Chapter 5

Reforming Energy Subsidies

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1 Introduction

Energy subsidies make for popular policy across the world (Coady et al., 2017, 2019; Min, 2015; Bello, 2022). However, especially in developing countries, they also command a very large share of government spending. Figure 1 shows state expenditures as a share of GDP on energy subsidies compared to other

social protection spending.[1] As the chart shows, although these subsidies are large everywhere, they dwarf other social protection expenditures in lower-middle and low-income countries. Given that governments in these countries have very limited fiscal room to fund social safety nets, the size of these subsidies implicitly comes at the expense of other social protection spending.

[PLACE CHAPTER 05 – FIGURE 1 HERE]

Figure 1: Comparison of social protection spending against energy subsidies for High Income, Upper Middle, Lower Middle, and Low Income Countries. Modified from World Bank (2022).[2]

The prevalence of energy subsidies is surprising in part because of the widespread policy criticism they consistently attract. Not only is it expensive for the state to lower household energy bills, doing so is also typically regressive. In addition, cheap power risks hampering economic growth by distorting consumption choices, increasing deadweight loss, and inducing the

[1] The definition of social protection expenditures in this context — based on the World Bank's ASPIRE indicators — is broad, covering policies relating to conditional and unconditional cash transfers, non-contributory pensions, school meals, public works, food and in-kind transfers, education, housing assistance, non-contributory health services, and other social assistance paid for by the state (e.g., childcare services). Unlike energy subsidies, these instruments tend to be efficient, progressive, or both (World Bank, 2022).

[2] Required disclaimer: 'This is an adaptation of an original work by The World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by The World Bank.'

many environmental externalities associated with energy use (Coady et al., 2017; Inchauste and Victor, 2017; Jiang, Ouyang, and Huang, 2015; De Granado, Coady, and Gillingham, 2012; Coady et al., 2019). These characteristics are the basis for frequent arguments for ending these subsidies (World Bank, 2022), recommendations which invariably bump up against the reality of their enduring and widespread existence and remarkable political popularity.

The point of departure for this chapter is therefore the notion that energy policy forms a central component of social protection policy in developing countries, and it is therefore essential to both appreciate what makes energy subsidies difficult to dislodge and to identify creative but *politically feasible* approaches to reform.

A short story – one of many from around the world – helps illustrate how energy subsidies emerge as an outsized part of social protection policy. Recently, in a 2023 election in the state of Karnataka in India, the Indian National Congress ran a campaign focused on expanding social protection expenditures on several dimensions. One of these was the provision of 200 kWh of power every month for free to every resident. This single policy estimated costing approximately 130 billion Indian Rupees, or 1.6 billion dollars (IANS, 2023). To put this in perspective, this number is approximately equal to the entire health budget for the state in the year of this election. In a world with budget

constraints, generous energy subsidies make other social spending difficult. To quote the Deputy Chief Minister of Karnataka some months after victory: "*This year, we can't provide development. Even in irrigation and public works, we can't give (funds for development)*" (Joshi, 2023).

Meanwhile, political rhetoric focused on reform is often less predictive of eventual outcomes than would be desirable. To take another example from Indonesia, in 2014, then-incoming President Jokowi pledged to eliminate Indonesia's fossil fuel subsidies: "*In four years, the fuel subsidy should be eliminated gradually, step by step, until it's gone*," (Sambijantoro, 2014). Despite these lofty promises, however, in 2024 – two terms later – his outgoing government had a projected energy subsidy bill of USD 12 billion annually (Sidik, 2024).

In the remainder of this chapter, we provide a brief overview of what we know about energy subsidies, approaches to reform, and a discussion of the many areas where additional research would be valuable. In Section 2, we discuss the monetary costs of these instruments, including environmental externalities. In Section 3, we discuss the incidence of this spending and more subtle but pernicious spillovers such as political interference and increased theft. In Section 4, we offer some reasons why removing these subsidies may be difficult. We go beyond political factors to discuss aspects of how energy subsidies are designed, and some underappreciated benefits that may be difficult

to replicate through other instruments. In Section 5, we consider feasible options for reform and the design challenges that reform policies need to overcome. We conclude in Section 6. Overall, we suggest that the role of energy subsidies as part of the social safety net in poor countries is still severely under-researched, with a significant need for more empirical evidence from Africa in particular.

2 The costs of subsidized energy

The full costs of energy subsidies can be hard to estimate and go well beyond their substantial budget line items. In this section we discuss both directly-observed and more indirect economic costs.

Pre-tax costs: We begin with the most direct measure of the cost of energy subsidies: funds that might appear as line items on state or public utility budgets. This number is sometimes referred to as a 'pre-tax' subsidy, and is approximately the difference between the supply costs (or procurement costs) of energy and the price that end-use consumers pay. Globally comparable measures of these numbers are hard to obtain, so we focus here on estimates from different parts of the world that serve to highlight the importance of this spending.

Assembling data from Tanzania, Ethiopia, and the Democratic Republic of Congo (DRC), Burgess et al. (2020) estimate that the average price of domestic

electricity is 3.6 cents per kWh, compared with a procurement cost of 6.4 cents per kWh. They report an average annual consumption of 1,176 kWh, implying an annual subsidy bill of about USD 33 per household. Compared to other social protection spending in these countries, this number is very large. For example, Barroy et al. (2014) report that annual per capita health expenditures in the DRC were approximately USD 15.

