

»» Perspectives on Development Financing



No. 2, March 06, 2017

Cooking with Liquefied Petroleum Gas - a viable alternative to wood? Challenges and opportunities for the usage of gas

Authors: Claudia von Fersen / Friederike Bauer
Editor: Dr Charlotte Schmitz

Wood has been used as a source of fuel since the dawn of civilisation. But while wood has been superseded in many countries by alternative sources of energy, it is still the number one fuel in Africa. However, the unsustainable use of wood has negative consequences for both people and nature: the use of wood as a source of energy pollutes the environment and damages human health, especially when used for cooking in enclosed spaces. Liquefied Petroleum Gas (LPG) could be considered an interesting alternative: but under what circumstances and conditions?

Approximately 2.7 billion people use wood or dung daily as a source of energy. In Africa, four out of five people cook using wood or charcoal. According to current prognoses from the International Energy Agency (IEA), this number is predicted to decrease worldwide to 1.8 billion until 2040 but this number is still high. However, the damaging effects of cooking with bio-

masses, such as wood or dung, raise questions about their use for cooking. This affects the following areas:

- **Health:** The World Health Organization reports that household air pollution from burning solid fuels in enclosed spaces is the cause of more than four million premature deaths each year; this

figure is more than the number of deaths resulting from malaria and AIDS put together. As a result, indoor air pollution is considered to be one of the most critical health risks.

- **Environment:** Deforestation has already increased at an alarming rate in many regions across the



Cooking is easy with liquefied petroleum gas.

world. As a result, the atmosphere's carbon dioxide buffer is depleted which contributes to climate change.

- **Income and employment:** Women and girls in particular collect wood daily for many hours; this is time that could be put to better use for earning an income or acquiring an education.
- **Safety:** The search for wood is often very risky, particularly in unstable contexts. It is not uncommon for women and girls to be assaulted while collecting wood.

Uganda is an example of the consequences which may result when wood is used unsustainably for cooking. The African country has lost around two thirds of its forest in the last twenty years, one reason being the need to clear forests to use the wood for heating and cooking. "If the forest continues to be decimated at this rate, the country will probably be deforested by 2050," explains KfW director Dr Klaus Müller. Other countries in Africa and Asia are facing similar situations.

The consequences are disastrous: forests are not only a source of energy; they are also precious, natural treasures. They provide nutrition, construction material, natural resources, medicinal plants and habitats for millions of people. Moreover, they are home to 75 percent of known animal and plant species, produce oxygen, bind carbon dioxide, store water and also regulate temperature and climate. Forests are therefore absolutely crucial for climate protection and for the survival of the human race. Exploiting them for cooking and heating creates a serious energy problem, particularly for the poorest sections of the population, while also posing far-reaching consequences for the environment and agriculture of national economies.

As a result, alternative sources of energy are required for cooking and heating such as LPG and other gas liquids. LPG is a by-product of crude oil and gas processing and comprises mainly propane or butane.



Transport is not difficult.

Advantages for consumers

The use of gas liquids for cooking could be a good alternative until more environmentally friendly technologies that use renewable energy are properly developed for the market. Gas liquids are simple to transport and store, and gas stoves are easy to use, robust and easy to acquire in many areas of the world.

Simple gas cooking systems usually consist of a gas canister, a valve connection, and a pressure regulating valve, a pipe and a cooking range with one or more hobs. Most are highly durable and can certainly last for up to ten years, depending on the materials they are made from. Once distribution channels have been established, empty gas canisters can simply be refilled.

Liquid gas stoves offer users a whole range of advantages:

- They use energy in a comparatively efficient way. The fuel efficiency rate is between 45 and 60 percent and is therefore greater than many modern wood-burning stoves.
- The pollution levels emitted into the air when gas liquids are combusted are considerably lower than when biomasses are used, thus lowering the risk posed to

health.

- The stoves light immediately and provide good, quick and consistent heat for cooking.
- The systems are transportable and can be used outside or inside, depending on living conditions and preferences.
- When compared to how long it takes to collect firewood (on a daily basis), exchanging a gas canister takes significantly less time.

