



POLICY BRIEF
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OPPORTUNITIES FOR CLEAN COOKING IN SOUTH EAST ASIA: WHAT CAN WE LEARN FROM THE INDONESIAN FUEL CONVERSION PROGRAMME?

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KEY MESSAGES

- The Indonesian kerosene to LPG program demonstrates that large-scale household energy transition can be implemented rapidly and maintained over time.
- Focusing on primary domestic fuel usage ignores the reality that the majority of people use more than one fuel at home. Such 'fuel stacking' can hide solid fuel use with corresponding negative health impacts.
- To better capture solid fuel use national surveys should include questions on secondary fuel use and be harmonised across countries.
- Energy departments should take greater responsibility for the impacts of HAP while Health Departments should be encouraged to monitor and make publicly available existing health data that may be attributed to HAP.
- Financial inclusion and consumer affordability of clean fuels should be a priority.

Photo credit: Reuters/Crack Palinggi
Taken from <http://www.atimes.com/article/empty-barrels-mounting-indonesia>

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1. INTRODUCTION

Household Air Pollution (HAP) is a leading risk factor for mortality and ill health in most Southeast (SE) Asian countries. Between 2007-2012 Indonesia carried out one of the largest household energy transition initiatives globally, with over 50 million households, approximately two thirds of all households in Indonesia, gaining access to LPG for cooking in five years^a.

This brief summarises the negative impact of HAP in SE Asia and reviews opportunities to address this, primarily considering what can be learnt from the Indonesian fuel conversion experience, but also highlighting other regional examples. Domestic energy decisions are considered in terms of addressing the enabling environment, fuel accessibility and affordability.

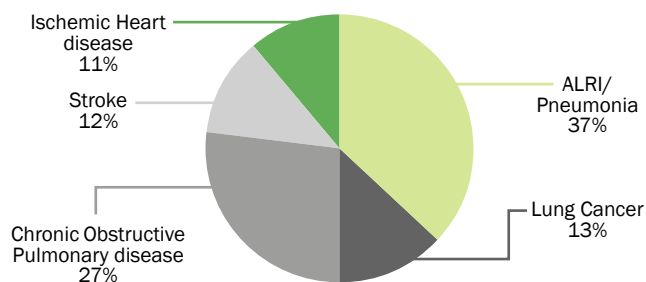
2. A HIDDEN HEALTH CRISIS?

Where air pollution has been considered in terms of public health, the focus has tended to be on outdoor or Ambient Air Pollution (AAP). This is partly because it is easier to monitor outdoor concentrations of air pollutants while HAP studies, requiring personal exposure monitoring, can be time-intensive and costly to carry out. Few SE Asian countries have such studies. However, as Figure 1 illustrates, in half of the countries looked at in SE Asia, HAP is estimated to contribute to more deaths than AAP.

In 2016, between 2.2 and 3.6 million people globally were estimated to die prematurely from HAP^b. In SE Asia, 215,000 deaths (5.3% of all deaths) were attributable to HAP in the same year, with some countries being more affected than others - up to 12.3% and 11% of deaths in Laos PDR and Cambodia

respectively (see Figure 3). The deaths, a result of the diseases illustrated in Figure 2, may also often not be attributed to HAP because it is not the only cause of those diseases where health impacts are incremental, in contrast to communicable diseases such as Dengue.

