PERI REPORT
APRIL 2025

Phasing Out Fossil Fuel Subsidies for the Green Transition:

Financing and Distributional Prospects

ROBERT POLLIN
Distinguished University Professor of Economics and
Co-Director, Political Economy Research Institute (PERI)
University of Massachusetts Amherst

SHOUVIK CHAKRABORTY
Assistant Research Professor, PERI
University of Massachusetts Amherst

GREGOR SEMIENIUK
Assistant Research Professor, PERI
University of Massachusetts Amherst

POLITICAL ECONOMY RESEARCH INSTITUTE / **PERI.UMASS.EDU**

POLITICAL ECONOMY RESEARCH INSTITUTE
PERI
University of Massachusetts Amherst

Table of Contents

JEL Codes: H23, L71, Q42, Q43, Q54

Abstract

Despite this near-universal global recognition that consuming fossil fuels to produce energy must be phased out by 2050 as the centerpiece of a global climate stabilization project, governments throughout the world continue to subsidize both the consumption and production of oil, coal, and natural gas. Fossil fuel subsidies clearly constitute an obstacle to advancing a viable global climate stabilization program. This is because they create perverse incentives, encouraging both consumers to continue purchasing fossil fuel energy and producers to continue producing it. They also represent a huge financial resource that could be mobilized to help finance the transition to a clean energy-dominant energy infrastructure. At the same time, in many countries, fossil fuel subsidies provide critical support to low-income people, by reducing the costs they must pay to meet their energy needs. Fossil fuel subsidies also support business activity in many countries, by lowering their energy input costs. Any workable program to eliminate fossil fuel subsidies must also establish alternative measures to maintain support for consumers and businesses that are justifiable independent of whether fossil fuel subsidies are the policy instrument used to provide such support.

This study presents an approach through which fossil fuel subsidies can be phased out altogether while still protecting, and indeed, enhancing, the well-being of the poor and affected communities. Moreover, the approach we develop will help undergird the transition to a high-efficiency and renewable energy dominant infrastructure. Section 2 reviews the range of issues involved in defining and measuring fossil fuel subsidies. Section 3 tracks the movements of global fossil fuel subsidies between 2010–2023. We show that, over this period, fluctuations in the fossil fuel subsidy/GDP ratio closely track those of global crude oil prices. This demonstrates that, on a global basis, the extent of subsidies is driven primarily by movements of crude oil prices rather than changes in governments' fossil fuel subsidy policies.

Section 4 reviews the extensive literature on fossil fuel subsidies. The benefits of fossil fuel subsidies are spread widely across all segments of society—households at all income levels, businesses within all sectors of the economy, and, not least, the fossil fuel corporations themselves. With respect to households specifically, fossil fuel subsidies are a critical resource in supporting lower-income households' efforts to meet their basic needs. This is true, even while, in terms of absolute amounts of money, the benefits of fossil fuel subsidies flow overwhelmingly to high-income consumers and fossil fuel corporations and ancillary businesses. Section 5 presents case studies on fossil fuel subsidy policies in India and Indonesia. For both countries, fluctuations in subsidy levels closely follow the patterns for the global economy. For both countries, we provide brief summaries of their fossil fuel subsidy policies since they achieved independence—in 1947 for India and 1949 for Indonesia. In particular, policymakers in both countries have at times undertaken significant initiatives to phase down the subsidies. At times, both countries have also introduced alternative forms of cash or in-kind support for low-income groups to protect them against sharp fossil fuel price increases resulting from the subsidy phase downs. For both countries, we work through

some simple examples to illustrate ways through which alternatives to fossil fuel subsidy programs that are distributionally progressive can be implemented to protect living standards of lower- and middle-income households. We show that, even under assumptions of generous cash or in-kind alternative subsidy programs to support lower- and middle-income households, the Indian and Indonesian governments will still be able to capture large-scale savings by phasing out fossil fuel subsidies. These large-scale savings can then be rechanneled into financing these countries' respective clean energy transitions. Section 6 offers brief concluding perspectives for both the Indian and Indonesian economies, as well as more generally.

