WLPGA

Cooking with Gas:
Why women in developing countries want LPG and how they can get it

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and Sustainable Energy

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GLOBAL ALLIANCE FOR CLEAN COOKSTOVES

ENERGIA

SUSTAINABLE ENERGY FOR ALL

The World LP Gas Association
The World LPG Association was established in 1987 in Dublin, Ireland under the initial name of the World LPG Forum.

The World LPG Association unites the broad interests of the vast worldwide LPG industry in one organisation. It was granted Category II Consultative Status with the United Nations Economic and Social Council (ECOSOC) in 1989.

The World LPG Association exists to provide representation of LPG use through leadership of the industry worldwide.

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Foreword

In the year 2014 it is shocking to recognise that billions lack access to basic energy services. The World Energy Outlook estimates that almost 1.3 billion people living mostly in developing Asia or Sub-Saharan Africa and in rural areas are without access to electricity.

Reports estimate that another 2.6 billion people rely on traditional use of biomass for cooking and heating purposes which causes them to inhale carcinogenic smoke resulting in over 4 million premature deaths worldwide, affecting mostly women and girls.

Unfortunately, for women and girls, that is not all! Simply collecting firewood puts women and girls at risk of attack and rape. They are also deprived of their basic right to a decent education: we know that without access to light, they simply cannot study. Access to modern energy services, lighting, refrigeration, and clean water is essential in nearly every sector; in health care, it is more than that – it can mean the difference between life and death. The world community has taken notice.

In 2011, following the launch of the initiative on Sustainable Energy for All by Secretary-General Ban Ki-moon, in 2012 the United Nations General Assembly declared 2014 – 2024 as the International Decade of Sustainable Energy for All in recognition of the crucial role that energy plays in socio-economic and sustainable development. In this regard, we have dedicated the first two years (2014-2016) to the theme "Energy for Women and Children's Health and Economic Empowerment".

The issue of women and access to modern energy services is real. A focus on energy and women's health is critical for reducing child mortality and improving maternal health in a tangible, scalable, and sustainable way. One of the many ways we can meet our global target of providing universal access to energy is transitioning to the use of Liquefied Petroleum Gas (LPG).

LPG is a portable, clean and efficient form of energy source and thus ideal for cooking and heating purposes for women. In October 2013, Sustainable Energy for All and the World LPG Association signed a Memorandum of Understanding (MOU) and both organisations committed to accelerate access to LPG for one billion people in developing countries by 2030. I strongly believe LPG can help us save millions of lives a year.

In my capacity as the Secretary-General's Special Representative for Sustainable Energy for All and chief executive of the initiative, I reaffirm the commitment of SE4ALL to fight for women's rights including the rights to sustainable access to clean energy.

Kandeh K. Yumkella

United Nations Under-Secretary-General
Special Representative of the Secretary-General Sustainable Energy for All
Chief Executive Officer Sustainable Energy for All Initiative

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 realising the full potential of economic, political and social development. The Millennium Development Goals (MDGs) up to 2015 have provided a framework for nations to reduce gender disparities considerably in education and political representation. But maternal health and child mortality goals still lag behind. The Sustainable Development Goals for 2030 proposed by the Open Working Group includes a 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, recognise 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. In the past, energy access programmes and policies have focused mainly on providing electricity connections and have neglected cooking energy. While 1.3 billion people lack access to electricity, more than double that number – about three billion people, mainly in South Asia but also in Africa, parts of Latin America and elsewhere – still rely on solid fuels for cooking and heating. 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 pillars of the UN Sustainable Energy for All (SE4All) initiative. 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.

In October 2013, SE4All and the WLPGA announced the goal to transition one 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. In 2012, WLPGA 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.

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 CO_2 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 in 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 ever 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 woodfuels, 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.

This 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. It explains in **Chapter 2** why women want LPG – both short and long-term benefits of saving time, reduced drudgery, and health improvements for women and their families as a result of reduced household air pollution. **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**.

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. Fuel switching from traditional biomass fuels to modern fuels for cooking such as LPG can reduce women's work and time burden, 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.

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 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. 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. Cooking however, which is 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 time savings 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 labour 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 child care 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

Traditional fuels and health

Almost three billion people worldwide who continue to depend on solid fuels, cooking and heating on open fires or traditional stoves are exposed to high levels of health-damaging pollutants including small particulate matter and carbon monoxide, sometimes exceeding 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. In 2010, household air pollution from solid fuels was the third leading risk factor for global disease burden after high blood pressure, tobacco smoking including second-hand smoke, and contributed to 4.3% of the global disease burden. Health problems linked to household air pollution from use of solid fuels include acute lower respiratory infections in children under five, and ischaemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer in adults. Household solid fuels smoke is a risk factor for low birth weight, perinatal mortality, asthma, cataracts, tuberculosis, asthma, and adverse pregnancy outcomes, as well as cardiovascular disease. Women and children in developing countries are the most exposed to solid fuels smoke while men bear a larger burden of disease than women due because of larger underlying disease rates among men. As such men, women and children will all benefit from decreasing household air pollution.

LPG: Lower emissions and better 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. 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 fuel whose emissions are below the critical level of 10µg per m^3 and hence the most likely to yield health benefits. In contrast to LPG, biomass burning typically releases 19 times more emissions per meal.

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. However, 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 however be problematic due to low incomes, unreliable supply of LPG, taste and cultural preferences and fears related to LPG use. Yet, according to the WHO, any massive investment clean fuels and clean stoves such as LPG 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, back aches, 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 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.

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. In northern Mozambique, VidaGas supply of LPG to health clinics has contributed to a 36% increase in the number of children immunised in participating districts, and to Mozambique's national targets for maternal and child health.

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 paediatric 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. 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 have been greatly reduced in developed countries, through regulation, enforcement, and consumer education.

3.2 Consumer education and awareness

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 also 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 organisations can work with industry associations and consumer groups to help with monitoring by raising public awareness about malpractice and even conducting and publicising 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 program.

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 programs. Neighbourhood 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 organisations 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 labour-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.

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 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. Few 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 women to become LPG energy entrepreneurs.

New approaches that include training and microcredit, and partnering with formal and informal women's organisations, 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. Some nascent initiatives such as GenteGas aim for a woman-to-woman sales force.

With women being the main consumers, women might 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.

Women's networks such as the Women in Propane Council in the US can support the advancement and success of women in business operations and professional development. 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 organisations can influence household energy policy and discussions on the global energy mix and climate change

Women and their organisations are increasingly active in shaping policies and programs 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 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, and lobby and protest about LPG pricing and availability.

Women's organisations 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. Organised 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 it is only for middle and upper income households? LPG has usually been branded as a fuel for the middle and upper class, but the Indonesian and other experiences show that much depends on government policy, as well as private sector company approaches. 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. Innovative programmes such as Switch SA in Haiti are tackling the low-income market by offering credit for stoves and low-cost refills.

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 (SE4All) has recognised 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 in proposals for the newly targeted sustainable development goals. The Global Alliance for Clean Cooking (GACC), has established a public-private partnership that seeks to mobilise 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. The WLPGA Cooking For Life Programme, and the Global LPG Partnership (GLPGP) complement the work that is being done by GACC and SE4All, with the goal by 2018 of transitioning 50-70 million people to LPG for cooking, creating 150,000+ new jobs, and offsetting more than 18m MT of wood used for cooking per year.

Partnerships with women's organisations 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 decentralised energy projects, and also used in rural electrification projects, to ensure development linkages. Coordination of LPG promotion with road improvements, school cooking programs, 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 organisations 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 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 organisations 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

Much is known about the advantages and disadvantages of LPG compared to biomass and kerosene as cooking fuel. **Table 4.1** summarises 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 impact evaluations of LPG switching programmes have been carried out.*** An otherwise excellent impact analysis of the Indonesia program (Andadari, Mulder, & Rietveld, 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 has been 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 reduced effort, 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 can 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?

- ***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, 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.

4.2 Recommendations

A wide range of recommendations for promotion of LPG in developing countries have been made by the World LP Gas Association (WLPGA, Guidelines for the Development of Sustainable LPG Markets, 2013) and by the World Bank (Kojima, The Role of Liquefied Petroleum Gas in Reducing Energy Poverty, 2011), summarised in **Table 4.2**.
This report suggests some options for involving women in meeting these goals. In particular:

1 - Gender-equitable financing at global and national level should be provided to meet both women's and men's energy needs. Investments need to be increased for improved cooking options, women's primary energy use. Discussions are underway on how universal energy access should 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 discussion, along with other options such as improved biomass stoves, electricity, and energy efficiency.

2 - New guidelines on household air pollution being issued by WHO should link targets to strategies to promote health through adoption of clean cooking fuels and the role of women. LPG is well positioned to provide early wins in addressing the guidelines. To achieve a community health benefit a strategy working with public health to develop health awareness and promotion of clean cooking is needed. Public Health working with women's organisations could support local awareness and health promotion campaigns, 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 organisations 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 programs and policies, and having input into the appropriateness of regulations, markings, and other measures for strong monitoring and enforcement. Women's groups could advocate for appropriate regulation and participate in conducting and publicising the results of spot-checks monitoring compliance and prices. Individual women could be employed in consumer education programs and monitoring. Consultations should be two-way, gathering input from women's experiences as well as informing them about good practices.

5 - Women consumers 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 organisations can be involved, based on this knowledge, in raising public awareness and advocacy for LPG and other modern fuels. 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. Market assessments need to be undertaken that take into account not only income levels but also the potential of these innovative approaches. Women's organisations, 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. 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 Early Market Guidelines 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.

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

Women are now 40% of the global labour force, 43% of the world's agricultural labour force, and more than half the world's university students. Improvements in women's education and health have been linked to better outcomes for their children in many countries.

Empowering women and improving their status are essential to realising the full potential of economic, political and social development. Empowering women is also an important equity and human rights goal in itself. Women are now 40% of the global labour force, 43% of the world's agricultural labour force, and more than half the world's university students. Improvements in women's education and health have been linked to better outcomes for their children in many countries. 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: 70% of the approximately 1.3 billion people living in poverty are women, women have access to a disproportionately low share of land, credit and schooling and receive in general lower average wages than men. Globally women occupy only 20% 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, 2012).