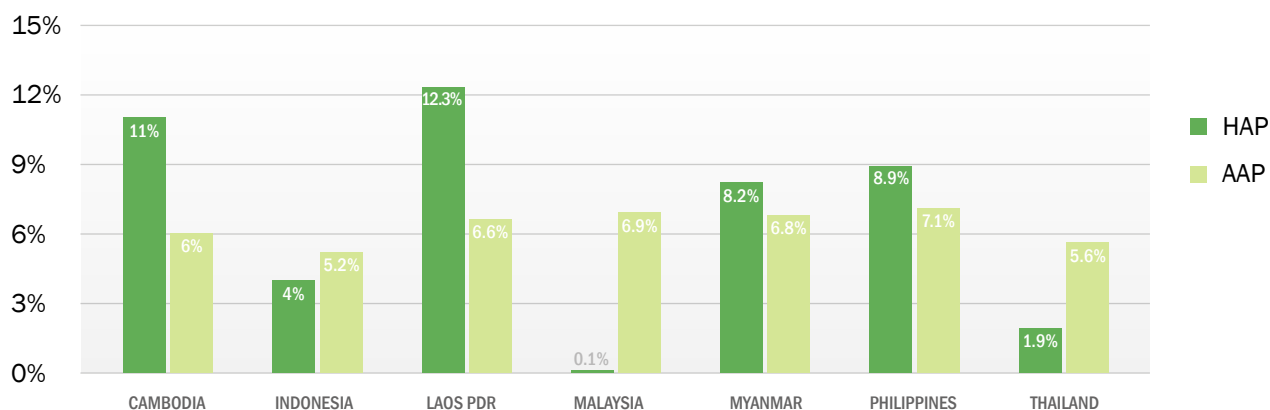
Figure 2. Deaths attributable to HAP by disease in 2016



SOURCE: IHME GBD, 2016^b

Domestic fuel burning is estimated to contribute approximately 19% to AAP in SE Asia^c. Added to this, but as yet not quantified due to lack of sufficient research and weaker evidence, are deaths and disease from HAP as a result of heating and lighting. The negative health impacts are a result of exposure to health-damaging pollutants (primarily fine particulate matter PM_{2.5} and carbon monoxide, CO) and depend on the stove/fuel combination used and ventilation of the cooking area. The table below highlights the relative health-damaging pollutant emissions of various fuels for a standard meal.

Figure 1. Burden of disease from Ambient Air Pollution (AAP) and Household Air Pollution (HAP) in selected South East Asian countries (% of deaths), 2016



SOURCE: IHME GBD, 2016^b

Table 1. Relative health-damaging pollutant emissions of various fuels in comparison to LPG for one meal (g/MJ-d)

Emissions	Biogas	LPG	Kerosene	Wood Residues	Crop
Carbon Monoxide (CO)	0.1	1	3	19	60
Particulate Matter -PM	2.5	1	1.3	26	124

SOURCE: SMITH, ROGERS & COWLIN, 2005⁹

CONTRIBUTION TO CLIMATE CHANGE

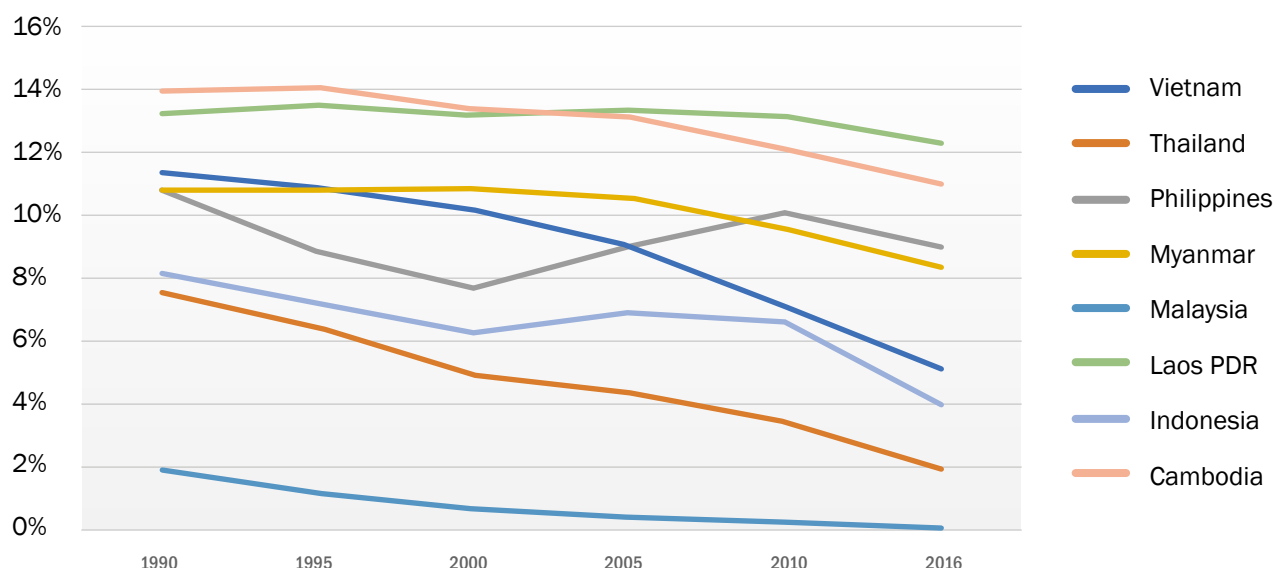
In addition, household combustion produces short-lived climate pollutants (SLCPs) - black carbon (BC), organic carbon, sulphur dioxide, nitrogen oxide and non-methane volatile organic compound. Household combustion is estimated to produce 25% of global emissions of BC, a major component of particulate matter^e. BC is one of the largest contributors to climate change after carbon dioxide (CO₂). Countries are being encouraged to consider reducing SLCP emissions as part of their climate change action plans.