1. Introduction

The March 2023 Sixth Assessment Report of the Intergovernmental Panel on Climate Change reaffirmed the most basic conclusion that has been supported by the overwhelming weight of evidence from the climate science research literature for a generation: that the dominant factor causing climate change is burning fossil fuels to produce energy. This is because burning fossil fuels to produce energy releases carbon dioxide (CO_2) into the atmosphere. The accumulating stock of CO_2 in the atmosphere that results, in turn, causes the greenhouse gas effect that raises the average global temperature.

It follows that the most significant measure that needs to be undertaken to move the global economy onto a climate stabilization path is to phase out fossil fuels as an energy source. In all of its major publications since the landmark 2018 study, *Global Warming of 1.5^{0}C*, the IPCC has been emphatic that a viable climate stabilization program requires that global CO_2 emissions need to fall by roughly 50 percent as of 2030 and reach net zero by 2050. Global fossil fuel consumption will need to be phased out at basically this same rate in order to achieve anything approximating the IPCC's emission reduction targets.

At present, roughly 80 percent of total global energy consumption is produced through combusting oil, coal, and natural gas. As of 2050, this global fossil-fuel dominant energy infrastructure will need to be supplanted by an infrastructure dominated by high efficiency and clean renewable energy sources, primarily solar and wind power. Of course, major obstacles have emerged to date, and will continue to emerge, in advancing a global energy system transition of this magnitude. Overcoming all such obstacles will require the consistent application of a wide range of effective policy initiatives, targeted, among other concerns, to meet the most critical specific requirements for any given region or country's transition process. At the same time, allowing that effective policies can be implemented on a consistent basis, there will be no obstacles that are insurmountable. This is certainly true with respect to the adequacy of either the technical capacities or financial resources necessary for achieving a zero-emissions global economy by 2050.[1]

Despite this evident imperative, as well as the feasibility, of phasing out fossil fuels over the next 2 ½ decades as the centerpiece of a global climate stabilization project, governments throughout the world continue to subsidize both the consumption and production of oil, coal, and natural gas. As we will discuss below, there is a range of methods for measuring the extent to which governments subsidize fossil fuel production and consumption. Working from figures compiled by the Fossil Fuel Subsidy Tracker website, the result is that, for 2023, overall fossil fuel subsidies throughout the global economy amounted to $1.1 trillion. This is equal to roughly 1.0 percent of 2023 global GDP. In the immediately preceding year 2022, the global fossil fuel subsidy level had spiked to $1.7 trillion (in 2023 US dollars),[2] which was equal to 1.7 percent of 2022 global GDP.

Fossil fuel subsidies clearly constitute an obstacle to advancing a viable global climate stabilization program. This is because they create perverse incentives, encouraging both consumers to continue purchasing fossil fuel energy and producers to continue producing it. They also represent a huge financial resource that could be mobilized to help finance the transition to a clean energy-dominant energy infrastructure. Within any viable global climate stabilization project, a first-order

priority will be to build a clean energy infrastructure capable of supplanting the existing fossil fuel-dominant infrastructure.

At the same time, in many countries, fossil fuel subsidies provide critical support to low-income people, by reducing the costs they must pay to meet their energy needs. Fossil fuel subsidies also support business activity in many countries, by lowering their energy input costs. This reduction in businesses' energy input costs can then become a stimulus for expanding overall economic activity and job creation. As such, any workable program to eliminate fossil fuel subsidies must also establish alternative measures to maintain support for consumers and producers that are justifiable independent of whether fossil fuel subsidies are the policy instrument used to provide such support.