The Millennium Development Goals (MDGs) up to 2015 have provided a framework for nations to reduce gender disparities considerably in education and political representation. But of all the MDGs, the least progress has been made toward the maternal health goal (#5), while the child mortality MDG (#4) is one of the goals lagging farthest behind. The Sustainable Development Goals for 2030 proposed by the Open Working Group include a Goal 5: Achieve gender equality and empower all women and girls. Goal 5 includes measures relevant to the energy sector, including:

- end all forms of discrimination against all women and girls everywhere, including to eliminate violence against women;
- recognise and value unpaid care and domestic work through the provision of infrastructure;
- 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 be able to contribute to economic growth and broader development goals. **Table 1.1** shows linkages between the MDGs, gender, and energy. Increased supply of time- and labour-saving energy services, to meet both women's and men's needs, 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 Millennium Development Goals[1]

Source: (ENERGIA, 2006)

Millennium Development Goals	Gender & energy indicators relate energy access with impact on:
1 **Eradicate extreme poverty & hunger by 50%**	1 - Time & effort spent (M/F, B/G) in cooking & fuel collection and in food processing; and use of time saved 2 - Income generation (M/F): Direct applications in agriculture, home industry, extension in work hours through lighting, energy entrepreneurs 3 - Reduction in household expenditures on energy 4 - Improvement in social capital
2 **Achieve universal primary education of boys and girls**	1 - School attendance (B/G) 2 - Hours of study (B/G) 3 - School performance (B/G)
3 **Promote gender equality and empower women**	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
4 **Reduce child mortality (by 2/3 the <5 mortality rate)** 5 **Improve maternal health (reduce mortality by ¾)**	1 - Indoor air pollution (IAP) exposures and acute respiratory diseases due to biomass fuel use (M/F, B/G) 2 - Low birth weight due to IAP and maternal overwork 3 - Quality of primary health care and vaccination 4 - Women's workload and child care 5 - Burns and kerosene poisoning 6 - Fuel scarcity, water boiling and cooked foods
6 **Combat HIV/AIDS, malaria, other**	1 - Recommended health behaviours (e.g. cooking food) for persons living with HIV/AIDS (PLWHA) 2 - Reduced women's burden of care for PLWHA 3 - Reduced drudgery for women LWHA 4 - Reduced exposure to disease vectors for women LWHA 5 - Sterilisation of equipment in clinics 6 - Risk of infection from violence collecting fuel 7 - HIV/AIDS induced poverty and deforestation from increased natural resources dependency
7 **Ensure environmental sustainability including safe drinking water and slum dwellers**	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)

M/F denotes to Male/Female, B/G denotes to Boy/Girl

Access to clean cooking energy is a particularly gendered issue, because women are primarily responsible for cooking in virtually all cultures. In the past, energy access programmes and policies have focused mainly on providing electricity connections and have neglected cooking energy. While 1.3 billion people lack access to electricity, more than double that number – about three billion people, mainly in South Asia but also in Africa – still rely on solid fuels for cooking and heating (IEA, 2012). 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) argued 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, the 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). 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 the UN's Sustainable Energy for All initiative (SE4ALL) (see section 1.2 below).

[1] This table needs to be updated to the proposed Sustainable Development Goals through 2030.

Table 1.2: People relying on traditional use of biomass for cooking in 2011 (millions)

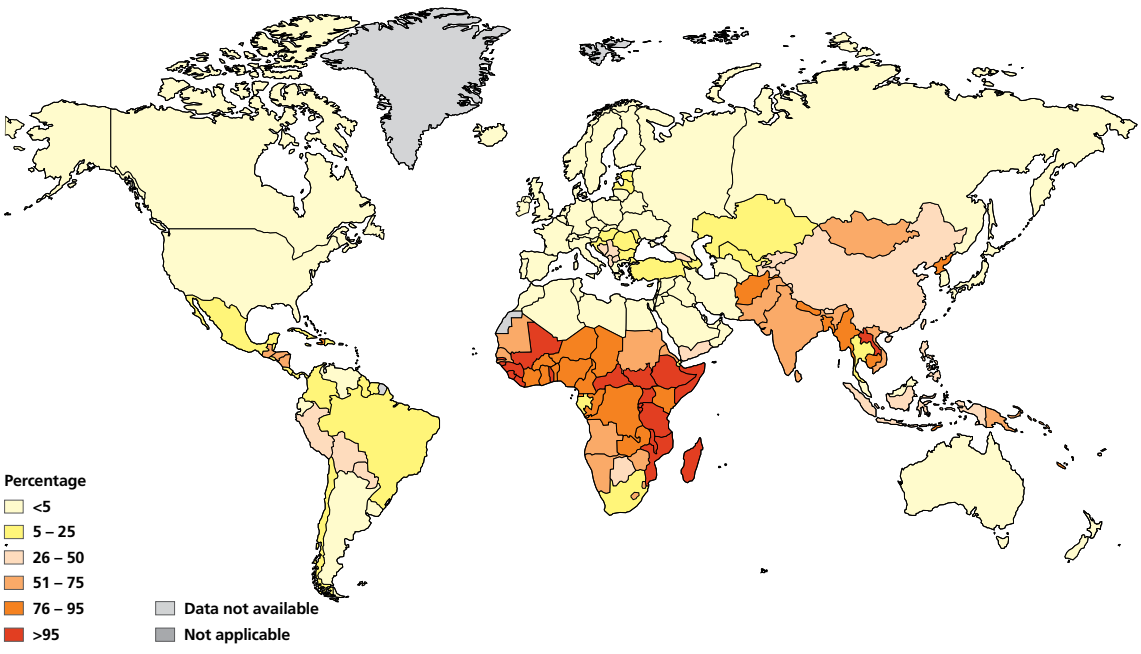
Source: (IEA, 2013)

Developing countries	**2,642**
Africa	**696**
Sub-Saharan Africa	695
Nigeria	*122*
South Africa	*6*
North Africa	1
Developing Asia	**1,869**
India	*818*
Pakistan	*112*
Indonesia	*103*
China	*446*
Latin America	68
Brazil	*12*
Middle East	9
World	**2,642**

Energy access will be a key contributor to meeting gender goals and reducing poverty. 40% of the world's population, in both rural and urban areas still cook 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 2012. These diseases have a significant impact on maternal and child health (WHO, 2014).

Map 1.1: Population using solid fuels (%), 2012

Source: (WHO, 2013)



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organisation concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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 fuel collection can range from one to five hours per household per day or more (ENERGIA, 2006). When fuel is monetised, 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-monetised work which is largely invisible in national energy accounts and labour force statistics. Collecting biomass and using inefficient cooking methods can take away from productive activities such as schooling, child care 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. Traditional biomass fuel use is also related to climate change and agricultural production that affect women's work and livelihoods. Black carbon contributes to 18% of temperature increases and is second only to CO_2 in its contribution to climate change (Ramanathan & Carmichael, 2008). About 25% of global black carbon emissions are attribute to residential solid fuel burning and about 84% of this black carbon is from households in developing countries (EPA, 2012).

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 less than men. In the petroleum sector, about 25% of the global labour force is now women. In national and international energy policy, women's voices are only beginning to be heard. Due to their under-representation, women in the energy sector can often feel isolated. Networking has proven valuable to women in the energy sector, both in the North and South.

1.2 LPG and energy poverty

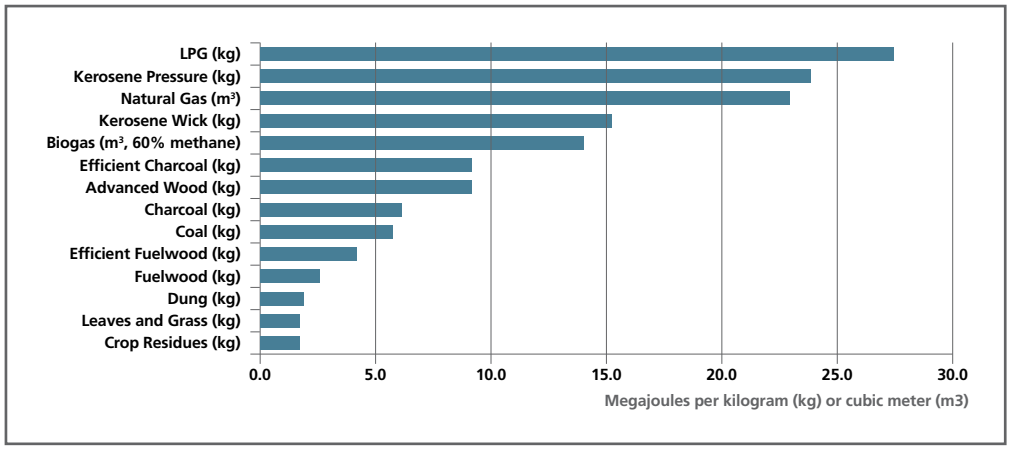
For the first time, access to cooking and heating energy, the most important energy need for poor women, is treated on an equal footing with access to electricity.

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. This is one of the three pillars of the UN Sustainable Energy for All (SE4All) 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 have been proposed by the Open Working Group as targets for an energy sustainable development goal, 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.

In October 2013, SE4All and the WLPGA announced the goal to transition one billion people from traditional fuels to LPG. To secure this, 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. In 2012, the WLPGA 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.

Figure 1.1: The energy transition for cooking

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



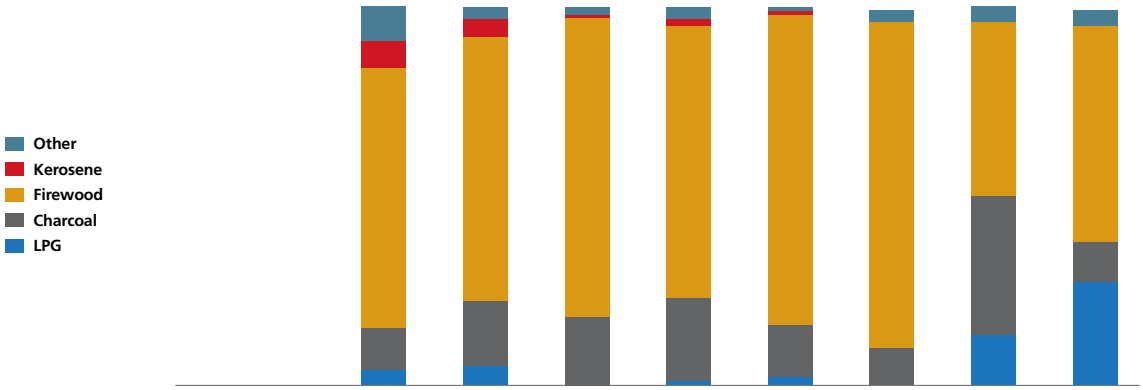
LPG is a clean-burning, efficient, versatile and portable fuel, produced as a by-product of natural gas extraction and crude oil refining – therefore either it is used or wasted. It is consistently among the most efficient heating options and can be up to five times more efficient (high calorific value) than traditional fuels (see **Figure 1.1**). LPG produces less air pollutants than kerosene, wood or coal and emits about 20% less CO_2 than heating oil and 50% less than coal; it also reduces black carbon emissions. It can be transported in small or large quantities by sea, rail or land, including human portage, so can that 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 (ENERGIA, 2006; 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 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. 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. 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.