3. HOW PREVALENT IS SOLID FUEL USE FOR COOKING?

Solid fuels include biomass fuels (i.e. firewood, charcoal, dung and crop residues) as well as coal. While the trend with modern energy systems has been that people are moving away from cooking with solid fuels, usage remains high in rural areas and in informal settlements of rapidly urbanising areas. Figure 4 shows that even in an Upper Middle-Income Country such as Thailand, 23% of the population was estimated to use solid fuels as their primary cooking fuel in 2013. This is 39% in Indonesia, rising to approximately half the population in the Philippines and Vietnam, and well over 80% of the populations of Cambodia, Lao PDR and Myanmar in the same year.

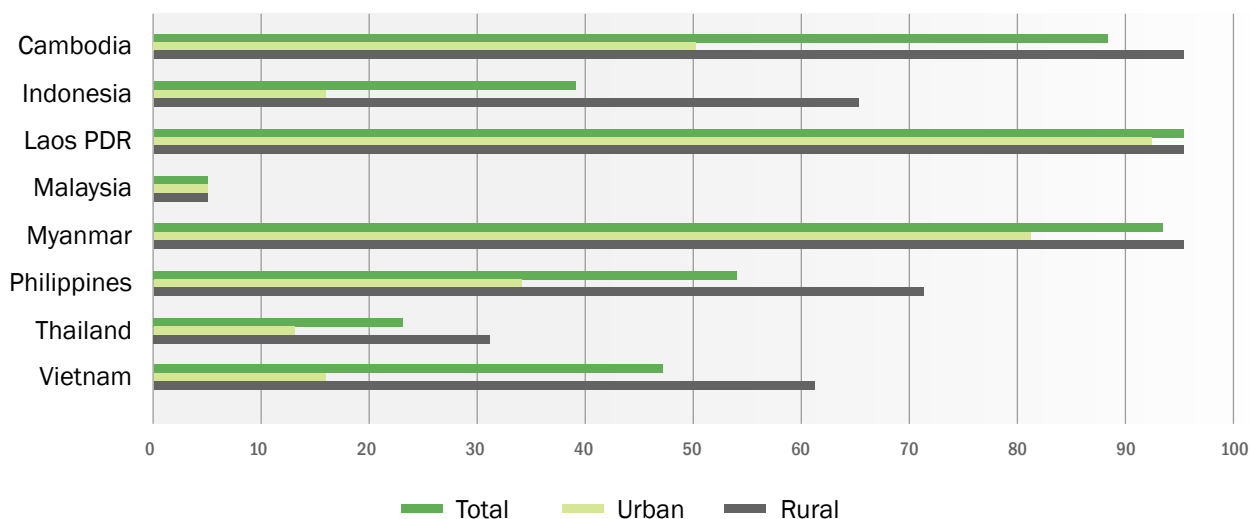
Fuel stacking, or the side by side use of different stoves and cooking fuels, is also common practice globally, but is often overlooked, as surveys and statistical data tend to capture only primary fuel usage. Secondary fuel usage and the consequent health impacts are therefore often missed.

