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Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Providing cleaner energy access in Indonesia through the megaproject of kerosene conversion to LPG

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ARTICLE INFO

Article history:

Received 1 December 2010

Accepted 12 February 2011

Available online 8 April 2011

Keywords:

Cooking fuels

LPG

Fuel switching

ABSTRACT

In 2007 Indonesia undertook a massive energy program to convert its primary cooking fuel from kerosene to LPG in more than 50 million households. This megaproject, to be completed in late 2011, provided an improved household cooking fuel, with its associated benefits in user costs, cleanliness, convenience, and environment, and reduced the government's huge subsidy for petroleum fuels. Presented from the perspective of Pertamina, Indonesia's sole NOC, and the program implementer, this paper describes the background of the fuels situation, the planning stages, including the preparatory analytical work, targeted market surveys and tests, and the subsequent building of the financial, technical, and institutional models for carrying out the program on an expeditious schedule. It presents the project's major execution steps, results of the program to date, and the unique institutional roles of each party, including the activities and benefits for the government, Pertamina, the public, the industry, and the crucial agents in the fuel supply chains. Finally there is a retrospective policy analysis and a discussion of key factors and challenges in the execution of Indonesia's largest-ever energy initiative to provide improved cooking fuel.

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1. Introduction

1.1. The situation before the program of kerosene conversion to LPG

Kerosene, the main fuel for households and transportation, has been subsidized for decades by the Government of Indonesia (GOI) (Said, 2000). However, because of the increase in population and oil price, this subsidy has become a huge burden for the government. Table 1 shows that the subsidies from 2001 to 2008 were very great, ranging from 9% to 18% of total state expenditures. Compared to total GDP, the petroleum fuels subsidy ranged from 1.9% to 3.7%. These subsidies peaked in 2008 when the price situation gave additional momentum to the program and an opportunity to test its benefits.

Furthermore, the subsidy for kerosene became the largest contributor among the petroleum products (Fig. 1). In 2006 and 2007 before the conversion program was launched, the subsidy for kerosene was 57% and 48%, respectively, of the state's total petroleum product subsidy. Meanwhile, the policy to reduce the petroleum fuel subsidy by increasing the kerosene price became an increasingly sensitive social issue with a potential to disturb state stability. In summary, modern Indonesia is highly dependent on petroleum fuels, including kerosene, and for many years these fuels have been a huge burden on the state budget. Indeed,

elimination of energy subsidies has been one of the most crucial economic and social problems facing Indonesia (Foell, 2004).

Reacting to this heavy burden of subsidy, government and parliament agreed early this decade to initiate attempts to reduce petroleum fuel subsidies. Initial focus was on industrial fuels, since this sector had the highest capacity to react efficiently to higher prices. This program had considerable success, particularly in years after 2005, when subsidies for diesel, industrial diesel oil (IDO), and marine fuel oil (MFO) were greatly reduced by pricing them at international prices (Singapore spot market—Mid Oil Platts Singapore). There is now open market competition with four big players: Pertamina, AKR, Shell, and Medco.

One negative impact of subsidy removal was price disparity between economic prices for industry and subsidized prices, mainly for the kerosene that was primarily intended for the household sector. This price disparity increasingly triggered unintended misuse of subsidized fuel, e.g., industry mixing it for use in industry or smugglers exporting it and reselling at a much higher price. This negative impact is a major incentive for the government to develop initiatives for reducing oil consumption and, more specifically, to establish the *Kerosene Conversion to LPG Program* as one of its biggest efforts.

1.2. Subsidy and the demand for kerosene

Based on 2004 data from the National Statistics Office (Badan Pusat Statistik, 2004), kerosene is consumed by 48 of 52 million

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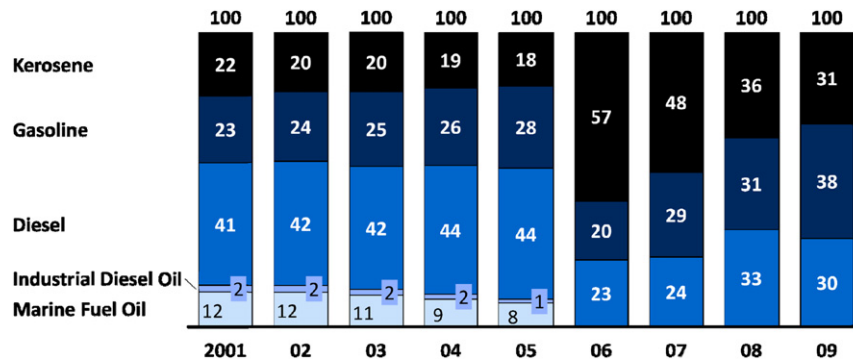
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Table 1

Portion of total petroleum subsidy in state and GDP, years 2001–2009.