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.

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

Source: (GLPGP, 2013)



	Sub-Saharan Africa	**Kenya**	Tanzania	Uganda	Mozambique	Malawi	Ghana	Senegal
Data year for fuel data	(2010)	**(2009)**	(2010)	(2010)	(2009)	(2010)	(2008)	(2011)
GDP per capita	$2,061	**$1,510**	$1,336	$1,188	$861	$789	$1,652	$1,737
Urban population	37%	**24%**	27%	16%	31%	16%	52%	43%
Urbanization rate	37%	**4.36%**	4.77%	5.74%	3.05%	4.2%	3.5%	3.32%

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, women 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 also maximises 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 labour is also a factor in fuel choice (see **section 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.

Clearly, many millions of households will continue to be dependent on woodfuels 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 multipronged solution, as a preferred option for cooking for women in developing countries.

This 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. 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. **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**.

Chapter 2

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 Millennium Development Goals (MDGs) over the last decade, earlier thinking about productive uses of energy is being updated with an enhanced understanding of the tremendous impact that modern energy services can have on education, health and gender equality (Cabraal, et al., 2005). 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

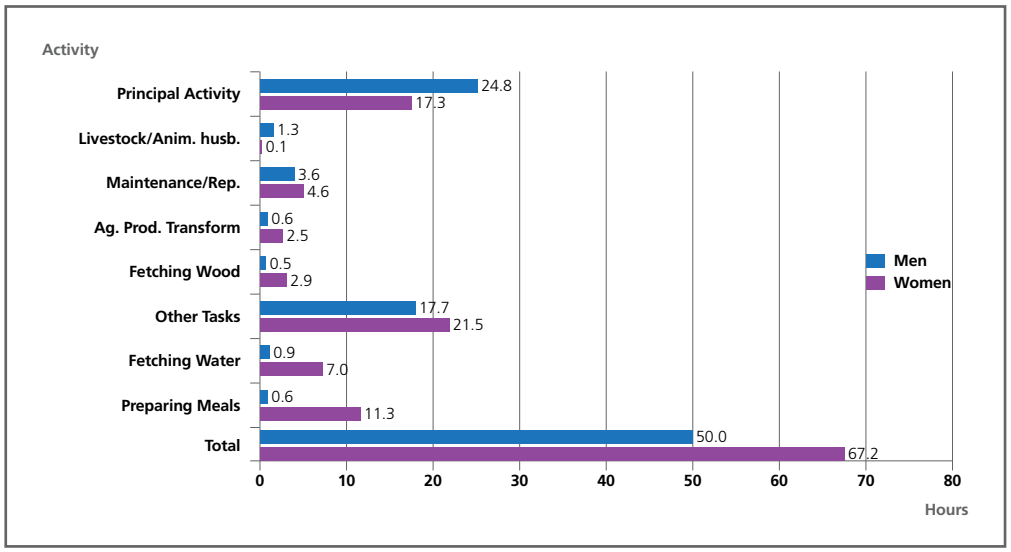
2.1.1 Women's triple burden

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*. 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).

When both paid and unpaid work is accounted for, norms about responsibilities for care and housework mean that women in nearly all countries work longer hours than men (ILO, 1995), with a "triple burden" of market work, housework, and family care, 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

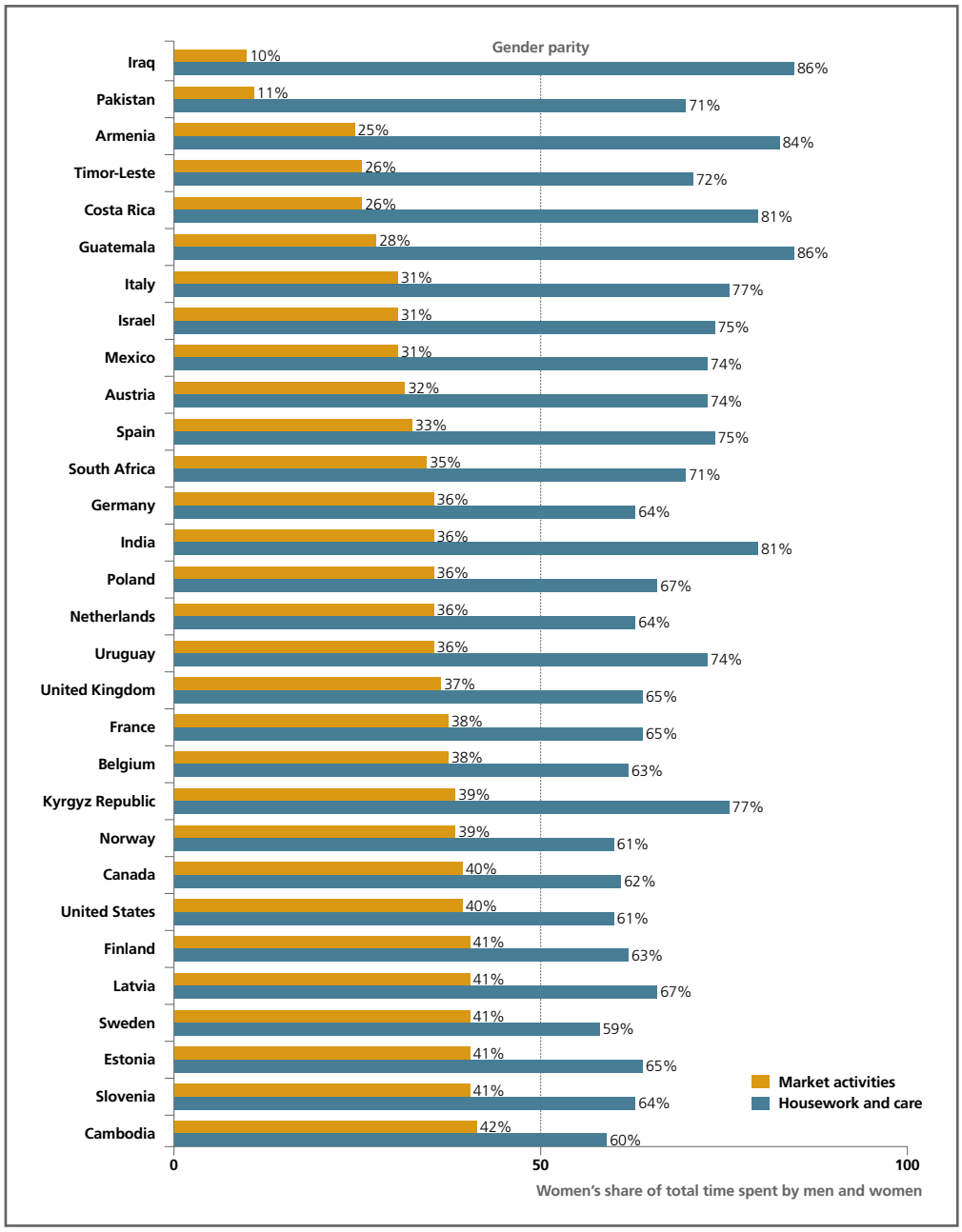
Source: Benin – Time Allocation Study, UNDP, 1998, in (Blackden, 2002)



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", which 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).

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

Source: (World Bank, 2012)

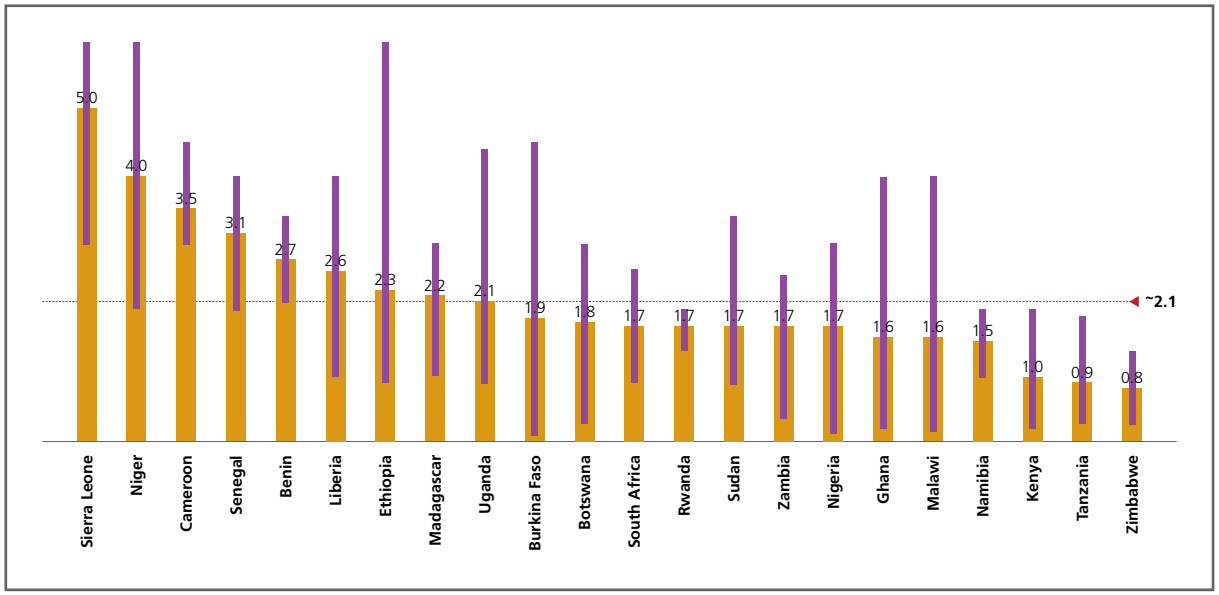


2.1.2 Time spent in fuel collection and cooking

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. 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 (Clancy, et al., 2013). A WHO review of fuel-collection time and biomass energy use among 14 countries in Sub-Saharan Africa found a wide range of estimates for the number of hours spent collecting biomass, from a low of 0.33 hours up to four hours per day (WHO, 2006). World Bank (2012) has collected 51 data points and this charting for the region is shown in **Figure 2.3** below, ranging from 0.8 to five hours per household per day.

Figure 2.3: Firewood collection times in selected Africa countries (Hours per household)

Source: (World Bank, 2012)



In some places and households, however, the fuel collection burden is much higher: An ENERGIA/DfID review (Dutta, 2005) found surveys giving as high as 14 hours per week per household, and load carrying of as much as 75kg. SEWA recently reported findings from quantitative and qualitative studies in rural Gujurat, that women 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. Zaidi and Bloom (2004) suggest women's need to command labour in fuel collection (and other household tasks) as an important factor in valuing children's labour and hence higher fertility rates.