Similar conclusions hold in developing countries with higher incomes than the DRC as well. Barnwal and Ryan (2023) evaluate the subsidy bill for electricity in India. Their estimates imply that in 2021-22, state and central governments spent about 22 billion dollars on electricity subsidies and funds for distribution utilities.[3] For 2019-20, they estimate a number of approximately USD 18.6 billion. Beyond electricity, India also spent USD 4.7 billion on cooking gas subsidies and another USD 640 million on kerosene for the poor in the same year (Mishra, 2019). Finally, transportation fuel subsidies for gasoline and diesel are estimated to have cost the state approximately a further USD 10 billion (Vibhuti Garg et al., 2020). Taken together, the pre-tax cost of these subsidies was approximately USD 29 billion in India in 2019-20. To put this in

[3] The authors report INR 178,694 crore net of both operating losses and subsidies and INR 16,968 crore in operating losses. We take the difference and use an exchange rate of INR 74 = 1 USD.

context, India's Ministry of Health and Family Welfare reported budget estimates for the same year of just USD 9.2 billion.[4]

How might these costs evolve in the face of economic growth and a changing climate? On the first point, Gertler et al. (2016) use evidence from the *Oportunidades* cash transfer scheme in Mexico to show that the energy-using asset ownership grows rapidly and nonlinearly with income. On the second, Rode et al. (2021) find that climate change will cause tropical emerging economies to dramatically increase electricity use for cooling. Absent rapid reforms, it is critical to understand how these two forces might affect the energy subsidy burden for developing countries in the short and medium term, and the concomitant implications this might have for other forms of necessary social spending.

Post-tax costs: Large though they may be, pre-tax subsidy figures underestimate the full economic costs of energy subsidies. Because energy consumption is associated with large environmental externalities, including the production of both local pollution (e.g., $PM_{2.5}$) and global pollution (e.g., CO_2), when accounting for their full social cost, global energy subsidies come with a much larger price tag.

[4] We calculate this number using an exchange rate of INR 70 per USD applied to budget estimates of 64,559 crore INR, as reported by the Ministry of Health and Family Welfare.

Coady et al. (2017) carry out a careful accounting of so-called 'post-tax' subsidies that capture the gap been social costs and prices. Their estimates indicate that post-tax subsidies are an order of magnitude larger than pre-tax subsidies. They find that post-tax subsidies were about $4.9 trillion worldwide in 2013. 22% of these costs were due to climate change externalities, 46% due to air pollution damages, 13% due to congestion and vehicle externalities, 11% due to undercharging supply costs, and 8% due to foregone consumer taxes.

Figure 2, redrawn from Coady et al. (2017), shows the break-up of energy subsidies into externalities (inclusive of climate change and air pollution), pre-tax subsidies, and foregone consumption taxes. Note that, as in the rest of the world, in Emerging and Developing Asia and Sub-Saharan Africa, environmental externalities dwarf pre-tax subsidies. Because the majority of these environmental costs are local and short-term (air pollution, congestion, etc.) there are sound policy reasons to address them even if governments prefer to privilege short-term national growth considerations over a longer-term climate change agenda.

[PLACE CHAPTER 05 – FIGURE 2 HERE]

Figure 2: Pre-tax energy subsidies compared with unpriced environmental externalities and foregone consumption tax revenues (components of post-tax subsidies) for different global regions. Modified from Figure 5 in Coady et al

(2017). See Coady et al (2017) for countries included in each of Emerging and Developing Asia (E.D Asia); Advanced Countries (Advanced); Commonwealth of Independent States (CIS); Middle-East, North Africa, and Pakistan (MENAP), Latin American Countries (LAC), Emerging Europe, and Sub-Saharan Africa (SSA).

Deadweight losses: In addition to these direct and external costs, artificially lowering prices is also distortionary. When energy is artificially cheap or even free, consumers may use too much (Davis, 2017). Inefficient energy consumption can also have knock-on effects on other natural resources, such as groundwater extracted using electric pumps (Ryan and Sudarshan, 2022; Burlig, Preonas, and Woerman, 2021). Subsidies may distort appliance markets, for example by reducing the demand for energy efficiency (Fowlie and Meeks, 2021).

Although these mechanisms are uncontroversial, there is room for more work to empirically quantify these different distortions. For instance, although the theoretical link between energy subsidies and underinvestment in energy efficiency is straightforward, there is little empirical evidence from developing countries on how important this is in practice, and how it varies with the size of subsidies. Similarly, quantifying dead weight losses due to energy subsidies depends on the price elasticity of energy consumption. While prior work in low-

income countries suggests households are relatively inelastic (Filippini and Pachauri, 2004; Bose and Shukla, 1999; Balarama et al., 2020; Labandeira, Labeaga, and López-Otero, 2017), much of this work is focused on South Asia. Understanding the extent to which this holds across developing economies is an important area for future work.

