viable LPG network in the face of low consumption and poor infrastructural challenges can be difficult, especially in rural areas. Infrequent delivery of refill cylinders serves as a disincentive to switching to LPG, and high upfront cost of LPG infrastructures and unreliable supply network constitute constraints on the supply side. On the demand-side, low per-capita incomes, lack of awareness of benefits of alternative fuels, inappropriate stove designs and simple force of habit are popular constraints, as well as the necessary capital investment for stove and cylinder and recurring expenditure for the fuel itself.⁶

Government actions such as establishing a regulatory environment and supporting subsidy

and micro-finance schemes will be essential to further expansion in many countries. Because high costs present the greatest barrier to the adoption of LPG, making the market as efficient as possible and passing efficiency gains to consumers to lower prices is crucial to expand household use of LPG. In addition to cost, other obstacles that deter LPG include short selling, fires and other accidents, and fuel shortages. These need to be addressed in policy and regulatory frameworks. Enforcement of standards for safety needs to be ensured. Consumers need to be well informed. Both the WLPGA (WLPGA, 2013) and the World Bank (Kojima, 2011) have developed detailed and excellent guidance on international experience and standards necessary for successful LPG adoption programmes.

⁶Thanks to Ms Oyindamola Fagbenle of Georgetown University for this concise summary

...LPG is an aspirational product and would be the first choice of a cooking fuel for almost all women [in the South Asia study] but uncertainty over its ready availability, high cost, difficulty to cook traditional food items, and fear of safety are the limiting factors for its wider adoption...

Practical Action, 2014

Better LPG distribution, policies, regulation and enforcement may initially benefit middle and upper income households most, but these are pre-conditions for lower prices and better distribution infrastructure that can make LPG more accessible for working women of all income levels. Further, middle-class women's movements give women an opportunity to express their needs vis-à-vis the household domain - which are often neglected in policymaking - and in the long term improve the voice of working class women. Women's voices can sensitize politicians (often men) to the household energy needs of women, and give women a political voice.

The potential to widen the reach of LPG beyond middle- and upper-income cooks depends crucially on the policies adopted. Social protection measures, including targeted fuel and equipment subsidies, can be effective in weathering short-term energy price shocks, forestalling increases in poverty and responding to longer-term needs such as deforestation. They can help poorer households bridge the affordability gap until they generate sufficient cash income from livelihood activities (Lallement, 2009).

Cost has been seen as the major limitation for increased use of LPG in cooking. An obstacle is that world LPG prices are volatile and linked to the global price of crude. Higher prices across the oil complex in 2017 resulted in corresponding rises in LPG prices compared with the period of relatively low prices that extended from 2011 to 2016 (WLPGA 2018). According to the World Bank (Kojima, 2011), household income is one principal determinant of a household's decision to adopt LPG and how much to consume, and fuel prices are the other. This World Bank study suggests that LPG programmes are likely to be more effective if they first focus on areas where biomass is diminishing, the costs of biomass cooking are high, and infrastructure exists for reliable LPG delivery, starting with tarred roads.

There are many arguments against subsidies. First, subsidies represent a more or less permanent burden on national budgets. Second, subsidies are often captured mainly by higher income users, who could actually afford to pay full cost; while low-income households are frequently still unable to afford even subsidized fuels. In an IMF working report evaluating the benefits of fuel subsidies based on cases studies of 20 developing countries from Africa, Asia, the Middle East and Latin America, it has been found that only 4 percent of LPG subsidies went to households within lowest income groups, while over 50 percent went to highest income group (Granado, Coady, & Gillingham, 2012; Toft et al., 2016). Modelling of household behavior on energy technology choices shows those rural households barely change their energy technology choices if LPG stove cost is

reduced by 50%. Rather, rising incomes are the important driver in adoption of LPG stoves (Zhang, 2010).

Nonetheless, for countries where kerosene is subsidized, household fuel switching to LPG can save government budgets considerable financial resources: The Indonesian government was able to save almost US\$ 3 billion gross in crippling kerosene subsidies by May 2010⁷, and the Indian government may also hope for such savings. Subsidies of LPG are still costly, and Indonesia is currently struggling to reduce this cost burden. But as Box 3.8 explains, providing energy access for many energy-producing countries would require only a small portion of their expected energy revenues.

Box 3.8: With only 0.4% of revenues, oil- and gas-exporting Sub-Saharan African countries could provide electricity and clean cooking fuels to their populations

The International Energy Agency focused on oil- and gas-exporting Sub-Saharan African countries and assessed whether their resources could alleviate energy poverty. Despite the enormous revenues expected to be collected by these countries from hydrocarbon exports, a significant portion of their population is expected to remain without access to

electricity and without access to clean cooking fuels in 2030. The IEA estimated that the capital cost of providing minimal energy services such as electricity and LPG stoves and cylinders, to households during the 2006–30 period would represent only 0.4% of governments' take from oil and gas exports.

Source: IEA 2008 in Ekouevi and Tuntivate 2012.

Can LPG meet lower-income and rural women's cooking needs, or it is only for middle and upper income households? LPG has usually been branded as a fuel for the middle and upper class, but much depends on government policy, as well as private sector company approaches (Box 3.9)

⁷After accounting for the LPG conversion costs of almost US\$ 1.2 billion, net savings were about US\$ 1.8 billion by May 2010 (Budya & Arofat, 2011).

Box 3.9: Can LPG meet lower-income and rural women's cooking energy needs or is it only for middle and upper income households?

In India, Brazil, Indonesia, Senegal, Bangladesh and other countries with LPG promotion programmes, with the right policies - and quite possibly in places where women's work is becoming more highly valued economically - it is possible to very quickly expand use of LPG to lower as well as middle income households:

- In Senegal, subsidies to support the dissemination of 3 kg and 6 kg LPG cylinders with supports for pots and pans and including burners, enabled lower- to middle-class households to adopt LPG. The LPG promotion programme led to a remarkable boom in LPG consumption, which grew from less than 2,000 tons in 1974 to 15,000 tons in 1987 to more than 150,000 tons in 2017). Today 90% of households in Dakar normally cook on LPG - though supply is not always reliable in which case they fall back on charcoal (EnDev, 2018).

- In Brazil, 98% of households (including 93% of rural households) have access to LPG, due to government policy that has promoted the development of an LPG delivery infrastructure in all regions, including rural regions, and subsidies to LPG users. Access to LPG was one part of the very successful Bolsa Familia programme, which in 2016 was facilitating small cash transfers to 46 million Brazilians with incomes below the poverty line (Huffingtonpost, 2016). A consolidated cylinder recirculation model has also been set up, helping Brazil increase its LPG penetration (Bruce et al., 2017).