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 1 to more than 8 hours per household per week.

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

Source: (Barnes and Sen, 2004)

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.

Cooking however, which is exclusively women's task, can also take considerable time, sometimes equal to the time spent in fuel collection, as shown in **Table 2.1**. Most life cycle cost comparisons of cooking fuels appear to measure time saved in fuel collection but not time saved in cooking e.g. Sánchez-Triana (2007). The valuation of labour time is a key factor in cost comparisons. Women's unpaid time in both fuel collection and cooking is not always economically valued and can be "invisible" in household as well as energy policy decision making about fuel switching.

2.1.3 Time and effort saved with modern fuels

Considerable time savings 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). 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 as 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 factors 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 also been reported as well. Cylinders can run out of gas while in the middle of cooking or showering, and there is not always a backup cylinder on hand.

Little comparative data is 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. Time savings in cooking could be even greater that 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

Source: Xxxx

Location	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)

Time savings 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. 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.

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, and including carrying heavy cylinders if a home delivery service is not in place or smaller LPG cylinder programs are not available (Kooijman-van Dijk, 2008; Masera, et al., 2000). As well as women spending time, men missing work and children missing school to queue for LPG is 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, and 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, can help free up women's time spent on domestic and care work. Although few studies exist for LPG, electrification (including electric cooking) in rural South Africa has increased women's labour 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 Kenya, women adopting LPG reported using time saved on small enterprise or farming (Bates, 2007). In Himachal Pradesh, a study found that women's participation in wage work increased noticeably as a result of an LPG adoption program: 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).

Other studies show no impact on market work but noticeable impacts on leisure and socialising time, which increase women's and often family welfare (World Bank, 2012). An ESMAP study in India found that in households with access to LPG or electricity, women enjoyed a more balanced life between arduous tasks and leisure compared to women who use biomass. They spent less time collecting fuel, fetching water and cooking, and more time reading and watching TV (Barnes & Sen, 2004). Leisure is often combined with entertainment, as in listening to the radio or watching TV. Recreation and social activities are often a chance to build social capital and participate in community organisations and political life.

The time 'saved' as a result of switching to modern fuels is often used for more household chore, agricultural activities, and child care, watching TV, listening to the radio, leisure time, reading, 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). When opportunities exist, women sometimes use this time for attending community meetings and for engaging in income generation activities(Practical Action, Gender and Livelihoods Impacts of Clean Cookstoves in South Asia, 2014; UNDP, Women's Power: Energy Services for Rural Women in India, 2011).

A recent Practical Action (2014) draft study in South Asia identified the availability of daily waged work as one of the principle drivers for the shift to LPG. The same study, one of the few to examine time savings from improved stoves and their use, 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 2.2**). It has been reported that the mothers who use improved cook stoves (ICS) are able to give more time to their children to prepare them 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 showed that there is higher children school enrolment percentage among ICS user households compared to traditional cookstove (TCS) users.

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

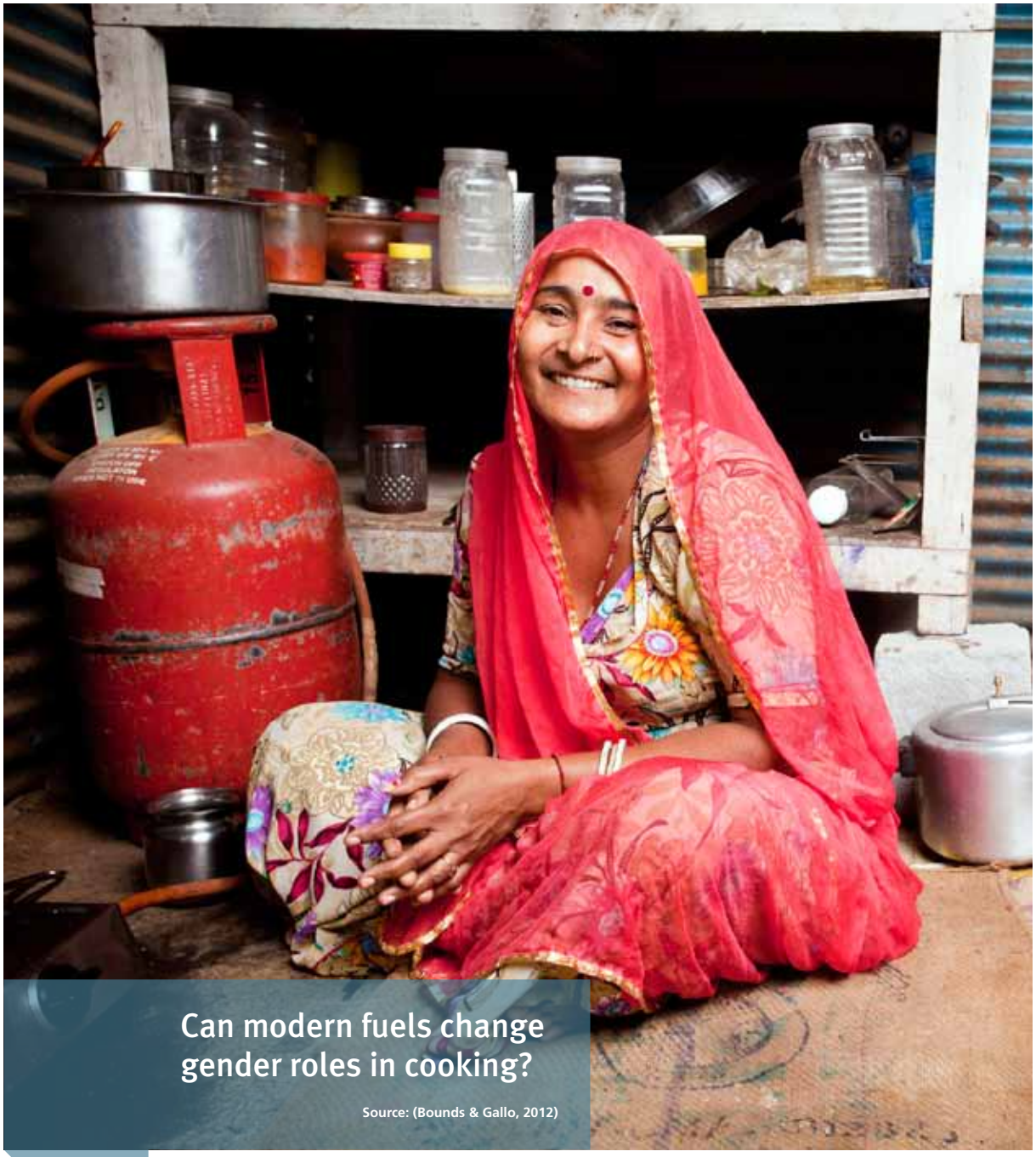
Source: (Practical Action, 2014)

Activities	Karnataka	Himachal Pradesh	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

The opportunity cost of women's time is a key factor in how time savings 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 labour. 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 commercialisation 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 labour with rising tourism led to a complete rural fuel transition. Once women's labour became a constraint to their employment in the tourism sector, there was a switch to LPG for domestic cooking to save women's labour 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 labour. Users will find it hard to give up a "free" biomass stove and fuel, unless alternate economic opportunities exist.

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.



Can modern fuels change gender roles in cooking?

Source: (Bounds & Gallo, 2012)

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. 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 "modernisation" 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 can 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."

In South Africa and Zanzibar, men sometimes cooked with electricity but not with LPG. In Zanzibar, men appear to take on the tasks which do 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 project in Sudan, many of the women in the society where the project has been conducted rely exclusively on their husbands for their finance. Those who work are often engaged in seasonal activities, yet although their husbands see that they do not have goods to sell, they are reluctant to provide additional money for the family for clean fuel and appliances. Once bought, LPG provides a pathway towards more savings for the women, as it is cheaper than other fuels in the market place in Sudan (Bates, 2007).

In Himachal Pradesh, the introduction of LPG was made through community organisation focusing on organising 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. At an individual basis, women reported increased self-esteem, increased networking and interactions with government officials and greater mobility also increased (UNDP, 2011).

2.2 Health improvements for the family and women

2.2.1 Traditional fuels and health

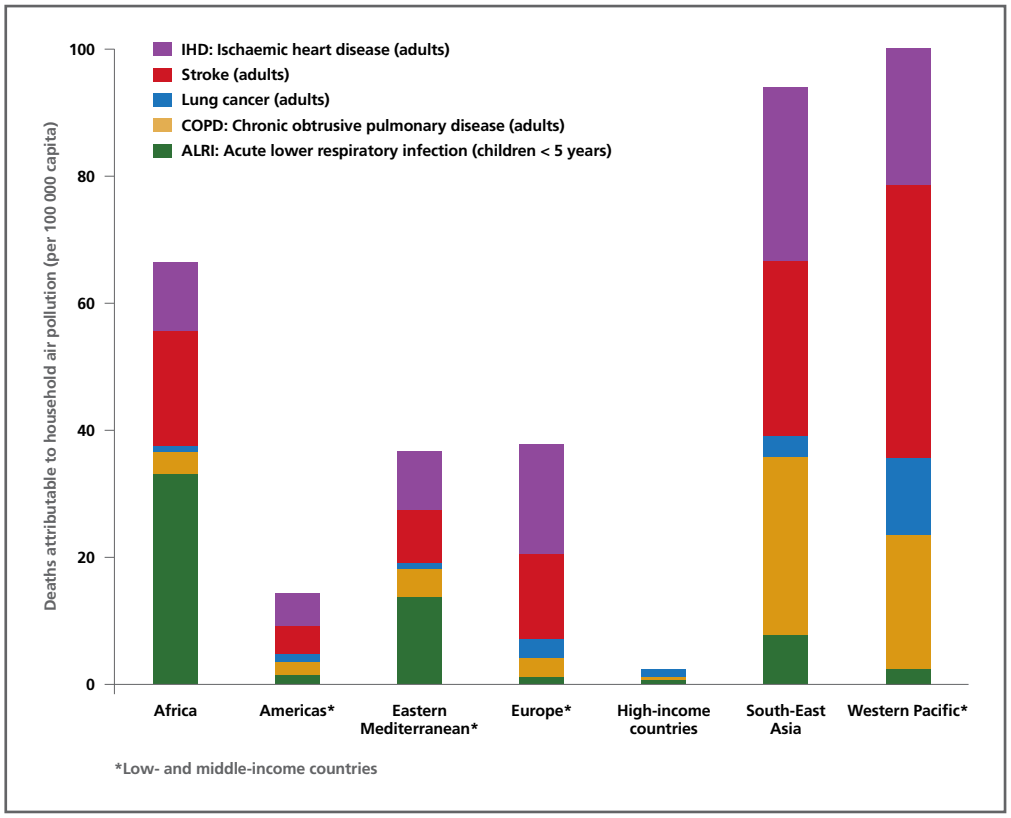
For the almost three billion people worldwide who continue to depend on solid fuels (biomass fuels such as wood, dung, agricultural residues, and coal), cooking and heating on open fires or traditional stoves results in high levels of household air pollution. Indoor smoke contains a range of health-damaging pollutants, such as small particles and carbon monoxide, and particulate pollution levels may be 20 times higher than accepted guideline values (WHO, 2014).

