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Global Kerosene Subsidies: An Obstacle to Energy Efficiency and Development

EVAN MILLS*

Lawrence Berkeley National Laboratory, USA

Summary. — It is widely agreed that energy subsidies impede the efficient functioning of markets. The resulting distortions in prices work at odds with policies to improve energy efficiency and reduce the cost of energy services and associated externalities such as health and environmental damages. The analysis developed in this article finds that kerosene is used in 173 countries, at a cost to consumers of $43.4B/y, $60.3B/y including direct economic subsidies, and $77.2B/y including certain externalities. Despite low world oil prices, direct economic subsidies for kerosene were $18.4B in 2013, and $34.7B including environmental externalities. These values correspond to 72% and 56% of total kerosene costs being passed through to consumers, respectively. When excluding advanced economies, the pass-through values fall to 40% and 35%. Approximately 52% of the global kerosene supply receives direct subsidy, or 63% when externality costs are considered. The cooking end use receives $2.0B/y in direct kerosene subsidies, lighting $7.1B/y, and heating and other residual uses $9.3B/y, or $76 per over all households each year. Defining subsidies at this level of granularity is useful for pinpointing policy issues and opportunities. Promoting a transition to energy efficient off-grid energy services is one of the most cost-effective ways of reducing dependency on subsidies. However, the very presence of subsidies undercuts this process by diluting market price signals and rendering energy efficiency investments less cost-effective, while competing with other social and development-focused budgetary needs. Kerosene subsidies are additionally counterproductive because the emerging technologies they impede (e.g., improved lighting and cook stoves) also improve productivity, safety, and quality of life. Forty-five countries—many in the developing world—have priced kerosene such that there are no direct subsidies, and twenty-two have done so even when accounting for environmental externalities, suggesting the practice is economically and politically feasible.
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Key words — kerosene, subsidies, subsidy reform, lighting, cooking, heating

1. INTRODUCTION

While energy services are a key to quality of life, particularly in developing countries, the cost of energy also fuels poverty. Energy subsidies are typically employed to encourage the use of particular fuels or energy supply technologies, protect consumers from energy price volatility, or provide a safety net for low-income populations. In isolated cases an additional goal is steering users toward less polluting and environmentally damaging alternatives, although the reverse effect has historically been more common due to a diluted price-demand response. Yet, the cost of even subsidized energy used inefficiently can be unaffordable, and underwriting subsidy costs can be a major expense for governments in comparison with other social programs. For these reasons, subsidies can work at cross-purposes to development objectives.

Subsidies arise from differences between actual direct prices paid by consumers and true supply costs including transportation, distribution, retail operations and profits, as well as taxes and a host of indirect un-priced externalities. For oil exporting countries, the direct subsidy is the difference between the domestic consumer prices and the foregone value on the international market plus any uncollected tax revenues resulting from consumer price discounts.

Global subsidies across the entire energy sector (coal, natural gas, petroleum fuels, and electricity) reached $5.3 trillion in 2015, 6.5% of GDP (Coady, Parry, Sears, & Shang, 2017). Excluding externalities and taxes, $333 billion in direct subsidies were awarded in 2015. Petroleum fuels received $1.5 trillion of this total, with $135 billion in direct subsidies, including externalities (down from $220 billion in 2011 when world oil prices were higher). This latter level is also referred to as the "post-tax" price. These Subsidies are also awarded on the supply side. These producer subsidies have been estimated at $45 to $75 billion for 24 OECD member countries (OECD, 2013) and $88 billion annually for the G20 nations (Bast, Doukas, Pickard, Burg, & Whitley, 2015). No comprehensive estimates of global producer subsidies have been identified.

While the conceptual benefits of subsidies are evident, they are also subject to broad-based criticism for failing to efficiently achieve policy goals and for distorting markets. Most subsidies do not reach their intended target audiences (IMF, 2013), thereby amplifying the very inequalities they are intended to reduce. By underwriting inefficient consumption of energy, the economic "savings" in the cost of energy can in fact block technology changes in the direction of improved energy efficiency that would otherwise provide even greater

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long-term value in the form of energy savings and other benefits to consumers (IFC, 2012).

As an indication of their economic scale and significance, in the developing world energy subsidy outlays routinely exceed other government expenditures targeted to essential social functions such as healthcare and education. The increased energy use they induce also work at cross purposes to policy objectives such as improving public health, decongesting roadways, promoting energy efficient vehicles, increasing grid-independent rural electrification, reducing greenhouse-gas emissions, lessening energy import dependence, and ensuring competitive free-market conditions for emerging technologies. Governments are often compelled to relax subsidy reforms due to civil unrest during spikes in world oil prices—just when they are most needed (Baig, Mati, Coady, & Ntamatungiro, 2007).