- In Indonesia, the Kerosene to LPG substitution programme induced a 28 percentage-point decrease in energy poverty in suburban areas. Andadari et al (2014) found that while the LPG programme failed to substantially reduce the overall number of energy-poor people, it has been effective in alleviating extreme energy poverty, or the number of people living under the lowest energy-poverty line.

- Bangladesh was undoubtedly the fastest growing LPG market in the world in 2017, growing from 343,000 tons in 2016 to nearly 520,000 tons in 2017 (WLPGA, 2018). This accelerated growth is due to the country's dwindling natural gas production, which has led the government to encourage the use of LPG primarily for cooking. The population density of Bangladesh and relative economic growth of the economy means that the growth is expected to continue, reaching an estimated 3 million tons by 2025 (The Financial Express, 2018).

-Kenya's government launched the Mwananchi Gas Project in 2017 as part of the country's efforts in managing a LPG subsidy campaign to drive down the price of fuel. Under the scheme, the government provides between 5 and 15 million cylinders each fitted with a cooking stove to low-income families across the country, with 60 percent of the price for the package being covered by subsidies (van der Berg, 2018). The project gives priority to women, youth and people with disabilities to be included in the supply chain as distributors, retailers and brand ambassadors (National Oil of Kenya, 2018).

Based on the country studies on LPG market development, five principles have been summarized by GLPGP on the rapid and sustainable application of LPG: Implement and enforce effective, self-consistent LPG market rules, with central emphasis on property rights protection in marketer-owned LPG cylinders and on public safety; Ensure stability and continuity of the LPG fuel supply in all regions to be served; Implement stable, market-sustaining and market-stimulating policies; Ensure high LPG retail density; Develop a consensus-based national master plan for coordinated LPG investments and interventions (Van Leeuwen, Evans & Hyseni, 2018; GLPGP, 2015).

Source: Michael Kelly, WLPGA

Financial inclusion and access to bank accounts and LPG connection in women's names and for women will be key if such schemes aim to empower women. Where LPG is less expensive than competing fuels such as charcoal, credit to purchase appliances can be a huge barrier. Private LPG companies have used targeted approaches to provide LPG specifically to lower-income groups. Innovative programmes such as Paygo Energy in Kenya and Switch SA in Haiti are tackling the low-income market by offering credit for stoves and low-cost refills. Kalinda Magloire, Chair of Switch, points out that although very few people have the luxury to make a large sum cash-purchase, the product might still be affordable since the daily savings that households make by switching from charcoal to LPG (US\$0.50/day) can be used to acquire the equipment over time (ten months). However they need to be provided with a mechanism to pay by instalment. In Kenya, pay as you go technology has the potential to make LPG accessible in small amounts and thus available to end users at the bottom of the pyramid. This kind of digital communications technology was once prohibitive in developing countries. Now it is being leveraged to increase energy access and cut down on bad practices in the LPG industry.



Estate workers in Sri Lanka received LPG through a tripartite public-private partnership.

In Sri Lanka, a public-private partnership and CSR initiatives, the Plantation Human Development Trust (PHDT) - a Tripartite Organisation consisting of the Government of Sri Lanka, Regional Plantation Companies, and Plantation Trade Unions (and an observer member of the WLPGA) - has been active working to bring LPG to one million plantation estate workers community, a marginalized group. To alleviate women's work and health, PHDT has provided concessionary rates on the cylinder, LPG and cooker, along with over 8 months to pay on interest free terms, to plantation workers on estates, with the help of the Estate Worker Housing Co-Operative Society (EWCHS) and Laugfs Gas(WLPGA, 2016).

In South Africa, an innovative programme by the electricity utility, ESKOM, was initiated in 2006 to expand electrification together with provision of LPG cooking equipment. It successfully addressed the key barriers of the capital costs of switching as well as providing information and awareness to address safety concerns of households. But it was undermined by the ensuing national LPG supply constraints, due to inadequate consultation with the LPG industry (Tait, et al., 2013).

Another example is the model found in Carbon Clear's Darfur Low-Smoke Stoves Project, the first ever LPG programme to be registered by The Gold Standard for carbon credits. Launched in 2007 with Practical Action and Nile Gas, LPG cookstoves were purchased through a micro-finance initiative managed by the Women's Development Association Network (WDAN), a network of more than 60 female-led community-based organizations that facilitates women's activities in communities in North Darfur. The WDAN played a key role in the project's success. Women involved with the WDAN worked in the community to help people understand how buying a low smoke cookstove through a micro-credit arrangement can work for them.

They also explained how families could continue to cook the foods they are used to while improving their health, reducing the money spent on fuel and the time spent cooking. WDAN worked with Practical Action to manage membership registrations, distribute the LPG stoves, collect loan instalments, manage micro-credit facilities, measure usage of equipment, and monitor the tangible benefits. Carbon finance was used to pay all project management and monitoring costs in the field and establish the micro-finance fund. More than 5,000 stoves and canisters had been distributed up to 2014, with a 90% repayment rate, due to the very close link between the women and their local associations (Levallois, 2014).

The Women Development Association (WDA) in Sudan partnered with Practical Action UK and representatives from Nile Petroleum, Medical Officer of Health, and Civil Defense, in a Policy Forum to launch LPG entrepreneurship for displaced women.

Source: (Bates, 2007)



The following section looks more closely at the experiences of India and Indonesia, where national LPG programs have been rolled out in recent years, aiming to target poor households and women.

3.3.3 Targeting subsidies to women and poor households are critical in realizing benefits: Experiences from India and Indonesia

India: Women are reaping benefits from better targeting with identity schemes and bank accounts, but more needs to be done

India is the country with the single largest burden of diseases from Household Air Pollution – 900,000 premature deaths a year (Bruce, et al., 2017).

Since 2012, the Government of India and three oil marketing companies have promoted a series of national reforms to promote LPG for cooking and reduce the health burden associated with solid fuel use. Box 3.x below describes the operation of the latest LPG scheme in India, Pradhan Mantri Ujjwala Yojana (PMUY).

Box 3.10: LPG Subsidy Reforms and India's Pradhan Mantri Ujjwala Yojana (PMUY)⁸

The latest LPG scheme in India, Pradhan Mantri Ujjwala Yojana (PMUY), aims at “empowering women and protecting their health” (Gol, 2018). India has a long history of subsidizing LPG, a preferred cooking fuel for its efficiency and clean-burning properties. For decades, the government provided a blanket subsidy on LPG for purchase by domestic customers. However, LPG was bought largely by the urban rich and middle class because accessibility and affordability in rural regions remained poor. Complaints of domestic subsidized LPG being illegally diverted for commercial use also emerged. The heavy health burden of about a million deaths a year from HAP related to cooking was a growing concern (Watts et al., 2018). To address these issues and the rising burden on the public budget, the government undertook a series of reforms to better target poor consumers (GSI, 2016).