In 2012, according to the WHO, household air pollution was responsible for 7.7% of global mortality or 4.3 million deaths (WHO, 2014).[2] The largest numbers of premature deaths from household air pollution are in Asia, dominated by India and China, 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.

[2] This 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, 2014).

Figure 2.4: Deaths attributable to household air pollution (per 100,000 per capita)

Source: (WHO, 2013)

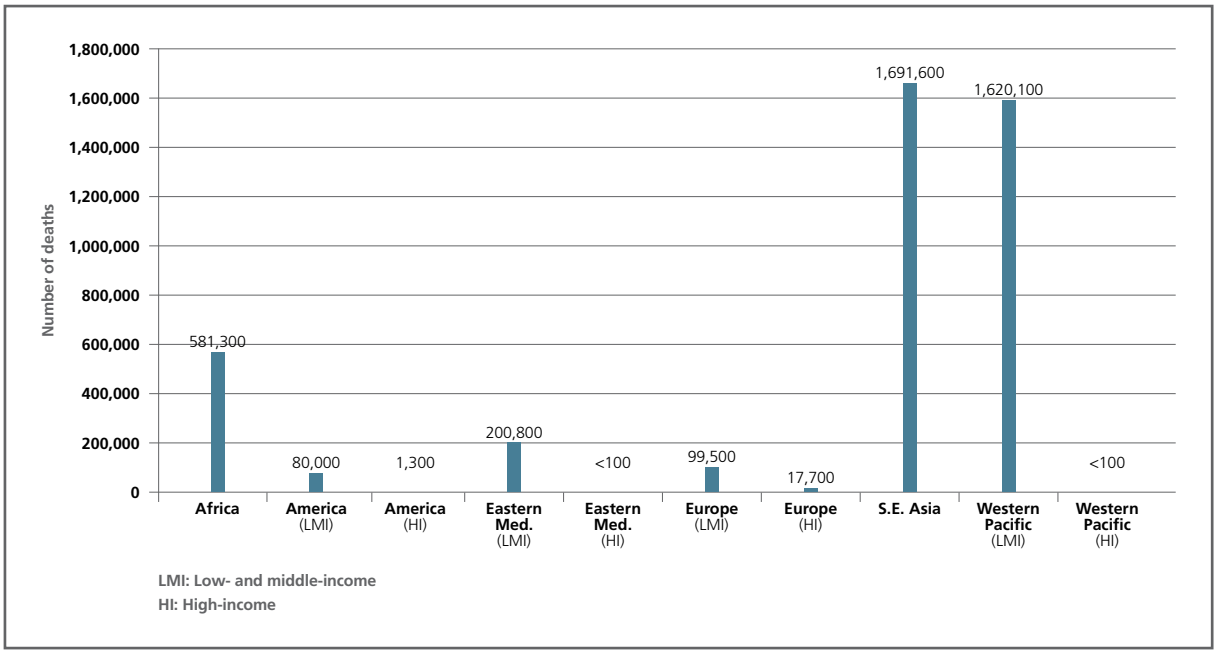


For the almost three billion people worldwide who continue to depend on solid fuels (biomass fuels such as wood, dung, agricultural residues, and coal), cooking and heating on open fires or traditional stoves results in high levels of household air pollution.

There is consistent evidence that exposure to household air pollution can lead to acute lower respiratory infections in children under five, and ischaemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer in adults (WHO, 2014) 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 moderate and 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, as well as cardiovascular disease (Ekouevi & Tuntivate, 2012; Smith, et al., 2005).

Figure 2.5: Deaths attributable to Household Air Pollution (HAP) in 2012 by region

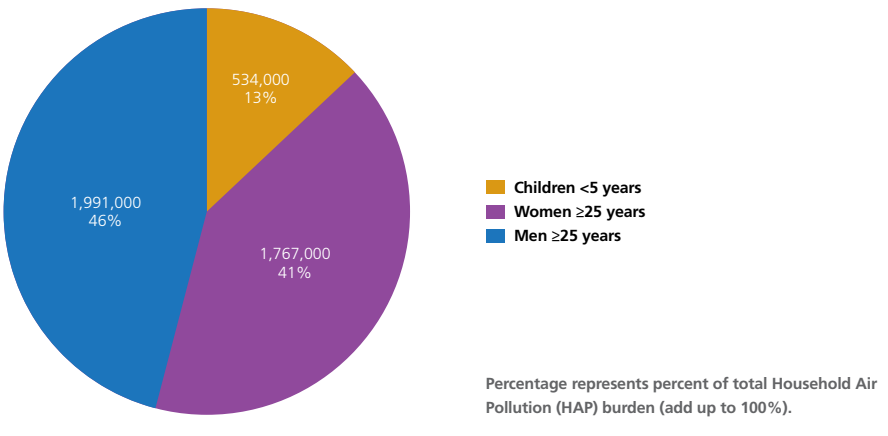
Source: (WHO, 2014)



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, 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 risks 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, 2014). Hence men, women and children will all benefit from decreasing household air pollution.

Figure 2.6: Global deaths by age and sex, 2012

Source: (WHO, 2014)



In India, household solid fuels are the third most important health risk factor, only exceeded by poor water/sanitation and malnutrition (Smith, et al., 2005). Household solid fuel is responsible for about 17% of all deaths of children under five in India. In the 20 most-unhealthy countries of Sub-Saharan Africa, the HIV/AIDS epidemic dominates as a risk factor, followed by malnutrition. But in 2010, household air pollution from solid fuels was the third leading risk factor for global disease burden after high blood pressure, tobacco smoking including second-hand smoke, and contributed to 4.3% (3.4–5.3) the global disease burden (Lim, et al., 2012).

As part of WHO's Total Burden of Disease from Household Solid Fuels Study (Lim, et al., 2012), it was found that even though the fraction of the population using household solid fuels is likely to decline due to rising incomes and economic growth, this decline would barely keep up with predicted population growth. Hence traditional fuels will remain a severe health risk for hundreds of millions of people globally in the "business-as-usual" scenario.

2.2.2 LPG: Lower emissions and better 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 clean stove such as an LPG or kerosene as the primary stove significantly reduces indoor air pollution (IAP) concentrations (Ekouevi & Tuntivate, 2012) but kerosene has high risks of burns (Lloyd, 2002)and has been associated with increased susceptibility to tuberculosis (TB) (Pokhrel, et al., 2010). Studies show that not only does LPG have much lower emissions than biomass and coal burnt in open fires, but also lower emissions compared to 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 m^3 (Smith, 2012) as shown in **Figure 2.7**. A study comparing $PM_{2.5}$, PM_{10} 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). 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, as with LPG.

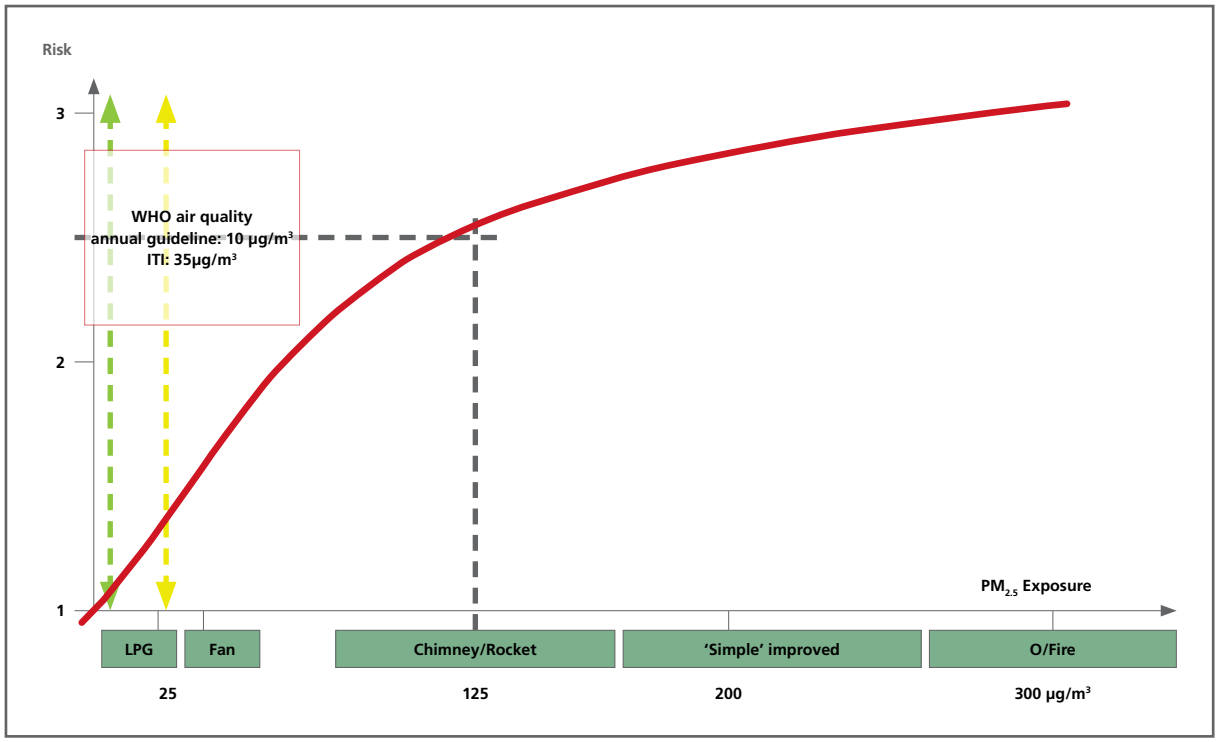
Better health outcomes have been associated with LPG in comparison with other solid fuels such as biomass and coal. According to Grieshop et. al (2011), LPG (and kerosene) offer unrivalled air combustion performance and air quality benefits and unmatched PM2.5 exposure reductions. These authors make 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.