3 Distributional considerations and politics

In the context of a government's social safety net, another critique of energy subsidies is that they may be highly regressive. Fiscal analysis suggests that in low- and middle-income countries, roughly 50% of spending on energy subsidies goes to the richest 20% (IEA, IRENA, UNSD, World Bank, WHO, 2020). In Ghana, research using household survey data from 2009-10 found that the top 20% by income benefited twice as much as the bottom 20% from petrol subsidies (Soile and Mu, 2015). In Indonesia, Dartanto (2013) estimate that, in 2008, the top income decile received fuel subsidies of approximately IDR 111,533/month/capita while those for the lowest decile were an order of magnitude lower, at approximately IDR 10,787/month/capita. Changing the incidence of energy subsidies thus seems an important area for more research. Different subsidy designs yield different incidence curves and given that energy subsidies themselves show little signs of disappearing, "second-best" strategies

of making them more progressive and/or improving targeting may be extremely useful.

The incidence of energy subsidies depends not only on prices and baseline consumption but also on energy access and supply quality. In an interesting case study, Harish and Tongia (2014) used administrative utility data from rural areas surrounding the Indian city of Bengaluru and suggest that after accounting for differences in supply quality, low-income rural consumers were effectively cross-subsidizing richer urban consumers. If poor households are subject to frequent outages that further dampen their consumption – as in Colombia (McRae, 2015), as well as many other developing countries — these subsidies can be extraordinarily regressive. On the other hand, if states are able to guarantee high-quality supply and introduce more stringent limits on who qualifies for cheap energy, then targeting may improve significantly. Similarly, the choice of fuel may affect targeting because the marginal willingness to pay for different fuels varies with income. For example, wealthy households may not use kerosene for lighting, even when it is heavily subsidised.

Quantifying the incidence of subsidies, ideally coupled with structural modelling to provide counterfactual policy guidance, would be highly valuable. However, these exercises are complicated by the fact that energy subsidies around the world are often built into complex, non-linear tariff structures (Ito, 2014; Borenstein, 2012). Khanna and Rowe (2022) describes a subsidy regime

in the state of Delhi in India with interesting threshold characteristics where power was made free up to a cutoff level, above which households were liable to pay not just for their additional units, but rather for their entire consumption. These designs make subsidy incidence less regressive but arguably set up extremely high-powered incentives for households to cheat.[5]

Understanding how these non-standard tariff structures influence subsidy targeting, incidence, and consumer responses is an area of work where more empirical evidence would be very valuable in developing new designs. Here, work on electricity pricing from developed contexts such as Japan may provide useful theoretical and econometric insights (Ida et al., 2022; Ito, Ida, and Tanaka, 2023).

Theft and political interference: Beyond the direct cost of environmental externalities, energy subsidies may have insidious and unintended effects on consumer behavior. For example, policies providing free or subsidized electricity may serve to generate a broader social norm that electricity is a right, rather than a commodity that is bought and sold (Burgess et al., 2020). These norms may result in frequent protests at attempts to raise energy prices. This is particularly challenging in low-income countries where governments have very

[5] Szabo (2015) discusses South Africa's Free Basic Water pricing scheme, which works in a similar way.

little fiscal headroom. For instance, Agbonifo (2023) discusses the policy implications of public opposition to reducing fuel subsidies in Nigeria. Political challenges to subsidy reform are widespread: in just the three-year period from 2019 to 2022, protests against reductions in energy subsidies were reported in countries as diverse as Kazakhstan, Ecuador, Pakistan, Iran, Zimbabwe, Lebanon, and even France Kasturi. Other important examples of recent protests include Angola, Azerbaijan, Bolivia, Egypt, India, Mexico, Sudan, and Venezuela (Mahdavi, Martinez-Alvarez, and Ross, 2020).

Beyond explicit policy, the effect of shifting social norms may be to reinforce a *hidden* energy subsidy, namely electricity theft. The cost of illegal nonpayment can be very large. Burgess et al. (2020) document the extent of transmission and distribution losses across countries. They find evidence consistent with widespread theft in developing countries, with transmission and distribution losses exceeding 20% on average in low-income countries. In India, for example, electricity distribution losses are now a substantial burden on the state exchequer, and many states report distribution losses exceeding 30% in 2022 (Burgess et al., 2022). Issues of theft, non-payment, and corruption extend beyond the electricity sector, with recent research quantifying a substantial quantity of theft and corruption in markets for subsidized cooking gas (Barnwal, 2023).

A small but growing body of evidence suggests that politicians may actively interfere in billing and supply, perhaps because doing so can become a means of rewarding supporters (Mahadevan, 2023; Min and Golden, 2014). In Colombia, state support to utilities has been structured in ways that remove incentives to improve metering, supply, and payment rates (McRae, 2015). These facts suggest that the dividing line between explicit electricity subsidies and unrecovered costs is blurred rather than sharp.

These facts also highlight some clear gaps in the literature. For instance, Burgess et al. (2020) posit that subsidies set up a social norm that encourages non-payment. This is a plausible hypothesis with potentially immense implications for the full costs of subsidies. However, we have no direct empirical evidence testing this hypothesis. Research quantifying the extent to which free or subsidized power changes long-term payment behavior or attitudes towards theft would constitute a significant contribution. In a similar vein, one explanation for persistent non-payment is that utility employees tolerate such behavior given the perverse social norms that have been created. However, we lack evidence on whether enforcement instruments currently available to utilities would improve matters. In other words, are inaction and widespread non-payment the result of a colluding state utility or a helpless one? Lastly, although we have some evidence linking political interference with electricity theft (Min and Golden, 2014; Mahadevan, 2023) and data showing

that formal subsidy announcements are linked to political imperatives, election cycles, and government transitions (van Beers and Strand, 2013; Klomp, 2020), we still know relatively little about the political returns to energy subsidies. Since these promises are expensive, it would be useful to gather evidence on how much they matter for political outcomes and under what conditions.