First, important initiatives were launched that allowed for beneficiary targeting and helped to plug leakages that had plagued the government subsidy system in the past: In 2010, the government of India launched

Aadhar, the world's largest biometric unique identification number system; in 2014 Pradhan Mantri Jan-Dhan Yojana, India's national mission for financial inclusion to ensure access to financial services, was initiated, and then Jan Dhan-Aadhaar-Mobile (JAM) trinity, the government's initiative to link bank accounts to the unique Aadhar identity number as well as mobile phone numbers. In January 2015, the Direct Benefit Transfer of LPG subsidy (DBTL) or PAHAL (in Hindi) linked all subsidy payments to bank accounts and to India's universal identification scheme Aadhar. This meant all consumers paid a single market price (non-subsidized) for their LPG purchases and only those eligible received a subsidy in their linked bank accounts after their purchase. In addition, the national oil marketing companies (OMCs) carried out audits of their consumer databases in 2012 and again in 2014/15 to weed out fake/duplicate connections and address concerns regarding diversion of cylinders for unintended uses. A rapid expansion of rural LPG dealer and distributor network occurred in parallel during this period.

A voluntary “Give It Up” campaign was rolled out in March 2015 that, by appealing to the patriotism of the rich, encouraged wealthier households to voluntarily give up their LPG subsidies in favor of poorer households. More than 10 million consumers have since given up their subsidy providing a successful example of a “nudge” towards self-selection for the subsidy scheme (Mittal et al., 2017). The campaign was subsequently extended to eliminate the rich from receiving any subsidy on the basis of their self-declared income (anyone earning over Rs.1 million in the previous year does not qualify for the subsidy).

The PMUY, which aimed to provide almost universal access to LPG by 2019, had by January 2019 to date provided more than sixty million households a connection to LPG within 33 months since its launch (GoI, 2018). The program explicitly targets households that fall below poverty line (BPL) and are socio-economically disadvantaged in other ways. Importantly, the scheme makes women the sole beneficiaries. Women are eligible for both a subsidy on the fuel and a zero-interest loan to purchase LPG stoves and to pay for the deposit on the installation LPG cylinder. By reducing the upfront cost of connection for the poor, the program has reduced the initial barriers to gain access to LPG.

However, despite its uncontested success in increasing connections to LPG, the program does not include any additional incentives to encourage regular use of the fuel. About 21% of those who have benefitted from a connection, have not taken a single refill even after a year of being a customer, and among those purchasing refills, only 30% buy between 5-9 cylinders a year that would indicate regular use (Kar & Zerriffi, 2018a). This suggests that PMUY beneficiaries in rural areas continue to depend heavily on traditional biomass fuels for cooking. Criticisms of the program from a gender perspective have also emerged. Women, the primary beneficiaries, still face issues in accessing funds from their bank accounts to purchase LPG; without home deliveries they have to depend on their husbands to go purchase the cylinders; and the low opportunity cost of women's labor time makes self-collection of free biomass fuels the default option (GSI 2016; Kelkar et al 2018).

The health, gender and other benefits of cooking with LPG can only be realized when there is a complete transition and fuel stacking stops. Bringing about the behavioral changes required to transition to cooking with LPG will require additional interventions and reforms to the program (Kar & Zerriffi, 2018b). A complete evaluation of the PMUY is needed to provide further insights that can be used for guiding mid-course corrections to the program.

⁸ By Shonali Pachauri, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria; Abhishek Kar, University of British Columbia, Vancouver, Canada.

A number of experiments were necessary before achieving success in India. Through the PAHAL scheme, LPG supplies were initially subsidized through a dual pricing system: The government made subsidized payments for cylinders into bank accounts, instead of at the point of sale. Although the scheme was meant to reach mainly poorer strata, subsidies became ineffective and were benefiting higher income households, while by 2015, 'ghost' connections were soaring, with a gap of 33 million unused or duplicate connections (Sharma, 2016). A study of this earlier fossil-fuel subsidy reform in India by the Global Subsidies Initiative of the International Institute for Sustainable Development (Merill, 2014) found that fossil fuel subsidies had historically provided little benefit for rural women, and recommended cash transfers as an alternative – although where cash transfers to replace fuel subsidies were originally piloted in India, women were at a disadvantage due to being unbanked, and hence unable to access the transfers.

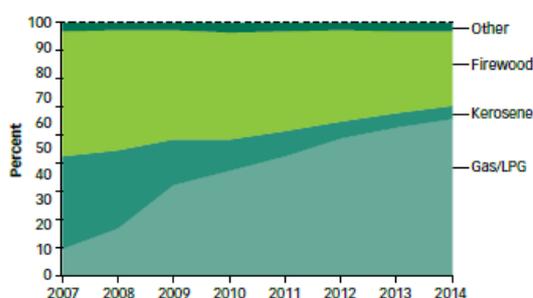
Efforts to better target and expand the LPG subsidy to poorer women vis the PMUY scheme are bearing fruit, however, with poor women receiving the LPG subsidy vis their bank account. A more recent GSI study (RA4, 2018), under the ENERGIA Gender and Energy research program, found that India's recent PMUY 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. The study also found an increase in women making decisions on cooking sources that may be attributed to the PMUY scheme subsidies.

Nonetheless, the GSI study found much could be improved. Current LPG subsidies are 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. Some families would increase biomass use if LPG prices rose. More than

half of surveyed households in the states of Chhattisharh and Jharkhand did not use LPG – and thus had not benefited from the PMUY. Among surveyed households, only 48 per cent of PMUY beneficiaries were among the poorest 40% of households, while 36 per cent were among the top 40% by income. Hence while the PMUY has had positive impacts on the affordability of LPG connections among some poor households, it is itself based on an outdated targeting system with many errors, and it has 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.

