

# ***ELECTRICITY SUBSIDY REFORM IN INDONESIA: DEMAND-SIDE EFFECTS ON ELECTRICITY USE***

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## **Overview**

Indonesia, with a population exceeding 258 million people, has recently introduced one of the world's most ambitious programs of electricity subsidy reforms. In this paper we estimate demand-side effects of these reforms on electricity use. Our analysis utilizes a three-dimensional dataset covering six consumer groups, 16 regions, and each year during 1992–2015. We control for multiple dimensions of fixed effects. Our estimates suggest that subsidy reductions since 2013 have induced electricity savings of around 7%. Phasing out remaining subsidies has the potential to generate further improvements in the efficiency of electricity use, while freeing up resources for other priorities.

## **Methods**

We use panel data by consumer group and region for 1992–2015 to estimate the price elasticity of demand for electricity in Indonesia. We use our estimates to quantify the demand-side effects of Indonesia's electricity subsidy reforms on electricity use. Our dataset covers six consumer groups – residences, business, industry, social services, government buildings, and public street lights – and 16 regions.

We use two strategies for dealing with non-price factors – both supply-side and demand-side – that potentially affect electricity use and are potentially correlated with electricity prices. The first is to explicitly control for a set of observed demand-side and supply-side variables. The second is to include multiple dimensions of fixed effects. In our three-dimensional panel we are able to control for factors common to consumer groups in any region (across all years), regions in any year (across all consumer groups), and consumer groups in any year (across all regions). Identification is also aided by the observation that the timing of and motivation for electricity tariff decisions have been largely determined by budgetary and political considerations. The schedule of tariff changes has varied by consumer group.

Before adopting a functional form, we carried out unit root tests on the logs of electricity use, the average electricity price, and gross domestic product per capita. Using aggregate data for Indonesia, Dickey-Fuller tests with linear time trends were unable to reject the nulls that these variables contain unit roots. We consequently employ models in first-differences.

An additional consideration is the potential for small consumer groups and regions to have undue influence over our estimations. To address this possibility, we supplement our main estimates with results using weighted least squares, employing a weight equal to the square root of the number of consumers in each panel unit.

This paper provides the first known estimates of the price elasticity of electricity demand in Indonesia. To our knowledge, it is also the first study for any country to use a three-dimensional panel approach to identify the price elasticity of electricity demand.

## **Results**

Our estimates suggest Indonesia's electricity demand is price inelastic, with a same-year elasticity of around  $-0.2$  and a four-year elasticity of around  $-0.4$ . This is broadly consistent with estimates from other countries.

On the basis of our estimates we calculate that electricity subsidy reforms during 2013–2015 induced demand-side electricity savings of around 7% relative to the counterfactual of no reform. This is a sizeable reduction and is consistent with the observed fact that, despite fast growth in the number of electricity connections, total electricity use grew at only 2.1% in 2015, the slowest rate this century. We estimate that the full removal of electricity subsidies would have induced additional electricity savings of around 6%.

## Conclusions

Indonesia's electricity subsidies have represented a large drain on the national budget. Recent reforms have substantially cut this bill. In addition to improved efficiency of electricity use, Indonesia's electricity subsidy reforms have freed up resources for priorities such as expanding electricity access to undersupplied regions. The reforms have also reduced the risk of electricity outages, as the quantity of electricity demanded is now less likely to exceed available supply. Another effect is a reduction in emissions from the on-grid electricity sector; we estimate that reforms since 2013 averted around 14 million tonnes in annual carbon dioxide emissions as of 2015. Because electricity demand is price inelastic, the reforms increased PLN's revenue from electricity sales. The reforms have boosted the direct incentive for PLN to expand electricity access and improve the quality of electricity supply. Economic theory suggests large reductions in deadweight loss.

Indonesia is establishing itself as an international exemplar in the speed and ambition of electricity subsidy reductions. While progress has not been completely smooth – planned increases in electricity tariffs in 2016 were postponed, for example – the overall reform process has been impressive. The latest step in the reforms is currently underway, with electricity subsidies being removed during the first half of 2017 for households with connections of 450–900 VA (with an exemption for poor households). Further reforms are planned thereafter. It might at some point become possible to remove electricity subsidies for even poor households, turning instead to other means of assistance. Indonesia has a system for targeting transfers to poor households (Bah et al., 2015) that could be used towards this end.

Indonesia considered a carbon tax in a 2009 Green Paper, although the idea has yet to be pursued. One of the ways a carbon tax helps to reduce emissions is via incentivising efficient electricity use. Our finding that the price elasticity of electricity demand in Indonesia is negative suggests this incentivising effect would indeed occur.

In the future there may be opportunities for Indonesia to have lower electricity prices without electricity subsidies. More competition within the wholesale and retail levels of the electricity sector could be one way to achieve this. Boosting grid connections to neighbouring countries might also offer low-cost electricity import opportunities. Ongoing reductions in the cost of solar panels also provide hope for a low-cost electricity future.

Energy subsidy reform is one of the most pressing reform priorities for not only Indonesia, but many other low- and middle-income countries. Indonesia has shown that ambitious reforms can simultaneously deliver increased fiscal space and improved efficiency of resource use.