In a study of 1,260 women from the same neighbourhood 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. Nonetheless, ventilation conditions play a significant role in indoor air pollution (IAP) levels, as does fuel stacking. 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 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 mostly likely due to affordability and/or supply constraints, compared to those that transition to improved biomass. As such LPG users may still be exposed from high pollution levels although these would be from complementing biomass use rather than from

[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.

Figure 2.7: Exposure-response relationship (Child pneumonia)

Source: (Smith, 2012)



the use of LPG. 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. Fuel stacking is a rational response by women cooks to the often unreliable supply of LPG. It also helps them manage between their costs (for modern fuels) and their time (to collect biomass).

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. New guidelines on household air pollution being issued by WHO will provide the scientific rationale and framework to move clean fuels forward, and LPG is expected to be best positioned to provide early wins in addressing the guidelines (Bruce, Pope, Rehfuess, Balakrishnan, Adair-Rohani, & Dora, 2014).

2.2.3 Beyond indoor air pollution

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. 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; ENERGIA, 2006). Echarri and Forriol, (2002; 2005) found degeneration of the cervical spines of women who carry firewood on their heads against a control group. SEWA has documented in studies and video the effort and pain it takes to carry 25-30 kg of firewood on the head and walk for 4-5 km (SEWA, 2014).

Figure 2.8: Bio-fuel chain and health impacts

Source: (Parikh, 2011)

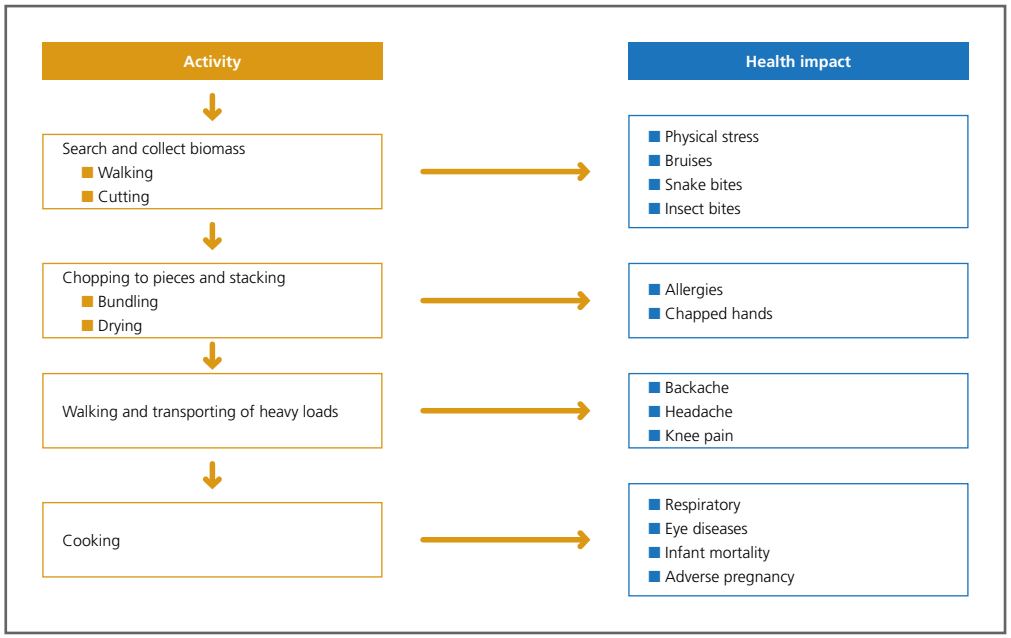
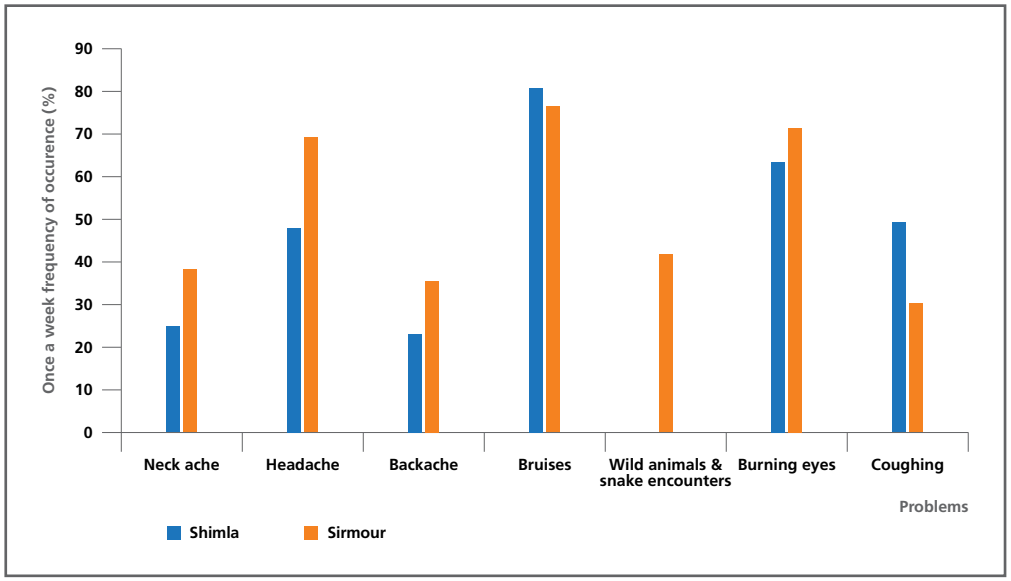


Figure 2.9: Health impacts of collection of fuels in Himachal Pradesh, India

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

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.

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 (ENERGIA, 2006).

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 (World Bank, 2012).

Another health linkage with modern cooking fuels is that increased 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. Scarcity of firewood has been linked to abandonment of certain nutritious foods such as beans (Brouwer, et al., 1997). Maintaining good nutrition is also difficult for women when they spend several hours in far-away forests.

Modern fuels can 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 immunised 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 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 (Lloyd, 2002). Child poisoning is also a major paediatric problem in Africa.

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

Source: (Lloyd, 2002)

	Homes	Injuries	Deaths
Paraffin	16700	1700	1000
LPG	9	9	5

Burns and deaths from burns are a serious problem with paraffin, both accidental and intentional, especially for women and children. 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.

Paraffin poses two major risks of injury, especially to children. First, paraffin poisoning is the most common form of poisoning in children in Africa, more than 60% of all paediatric poisoning cases in Kenya and South Africa (Lang, et al., 2008). This is due to paraffin's resemblance to water and storage in similar bottles. Second, paraffin is highly flammable and poses fire risk when contaminated by water or other fuels, used in malfunctioning appliance, or used carelessly by intoxicated individuals or children. Once a fire starts, children are at particular risk. Epidemiological data show that the risk may be greatest in Africa and southern Asia (Schwebel & Swart, 2009).

Burns and deaths from burns are a serious problem with paraffin, both accidental and intentional, especially for women and children. 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 recognised as an important public health problem in India. Police in India registered 8,233 murders of women as dowry deaths in 2012 according to national statistics (NCRB, 2013), a doubling since 1995. While removal of the easy availability of large quantities kerosene for cooking may not stop bride burning, 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.

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, 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. 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.

Further, beyond consumer education, women cooks may need to take a more active role in design of LPG stoves, training programs, 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.

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

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, 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 shows, 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). 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 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. Unfortunately this is often lacking in many developing countries (WLPGA, 2013).

The 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 are much reduced through regulations and enforcement following international guidelines on safety procedures.
- Accidents related to consumer use, often due to defective cylinders 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.

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).

In India, 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). Similar findings of preventable burn accidents come from Turkey (Tarim, 2014). Sub-standard cylinders, old valves, worn-out regulators are also identified as causes. Many LPG consumers are unaware of the need for safety checks of gas 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).

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). LPG gas fires are the second leading cause of fire incidents in the country. 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 vapour, which can accumulate in enclosed and low-lying areas and explode if a spark is present.

In Indonesia, too, it appears that accidents have been mainly 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 & Arofat, 2011).

3.1.2 Consumer education and awareness

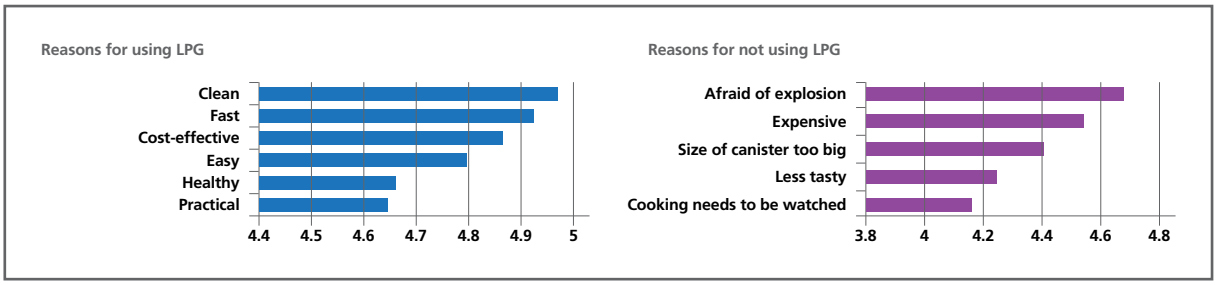
Women's fears about using LPG are not misplaced, given the lack of regulation and absence of enforcement of safety standards in many countries. Hence consumer education and awareness in LPG promotion must not only dispel the idea that LPG is a fuel that "burns houses down," but must also give women cooks 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 also 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 often 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 is 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).

With this knowledge, women can also promote and lobby their governments and LPG companies to adopt regulations, and enforce standards. They need to understand the difference between cheaper, low quality and potentially dangerous canisters, 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 minimise costs." While government agencies engage in the long-term process of strengthening monitoring and enforcement, women's organisations can work with industry associations and consumer groups to help with monitoring by raising public awareness about malpractice and even conducting and publicising the results of spot-checks.