Another recent ENERGIA-supported study in India (RA3, 2018) found that women as independent income earners came out as a key factor in the switch to LPG, due to the higher economic value of women's labor. In the survey sample, 57 per cent of women who were independent income earners used LPG as their primary fuel, compared to 29 per cent of women who were unpaid family workers. Membership in community-based organizations was particularly important – 89 per cent of CBO members used LPG as primary fuel while, among those who used LPG as primary fuel, 60 per cent were CBO member. Women having some decision-making power within the household also had a positive effect on fuel switching. However while there was a reduction in the time required for cooking, little redistribution of household work was found between men and women. The study also found a low rate of refill orders from beneficiaries in Indian states where women largely collect with their own unvalued labor. The authors argue that this high level of fuel stacking (of LPG and biomass fuels) shows that capital and fuel subsidies need to be combined with women's empowerment as income earners in order to promote fuel switching, rather than fuel stacking. An additional suggestion to turn access into use, is the promotion of the notion of clean cooking fuel as the "new normal" – a "nudge" by the government of an aspiration to use LPG as clean cooking energy, both to reduce women's drudgery and to promote their health through reducing household air pollution.

Indonesia: Lower mortality and morbidity, but little impact on energy poverty or biomass use the Kerosene-to-LPG Conversion programme launched in 2007 by the Indonesian Government - motivated mainly by the high cost of kerosene - shifted subsidies from kerosene to LPG, and provided households with a free stove, one fill and an additional 3 kilograms LPG cylinder. LPG usage increased more than four times between 2007 and 2017, to almost 100 million in urban areas and 70 million people in rural areas. Domestic consumption of LPG increased from 4.7 kg/capita in 2007 to 24.4 kg/capita in 2015, and the number of people cooking with traditional fuels has decreased by more than 50% since 2000 (IEA, 2017).



Source: Durix, 2016

Women, as 96 percent of stove users in Indonesia, have been direct beneficiaries of the program (Durix, 2016). Between 1990 and 2016, mortality associated with Household Air Pollution (HAP) has halved from 8% to 4% of total deaths, while morbidity reduced from 6% to 2.5% of all DALYS (Thoday, 2018). An IISD study evaluating the effect of the programme on women's livelihoods found that switching from kerosene to LPG implied a 15 minutes time saving per day for women (IISD, 2017).

Still, the impact on biomass consumption in Indonesia has remained limited, especially in rural areas. The expansion of LPG developed at a lower pace after 2012, especially in remote areas, with no access to LPG distribution networks. Indeed, 70% of households do not seem to perceive firewood collection or cooking with firewood as a burden or inconvenience, according to a survey in peri-urban Java (IISD, 2017). Also, most cooks

consider smoke uncomfortable, but not a major threat to health (Durix, 2016).

By 2014, Andadari et al (2014) found that the LPG programme failed to substantially reduce the overall number of energy-poor people. It had been effective though in alleviating extreme energy poverty, or the number of people living under the lowest energy-poverty line. In suburban areas the LPG programme had induced a 28 percentage-point decrease in energy poverty. A later study showed that only 12% of benefits reached the poorest strata of the population (IISD, 2017). Many women in poor and near-poor households did not use the LPG subsidy, or paid much more than the official price to get it. For this reason, from 2018, the Indonesian Government started working to replace the general subsidy with one targeted only at lower income households (Thoday, 2018).

...Still, the impact on biomass consumption in Indonesia has remained limited, especially in rural areas. The expansion of LPG developed at a lower pace after 2012, especially in remote areas, with no access to LPG distribution networks...

3.3.4 Global partnerships can be more effective in implementation by working with women's networks

The last decade has seen the emergence of several global partnerships around household energy. Sustainable Energy for All (SEforALL) recognized access to energy for cooking and heating on an equal par with access to electricity, and ensured that this goal (which was absent in the MDGs) is now part of Goal 7 on energy of the Sustainable Development Goals adopted in 2015.

It continues to support efforts to drive further, faster actions towards the achievement of Goal 7. In 2010, the Global Alliance for Clean Cooking (GACC) – now the Clean Cooking Alliance (CCA) - established a public-private partnership that seeks to mobilize high-level national and donor commitments toward the goal of universal adoption of clean cookstoves and fuels. Its ten-year goal was to foster the adoption of clean cookstoves and fuels in 100 million households by 2020. LPG fuel and stoves are an integral part of this strategy, continuing since 2018 as the renamed Clean Cooking Alliance (CCA).

Box 3.11: ECOWAS

The Economic Community of West African States (ECOWAS) Policy on Gender Mainstreaming in Energy Access (ECOW-GEN), adopted in June 2017, is one of the international initiatives that try to mainstream women's decisive role in the energy sector. 15 countries have committed to address existing gender barriers in expanding energy access in West Africa. This policy targets to increase general awareness of gender and energy within government, academia and at large; mainstream gender perspectives into all public-sector energy activities; achieve gender balance in public sector energy-linked jobs and decision-making roles; and ensure women have equal opportunity to participate in the private energy sector.

The ECOWAS Women's Business Fund sponsored the project "Promotion of Anomena Improved LPG Stoves as a Clean Energy Initiative for Cooking" in Ghana to accelerate the transition from traditional firewood cooking to LPG stoves and to include women in the production process. These stoves would be manufactured by well-trained women technicians. Under the scheme, around 1000 women street vendors would have access to LPG stoves. Besides that, in 2018, to tackle with the health challenges and environmental degradation associated with the lack of energy access, ECOWAS validated a regional strategy to popularize the use of LPG in West Africa especially in rural areas, where biomass accounted for 80% of total energy consumption.

Source: IEA 2008 in Ekouevi and Tuntivate 2012.

The WLPGA Cooking For Life programme, and the Global LPG Partnership (GLPGP) complement the work that is being done by the Clean Cooking Alliance (CCA) and Sustainable Energy For All (SEforALL), with the goal by 2030 of transitioning 1 billion people to LPG for cooking, creating 150,000+ new jobs, and offsetting more than 18m MT of wood used for cooking per year. In October 2017 during the LPG For Development Summit (LPG4DEV) in Marrakech, Rachel Kyte, the Special Representative of the UN Secretary General for SEforALL along with then WLPGA President Yagiz Eyüboğlu signed a partnership agreement with the goal of transitioning one billion people from cooking with traditional fuels, to cooking with LPG. They agreed to support a multi-stakeholder partnership that would build on best practices and sustainable business models in order to overcome the multitude of policy, market regulation, business environment, and local financing bottlenecks inhibiting the ability of governments and the private sector to meet the need for LPG. The continuation of the partnership between WLPGA and SEforALL which was originally agreed in 2013, demonstrates the high level of support throughout the LPG industry for the flagship “Cooking For Life” campaign, which aims to communicate the health benefits and industry experience and know-how to switch communities from wood, charcoal, dung and other traditional fuels to LPG for cooking. Since launching in 2012, Cooking For Life has supported WLPGA member activity around the developing world, impacting over 1.3 billion end users. The programme has held numerous workshops in countries as diverse as Myanmar and Nigeria which are designed to highlight the benefits of LPG for cooking along with providing case studies from around the world and access to the experience and expertise of the global industry on key elements such as regulatory structures, industry best practices, standards and guidelines to help grow markets in a safe and sustainable way.