Figure 3. Percentage of deaths attributable to HAP in select Southeast Asian countries, (1990-2016)



SOURCE: IHME GBD, 2016^b (based on primary fuel use data)

Figure 4. Percentage of Population Using Solid Fuel as Primary Cooking Fuel in Select Southeast Asian Countries (2013)



SOURCE: WORLD HEALTH ORGANISATION GLOBAL HEALTH OBSERVATORY, 2013¹

The largest reductions in HAP are achieved by switching from solid fuels to clean and more efficient fuels and energy technologies, such as liquefied petroleum gas (LPG), biofuels, solar, natural gas and electricity. Exposure can also be reduced through

considering kitchen and household ventilation, but these improvements alone are not sufficient if households continue to rely on polluting solid fuels, Young children, women (as the main cooks) and the elderly tend to be most affected.



BOX 1: GROWING AWARENESS OF THE IMPACTS OF HOUSEHOLD AIR POLLUTION - INTERNATIONAL POLICY DEVELOPMENTS

In 2014, for the first time, the World Health Organisation issued guidance on acceptable levels for fine particulate matter (PM_{2.5}) and carbon monoxide (CO) emissions from household energy sources in *Guidelines for Indoor Air Quality: Household Fuel Combustion*. These set health-based emission targets for fuel and stove combinations, they recommend against the household use of unprocessed coal and kerosene, and support greater access to clean fuels (such as electricity, liquefied petroleum gas (LPG), biogas and ethanol) and optimal interim technologies.

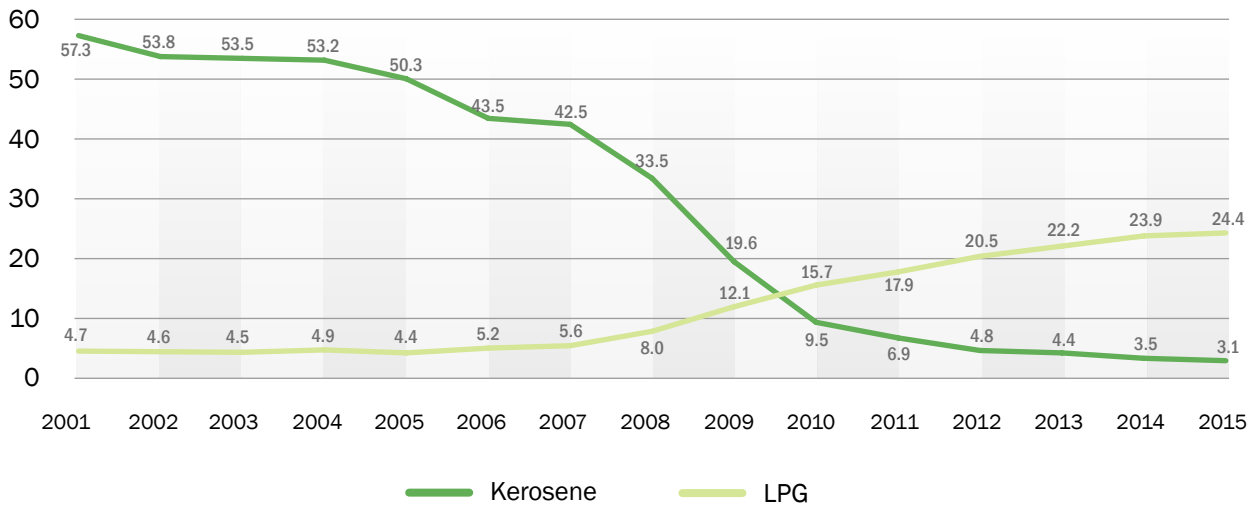
In May 2015, the World Health Assembly (WHA) adopted a resolution on air pollution and health, calling for an enhanced global response to the adverse health effects of indoor and outdoor air pollution. One key activity is the development of a Clean Household Energy Toolkit (CHEST), which will bring together evidence and recommendations found in the latest WHO Indoor Air Quality Guidelines to policy-makers and health professionals. See: <http://www.who.int/airpollution/household/chest/en/>

