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# The Mega Conversion Program from kerosene to LPG in Indonesia: Lessons learned and recommendations for future clean cooking energy expansion

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ABSTRACT

*Background:* In 2007, the Indonesian Government instigated a national program to convert domestic kerosene users to liquefied petroleum gas (LPG) for cooking. This was primarily motivated by the rising cost of kerosene subsidies.
*Objective:* To review the national conversion program and LPG scale up by evaluating its impacts, including assessing sustained changes in cooking behaviour and consequent reductions in exposure to household air pollution (HAP).
*Methods and data sources:* Searches of peer-review and grey literature in both English and Bahasa Indonesian were conducted and supplemented by interviews with key informants, data from the National Statistics Agency and results from household surveys. The data were extracted and analyzed using an Implementation Science approach.
*Results:* The main kerosene to LPG conversion phase took place in highly populated kerosene dependent areas between 2007 and 2012 reaching over 50 million households, approximately two thirds of all households in Indonesia. Since then the drive to expand LPG use has continued at a slower pace, especially in more remote provinces where solid fuel is more widely used. Over 57 million LPG start up kits were distributed as of 2015. Beginning in 2018, the open subsidy for LPG is expected to be replaced by one targeted at lower income households. While the main conversion phase has been highlighted as an example of effective and impressively fast fuel switching at scale, the impact on domestic biomass use remains limited.
*Conclusions:* Addressing HAP and the health impacts associated with kerosene and biomass use was never an objective of the program. Consequently, there is limited evidence of impact in this area, and in hindsight, missed opportunities in terms of influencing cooking behaviour change among biomass users, who are more at risk.


## Introduction

Indonesia is the world's largest archipelago and the fourth largest country, with over 260 million inhabitants in 2016. It is classified as a lower-middle income country with GDP per capita of US$3570 and an urban population of 55% (World Bank, 2017). Household air pollution (HAP) from daily use of solid fuels is an important contributor to mortality and morbidity in Indonesia. In 2016, an estimated 60,835 deaths (4% of all deaths) and 33.7 million lost disability-adjusted life years (DALYs) (2.5% of all DALYs) due to ischemic heart disease, stroke, chronic obstructive pulmonary disease, lung cancer, and acute lower respiratory infections were attributed to HAP (IHME, 2017). These numbers have dropped from 1990, when HAP accounted for 8% of all deaths and 6% of all DALYS reported.

In 2007, the Indonesian Government embarked on the largest household fuel conversion program for cooking that had been attempted at that time, to phase out the domestic use of kerosene completely in five years and replace it with liquefied petroleum gas (LPG). LPG is an abundant by-product of oil refining and natural gas extraction, and is a clean-burning and portable fuel used as the primary or secondary cooking fuel by almost 3 billion people across developing and developed countries (Bruce, Aunan, & Rehfuess, 2017; WLPGA & Argus, 2018).

In terms of the Government's stated objectives, the program was successful in reducing domestic kerosene use by 92% in less than 10 years. While subsidy reductions were achieved, the cost effectiveness of these reductions needs to be considered in light of a high initial subsidy and the sustainability of the changes in terms of rising energy prices and growing energy needs. The impact on household cooking behavior,

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sustained usage of LPG for daily cooking and associated health gains has also been less clear.

The objectives of this investigation were to review the conversion program in terms of sustained changes in cooking behaviour and consequent reductions in exposure to HAP. It also sought to characterize the factors that contributed to successful program implementation and determine what lessons might be transferrable to other countries seeking to rapidly move towards clean cooking, particularly at scale.

## Sources, methods and approach

Multiple sources of quantitative secondary data, combined with primary qualitative data, have been used for this case study investigation. Searches of peer-reviewed and grey literature concerning the conversion program and current household fuel use were conducted in both English and Bahasa Indonesian. Searches were conducted in Scopus and Google Scholar using the keywords 'LPG' and 'Indonesia' in order to be as inclusive as possible. Primary fuel usage data were extracted from the National Statistics Agency (Badan Pusat Statistik Indonesia) and from household surveys published in peer-reviewed and grey literature identified through the search, which also provided information on cooking fuel use practices and expenditure. Data were also accessed from the Ministry of Health and the National Consumer Protection Agency with online local newspaper searches being carried out in Bahasa Indonesian using the terminology of LPG consumer use and safety. It is rare that exchange rates accompany figures, so these are not always included when presenting costs that are only given in US dollars rather than in Indonesian Rupiah (IDR). Where calculations have been made by the authors, unless otherwise specified, the exchange rate used is the exchange rate as of January 1st in the quoted year; consequently some costs given in US dollars might be different than those published in previous literature.