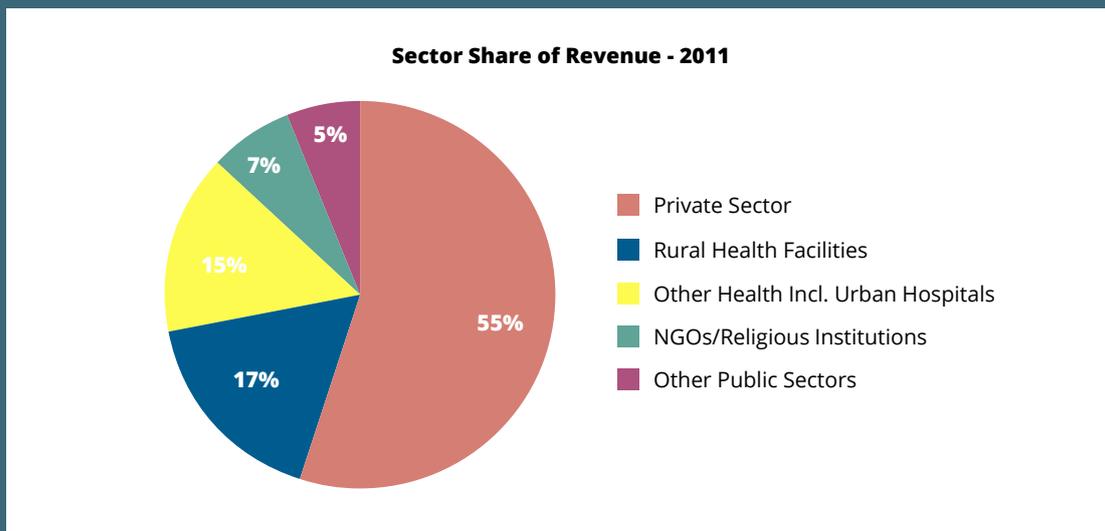
The Global LPG Partnership (GLPGP), a public-private partnership of national governments, local LPG businesses, and the global health community, among others, under SE4ALL launched in 2012, has been helping developing countries and stakeholders plan, finance and implement their national LPG transition programs. In Cameroon for example, after the launch of Cameroon National LPG Working Group in 2015, GLPGP has been working closely with Cameroon government in expanding LPG application through facilitating the work of LPG Development coordination committee. The programme aims to have 10 million additional LPG users, over 100,000 lives saved, 100 million tones of wood saved and 100 million dollars of annual economic activity generated by the year 2035 (GLPGP, 2017). In May 2018, The Government of Rwanda and GLPGP signed an agreement to bridge collaboration on national LPG scale-ups to reach the target of expanding to 40% of its population the availability of LPG by 2024. GLPGP would provide support in the development of a national Strategic Plan as well as technical assistance on project investments (GLPGP, 2018).

Partnerships with women’s organizations and other development actors can move this agenda forward faster. Multi-sectoral approaches can multiply benefits for women and their families. Few LPG programmes appear to have adopted an integrated approach to using energy for local development and poverty reduction, an approach fairly common in improved stoves initiatives and decentralized energy projects, and also used in rural electrification projects, to ensure development linkages.⁹ A multi-sectoral and multi-infrastructure approach can multiply benefits, especially for women.

⁹ For example, the PROGEDE community-led sustainable forestry management programme in Senegal integrates biogas and improved stoves, gender equity in local committees and new businesses, and beekeeping, resulting in improved participation of women and a sharp boost in family incomes (World Bank, 2014). In Peru, bundling or joint provision of basic services of electricity and water had a significantly greater impact than either alone. A household survey in India showed that both education and electricity can result in higher nonfarm income, but when the two services are delivered together the effect is amplified by as much as 23 times (Cabraal, et al., 2005). An early example was the GTZ (now GIZ) Household Energy programme (HEP), which in the 1990s practiced integration of improved biomass cookstoves with other development planning and policy, for example with forestry, food security, and health initiatives in northern Ethiopia (ENERGIA, 1997). In Mali and other West African countries, UNDP’s multi-functional platform combined provision of drive shaft power for grain grinding, oil presses and hullers and alternators for electricity to provide lighting, battery charging, refrigeration, water pumping, welding and power carpentry tools, with women’s leadership and management initiatives (UNDP, 2004).

Box 3.12: Delivering better health to northern Mozambique with LPG social entrepreneurship

When VillageReach, a US NGO, first started its work to improve the last mile of delivery capacity in Mozambique’s Ministry of Health, it realized that a critical gap in energy supply was affecting the performance and economics of the cold chain, and in turn limiting the ministry’s ability to store and distribute vaccines. VidaGas, jointly owned by VillageReach and the Mozambique Foundation for Community Development (FDC), was established to address this lack of reliable energy supply. Operating VidaGas as a business instead of a charity addresses the critical requirement for a sustainable supply of energy for the health system. VidaGas supported its social mission by selling gas to a variety of enterprise customers: restaurants, hotels, small factories, plus a growing retail network and several urban hospitals. The figure shows that rural health centers represent only 17% of sales.



VidaGas established its reputation as a reliable supplier and in 2011 shipped more than 350 tons of LPG, an increase of 35% over 2010. In 2012, the Oasis Fund, a European investment fund, committed a \$1.375 million investment in VidaGas to establish additional filling and storage facilities and increase its market for LPG sales to all four northern provinces. However the Vidagas project was shuttered in 2016 due to disagreement between the partners and a lack of reliable supply of LPG.

Source: (Beale, 2012), (Michael Kelly, personal communication, 2017)

Though a causal link has not been established, electrification and adoption of modern cooking fuels are correlated, as shown in Table 3.3 below (ESMAP, 2003): Promotion of both electricity and cooking household energy access improvements simultaneously in pursuit of SDG7 could have considerable synergies.

Table 3.3: Electrification status and modern cooking fuels use, eight countries

Enterprise	Electrified	LPG for Cooking	Kerosene for Cooking	Electricity for Cooking	All Nonsolid Cooking Fuels
Brazil	92.3	92.3	0.1	1.6	92.8
Nicaragua	68.7	29.0	1.8	1.0	31.7
South Africa	53.6	7.9	43.2	45.8	85.8
Vietnam	78.5	22.3	8.0	13.1	33.0
Guatemala	73.1	44.9	5.5	2.0	50.1
Ghana	41.0	5.4	1.1	0.4	6.9
Nepal	14.1	1.6	7.1	0.3	9.0
India	59.4	16.0	7.9	0.2	24.3

Notes: Row shares of individual nonsolid fuels may not sum to the total for all nonsolid fuels because of multiple fuel use by households.