Concern about energy subsidies has come from many quarters. The International Monetary Fund (IMF) has called on governments to reconsider and reform subsidy practices, as has the Kyoto protocol. The G-20 leaders have recommended subsidy reforms (G-20 Leaders, 2009). The World Bank finds subsidies to be an inefficient means of alleviating poverty in light of the fact that wealthier populations capture most of the benefits by virtue of using most of the energy (World Bank, 2012). The EU's Climate Commissioner has stated that: "Instead of offering unsustainable and environmentally damaging subsidies for fossil fuels, public finance should encourage the development of new industries and businesses that are emerging in the course of the low-carbon transition" (Maclellan, 2013).

The reduction of kerosene subsidies in particular has long been identified as a key need (Reddy, 1981), although past research and policy analysis on subsidies for this particular fuel is scant. More than a decade ago, the United Nations Development Program concluded that there is no effective way of subsidizing kerosene (UNDP, 2003). The omission of kerosene subsidy costs from macro-scale analyses (e.g., Bloomberg New Energy Finance and Lighting Global, 2016) understates the economic burden on nations and potential financial benefits of new technologies that can displace kerosene. Although kerosene use and associated subsidies are a small fraction of global totals, for some countries, kerosene subsidies can be the largest aggregate subsidy awarded to any fossil fuel (Budya & Arofat, 2011). This is due to the large numbers of un-electrified households using the fuel for lighting as well as in meeting goals to substitute biofuels with "modern" and "cleaner" kerosene for cooking. Importantly, the World Health Organization no longer regards kerosene as a "clean fuel" for any purpose, and recommends that governments and practitioners immediately stop promoting its use (WHO, 2016).

Prior efforts have tended to disaggregate subsidies only into broad and highly heterogeneous energy categories (e.g., electricity, petroleum, coal). The overarching original contribution of this article is to isolate kerosene subsidies from other fossil fuels, both globally and by region. This is important, as the geography and magnitude of kerosene subsidies often vary from that of other petroleum products. Country-specific illustrations are provided as well. The analysis is also unique in that it further disaggregates kerosene subsidies into specific end uses (lighting, cooking, and heating/other), and is accompanied with analysis of average and variance in per-household subsidies received. Illustrations are provided as to the anticompetitive effect of subsidies on emerging technologies that can eliminate the need for kerosene. The literature on economic, social, and environmental consequences of kerosene use is summarized for context. Such assessments are useful for policy analysis by helping illuminate the exact distribution of subsidies by types of end user, activity, and technology as well as the societal cost-benefit of technology change. This work substantially expands on a prior study by the author that focused exclusively on kerosene lighting in West Africa (Mills, 2014).

2. MATERIALS AND METHODS

(a) *Kerosene demand and end use allocations*

Energy subsidy price estimation is a function comparing unit prices to actual supply and externality costs, aggregated across population groups or geographies. Such analyses can rely on readily available statistics. Developing more granular estimates that allocate consumption and subsidies to specific fuels, sectors, and end-uses requires more extensive analysis, as these data are rarely available in national statistics.

Kerosene is used in more than 170 countries, and is often among the *primary* sources of energy among poorer populations. Global kerosene use trended around 1800 thousand barrels (kbbl) per day during 1987–2000, dropping by about 40% to ~1000 kbbl/day as of 2013, excluding kerosene for aviation (Figure 1). The decline occurred during a period in which there were growing government admonitions against the use of unvented kerosene heating in industrialized countries, efforts to shift from this "clean" cooking fuel to "cleaner" LPG (Gangopadhyay, Ramaswami, & Wadhwa, 2005; Malla & Timilsina, 2014) in some developing countries, and the inception and rapid market uptake of a new generation of compact, affordable solar lighting systems for off-grid populations (Bloomberg New Energy Finance and Lighting Global, 2016; Mills, 2005).

Compared to the earlier peak demand, kerosene consumption has fallen in every major region. The decline has been most rapid—both in terms of absolute magnitude and rate of decline—in the industrialized world, thereby increasing the relative share of kerosene use in developing countries. During 2000–13, kerosene consumption fell 4.4%/year globally, while, for example, the decline was only 1.3%/year in Africa. These trends stand as an "existence proof" of the potential for transitioning away from kerosene. The underlying drivers of kerosene demand, however, differ widely among countries. Even within the developing world, demand trends vary widely from country to country, perhaps most dramatically illustrated in the cases of India and Indonesia (Figure 2). In both countries demand grew steadily from the mid-1980s to the late 1990s, after which the trends shifted in a downward direction, most likely reflecting the rise of rural electrification and other programs to that helped displace kerosene for illumination and cooking. Indonesia's kerosene demand subsequently declined by 14.9%/year to nearly zero in parallel with a national fuel-substitution program and the suspension of subsidies. During this period, kerosene demand in India declined by 2.8%/year while subsidies continued to prevail. Over this same period kerosene demand in Benin rose by nearly 10.4%/year as subsidies cut consumer prices nearly in half. Similar dramatic shifts can be seen in industrialized countries, e.g., in the United States where kerosene use declined 16.7%/year and in Japan where it declined by 3.5%/year—in both cases likely reflecting efforts to discourage the use of unvented kerosene heaters (increasingly deemed a health hazard) combined with general trends toward improved energy efficiency.

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