We contacted all stakeholders involved in program implementation in order to review data that existed. Six semi-structured face-to-face interviews plus a telephonic interview were conducted with the main program implementers and other key stakeholders with continued follow-up. Those interviewed included representatives of the Ministry of Energy and Mineral Resources (MEMR) (Analyst, Price and Subsidy Directorate), the Industry and Energy Agency of Jakarta Provincial Government (Head of Energy and Electricity, and colleagues), the National Oil Company Pertamina (Assistant Manager - Planning and Evaluation, Senior officer and colleagues), as well as the World Bank in relation to the Indonesia Clean Stove Initiative (Senior Energy Specialist) and the International Institute for Sustainable Development (IISD), Indonesia office (Indonesian Program Co-ordinator, Global Subsidies Initiative, (GSI)[1]). Due to the length of time that had passed since the program's initial implementation in 2007 we were unable to follow-up with some stakeholders, primarily the Ministry of Women's Empowerment and Ministry of Social Affairs where no program records appeared to have been retained. Informal enquiries were also made with the World Health Organization Regional Office for South East Asia, international and local NGOs focusing on clean cookstoves such as GERES and Kopernik, the Air Pollution Division of the Ministry of Environment and Forestry, and the Economics Faculty of the University of Indonesia in Jakarta.

Two of the six interviews were conducted in Bahasa Indonesian and the rest in English. Interviews were digitally recorded, transcribed verbatim and translated into English when necessary. The interview data were extracted and analyzed in Microsoft Word using an implementation science approach (Glasgow, Vogt, & Boles, 1999). Data were synthesised according to the following categories: (i) program goals and geographical reach, (ii) program roll-out and sustained use of technology and fuel over time; (iii) environmental and health impacts; and (iv) where the program stands now.

## Kerosene to LPG conversion program

### *Background*

Indonesia was, until the 1990s, a net exporter of oil and gas. The country has traditionally provided energy subsidies to its citizens, which peaked at 18% of total state expenditure in 2005 (Pertamina & WLPGA, 2012). These subsidies, including diesel, gasoline and kerosene, were justified as a form of social assistance. In 2007, kerosene was the primary cooking fuel for 37% of households (MEMR, 2016a) – 20.9 million households out of a total of 56.4 million (BPS, 2017) (see Fig. 1). However, a decline in domestic supply and increase in oil prices meant the amount of subsidy the Government was providing for household kerosene was becoming onerous, climbing from USD $1.96 billion in 2005 to USD $5.24 billion in 2008 (Budya & Arofat, 2011). Reducing the subsidy by increasing the price of kerosene had resulted in serious rioting (Beaton & Lontoh, 2010). The over-riding motivation for the conversion program was therefore to reduce the total subsidy while protecting households from economic shocks. Kerosene subsidies had already been phased out in the industrial sector in 2005 and fuel leakage from the subsidized domestic sector to the industrial sector (and even abroad where kerosene was more expensive) was further increasing the strain on the state budget (Pertamina & WLPGA, 2012).

Trends in primary cooking fuel usage from 2007 to 2015 are illustrated in Fig. 1.

LPG was chosen as the conversion fuel for various reasons. Although the economic price per kilogram of LPG was 24% more expensive than kerosene at the time of the program launch in 2007 (IDR 7966/US$ 0.89/kg for LPG compared to IDR 5570/US$ 0.61/l for kerosene) it was calculated that LPG's higher calorific value would make it cheaper to subsidize, allowing the Government to maintain low and constant energy costs to the consumer at lower budgetary cost (MEMR, 2007). The University of Trisakti in Jakarta estimated that 1 l of kerosene was equivalent in end use to 0.39 kg of LPG and this was used as the basis for calculating subsidy savings (Budya & Arofat, 2011). Secondly, LPG was chosen as elements of the supply chain were already in place (e.g. storage tanks and filling plants) and it was the easiest fuel to distribute to rural and remote populations across a vast territory. Indonesia is made up of many islands with seismically active volcanoes impeding grid infrastructure. It is not clear if cost benefit analyses were done on alternative fuels for cooking, but these were not seen as commercially developed enough to consider at the time (Budya & Arofat, 2011).

In 2008, Pertamina commissioned a private company, GreenWorks Asia, to calculate projected greenhouse gas emission reductions as a result of the program but health indicators were not considered (Budya & Arofat, 2011). Table 1 indicates that in comparison to LPG, kerosene contributes three times as much carbon monoxide (CO) emissions and

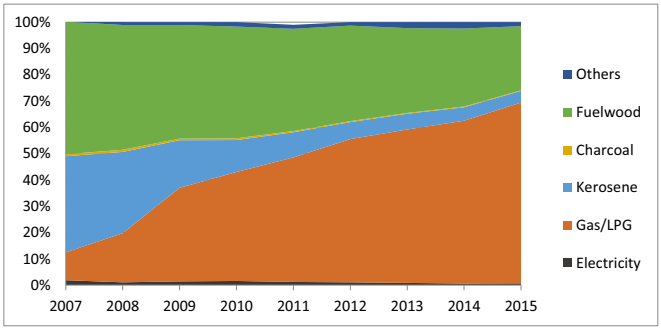


**Fig. 1.** Percentage of households and their primary cooking fuel in Indonesia, 2007–2015. (Source: BPS, 2017)

[1] The IISD Global Subsidy Initiative supports international processes, national governments and civil society organizations to align subsidies with sustainable development. See http://www.iisd.org/gsi/.

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