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

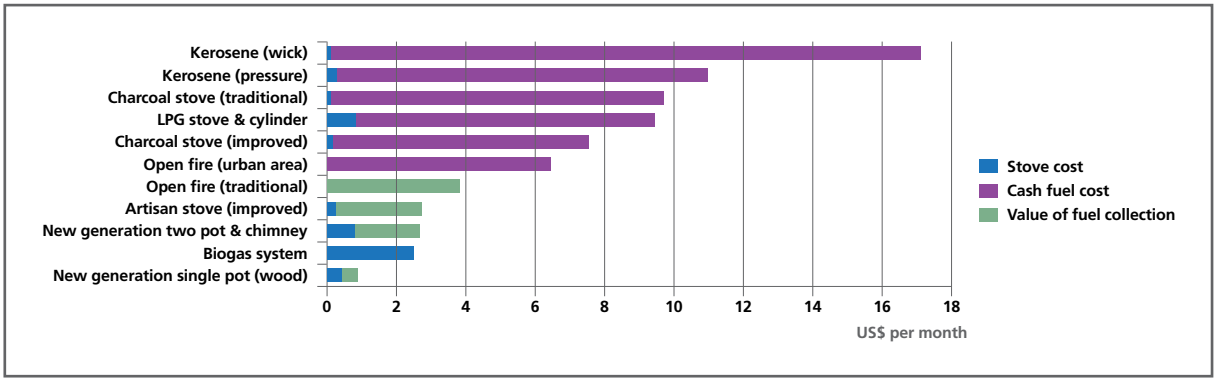
Source: (Andadari, et al., 2014)



Women's reasons for using LPG – and for not using LPG – in the Indonesian switching program 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 3.2: 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 in some countries, but in many it is competitive with charcoal and paraffin (kerosene), though more expensive than biomass (see **Figure 3.2**; also Kojima 2011). Women are not always aware of the 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).

Understanding the health and safety costs of using traditional biomass fuels and kerosene, described above in **Chapter 2**, also needs to be part of a fuel switching program. 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 their children. When they learn more about these 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, than LPG. Parikh (Parikh, 2011), and Matinga et al. (2013) and others suggest that health centres should be sensitised to the issues associated with IAP as well as diseases from hardships found in fuel transporting and collection.

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. In some cases, LPG stoves may be ill-suited for local

households and their cooking habits (Denton, 2004). 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, for example (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

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.

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

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 program in 2010. The campaign was successful in reducing accidents significantly by 2011. Although the percentage of accidents was small the impacts were large and could have eroded the success of the program. Pertamina and WLPGA worked together and held a Best Practice workshop with all stakeholders to identify issues and draw up and 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. The petroleum company PT 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, years 2007-2008

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

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

Awareness raising on the safe use of LPG in Sudan – would these cooks learn more from another woman?

Source: (Bates 2007)

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

Still, 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 organisations in developing and testing materials, or in direct promotion. Campaigns seem usually to be limited to promotion of LPG 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 familiarise 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 neighbourhood 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 an exploding paraffin stove. They were also concerned 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 behaviour. He felt it important that energy safety programmes needed to target both men and women (Tait, et al., 2013).

Box 3.2: Demonstrating LPG safety in neighborhoods in Peru

Fundación Repsol[4] 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 LGP (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)

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, Merven, & Senatla, 2013). Similar initiatives are needed for LPG and could be strengthened by the inclusion of women's organisations and consumer groupings in alliances.

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

3.2 Diversifying women's livelihoods with LPG

Many of women's traditional income-generating activities in developing countries, such as food processing, depend on their labour and thermal energy, and LPG is a welcome alternative to biomass fuels in these informal sector activities as well as in non-traditional sectors.

Improved technologies have been shown to create pathways for strengthening women's economic opportunities (Gill, et al., 2012). 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, and 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.

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, as well as indirectly, through gains in productivity or expanded economic activity resulting from new energy inputs. It 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. ENERGIA'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 (ENERGIA, 2007).

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).

Table 3.2: Examples of energy-intensive small-scale enterprises operated by female entrepreneurs

Source: (Cecelski, 1995)

Enterprise	Comments
Beer brewing	25% of fuelwood used in Ouagadougou; main source of income for 54% of women surveyed Tanzanian village; 1 kg 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/1 kg bread
Shea butter production	60% of cash income for women in parts of Sahel
Fish smoking	40,000 tons 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 Cameroons study
Gari (cassava processing)	Women in 2 Nigerian districts earned $17/year each; 1 kg 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

Modern fuels such as LPG can save time and improve productivity in many fuel and labour-intensive women's enterprises. They can save time for entrepreneurs, lower costs of process heat, and diversity 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, which is also likely to be attractive since entrepreneurs' time may have a higher value than household cooking time.

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, 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 fuelled with LPG are used to preserve fish while adding flavour (UNDP, 2003).

Box 3.3: Switching from firewood to LPG in the tofu and tempeh industry in Indonesia: Women's employment as 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 Euro 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. Time savings 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 CO_2 per year and to increase profitability of producers by an average of 500 Euro per year.

Top 5 reasons for using LP Gas over firewood in tofu and tempeh production in Indonesia, according to producers

1 - Cleanliness of the factory
2 - More hygienic
3 - Less labour intensive than firewood
4 - Less storage space needed than firewood
5 - Time efficiency

Source: (WLPGA, 2013?) citing Mercy Corps

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 woman entrepreneur stated that the 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).

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 storage containers, increasing cost (Broni-Bediako & Kakra Dankwa, 2013). 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 canisters;

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: http://takamotobiogas.com/changing-lives-with-biogas/lpg-vs-charcoal/

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; The Hindu, 2005).

Both businesses and households may be concerned about taste and adaptability of LPG stoves to traditional cooking methods. In Guatemala, GenteGas is seeing 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).

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 unorganised 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.

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

While women are the biggest users of LPG for cooking, they are generally not 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. Increasing the number of suppliers and distributors is critical to the expansion of LPG use. In Indonesia, for example, the LPG switching program involved eight LPG terminals, and 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 Programme[5], 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?).

New approaches that include training and microcredit, and partnering with formal and informal women's organisations can help overcome the traditional constraints on women's participation and take advantage of their strengths (Karlsson, 2012). The GVEP DEEP Programme above provides 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 organisations 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 modernised and provide employment opportunities. In Senegal, improved stoves production in two regions provides 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).

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.

[5] GVEP (Global Village Energy Partnership) 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 and run between 2008 and 2013. It aimed to develop sustainable micro and small energy enterprises.

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 tonnes of charcoal. Ms. Mallam Abukari Amadu is the entrepreneur behind Lambark, who received EDS from KITE 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 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 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 tonnes of charcoal. The company's refuelling 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 Agricultural Development Bank.

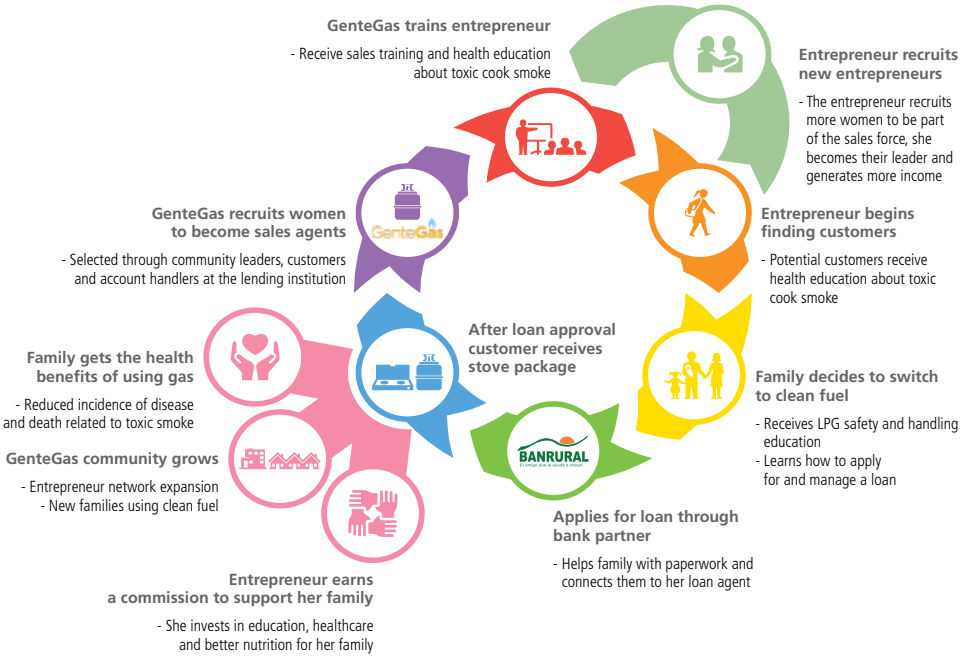
Source: (Haselip, et al., 2013)

Few examples were found in the literature of women's participation in the LPG supply chain however; 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 program 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 Ghandhi Gramin LPG Vitrak 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 are 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 (see **Box 3.5**).

Box 3.5: Women entrepreneurship dispensaries: GenteGas in Guatemala

GenteGas, a social enterprise under development in Guatemala, plans to use a woman-to-women sales force to increase consumer adoption of LPG fuel and stoves by raising awareness and education (health, safety, financial literacy) through the GenteGas women entrepreneur network. It would use revenues from advertising on cylinders to subsidise the cost of the stove package and give women entrepreneurs a higher profit margin, and partner with local Guatemalan corporations and rural banks. The company hopes to set up LP Gas dispensaries in every municipality, run by the women entrepreneurs, which would involve signing a contract with local LP Gas companies to furnish the fuel. GenteGas dispensaries would manage a separate inventory of cylinders for their customers to ensure safety and maintenance. In order to provide customers a more accessible and affordable fuel, the company's dispensaries would also make smaller LP Gas cylinders available when a family cannot afford a larger tank refill.



Source: (GenteGas, 2013?), last accessed 28th August 2014

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 organisation's concept globally. It encourages membership by both women and men who support the concept.

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.

Box 3.6: Women in Propane Council in US promotes the advancement of women in the industry

1 - Mentorship programs - confidentially connect with others in the industry to move their careers forward
2 - Professional development through live and online training, networking programs and webinars
3 - Learn how to recognise and encourage capable female workers with leadership potential
4 - Sensitivity training via webinar sessions designed to provide valuable information about working side-by-side with both genders for both internal and external customers (within the office workplace, in the field, and in interaction with clients, vendors, and industry colleagues)
5 - Outreach programs to attract more women to the industry
6 - Education seminars defining the power of women/men leadership boards and their ability to govern more effectively and drive improved profits.

Source: (NPGA, 2012). Last accessed 29th August 2014

3.3 Linking modern cooking fuels with women's empowerment

Women in New Delhi demanding lower prices for cooking fuel.

Source: (All-India)

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

Women and their organisations are increasingly active in shaping policies and programs 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 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.

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) . 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 have met with ministers and lobbied for increasing the cap on subsidised 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 labourers organised protests under the banner '*Penkoottu*,' an organisation of women labourers (The Hindu, 2014).

> "*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

Women's organisations 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 (2002) 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 CO_2 e/year (UNFCC, 2006).

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. As **Box 3.7** explains, providing energy access for many countries would require only a small portion of their expected energy revenues.

Box 3.7: 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)

Organised 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 the 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.

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 promotion. It is important to recognise that where kerosene is subsidised, 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 2010[6], and the Indian government may also hope for such savings.