Source: Fiscal policy agency, Pertamina analysis.

Subsidy item	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fuel subsidy (billion USD)	6.1	3.1	6.1	7.5	9.4	6.3	8.2	13.6	5.3
State expenditure (billion USD)	33.5	34.8	44.7	48.0	52.5	72.8	82.9	101.7	94.4
Fuel subsidy relative to total state expenditure (%)	18	9	14	16	18	9	10	13	6
GDP value (billion USD)	165.0	160.5	195.6	234.8	256.8	285.9	364.6	431.9	510.7
Fuel subsidy relative to GDP (%)	3.7	1.9	3.1	3.2	3.6	2.2	2.3	3.2	1.0

**Fig. 1.** Percentage of individual fuel subsidies in total petroleum fuel subsidy, 2001–2008.

Source: Fiscal Policy Agency, Pertamina.

households. The majority of Indonesians use subsidized petroleum, depend heavily on it, and have used kerosene in the household for many decades. The majority are housewives using it for daily cooking. Most have a low-to-medium income, under USD 150 per month. In addition, a much smaller portion of kerosene is used as lighting fuel by households, fishermen, and small industries.

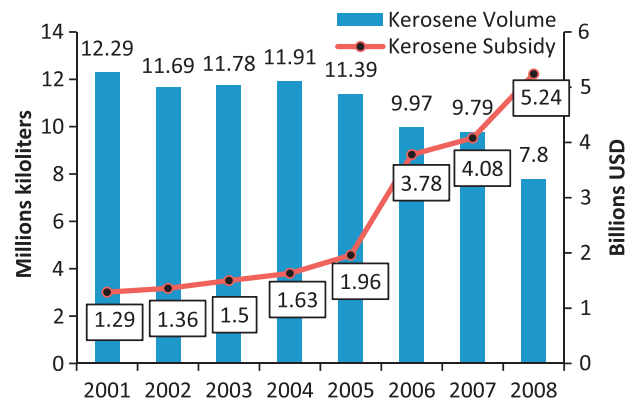
From government's perspective, fuel subsidy has a very big role in the state budget. Fig. 2 shows a greatly increased kerosene subsidy from 2001 to 2006, despite the parliamentary-imposed quota on the volume of usage. The main factor in this increase was the trend of increase in petroleum prices. The huge subsidy provided a strong incentive for establishment of the kerosene conversion program to significantly reduce the petroleum subsidy. In fact, in 2007 and 2008 when the program began, the volume was decreased drastically but the subsidy still increased because of increase in international oil price. This volume decrease continued in 2009, as explained in Section 4.

1.3. Why was LPG chosen as the conversion fuel

LPG was selected for the following reasons:

- (1) Replacing kerosene with LPG as primary household cooking fuel would greatly reduce the fuel subsidy. Based on the end-use calorific value of energy delivered for cooking, and the subsidy per unit of fuel, the LPG subsidy is significantly lower than that of kerosene. The parameters in the table below show that based on end-use "energy equivalence", 1 l of kerosene equals 0.57 kg of LPG (Table 2).

However, research by Universitas Trisakti (University of Trinity) in Jakarta and the State Ministry for Women's Empowerment, including laboratory experiments under various cooking conditions, indicated that usage of 1 l of kerosene equals 0.39 kg LPG. Because of the high credibility of the laboratory, which made these measurements, this energy equivalence value was used by Pertamina in its design and analysis of the kerosene conversion program. When one takes

**Fig. 2.** Subsidized kerosene volume and its subsidy, years 2001–2008.

Source: Pertamina analysis.

Table 2

End-use energy equivalence between kerosene and LPG.

Source: Pertamina analysis.

Description	Kerosene	LPG
1 Density	0.81	0.56
2 Calorific value (Kcal/kg)	10,478.95	11,254.61
3 Calorific value (Kcal/l)	8487.95	6302.58
4 Assumed apparatus efficiency (cooking stove) (%)	40	53
5 Effective calorific value/l (3 × 4)	3395.18	3340.37
6 Energy equivalence of 3395.18 Kcal	1 l	1.02 l
7 Energy equivalence of 3395.18 Kcal	1 l	0.5745 kg
8 Energy equivalence of 3395.18 Kcal	1.74 l	1 kg

into account the "misuse" of subsidized kerosene, i.e., for non-household purposes such as industrial fuel mixing, the effective equivalence value of kerosene would likely be even lower (see Section 4.2.1). This 0.39 kg value is used in the subsidy calculations below (Table 3) where the annual subsidy saving is shown for 2006, the year before the program was initiated. Based on the year 2006 calculation, the savings

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