4. WHAT ISSUES DOES INDONESIA'S EXPERIENCE OF FUEL SWITCHING HIGHLIGHT?

The Indonesian kerosene to LPG program (*Zero Kero Program*) is one of the largest household energy transition initiatives to have been carried out globally. Over 50 million households – approximately two thirds of all households in Indonesia – gained access to LPG for cooking in the five years between 2007-2012. By

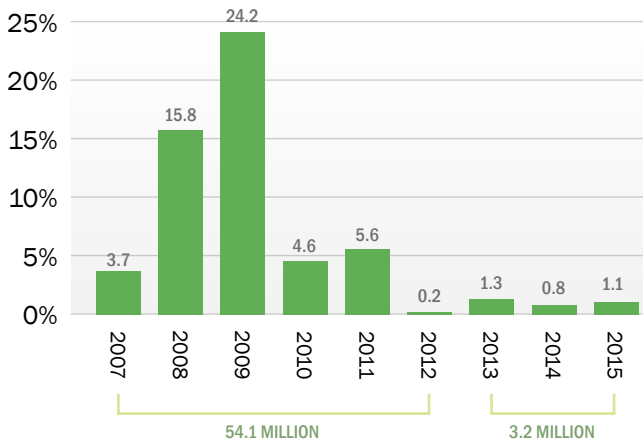
2015, 57 million “packages” had been distributed. Over this time there was a fivefold increase in LPG consumption from 4.7 Kg/capita in 2007 to 24.4 Kg/capita in 2015 (comparable to penetration rates similar to those of mature LPG markets such as Brazil, with a market of 25.5 Kg/capita in 2014) and a concomitant decrease of kerosene use by 92%^a. This demonstrates significant change in a very short time frame is possible.

Figure 5. Indonesian Kerosene and LPG Consumption (kg/capita), 2001-2015



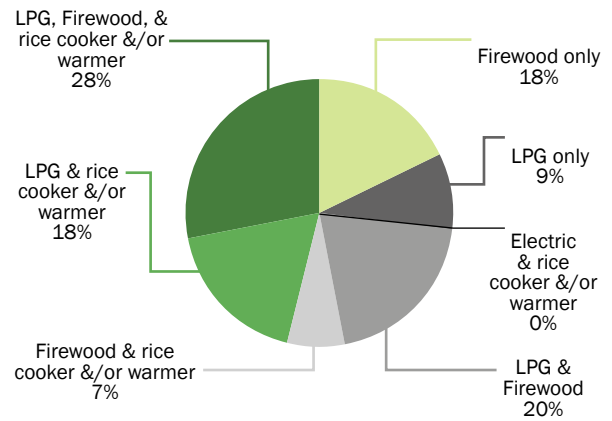
SOURCE: THODAY ET AL., 2018^a

Figure 6. Number of free LPG starter kits distributed from 2007 to 2015 as part of the Zero Kero program



SOURCE: INDONESIA MINISTRY ENERGY & MINERAL RESOURCES, 2016^b

Figure 7. Percentage of fuel stacking in peri-urban Yogyakarta City (2013)



SOURCE: DURIX ET AL., 2016^c

In terms of the Government's stated objectives, the program was successful in transitioning households from kerosene to LPG. However, while primary use of firewood is recorded as having halved over the same period, this underestimates the continued practice of fuel stacking.

A 2013 study conducted in peri-urban Yogyakarta, showed that only 27% of the surveyed households used a single fuel for all their cooking needs^h. The rest used a mix of LPG, firewood and/or electricity (e.g. rice cooker or warmer) for cooking, warming food and boiling water (see Figure 7). The majority continued to use firewood (a polluting fuel) generally the preferred means of boiling water.