Source: (ESMAP, 2003)

Women's organizations and networks can be powerful allies to work together with LPG companies and governments to advance these measures. They can share information and experiences, advocate for appropriate policies and regulations, and assist in their implementation. They can help pilot and implement micro-finance schemes and other mechanisms that make it easier to adopt LPG. They can support entrepreneurship among their members. Women's organisations have important perspectives and actions to contribute to these initiatives on household energy options, as described throughout this report. We close with an example in

Box 3.10 from the Self-Employed Women's Association (SEWA), an important association of women workers in the informal sector in India, that illustrates how women's self-help organizations can provide important perspectives and initiatives that can help deliver energy inclusion and facilitate economic opportunities for women to address their cooking energy needs. Women's energy networks and other women's organizations can be a powerful tool to increase women's agency and voice, and can help create conditions where women have the ability to demand, manage and use modern energy services.

Box 3.13: Women's organizations bring valuable perspectives and actions on modern fuels

True, the time saved is important – but when SEWA asked its members what they would like to do with the time saved, their first response was that now they feel less pressured, and feel relieved. Thereafter the response was that they would like to engage in a meaningful economic activity. It is very important to also integrate creating alternative economic opportunities as a part of energy access. This is also based on our experience.

Understanding this early on, SEWA has believed in organizing its women in self-help groups and cooperatives in order to:

- ▶ enable them to build bargaining power
- ▶ enable imparting skills and education through the SHG/cooperative
- ▶ enable building linkages to the market to make them self-sustainable

- ▶ raise awareness and access to health aspects, specially maternal and child
- ▶ enable access to savings and credit
- ▶ enable access to energy

SEWA today has two million women members across 12 states in India. We have built up a body of grassroots level learning of practical aspects, and are using them to deliver energy to our members in various ways. In India, where 80% of the population still cooks on biomass burning three-stone and mud stoves, LPG is a very aspirational fuel across all sections of society; however, among other challenges, affordability and availability are at the top of the list. SEWA is going ahead to work with the Global LPG Partnership on creating LPG assets in the name of women.

Source: (Nanavaty, 2014)



WAY FORWARD



This report has collected and assessed existing knowledge about the benefits of LPG cooking and heating for women and their families, the challenges to increasing access to LPG for cooking, and how women can be involved in increasing access to this modern fuel. This final chapter summarizes knowledge gaps that have been identified throughout the report, where more information is needed in order to move forward with appropriate actions and policies. Based on what is already known, it also makes recommendations about ways to move forward, so that women in developing countries can get increased access to modern cooking fuels, specifically LP Gas, an aspirational cooking fuel.

4.1 Knowledge gaps

Much is known about the advantages and disadvantages of LPG compared to biomass and kerosene as cooking fuel. Table 4.1 summarizes the assessment of Smith et al. (2005) of the characteristics of LPG compared with other cooking fuels currently used in developing countries. The present report has presented many of these advantages and disadvantages from a gender perspective. A number of questions remain, however, that need to be explored further:

- ▶ **Few gender-perspective impact evaluations of LPG switching programmes and targeted subsidies have been carried out;** fossil fuel subsidy reform in India is the first time that reforms have specifically targeted women, and initial research findings on impacts on gender inequality are promising. Most studies of LPG switching have not however used a gender lens; for example an otherwise excellent impact analysis of the Indonesia programme (Andadari, et al., 2014) shows poverty impacts but does not analyse specifically the effects on women versus men. Time savings and other impacts on women following electrification of households have been studied and have shown for example effects on women's literacy and girls' education.

There are few studies on the development impacts of improvements in cooking, however and most of these are on biomass fuels. Synergistic effects of bundling of more than one type of infrastructure or development intervention have been studied for electricity, e.g. electricity and water, electricity and education. But there is mainly only anecdotal evidence about the synergistic effects of providing modern cooking and heating fuels together with other development initiatives. The example of VidaGas in Mozambique illustrates how removing the energy constraint by enabling access to LPG by health clinics could be essential to improving access to vaccines and maternal and child health. But we have been able to identify few such examples.

- ▶ **Time savings in cooking and fuel collection** are nearly always the first advantage of LPG cited by women, including probably convenience and cleanliness, which also save time. One of the most important insights from gender analysis of time use is that there are synergies, and short-term trade-offs, between and within market-oriented and household-oriented activities. Data on time spent in fuel collection suggests that households could save ten hours a week or more by switching to modern fuels, but most field studies have focused on improved biomass stoves and there is little information on actual time savings when switching from biomass or other fuels to LPG, including cooking time savings, which could be significant. More studies are needed specifically on time savings in cooking and fuel collection when switching to LPG. How time savings are used by women also deserves study, because it seems that faster cooking with LPG may be especially important for women who wish to use saved time to add to their workforce participation and increase their families' income earnings. Shifts in gender roles with adoption of LPG and a more modern outlook also need to be documented.
- ▶ **The fuel switching process and health outcomes.** Lower emissions and hence lower exposures of women cooks to pollution when cooking with LPG have been well documented. However due to fuel stacking (continued use of multiple fuels), health outcomes can be ambiguous. Households with improved biomass stoves plus LPG will have lower emissions than

those with traditional stoves plus LPG. A correlation has been found between electricity connection and adoption of LPG. More understanding is needed of the fuel switching process and health outcomes in practice, and how to influence these. Is a "package" approach to fuel switching needed to ensure lower overall household air pollution? Possible behavioral "nudges" that governments could use to make clean fuels like LPG the "new normal" and avoid fuel stacking, need to be investigated.

- ▶ **Beyond household air pollution,** other public health impacts of switching to LPG have been little examined. Carrying heavy loads in fuel collection can have impacts on maternal and child health. Statistics on accidents, fires and burns comparing LPG with kerosene and biomass cooking would be essential to provide cooks with accurate risk assessment. Some available data suggests that, due to house fires, accidents, and child poisonings, kerosene (paraffin) is a much more lethal fuel than LPG. Better stoves and fuels could even lead to reduced violence against women – burning food was the third highest justified reason for wife beatings, in the 2012 World Development Report on Gender. We do not know whether the growth of LPG use in India, replacing kerosene, is leading to fewer dowry deaths, in which kerosene is commonly implicated.
- ▶ **What role have women played in successful LPG fuel switching programmes in e.g. Brazil, India, Indonesia, and Thailand?** Recent models of innovative distribution models with financial inclusion enabling lower-income women to access LPG, need to be documented and lessons learned need to be shared. Are there best practice examples of women's participation in consumer education, in advocating for standards, and in the LPG supply chain? Little is known about how women's businesses use LPG, and how they have benefited. The lack of studies on LPG and women's empowerment, and particularly its role in societal transformations, means the evidence is so far inconclusive. Cases such as Morocco where LPG is widespread with over 40,000 groceries selling it are likely to yield examples of women's involvement in supply chains and how and whether this (and other characteristics of LPG) changes gender roles and relations.

