CHALLENGES AND OPPORTUNITIES OF CLEAN COOKING PROGRAM IN INDONESIA: THE JOURNEY TO NET ZERO EMISSION

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Overview

The kerosene to LPG conversion program is changing the fuel composition of Indonesian households in cooking activities [1,2]. However, the program also strained the Indonesian government's budget with increased subsidies for LPG. In the 2019 Indonesian National Budget, the LPG subsidy is estimated to be over $ 4.9 billion [3]. Since LPG is a refined product of crude oil, the subsidy amount for the subsidized LPG fluctuates due to the uncertainty of global crude oil prices [1]. At the same time, Indonesia also faced a surplus of generating capacity. PLN (Perusahaan Listrik Negara as Indonesia's National Power Corporation) is currently constructing a large number of power plants with a total output of up to 35,000 MW [4,5]. The increased power plant capacity led to the increasing reserve margin in the power system that is underutilized [4–6]. In 2021, the Indonesian government introduced the induction cooking conversion program from LPG to induction stove to reduce the LPG subsidy while also utilizing the excess generation capacity [7,8]. The induction stove program is led by the Ministry of Energy and Mineral Resources (MEMR) of Indonesia. Through the program, induction stoves will replace the LPG stove in 8.2 million households by 2025, 18.2 million households by 2030, 28.2 million households by 2035[9].

Methods

This research aims to determine the economic valuation and policy implication of induction stoves compared to LPG stoves for each electricity tariff. In a way to address the research objective, this study applied descriptive analysis and economic valuation methodology. The economic assessment was performed by comparing the cost of cooking an induction stove and an LPG stove to determine the cost-saving. The efficiency assumption of the induction stove in this assessment is based on the reference from [10]. In reference [10], the PLN Research Institute performed an efficiency study and cooking time experiment using two different types of stoves, i.e., LPG stove and induction stove. The experiment carried out in this research is to boil 1 liter of water until it reaches the boiling point (100°C), however different electricity class and tariff is applied through different scenarios. The experiment used induction stoves with various rated power (300 W, 500 W, and 1,800 W) and a gas stove. The water is placed on a ferromagnetic pan if the experiment used an induction stove, and on an aluminum pan if the experiment used a gas stove. This study uses the LPG price assumption of $ 1.52/3kg for subsidized LPG, and $ 3.14/3kg for non-subsidized LPG based on [10].The experiment is performed with three types of electricity tariff applied, which is [10]:

a. Electricity tariff with the subsidy of $ 0.028/kWh for 450 VA and $ 0.042/kWh for 900 VA household
b. Electricity tariff non-subsidy of $ 0.094/kWh for 900 VA household
c. Electricity tariff non-subsidy of $ 0.101/kWh for 1,300 VA and 2,200 VA

The economic assessment in this study is divided into two scenarios. The first scenario calculates cooking cost savings made by households by comparing the cost of cooking using induction stove subsidized tariffs ($ 0.042/kWh) with LPG stove subsidized tariff ($ 1.52/3kg cylinder at the retail point). The second scenario calculates cooking cost savings made by households by comparing the cooking cost of induction stove with unsubsidized electricity tariffs ($ 0.101/kWh) and unsubsidized LPG tariffs ($ 3.14/3kg cylinder at the retail point). For the first scenario, we conduct a sub comparison of 3 different induction stove capacities (scenario 1A, 1B, and 1C).

Results

In scenario 1A, it is assumed that the induction stove used is a low-efficiency stove, i.e., a 300-Watt induction stove. Based on the financial calculation, there was a saving in cooking costs per month with a total of up to $ 0.58/ month for the 12 kg LPG/month usage pattern. If there is a scarcity of subsidized LPG then the savings in cooking costs also increase up to $ 5.66/month.

The 1B scenario calculates cooking cost savings made by households by comparing the cost of cooking induction stove subsidized tariff (500-Watt stove at electricity tariff of $ 0.042/ kWh) with LPG stove subsidized tariff ($ 1.52/3kg cylinder at the retail point). Based on the calculations, there was a saving in cooking cost per month of $

1.36/month for the 12 kg LPG/month usage pattern. If there is a scarcity of subsidized LPG cylinders in the market the cooking cost savings will also increase to $ 6.44/month.

The 1C scenario assumes that households that receive subsidized electricity tariffs can increase the installed electricity capacity through an uprating program to use high-efficiency induction stoves such as the 1,800-Watt induction stove. Based on the cost-saving calculation, there is a saving in cooking cost per month of $ 2.09/month for the 12 kg LPG/month usage pattern. If there is a scarcity of LPG cylinders in the market, the saving in cooking cost also increases up to $ 7.18/month. This third scenario has an economic saving that is more than three times greater than the first scenario.

The second scenario calculates the cost-saving that can be made for middle and high-income households by comparing the cost of cooking using non-subsidized LPG stoves and (1,800-Watt) induction stoves with non-subsidized electricity tariffs. There is an economic saving in cooking costs of $ 3.04/month compared to the 12 kg LPG/month. From all scenarios presented, it can be observed that the greatest cost savings would occur under the second scenario, where the middle and high-income households change their cooking behavior and migrate the cooking technology from non-subsidized LPG stoves to high-efficiency induction stoves with non-subsidized electricity tariffs.

Conclusions

This study has conducted an economic assessment of induction stoves compared to LPG stoves under various scenarios. The assessment carried out in this study considers various possibilities that can occur in the field.

- For various possible economic scenarios conducted in this study, the application of induction stoves for cooking is more economical when compared to LPG stoves.
- In the existing condition (without electrical installation uprating) for low-income households, the transition of cooking behavior from an LPG (subsidized) stove to a 300-Watt induction stove provides monthly savings per household of $ 0.64. The application of a 500-Watt induction stove provides savings in cooking costs of $ 1.42 per month per household. These scenarios need to consider the availability of low-power induction stoves, in this assessment, the induction stove with the 300-Watt and 500-Watt rates.
- In the existing conditions for the middle-and high-income household group, the cooking cost savings obtained will be even more significant, up to $ 3.04 per month per household. This economic scenario is carried out by considering the use of an 1,800-Watt high-efficiency induction stove.
- Suppose the electrical installation rating for a low-income household is upgraded so that the household can apply a high-efficiency induction stove (1,800-Watt). In that case, the cooking cost-saving gain will increase significantly by $ 2.16 per month per household.
- The economic savings for low-income households will increase significantly if there is a scarcity of 3 kg LPG cylinders in the field

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