I. CREATING A STRONG ENABLING ENVIRONMENT

The national scale of the conversion in Indonesia allowed it to realize substantial economies of scale in LPG infrastructure investments (bulk storage, filling plants, transportation and cylinder inventory). Strong government leadership from the Vice President's office also provided for an effective enabling environment and regulation of an affordable and accessible fuel supply. The table below shows the different functions required by the program and which institutions carried these out.

Table 2: Functions and Institutional Actors involved in Indonesian Fuel Conversion Program

Functions	Institutional Actors
Political instigator	National team for Poverty Alleviation (TNP2K) under the Vice President's office
Coordination	Ministry of Energy and Mineral Resources (MEMR)
Budget	Ministry of Finance
Procurement of cylinders	Ministry of Industry
Procurement of stoves	Ministry of Small and Medium Enterprise
Withdrawal of kerosene	Oil and Gas Regulatory Agency
Transfer of professions in kerosene trading business	Ministry of Social Affairs
Socialisation/communication	Ministry of Women Empowerment
Licensing LPG distributors to ensure regular supply	
Regulating LPG retail price (to accommodate additional costs for transportation)	Provincial Governments
Targeting households for conversion	
LPG supply and distribution	National Oil Company - Pertamina

SOURCE: INDONESIA MINISTRY ENERGY & MINERAL RESOURCES, 2007¹¹

Regulations included strengthening the already practiced LPG 'cylinder re-circulation model', where empty cylinders are exchanged by customers for filled ones and cylinder liability is responsibility of the LPG marketing companies. This is considered the safest and most sustainable LPG market model, used by many developed and developing countries worldwide. It gives the LPG company or marketer ownership and responsibility for its own distribution network and cylinder brands, discouraging illegal and unsafe practices such as micro-filling¹.



FOR CONSIDERATION A strong enabling environment and properly enforced laws and regulations are needed to coordinate investments and interventions for a sustainable and safe LPG market where the practice of illegal cylinder refilling is prosecuted. Safety considerations should be at the heart of any cleaner fuels and/or cookstove interventions, accompanied by user education and maintenance services.



BOX 2: FIVE PRINCIPLES FOR RAPID AND SUSTAINABLE LPG MARKET DEVELOPMENT

1. Implement and rigorously enforce effective, self-consistent LPG market rules, with central emphasis on property rights protection of marketer-owned LPG cylinders, and on public safety.
2. Ensure stability and continuity of the LPG fuel supply in all regions to be served.
3. Implement stable, market-sustaining and market-stimulating policies.
4. Ensure high LPG retail density.
5. Develop a consensus-based national master-plan for coordinated LPG investments and interventions.

SOURCE: GLOBAL LPG PARTNERSHIP (2015)⁷

II. ADDRESSING ACCESSIBILITY AND CREATING RELIABLE SUPPLY CHAINS

The LPG transition in Indonesia was undertaken using a phased approach with the government focusing initially on highly populated areas. Only now, when supply chains are established, are remoter and more sparsely populated regions being addressed. A reason for the success of the Indonesian program was that kerosene was taken out of circulation in conversion areas, while speed was achieved through converting existing agents and retailers from kerosene to LPG, meaning new supply chains did not have to be

established. An example of new supply chains being stimulated at the sub-national level is given below (See Box 3).



FOR CONSIDERATION Managing supply and demand of new fuels and cookstoves requires appropriate consumer targeting and engaging with retailers to establish local markets. Focusing on whole community transitions can help to increase market share while measuring job creation can make potential economic benefits more transparent.



BOX 3: DEVELOPING PARTNERSHIPS TO STIMULATE CLEAN FUEL SUPPLY CHAINS IN ILOILO CITY, PHILIPPINES.

The team at the Iloilo City Environment and Natural Resources Office working with local universities in 2015 were surprised to find high levels of household charcoal use. They identified this as a key cause of air pollution affecting local residents. As a local Government, they began raising awareness on adverse health impacts of charcoal use among the local population, but realised that to effect change they should also stimulate uptake of cleaner fuel options.