4 Why do subsidies persist?

It can be difficult to reconcile the substantial downsides of energy subsidies with their popularity. One might imagine that voters would prefer social protection programs that, unlike energy subsidies, allocate most of the available money to the majority poor rather than the minority rich, through non-distortionary instruments such as cash transfers, as these would be both sound economics and good politics. Nevertheless, energy subsidies persist. In this section we explore some of what makes these subsidies 'sticky'.

Universal access: We note first that although a rich literature in economics has come to mixed conclusions on the causal effect of electrification policy on economic growth, energy access as an end in itself is nevertheless a widespread

policy priority.[6] Indeed, the 7th UN SDG explicitly states as its primary target: "By 2030, ensure *universal* access to affordable, reliable, and modern energy services." Subsidies likely have a key role to play in this process. Burgess et al. (2023) estimate a structural model using a field experiment in India and data from several African countries and argue that the large difference in electricity access between rural India and rural Africa can be almost entirely explained by India's heavy electricity subsidies. In other words, energy subsidies may not be efficient, but conditional on universal access being the goal, they are very effective.

Cooking fuel choices: The full economic costs of cooking fuel subsidies are complicated to assess because households are making choices across a bundle of different energy sources. Some of these fuels are sold in informal markets or obtained outside markets with nonmonetary costs (such as the time costs of women collecting fuelwood). These relatively dirty fuels may impose a substantial indoor air pollution burden on households who use these fuels directly (Berkouwer and Dean (2023)), but even households who themselves use cleaner fuels are indirectly impacted by ambient pollution exposure driven by cooking fuel usage (Hanna, Duflo, and Greenstone (2016)). This is

[6] Lipscomb, Mobarak, and Barham (2013) estimate large benefits from electrification writ large, Lee, Miguel, and Wolfram (2020) find that subsidized rural electrification is welfare-reducing, and Burlig and Preonas (2022) highlight heterogeneity in the welfare consequences of rural electrification by community size.

particularly important in low-income countries, where households often use multiple fuel sources for cooking and lighting.

Governments may have legitimate reasons to intervene in cooking fuel markets. Clean cooking practices are potentially hindered by many market failures - lack of access to credit to pay for associated appliances (Berkouwer and Dean (2022)), inability to pay high operating costs due to the monetary costs of clean fuels (Afridi, Barnwal, and Sarkar (2024)), and a failure to internalize health externalities within and outside the home. The last of these may be exacerbated by the fact that men make purchase decisions while women and children are much more exposed to pollution when cooking (Miller and Mobarak (2013)). Since it is impractical to tax these informal fuels, subsidizing cleaner alternatives may be an alternative instrument for achieving the goal of moving people towards clean indoor cooking fuels. This observation underscores the need for more empirical evidence in the economics literature on the causal link between subsidies and transitions to clean cooking; and on how energy subsidies and capital subsidies for appliances such as electric or gas stoves interact with each other to affect take-up. Berkouwer and Dean (2022) present evidence that credit market failures hold back the purchase of efficient stoves, and providing loans can increase appliance purchases and reduce the use of charcoal. This raises an additional question: should governments prefer marginal energy subsidies, lump sum transfers, or credit interventions to

encourage appliance adoption and to help households to climb the energy ladder?[7] We note that the answer to these questions is likely to be different in different settings, as biomass use is much more prevalent in the household energy mix in sub-Saharan Africa than elsewhere (Figure 3). More broadly, given that households use multiple fuels for cooking, it is important that analysis of policy in this area account for the sometimes-complicated patterns of substitution and choice that might arise.

[PLACE CHAPTER 05 – FIGURE 3 HERE]

Figure 3: Primary sources of cooking fuel around the world. Data source: WHO Household Energy Database (2021).

Concentration vs incidence: Third, although energy subsidies often benefit the rich more than the poor in terms of expenditure levels, this masks the important fact that poor households face a greater "energy burden," spending a larger share of their income on energy than do the rich (Pachauri and Spreng, 2004). Although this is true across countries, it is particularly stark in LMICs. While

[7] [7] This question is complicated by a considerable gap in many settings between engineering solutions and real-world solutions. As an example, several studies have documented the difficulty in encouraging households to take up "improved" cookstoves, finding that these supposedly-better products often faced low household demand (Hanna, Duflo, and Greenstone (2016), Miller and Mobarak (2013)). In certain cases, (e.g. Berkouwer and Dean (2022)), subsidizing a particular technology may be warranted, but economics typically warns against "picking winners."

low-income households in the United States spend 8.1% of their income on energy (Drehobl, Ross, and Ayala, 2020), this share can be much higher in poor countries. As an example, Berkouwer and Dean (2022) find that the median household in a sample of Nairobi slum dwellers spends 22% of their income on energy. As a result, poor households in LMICs are particularly susceptible to energy price shocks (Guan et al., 2023). Furthermore, because the poor consume very little energy, their *marginal* willingness-to-pay (as distinct from ability to pay) may be much higher than rich households. These facts help to explain the widespread protests from the poor that have accompanied attempts at subsidy reform.