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

Source: (World Bank, 2012)

	Growth rate/year	Y10 LPG penetration	Country examples	Typical reforms
Low	1%	10 - 15%	Senegal, Morocco	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	Subsidies (directly deposited into users' bank accounts) Strict regulatory environment to prevent the misuse of cylinders (e.g., for commercial purposes)
High	3 - 5%	50%	Peru, Vietnam	Major and rapid policy interventions, including decreasing VAT/import tax of LPG, instituting LPG retail price ceiling, taxing biomass consumption
	18%	84% (Y4)	Indonesia	Conversion of existing infrastructure; establishing LPG conversion PPPs Heavy investment in infrastructure, education and promotion of LPG

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, 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.[7]

[6] After 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).
[7] Thanks to Ms Oyindamola Fagbenle of Georgetown University for this concise summary.

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.

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.

Source: (Practical Action, 2014)

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. 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. World LPG prices have more than doubled in real terms in the last decade, increasing at an annual average rate of 9% since 2001. Kojima (2011) on this basis estimates that regular users of LPG would likely need monthly household income in excess of US$350, thus unaffordable for the poor. This World Bank study suggests that 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. Modelling of household behaviour on energy technology choices shows that rural household 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) A recent study of 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 have historically provided little benefit for rural women, and recommends cash transfers as an alternative – although . where cash transfers to replace fuel subsidies have been piloted in India, it is clear that women are at a disadvantage due to being unbanked, and have been unable to access the transfers.

Can LPG meet lower-income and rural women's cooking energy 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 the Indonesian and other experiences show that much depends on government policy, as well as private sector company approaches (**Box 3.8**).

Box 3.8: Can LPG meet lower-income and rural women's cooking energy needs or is it only for middle and upper income households?

The Brazil, Indonesia, Senegal, Thailand and other experiences with LPG promotion programmes show that 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 program led to a remarkable boom in LPG consumption, which grew from less than 2,000 tons in 1974 to 15,000 tons in 1987 and nearly 100,000 tons in 2012. Nearly 85% of households in Dakar and 66% of those in other main urban areas now own LPG stoves (Ekouevi & Tuntivate, 2012). The subsidy was withdrawn in the 2000s (Laan, et al., 2010).**
- **In Kenya, while the share of households using LPG increases with income, 60% of all households using any LPG earn less than 20,000 KES per month (GLPGP, 2013). Pima Gas is testing a model in Nairobi that provides refills for one kg of gas at dispensaries close to customers, to serve the "kadogo" low income economy (Mulupi, 2012).**
- **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. This programme now forms part of the Bolsa Familia, by far the largest conditional cash transfer programme in the developing world (IEA, 2006).**
- **In Thailand, the LPG promotion program focused on lowering the price of LPG by increasing its availability beyond Bangkok (Ekouevi & Tuntivate, 2012).**
- **In Indonesia, the LPG program induced a 28 percentage-point decrease in energy poverty in suburban areas. Andadari et al (2014) found that while the LPG program 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.**
- **SEWA (Nanavaty, 2014) has recently emphasised that LPG is the aspirational fuel for its membership, lower income women working in the informal sector in India.**

Better LPG distribution, policies, regulation and enforcement may initially benefit middle and upper income households more, 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 policy making and in the long term improve the voice of working class women. Women's voices can sensitise politicians (often men) to the energy needs of women and LPG as a smokeless fuel with some barriers to access, and give women a political voice.

"The economy at the base of the pyramid is the future. Many multinationals for a long time assumed that the people at the base of the pyramid cannot be served and that they are not a viable market. That is the only frontier left in business. If you are not servicing this particular group you will not be in business for long."

Michael Momanyi, General Manager of Pima Gas marketer Premier Gas

Another example is the model found in Carbon Clear's Darfur Low-Smoke Stoves Project, the first ever carbon credit programme to be registered by The Gold Standard in Sudan. Launched in 2007 with Practical Action and Nile Gas, LPG cookstoves are 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 organisations 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 work in the community to help people understand how buying a low smoke cookstove through a micro-credit arrangement can work for them. They also explain how families can 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 works 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 has been 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 have been distributed to date, with a 90% repayment rate, due to the very close link between the women and their local associations (Levallois, 2014).

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. Innovative programmes such as Pima Gas 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. Most poor countries share similar barriers: Lack of credit and finance system, high interest rates, and big informal sector (Magloire, 2014).

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

Source: (Bates, 2007)

These women want LPG. Why should they wait?

Source: (Outlook India, 2014)

3.3.3 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 (SE4All) has recognised 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 in proposals for the newly targeted sustainable development goals. The Global Alliance for Clean Cooking (GACC) has established a public-private partnership that seeks to mobilise 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. The WLPGA Cooking For Life Programme, and the Global LPG Partnership (GLPGP)[8] complement the work that is being done by GACC and SE4All, with the goal by 2018 of transitioning 50-70 million people to LPG for cooking, creating 150,000+ new jobs, and offsetting more than 18m MT of wood used for cooking per year.

Partnerships with women's organisations 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 decentralised 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.

In Morocco, road improvements made LPG more affordable. This reduced the need for girls to collect firewood, giving them more free time and opening up new opportunities for education, work and other activities (Cabraal, Barnes, & Agarwal, 2005). In Haiti, LPG has been introduced in more than 23 schools as part of USAID energy and education efforts (USAID, 2014). In Mozambique (see **Box 3.3**), LPG promotion is being used to break a key constraint in delivering better maternal and child health in health clinics in the Northern provinces.

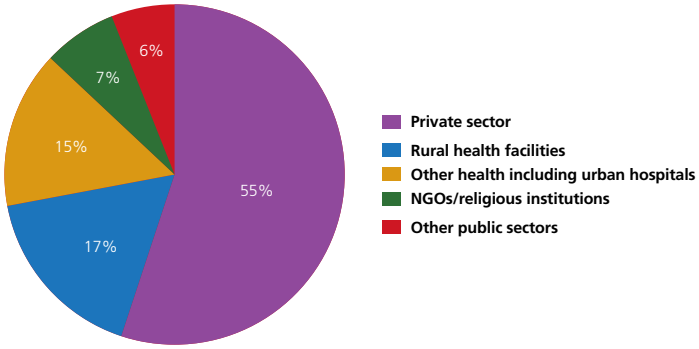
[8] The GLGP concept was generated by ETG, a company involved in the global LPG/LNG industry. In consultation with other industry players and the WLPGA, representatives of national governments, local LPG businesses, and the global health community, among others, a global public-private partnership was created in order to address the ecosystem of policy and investment requirements necessary to create a reliable and safe LPG. LPG supply chain in developing country markets and meet universal access to clean cooking solutions. The Global LPG Partnership strategy is to implement a multi-phase process in an initial four to five countries in Sub-Saharan Africa. Implementation will result in the launch of an initial US$250 million commercial equity fund for LPG infrastructure and distributions investments, to be supplemented by up to US$250 million of commercial debt. Joined by a US$250 million concessional fund for consumer first cost finance and local retail distribution. http://www.se4all.org/commitment/global-lpg-partnership/.

[9] For example, the PROGEDE community-led sustainable forestry management program 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 Program (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 3.9: 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 realised 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 supports 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 centres represent only 17% of sales.

Sector share of revenue - 2011



VidaGas has established its reputation as a reliable supplier. In 2011, VidaGas 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.

Source: (Beale, 2012)

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 through SE4All could have considerable synergies. An innovative program by ESKOM in South Africa initiated in 2006 to expand electrification together with provision of LPG cooking equipment 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).

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

Source: (ESMAP, 2003)

	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.
The Brazil questionnaire does not allow distinction between LPG and other types of gas (piped gas).

Women's organisations 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 organisations 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 organisations 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 3.10: Women's organisations 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 organising 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)

Chapter 4

Way forward

This report has collected and assessed the 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 summarises 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** summarises 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 impact evaluations of LPG switching programmes have been carried out;*** an otherwise excellent impact analysis of the Indonesia program (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 has been 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.[10] 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?

- ***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

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

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, 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 fuels[11]

Source: (Smith, Rogers, & Cowlin, 2005)

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.
Health-damaging air	LPG reliably produces much lower air pollution emissions for all classes of pollutants.	Kerosene pollution levels are lower than biomass, but are not as low nor produced as reliably with LPG.
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.
Impact on demand for children's time	Less need to harvest biomass can release time (for example, allowing children to attend school).	
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.	

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

4.2 Recommendations

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:

1 - Gender-equitable financing at global and national level should be provided to meet both women's and men's energy needs. Investments need to be increased for improved cooking options, women's primary energy use. Discussions are underway on how universal energy access should 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 discussion, along with other options such as improved biomass stoves, electricity, and energy efficiency.

2 - New guidelines on household air pollution being issued by WHO should link targets to strategies to promote health through adoption of clean cooking fuels and the role of women. LPG is well positioned to provide early wins in addressing the guidelines. To achieve a community health benefit a strategy working with public health to develop health awareness and promotion of clean cooking is needed. Public Health working with women's organisations could support local awareness and health promotion campaigns, 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 organisations 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 programs and policies, and having input into the appropriateness of regulations, markings, and other measures for strong monitoring and enforcement. Women's groups could advocate for appropriate regulation and participate in conducting and publicising the results of spot-checks monitoring compliance and prices. Individual women could be employed in consumer education programs 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 organisations can be involved, based on this knowledge, in raising public awareness and advocacy for LPG and other modern fuels. 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. Market assessments need to be undertaken that take into account not only income levels but also the potential of these innovative approaches. Women's organisations, 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. 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 programs. WLPGA's Early Market Guidelines 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, using examples of options for facilitating household use of LPG suggested by World Bank (Kojima, 2011)

Source: Adapted from 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	
	Minimise demurrage charges	Rapid customs clearance	
		Reduced port congestion	
		Round-the-clock staffing by port authorities	
		Adequate port receiving capacity	
	Minimise short-selling	Clear marking of cylinder tare weight	Women's organisations 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	
Enhance safety	Establish clear regulations	Formal adoption of international standards by reference	Women's organisations 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 organisations
		Small fee levied to finance monitoring and enforcement	

Goal	Option		Options to involve women
Enhance safety	Enforce safety regulations	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 inter-active 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
		Neighbourhood demonstrations by retailers, industry association, and consumer groups	Cooperation with national and local women's organisations; 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
Target financial assistance	Move away from universal price subsidies	Expansion of social safety net program to help pay for LPG, such as cash transfer or vouchers	Consultation with women's organisations can help identify and implement creative measures for targeting financial assistance
	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	
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. Consultation with women and their organisations on design of awareness programs Women's groups can be key in dissemination
	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		
	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		

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List of Abbreviations and Acronyms

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
SE4ALL	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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