Surveys have shown that consumers in areas where it is not necessarily possible for everyone to access sources of energy find gas stoves clean, quick, easy and practical to use.

Advantages for the national economy

Besides the advantages for the user, there are also positive effects for society as a whole: lower pollution levels improve the health of the population, particularly of women and children. In light of climate change, protecting the forest becomes even more important. The social aspects, such as having more time for productive activities and increased safety, are also key factors. Since LPG can be easily transported and stored, it is also suitable for wider



Cooking can take place either inside or outside

distribution.

Even from an environmental perspective, gas stoves do surprisingly well even though they use a fossil fuel. In fact, compared to cooking stoves that use other fossil fuels, they emit little carbon dioxide.

Wood and biomass are theoretically also CO₂-neutral, renewable natural resources. In practice, however, this is not at all guaranteed and users' habits play a considerable role. Felled trees are frequently not replaced or they are replaced only at a later date. Gases that are harmful to the environment therefore remain in the atmosphere, at least for a while. It can be assumed then that using wood affects the climate negatively.

Finally, it is a real concern that gas liquids must be extracted as a waste product from the crude oil refining process and that they are often burned off (flared) without being used

for fuel.

Studies show that when all the factors are considered, cooking with gas liquids affects the environment similarly or to a lesser extent than when biomass is used.

Good experiences

Gas liquids are readily available in many areas of the world. Every year, the supply of gas liquids increases by around three to four percent and exceeds current demand. Many countries are also witnessing encouraging results. In some states, gas liquids are the number one source of energy for cooking, for example in Gabon or Brazil where more than 90 percent of all households use it. This became the case when, faced with serious bottle-necks in supply, the governments in these states developed and financed comprehensive programmes for distributing natural gas liquids in rural areas.

In Indonesia, for example, a comprehensive government-led programme resulted in a switch from kerosene to gas liquids. In five years, more than 50 million households changed to using gas liquids. And not only those affected by the switch benefit; the state also gains because the energy content in gas liquids is greater than for kerosene and public subsidies can therefore be reduced.

A number of other states have also decided to pursue ambitious transformation projects. India is combining the switch with extensive subsidies for the poor, primarily to make the hur-

dles posed by investment costs smaller. By 2019, around 50 million of the poorest families, a figure which translates to approximately 300 million people, will have switched to using gas liquids. In addition to energy, the cause of such a paradigmatic shift is first and foremost health. From a global perspective, India is the most problematic country when it comes to premature deaths caused by the emission of household air pollution in enclosed spaces. Estimates say that around 900,000 people die every year as a result.

Even in industrialised countries such as Japan, consumers use gas liquids for cooking mainly because it is more efficient and easier. This demonstrates that this source of energy can also still be attractive to consumers, even when other clean sources of energy are available, such as electricity or natural gas.



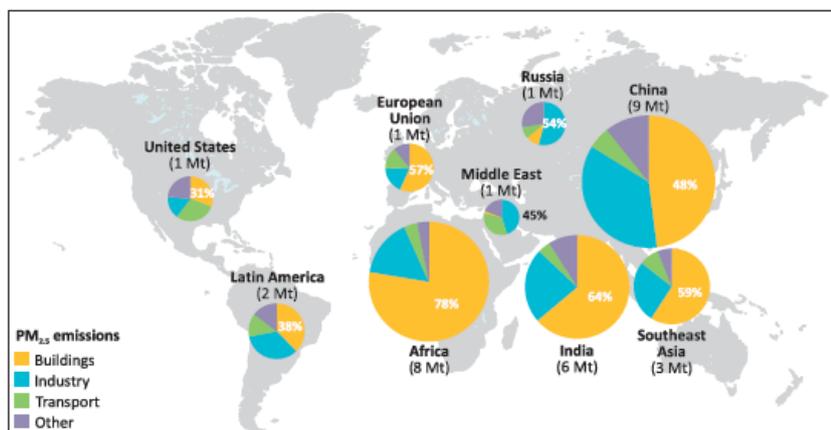
Quotation

"Using gas liquids means that in many countries the use of firewood and the amount of harmful household air pollution is reduced. In the light of rapid population growth and advancing deforestation, African countries need to consider where it would be worthwhile to use gas liquids and how this could best be encouraged. Donors and development banks ought to provide their support in this."