Table 4.1: Summary of advantages and disadvantages of LPG compared to biomass and kerosene as cooking fuels¹⁰

Characteristic	LPG compared to Biomass as Cooking Fuel	Kerosene compared to LPG as Cooking Fuel
Ease of use of household cooking	LPG is much easier to light, control, and store than biomass. However, it has to be bought in fairly large amounts	Kerosene is easier to control and light than biomass, but not as easy as LPG. It can be bought and stored in small quantities.
Safety	LPG poses some safety concerns in local transport and use. Government attention is required to reduce risks. As it is stored in sealed containers and generally contains odorants to warn of leaks, household risks are low.	Kerosene poses safety concerns in its use and storage, including child poisonings, household fires and burns, whereas safety concerns for LPG stem from leaky appliances to which odorants are added to warn of leaks.
Ease of local transport	Local LPG transport requires the use of low-pressure cylinders, which are heavy for a woman to handle at refilling time.	Kerosene does not require pressure vessels for transport or storage.
Greenhouse pollutants	Although always a net emitter, LPG emits far less than poorly combusted and/or non-renewably harvested biomass.	Kerosene produces somewhat more GHGs than LPG.
Dependence on Centralised networks	LPG is a product of the sometimes unstable and unpredictable global petroleum fuel cycle, but locally is independent of pipelines. Local reliability requires smooth operation of rail or road supply chains on a national and local level.	Kerosene is also a product of the international global petroleum fuel cycle and is independent of pipelines. Like LPG, it also requires smooth operation of national and local supply chains. Unlike LPG, however, its production competes with other middle distillates, such as diesel.
Impact on women's time	Less reliance on local harvesting of biomass can be positive, negative, or neutral depending on local conditions, such as value of women's time and alternatives available.	Kerosene may require somewhat more cleaning in kitchens than LPG and, perhaps, more care to keep children safe from burns.

Characteristic	LPG compared to Biomass as Cooking Fuel	Kerosene compared to LPG as Cooking Fuel
Impact on demand for children's time	LPG is much easier to light, control, and store than biomass. However, it has to be bought in fairly large amounts. Kerosene is easier to control and light than biomass, but not as easy as LPG. It can be bought and stored in small quantities.	
Local ecosystem	Less pressure on local biomass resources may reduce deforestation and soil degradation rates and increase availability of biomass wastes for crop enhancement in some regions.	
Daily cost at household level	LPG is generally more expensive in rural areas even where biomass fuels are purchased but is sometimes cheaper in peri-urban areas. Where biomass is gathered, LPG costs (excluding opportunity costs from time spent gathering) are usually substantially more expensive.	Kerosene is often somewhat cheaper than LPG, but prices vary according to a number of local factors. In the long run, the prices of both fuels are closely linked to the international price of crude oil.
Capital cost at household level	LPG stoves and cylinders are much more expensive than many traditional biomass stoves although not too different in cost from advanced biomass stoves (with chimneys, grates, baffles, dampers and good insulation).	Kerosene stoves cost less than LPG stoves, but cheap ones can be dangerous and can be short-lived. Fuel storage costs are minimal.
Impact on balance of payments	Most countries import a substantial portion of their petroleum fuels and thus increases in either LPG or kerosene use would put pressure on their balance of payments, assuming all other demands remained unchanged.	

Source: Smith, Rogers, & Cowlin, 2005

¹⁰ It might be useful to update the Smith et. al (2005) table from a gender perspective.

4.2 Recommendations

A broad range of suggestions for promotion of LPG in developing countries has been made by the World LP Gas Association (WLPGA, 2013) and by the World Bank (Kojima, 2011). Table 4.1 suggests some options for involving women in meeting these goals. However a broader range of policy actions should be considered, in particular:

1

Gender-equitable financing at global and national level should be provided to meet both women's and men's energy needs. Subsidies targeted specifically at poor women are essential to make best use of national budgets and ensure benefits. Policy makers can learn from recent gender-targeted innovations such as the India Direct Benefit Transfer scheme or Give It Up campaign in India that seek to minimize leakage and ensure subsidies reach the intended recipients. Investments need to be increased for improved cooking options, women's primary energy use. Universal energy access can be financed through international climate funds, national energy budgets, public-private partnerships, bank finance on multilateral, bilateral and local levels, microfinance, loans, targeted subsidies and innovative financing mechanisms. LPG for cooking should be an important part of this financing, along with other options such as improved biomass stoves, electricity, and energy efficiency.

2

The guidelines on household air pollution issued by WHO in 2014, alongside the ISO emissions standards for cook stoves (<https://www.iso.org/standard/61975.html>) have greatly facilitated the benchmarking of potential energy options for households. LPG is well positioned to provide early wins in addressing the guidelines. To achieve a community health benefit, a strategy working with public health agencies to develop health awareness and promotion of clean cooking is needed, especially when there is a project or marketing effort that is being planned in a community. Linking health promotion to local efforts would help strengthen the messaging and outreach.

3

Women and men who advocate at national and international levels need to understand the comparative emissions and global share of women's cooking in developing countries, to guard against stereotypes of "poor women", and to promote and encourage examples of women's agency in energy access, in order to influence energy policy. New energy policy and development initiatives should not be designed to reinforce the poverty cycle but should rather enable poor women to break out of the poverty cycle by using modern clean fuels.

4

Governments should ensure that women and their organizations are represented in the national household energy policy process and specifically in LPG policy and regulation, including in determining siting and monitoring compliance with safety regulations, commenting on programmes and policies, and having input into the appropriateness of regulations, markings, and other measures for strong monitoring and enforcement. Women's groups can advocate for appropriate regulation and participate in conducting and publicizing the results of spot-checks monitoring compliance and prices. Individual women could be employed in consumer education programmes and monitoring. Consultations should be two-way, gathering input from women's experiences as well as informing them about good practices.