This raises the crucial question of how reform policies should be implemented and designed to insure buy-in from the poor. A key challenge is that, although governments may propose more progressive targeting of funds that might leave the poor better off on paper, their increased vulnerability to energy price shocks means that practical concerns, such as whether the government can credibly commit to cash transfers that are timely or keep up with energy prices, become very important.

Spillovers to other areas of the economy: Fourth, energy subsidies are linked to other sectors. Household electricity access is a prerequisite for several other services that governments may be interested in. These include home water

purification, healthcare, opportunities for household work for women, access to information services and digital payments infrastructure, educational technology and so on. Many of these services have positive social externalities or private benefits that households may not internalize (such as the health benefits from cleaner water). In other words, policymakers may reason that universal *restricted* subsidies (such as a limited amount of free power) are very likely to provide higher social benefits than costs, because of such 'knock-on' effects. Documenting these links rigorously would be of significant policy value especially since studies of the long-term effects of electrification suggest meaningful benefits (Lipscomb, Mobarak, and Barham, 2013).

Lastly, for liquid fuels, reform is complicated even further by the fact that subsidies for transport fuels propagate throughout the economy, so that removing them would raise prices differentially across goods, unequally affecting poor vs. rich households (Coady, Flamini, and Sears (2015), Rentschler (2016)).

5 Subsidy reform

The substantial costs of energy subsidies we describe in Section 2 in combination with the reasons for stickiness in Section 4 raises critical questions: What does *feasible* reform look like, and what design challenges must reform

policies overcome? Evidence-based answers to these questions are both sorely needed and in short supply.

One approach that has appeared to work is to take advantage of global price fluctuations. Over the last decade some of the most substantial cuts in subsidies, without attracting public outrage, have occurred for liquid fuels. Developing-country governments have been able to enact reforms without substantial pushback by taking advantage of times when the supply-side costs of energy have fallen. This creates the fiscal space to reduce subsidies by simply choosing not to pass these savings through to consumers, thus reducing state costs without raising prices (see Jain (2018) for a detailed case study of India). Unfortunately, such reforms may not be structural in the sense that the state may still retain the ability to influence prices. As a result, political temptations to cushion the blow from future cost increases may remain in place.

A different starting point is the observation that the money spent on energy subsidies might be better used to fund unconditional cash transfers. These instruments could allow for better targeting and therefore might enable a budget-neutral *increase* in transfers to the poor (World Bank, 2022). This argument is based on sound economics, and cash transfers should leave households strictly better off than equivalent amounts of energy.

Unfortunately, there is very little empirical evidence comparing outcomes under cash transfers and equivalent subsidies. Hanna and Oliva (2015) find that

a permanent increase in household income in India is not sufficient to get households to switch from dirtier to cleaner fuels. This suggests that it is not necessarily the case that replacing subsidies for modern energy with equivalent cash transfers would yield similar outcomes as far as access to *energy* is concerned. This distinction becomes important once we acknowledge that individual governments — and indeed even the UN SDGs — might be interested in ensuring energy access as an end in itself.

Although a horse-race between conventional subsidies and cash alternatives would produce necessary and interesting new evidence on consumption outcomes, such comparisons do not fully engage with the problem confronting policymakers. Governments in developing countries do not have before them a tabula rasa upon which they may etch the optimal design of social protection expenditures. Rather, they must identify a credible policy framework that substitutes away from status-quo energy subsidies in favour of more efficient instruments and can be implemented in a democracy. In the words of Roland Coase: ". . . *whatever we may have in mind as our ideal world, it is clear that we have not yet discovered how to get to it from where we are. A better approach would seem to be to start our analysis with a situation approximating that which actually exists, to examine the effects of a proposed policy change, and to attempt to decide whether the new situation would be, in total, better or worse than the original one*" (Coase, 1960).

[PLACE CHAPTER 05 – FIGURE 4 HERE]

Figure 4: Subsidy reform attempts categorized by whether they involved simultaneous cash compensation and whether they generated public protests. Figure modified from Moayed and Guggenheim (2021) with additional data from Clements et al (2013).

The experience of past attempts at energy subsidy reform suggests that even modest changes may be hard to pull off without simultaneous compensation. Figure 4 presents data from Moayed and Guggenheim (2021), categorizing case studies of attempted subsidy reform across space and time by whether they involved simultaneous cash compensation, whether they generated public protests, and whether they (even partially) succeeded. This history suggests that in the absence of contemporaneous compensation, protests are likely and success is unlikely. We should stress that these examples are not exhaustive, and as Moayed and Guggenheim (2021) point out, successful examples of reform seem to be decreasing over time.