Dr Thomas Duve, KfW director, Southern Africa and Regional Funds department

Challenges

Despite numerous advantages, using gas liquids for cooking still presents challenges which, depending on the location, may be more or less relevant. Combustibility is one such challenge. Gas is highly flammable and must be used carefully. Safety requirements and education are required. Once these are in place and consumers are both aware of the requirements and have been educated, using gas liquids does not pose a problem. But the opposite is also true: if there are no safety standards and if consumers are not familiar with how to use the technology, the risks increase.



Energy-related PM_{2.5} emissions by region and sector
 © OECD/IEA, World Energy Outlook 2016, IEA Publishing.
 Licence: www.iea.org/t&c

Distribution poses a further challenge. In theory, gas liquids are available with greater or less ease almost everywhere in the world, but in practice there is often no local distribution network. Moreover, a working exchange system is required for the canisters. As a result, rural areas can prove problematic. In some circumstances, distribution chains must first be established with state support in order to distribute the technology



Transport by hand over the last part of the way

across the area. A clearly regulated framework is also required. Brazil has seen some success in setting up a well-established distribution infrastructure even in rural parts.

One hurdle facing poorer people in particular is the comparatively high investment costs (approximately 80 dollars) of the basic equipment required, such as a stove and an initial gas canister. Without subsidies and as long as wood is still somehow available, few will make the switch to using natural gas liquids. This is particularly true of families who collect firewood because they cannot afford to buy it. According to estimations from the World Bank, this is true of around half of all households in Sub-Saharan Africa.

Those who purchase their firewood can more easily make the switch to natural gas liquids because cooking already costs them money. Even though prices fluctuate greatly between countries and regions, there is still a rule of thumb: where deforestation

is already advanced, the price of firewood is higher meaning that natural liquid gases present a viable economic alternative to other fuels available on the market.

Finally, gas stoves must gain people's acceptance. They also need to fit with what and how people usually eat, while being socially and culturally accepted. Just how difficult this can prove to be is evident in Africa and Asia where the switch is being made to efficient, biomass-fuelled cooking stoves. Although they use up to 50 percent less fuel and produce considerably less smoke, they are not staggering sales success. Without an intelligent means of education where the advantages of gas stoves can be presented clearly, the technology will be met with scepticism and then rejection primarily in rural areas.

Conclusion

Using gas liquids for cooking purposes offers an interesting yet transitional alternative to firewood, since it combines appealing environmental elements with advantages for the families using them. Gas remains, however, a fossil fuel that will need to be replaced by sustainable sources of energy over the long term, if not simply to protect the environment.

According to current experiences, such as from Burkina Faso, gas liquids work best in urban or semi-urban areas because the distribution infrastructure is already available or can be established at little expense. In more rural areas, however, more effort is required and government agencies also therefore need to be active in implementing their policy, whether that relates to kick-starting distribution (i.e. by offering subsidies) or helping households purchase the necessary equipment.

Targeted subsidies or credit lines for microfinance institutions promote such a changeover. At the same time, targeted educational campaigns are required for outlying areas to explain the benefits of natural gas liquids as well as the associated hazards.

KfW is currently investigating the possible uses of natural fluid gas for cooking in Ghana, Cameroon and

Kenya and is checking if and how the distribution of systems of these kinds can be represented as having economic value for protecting health, the environment and providing for the poorest of the population, and what definitive contribution KfW can make towards this.



Photos

Cover photo: Michael Johnson / Berkely Air Monitoring Group. P. 01: Global LPG Partnership. P. 02: Nigel Bruce / University of Liverpool. P. 03: Olivier Levallois / Carbon Clear. P. 04: Lisa Thompson / University of San Francisco.



Contact

KfW Group
KfW Development Bank
Palmengartenstrasse 5-9
60325 Frankfurt am Main, Germany
Telephone +49 69 74310
Fax +49 69 7431 2944
info@kfw-entwicklungsbank.de
www.kfw.de