5

Women can help identify innovative approaches, both technical and non-technical, to key issues, constraints and barriers to wider access, such as fuel stacking, safety, underfilling, and unreliable supply. It would be useful for example, to have comparisons, done by women themselves, of the different fuels. Cost comparisons could be developed together with women's groups on the basis of local prices of fuels and stoves. Women need to have comparative information about safety, health impacts, costs, and other characteristics of different cooking fuels, and to understand technical as well as social aspects of LPG safety, in order to feel in control of the process. Women's organizations can be involved, based on this knowledge, in raising public awareness and advocacy for LPG and other modern fuels. Gender norms and aspirational norms can be "nudged" by government policy. The private sector is already active, and women see LPG as an "aspirational fuel", so there is an alignment of interests.

...Women's participation in the industry and supply chain, and in monitoring safety practices, can be encouraged through industry groups, including professional women's networks....

6

Private LPG companies and entrepreneurs need to continue to develop and share innovative ways to expand markets to lower-income households and to engage with women's development. This is an area where the LPG industry has been slow to recognize the potential for driving both market growth and for socio economic benefits. Market assessments need to be undertaken that take into account not only income levels but also the potential of these innovative approaches. Women's organizations, governments and LPG companies are natural allies in ensuring maximum access to and safety of LPG for cooking. Women's participation in the industry and supply chain, and in monitoring safety practices, can be encouraged through industry groups, including professional women's networks. One example of this is the Women in LPG (WINLPG) global network launched by WLPGA, which aspires to bring more women into the supply chain of LPG at all levels of the industry. Women's ownership of LPG assets, creative microfinance and delivery options led by women, and women-to-women sales and consumer education are likely to be effective means of promotion. Opportunities for synergies between sustainable development goals and LPG promotion, as in the VidaGas case, need to be identified and moved forward, in cooperation with NGOs and governments. As with rural electrification programmes, productive use components that encourage use of LPG in businesses and social infrastructure (which increases load) can be included in fuel switching programmes. WLPGA's suite of documents which promote industry guidelines and best practices such as the Guidelines for the Development of Sustainable LPG Markets could be expanded beyond technical and regulatory issues, to consider the need to connect all the linkages that will be needed to achieve scaling of LPG as a clean cooking solution that contributes to gender equality and sustainable development programmes.

Table 4.2: How women can be involved in increasing access to cooking with LPG, based on examples of options for facilitating household use of LPG suggested by World Bank (Kojima, 2011)

Goal	Option	Options to involve women		
Lower costs to consumers	Exploit economies of scale	Hospitality arrangements third-party access	Stakeholder involvement including women in determining siting and monitoring compliance with siting and safety regulations.	
		Bulk purchase, joint purchase, large import parcels		
		Large refineries		
	Lower barrier to entry	Hospitality arrangements, third-party access		
	Minimize demurrage charges	Rapid customs clearance		
		Reduced port congestion		
		Round-the-clock staffing by port authorities		
		Adequate port receiving capacity		
	Minimize short-selling	Clear marking of cylinder tare weight		Women's organizations can advocate for and comment on marking.
		Enforcement of scale calibration and date of last scale calibration visible to customer		Women can be informed and make input to procedures, through appropriate media and through their social and political networks, about scale calibration, how to check this, how government is enforcing, and how to complain and get redress
		Customer's right to check cylinder weight		
		Industry association's (voluntary) seal of quality/certification		
		Publication of names of companies found short-selling		Names of companies found short-selling should be disseminated through media that women tend to have access to, and through their own networks
	Increase price competition	Posting of prices by company, location, and cylinder size on government Web site		Consumers could be empowered to post prices through a cell phone app, like Gas Buddy.
Competition policy				
Improve auxiliary infrastructure	Improved road conditions			
	Publication of names of companies found short-selling			

Goal	Option	Options to involve women	
Enhance safety	Establish clear regulations	Formal adoption of international standards by reference	Women's organizations can advocate for adoption and full information on standards and regulations. They can have input into the specific requirements for training of supply personnel and education of consumers.
		All regulations posted in one place on the Web in reverse chronological order	
		Training of supply personnel legally required	
		Education of consumers about safe handling of LPG legally required	
	Enforce safety regulations	Where there is a ban on cross-filling, ban effectively enforced	Cross-filling pros and cons should be understood, considered, and disseminated by women's organizations
		Small fee levied to finance monitoring and enforcement	
		Registry of certified installers	Registries and markings should be accessible to women users who may be less literate than men.
		Clearly marked date of last cylinder recertification	
		Registry of certified private inspectors operating under government supervision	
		Training workshops organized by LPG industry association	Workshops can be organized jointly with women's groups and use women-to-women training. They can be interactive and provide space for women consumers to share experiences, identify issues and challenges.
		Publication of names of companies violating safety rules	Women can participate in identification of companies violating safety rules
	Educate consumers	Pictorial guides in local languages, newspaper/ radio/TV advertisements, Web posting of safety information	Information should be appropriate for women's literacy and education levels, and targeted at media that women tend to have access to
		Neighborhood demonstrations by retailers, industry association, and consumer groups	Cooperation with national and local women's organizations; women-to-women demonstrations
		In-house demonstration of proper cylinder and stove handling by installers	Women installers will be more effective at communicating with women users

Goal	Option	Options to involve women
Target financial assistance	Move away from universal price subsidies	Expansion of social safety net programme to help pay for LPG, such as cash transfer or vouchers
	Spread or reduce upfront adoption costs	Dealer incentives for cylinder deposit fee and stove
		Dealer-financed instalment plan
		Microfinance scheme
	Small cylinders in niche market	Consultation with women's organizations can help identify and implement creative measures for targeting financial assistance.
Minimize shortages	Require minimum commercial and/or strategic stockholding in regulations	
	Ensure reasonable returns (through, for example, removal of universal price subsidies) to efficient operators to build capital for construction of storage facility	
	Encourage hospitality and third-party access	
Raise awareness and involve consumers in improving market conditions	Government: Publish price information, industry statistics, frequently asked questions, safety tips, and names of companies violating rules that directly affect consumers on the Web and in reports; establish a simple mechanism for registering complaints	All information and the complaint process should be targeted appropriately to women's concerns, literacy levels, and media.
	Industry association: Publish information, frequently asked questions, and safety tips on the Web; publish brochures; take out newspaper/radio/TV advertisements; publicize information on retailer location and contact details; establish quality control and issue seals of quality for companies in compliance; establish a simple mechanism for registering complaints against members	Consultation with women and their organizations on design of awareness programmes
	Companies: disseminate information on proper handling of LPG cylinders, frequently asked questions, and safety tips; have installers show new customers in their homes how to handle an LPG cylinder and stove properly; establish a simple mechanism for registering complaints	Women's groups can be key in dissemination

Source: Adapted from Kojima (2011)



ANNEX

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