As part of the Cities for Clean Air Certification Scheme, the NGO Clean Air Asia facilitated the development of a partnership with an LPG provider, Pascal Resources Energy Inc., the social enterprise arm of PR Gaz Inc. While the City Government did not promote Pascal Resources Energy over other companies or clean fuel options, they were able to help the company identify which areas should be targeted and assist with establishing its supply chain infrastructure. In addition, they developed loan options with two local microfinance institutions – Taytay sa Kauswagan Inc. and Negros Women for Tomorrow – to address financial barriers and help make it affordable for residents to make the switch.

Product-related safety issues have been addressed through coordination with the Bureau of Fire Protection and working with the City Council to pass a local ordinance banning the illegal re-filling of LPG canisters. In seeking to stimulate clean fuel supply chains, 30,000 homes in Iloilo are expected to gain access to clean cooking fuel in 2018.



III. ADDRESSING CONSUMER AFFORDABILITY

A key factor contributing to the success of the Indonesian conversion program is that LPG, in terms of equivalent energy value, was cheaper to purchase than kerosene. The Government also addressed household conversion costs by providing free LPG equipment starter kits (single burner, 3 kg filled cylinder, rubber hose and regulator). However, as the program focused on kerosene-to-LPG conversion, there was a missed opportunity to address concurrent use of biomass, which many households could collect free of cost. This oversight led to a significant amount of continued fuel stacking. Both Indonesia and Malaysia also provide energy subsidies to citizens to maintain a low price (see Box 4).



FOR CONSIDERATION Promoting adoption of a costed clean fuel from freely available biomass fuels needs to take into account mechanisms to overcome the cost barrier for the very poor. When neither fuel subsidies nor consumer financing are in place to help these vulnerable segments of the population, then the focus of policy should also be on promoting the best available improved biomass cookstoves and improved household ventilation. There may also be further opportunity to develop hybrid options that perhaps combine the renewability of solar with the efficiency and cleanliness of LPG.



BOX 4 - THE MALAYSIAN EXPERIENCE WITH LPG: FROM “FUEL FOR THE ELITE” TO “FUEL FOR THE MASSES”

Unlike many Southeast Asian countries, Malaysia has low mortality and morbidity figures for HAP. Over 95% of the population in both urban and rural areas has access to either LPG or natural gas for cooking. As of 2016, the LPG per capita consumption for the cooking sector is 19.6 kg/capita.

Arguably one of the main factors contributing to the mass use of clean fuel is that Malaysia remains a net exporter of oil and gas, managed by the Government-owned Petronas (National Petroleum Ltd) company. Malaysia capitalised on these national energy resources by addressing:

- **Affordability** – Marketing and distribution is regulated, and price stability provided for with an automatic price mechanism. The pricing mechanism maintains a low retail price with the Government making up the difference between the retail price and actual market price through exemption from sales tax and subsidies.
- **Accessibility** – Transport infrastructure improvements (in particular, the creation of a North South Highway) allowing for fuel distribution throughout the peninsula.

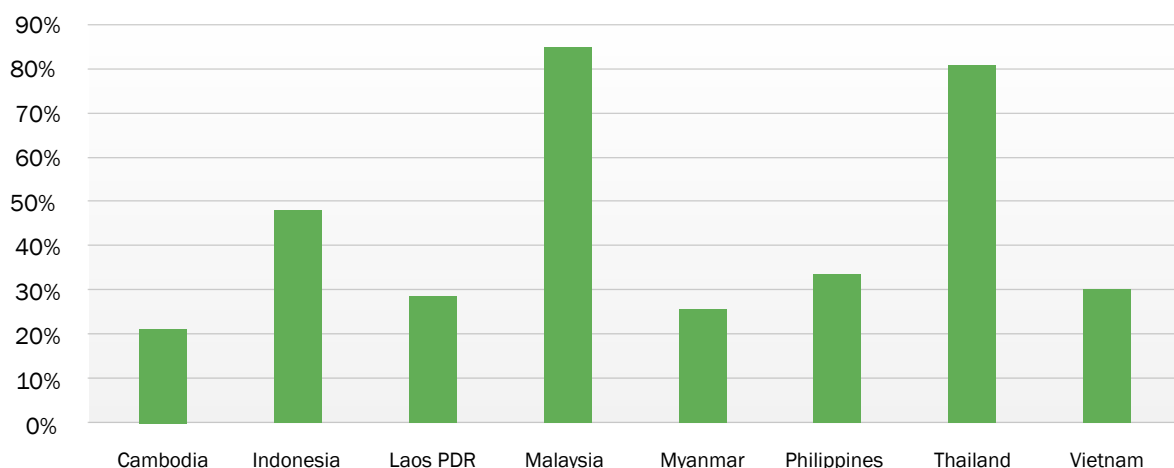
IV. THE ROLE OF HOUSEHOLD ENERGY SUBSIDIES