Swapping subsidies for cash compensation may also be challenging if such an exchange creates a large number of losers (as discussed in Sallee (2022)). Studying small farmers in India, Ryan and Sudarshan (2022) show that status-quo energy subsidies — which take the form of free electricity and a six-hour

power ration to pump groundwater — act like a heterogeneous and somewhat regressive transfer of surplus to farmers. Eliminating these inefficient subsidies in favour of pricing power at its full social cost significantly increases total agricultural surplus. Ryan and Sudarshan (2022) show that unproductive farmers benefit most as do farmers who use more water. The distribution of benefits is not straightforward. On the one hand, the ration limits how regressive the subsidy can become, and on the other, farmer productivity does not necessarily track income. These facts also mean that it may be difficult to make compensatory transfers without creating losers. In this setting, the authors test several possible transfer criteria that rely on farmer characteristics that the government observes (such as landholdings or the size of their water pumps). They show that compensatory transfers based on these rules leave a large number of farmers worse off, primarily because it is hard for the government to predict the level of compensation that would make farmers willing to give up subsidies. This occurs even though there would be additional surplus generated by efficient pricing without rations.

Although this example is specific, the problems it highlights are more general. Beyond the targeting of payments, a more pragmatic concern is whether the government can credibly commit to cash transfers that are timely and keep up with energy prices. Timeliness is important because electricity cannot be stored, so if subsidies were replaced with a lump-sum progressive transfer,

payments must reach consumers in a timely manner. This is a requirement that is more easily met in states that have a digital payment infrastructure that reaches all or at least most beneficiaries of electricity subsidies. Countries such as India have been able to replace subsidies for cooking gas applied at the point of sale with ex-post transfers to consumers, a reform that appears to have significantly reduced the illegal diversion of subsidised cooking cylinders towards commercial uses (Barnwal, 2023).

A final complication is that, in low-income countries, household energy consumption is often determined by a *combination* of a subsidized price and a binding ration. For instance, although clean cooking fuels are frequently subsidized, households cannot claim an unlimited quantity at the low price. Storage considerations and the very high transaction costs involved in secondary markets[8] imply that even were such caps not in place, household demand even at very low prices might be limited. In the case of electricity, a combination of outages, appliance ownership, and technical limitations on the power drawn by domestic connections mean that even if power is completely free, demand is constrained. This fact implies not all beneficiaries of subsidized energy are of equal concern when assessing the economic inefficiencies of artificially low

[8] For example, secondary trade between households and (say) commercial users might be illegal and difficult to execute given that energy in different forms is not easy to transport.

prices. Households whose marginal willingness to pay for power at the quantity cap exceeds the full costs of energy do not contribute to deadweight losses. For these households, the subsidy acts as a transfer, and they are constrained on quantity.[9]

Direct Benefit Transfers of Energy From the discussion above we suggest five desiderata for successful energy subsidy reform. First, an alternative policy instrument must improve economic efficiency. Second, even if reform is not Pareto improving, it should not create a large number of losers. Third, it should be progressive. Fourth, it should be budget neutral, given the constrained resources available. And fifth, it should present a credible alternative to households, providing for some households a guarantee that they will not be worse off under the reform.

It is immediately clear that the second and third item on this list are at odds with each other. Progressive designs for both electricity and cooking fuel subsidies may leave not only the very rich but also households with more moderate incomes worse off. It is unclear how many losers are 'too many' but the widespread conflict and protests that have accompanied reform attempts in

[9] Such transfers may nevertheless be undesirable to policymakers from a distributional point of view especially if richer households have higher valuation for power.

many countries suggest this is a difficult matter to get right (Moayed and Guggenheim, 2021).

An alternative approach is replacing subsidized energy tariffs with *voluntary* unconditional cash transfers, approximately equal to the value of the energy subsidy and accompanied by an increase to Pigouvian pricing. By setting the transfers based on pre-reform subsidy spending, this instrument remains budget neutral and addresses the four desiderata we outline above: improving economic efficiency, providing a Pareto improvement, retaining budget neutrality, and ensuring that households can credibly believe they will not be worse off under the alternative.

This combination could be implemented through energy bills that combine negative fixed costs (the unconditional transfer) and a positive marginal price.[10] In theory, this switch should leave all households better off. If households were to consume the same energy as under the price subsidy, their incremental costs due to higher tariffs would equal the unconditional transfer, by construction. Thus, if there is no change in behavior, there are no changes in household expenditure. This might happen in the case of households who were quantity constrained and thus had a marginal value of electricity higher than its full price.

[10] Borenstein, Fowlie, and Sallee (2023) discuss a two-part tariff with a positive fixed charge in the context of raising funds to encourage energy transitions using a more progressive and efficient design than raising marginal prices well above costs.

Conversely, if a consumer had a marginal willingness to pay under the original subsidy regime that was below social cost (e.g., equal to the subsidized tariff in the absence of quantity constraints), they are better off reducing the quantity of energy they use, leaving them with cash in hand available to spend on other goods they value. This bundle of goods should be strictly preferred to the energy subsidy.

A key is that this type of contract could be made voluntary. This is because the consumers most likely to opt-in are those who would value cash much more than cheap energy. These are precisely the consumers contributing the most to deadweight losses. This form of advantageous selection would allow such a reform to be introduced without imposing mandates, thus providing a path forward even in settings where many households have low trust in government. A disadvantage of this instrument is that because the fixed charge is negative, the government must have the ability to make (digital) transfers to consumers. In addition, this instrument could be just as regressive as the original subsidy because it is designed to ensure there are no losers. That said, adjusting the unconditional transfer allows governments to introduce more progressive regimes, at the cost of foregoing Pareto improvements and increasing the risk of opposition. Ultimately, further empirical work is needed to assess the extent to which these instruments are feasible across settings, and to measure the extent to which they reduce over-consumption of energy.

6 Conclusion

In this chapter, we document that energy subsidies constitute one of the largest de facto social protection programs in low-income countries. We highlight the challenges associated with these subsidies, and call for subsidy reform. We argue that any reforms must be done in a manner that is both feasible and informed by economics – and need to take seriously the notion that their persistence suggests that they have attractive features that any reforms must incorporate. Given the large size of these subsidies – both compared to other social protection and to the volume of existing research on them – the path to subsidy reform must involve creative solutions. In this regard, we encourage academics and policymakers alike to experiment with alternatives to costly fuel subsidies. Horse-races that evaluate second-best — but feasible — solutions against existing subsidies may be particularly valuable.

Figure 1

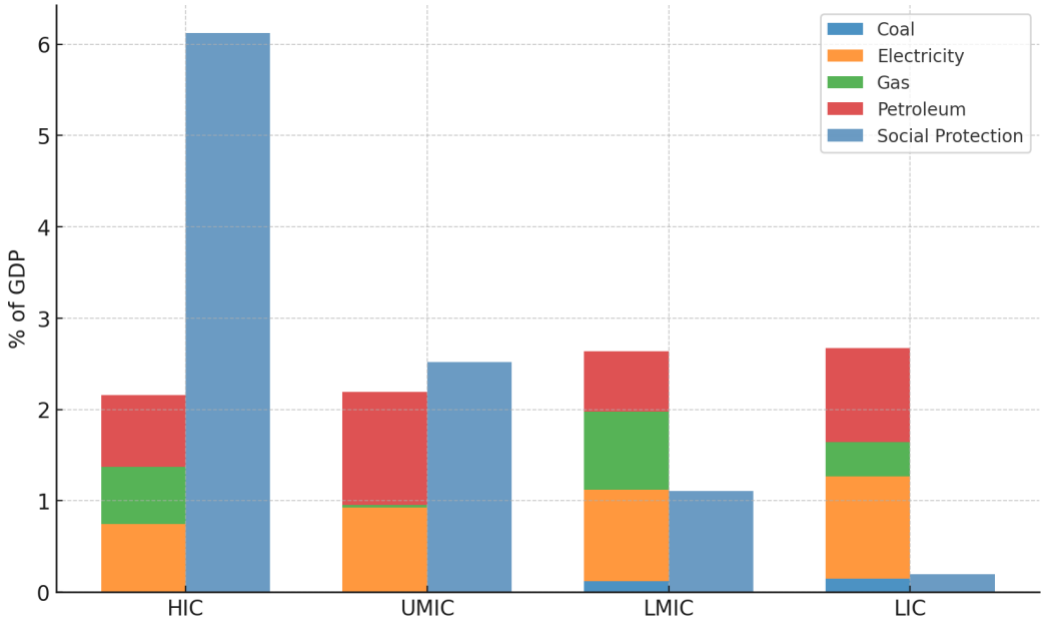


Figure 2

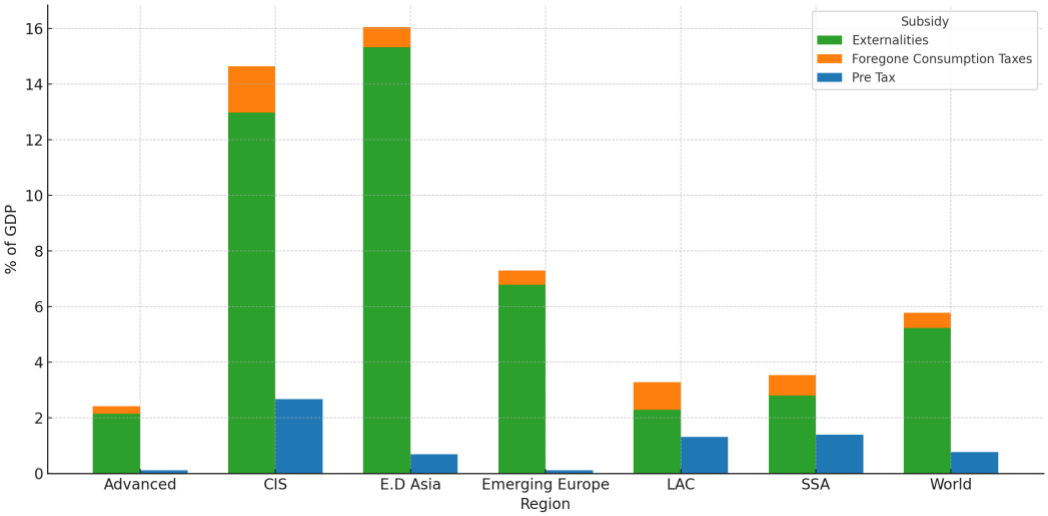


Figure 3

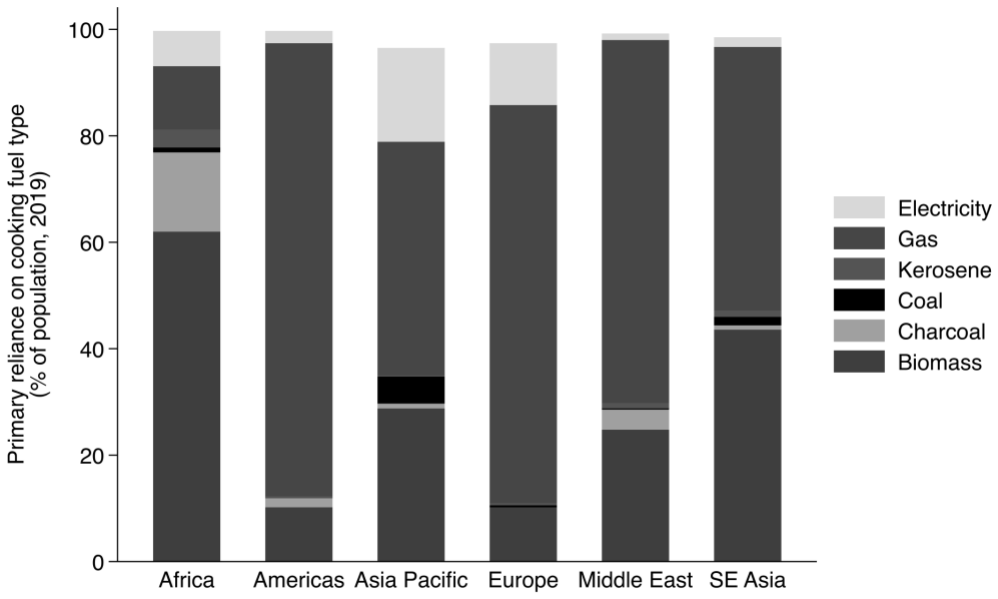
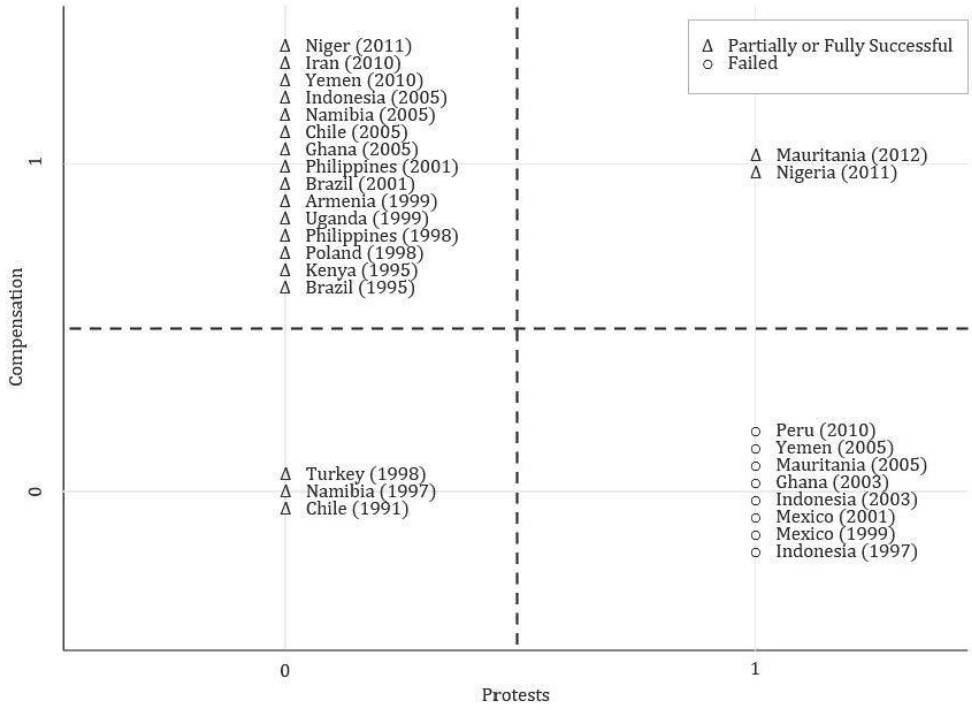

Primary reliance on cooking fuel type
(% of population, 2019)
100
80
60
40
20
0
Africa
Americas
Asia Pacific
Europe
Middle East
SE Asia
Electricity
Gas
Kerosene
Coal
Charcoal
Biomass

Figure 4


Δ Partially or Fully Successful
○ Failed
Δ Niger (2011)
Δ Iran (2010)
Δ Yemen (2010)
Δ Indonesia (2005)
Δ Namibia (2005)
Δ Chile (2005)
Δ Ghana (2005)
Δ Philippines (2001)
Δ Brazil (2001)
Δ Armenia (1999)
Δ Uganda (1999)
Δ Philippines (1998)
Δ Poland (1998)
Δ Kenya (1995)
Δ Brazil (1995)
Δ Mauritania (2012)
Δ Nigeria (2011)
○ Peru (2010)
○ Yemen (2005)
○ Mauritania (2005)
○ Ghana (2003)
○ Indonesia (2003)
○ Mexico (2001)
○ Mexico (1999)
○ Indonesia (1997)
Δ Turkey (1998)
Δ Namibia (1997)
Δ Chile (1991)
Compensation
1
0
0
1
Protests