Household energy subsidies have tended to be provided in countries which are (or have been) net energy exporters but can often be inefficient. Indonesia is a case in point: with declining oil production and growing energy demands, the cost of Government energy subsidies has continued to rise relative to actual fuel cost^l. Another challenge with subsidies is if the fuel is subsidised for households but not subsidised in other sectors, there is likely to be leakage, with those looking to profit from selling the cheaper subsidised fuel into other sectors or markets. For example, it is estimated that losses due to smuggling LPG out of Malaysia account for MYR10 million (US\$3.1 million) a year^m.

Universal energy subsidies often disproportionately benefit wealthier householdsⁿ. International experience shows that only about 8% of all energy

subsidies reach the poorest and that LPG subsidies can be even more regressive, with only 4% reaching the lowest income quintile^o. Targeting subsidies requires a demographic database and financial inclusion policies. Access to a bank or mobile banking account remains under 40% for most SE Asian countries (see Figure 8). While the Indonesian Government agreed that, from 2018 it would target energy subsidies at the poorest 40%, it faces a challenge in registering beneficiaries in line with this time-frame. India, by comparison, has been aggressively pursuing a national universal ID system through the ‘Aadhaar’ card and linking this to welfare, including direct energy payments. It should be of interest for SE Asian countries to both learn from and compare progress with other countries that are further ahead in taking such an approach.

Figure 8: Percentage of Population with Account Ownership at a Financial Institution or with a Mobile-Money-Service Provider (2017)



SOURCE: WORLD BANK DEVELOPMENT INDICATORS FINANCIAL INCLUSION, 2017⁹



FOR CONSIDERATION Energy subsidies can often be inefficient. Financial inclusion should be a priority if energy subsidies are to be targeted at those who really need them, and to make fuel transition programs more affordable.

5. CONSIDERING HEALTH AND THE ENVIRONMENT IN DOMESTIC ENERGY CHOICES

Energy choices are generally informed by considerations of security of supply and cost. The need to address climate change has meant that countries are now also looking to reduce their reliance on non-renewable sources of energy. Health has rarely been a factor in energy policy and was not considered in Indonesia's program. However, based on the reductions in kerosene and increase in LPG use, a study estimated that short-lived climate pollutants (as well as PM_{2.5} and CO) would have been reduced by 55%, potentially leading to significant health gains.

The main driver for the conversion in Indonesia was the existing kerosene subsidy, which represented an opportunity cost to the Government. However,

the health and environmental impacts of using solid fuel are also an opportunity cost (measured by the World Bank as Particulate Emission Damage to Gross National Income) that are often overlooked or treated separately. Energy departments should take greater responsibility for the implications of HAP, while Health Departments should be encouraged to monitor and make publicly available existing health data that may be attributed to HAP. Government leadership with effective public engagement can drive momentum for change.



AWARENESS RAISING RESOURCES

This [video](https://youtu.be/didCYcvBVV4) (https://youtu.be/didCYcvBVV4) was developed by the World LPG Association. It is useful at explaining the negative impacts of household air pollution, focusing on LPG as a solution.

The BreatheLife Campaign (a partnership between WHO, UN Environment and the Climate and Clean Air Coalition) - <http://breathelife2030.org/> - supports awareness raising and action on the health impacts of air pollution.

CITATIONS

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