The $1.1 trillion global fossil fuel subsidy figure for 2023, and even more, the $1.7 trillion figure for 2022, represented a sharp increase from the 2021 total of $907 billion. Fossil fuel subsidies had been declining since having reached a peak figure of $1.1 trillion in 2012. This declining trend resulted mainly from the fall in the global price of oil between 2012 and 2016. But governments throughout the world had also made conscious policy decisions during this period to phase out these subsidies, as one component of their overall set of climate stabilization policies. But the spike in global oil prices following from the relaxation of the COVID lockdown conditions and the supply shortages resulting from the Russia/Ukraine war have now reversed the declining trajectory for subsidies. What is clear from over the 2022–2023 experience is that low prices cannot be counted on to carry most of the burden of eliminating fossil fuel subsidies. The only way to definitively eliminate fossil fuel subsidies will be through explicit policy measures that will be sustainable regardless of how much fossil fuel prices may rise or fall. It also follows that any such policy for eliminating fossil fuel subsidies will need to incorporate measures to maintain justifiable levels of support for the consumers and producers who would face significant negative impacts as the subsidies are eliminated.

The United Nations' Sustainable Development Goals (SDGs) calls for a partial phase-down of fossil fuel subsidies, as one component of its overall Goal #12, "Responsible Consumption and Production." Specifically, SDG Target 12.C calls for the following:

> Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities.[3]

Clearly, this SDG target is written in order to recognize both the fundamental problems of maintaining fossil fuel subsidies amid the worsening climate crisis as well as the challenges posed for the living standards of low-income people and communities through eliminating these subsidies. This explains the equivocal phrasing of the text, e.g. proposing to only "rationalize inefficient fossil-fuel subsidies" as opposed to phasing out such subsidies altogether. Yet, in fact, to advance a realistic and viable global climate stabilization project, fossil fuel subsidies will need to be eliminated altogether in the most timely possible phase-out program, not merely "rationalized."

The 2023 Trade and Development Report from UNCTAD advances this perspective clearly, writing, "An immediate challenge with phasing out "inefficient" subsidies is that this category has no coherent or formal international definition. All are distortionary (and hence "inefficient") …. All subsidies artificially lower the price of fossil fuels relative to potential substitutes." At the same time, the Trade and Development Report is equally clear about the broader set of tensions that governments inevitably face in phasing out fossil fuel subsidies:

> If the aim of governments is to support poor households and reduce inequality, fossil fuel subsidies are not the way to do it. Subsidies often make inequalities worse because they are a blunt instrument that is usually not targeted by income. Even so, the relatively small benefit to the poorest decile can be nonetheless extremely important; it may mean the difference between having electricity or none at all.…Given this background, any efforts to cut fossil fuel subsidies need to acknowledge the complexities and asymmetries of producers and consumers (UNCTAD 2023, p. 164).[4]

This paper aims to sketch an approach through which fossil fuel subsidies can be phased out altogether while still protecting, and indeed, enhancing, the well-being of the poor and affected communities.[5] Moreover, the program we develop here will also help undergird the transition from the current fossil-fuel dominant global energy infrastructure to a high-efficiency and renewable energy dominant infrastructure.

This paper proceeds as follow:

Section 2 reviews the range of issues involved in defining and measuring fossil fuel subsidies. We begin by describing the categories of *explicit* subsidies, such as grants to producers and consumers, loan subsidies, preferential tax treatment, provision of energy services at subsidized rates and price controls. We also discuss what the International Monetary Fund calls *implicit* subsidies. These are the externalities—the environmental costs that are not incorporated into market prices—associated with burning fossil fuels to produce energy. We focus in this study on explicit subsidies, and then consider two approaches to measuring these, the "inventory" and "price-gap" approaches. In considering these approaches, we review figures generated by the Organization for Economic Cooperation and Development (OECD), and the International Energy Agency (IEA). As we discuss, the Fossil Fuel Subsidy Tracker (FFST) website provided by the OECD and the International Institute for Sustainable Development (IISD) provides the most accessible source for explicit subsidy data. As we show, the figures reported at the FFST site closely track the combined figures from the OECD and IEA. We therefore focus on figures reported by the FFST throughout this study.

Section 3 tracks the movements of global fossil fuel subsidies derived from the FFST figures. We review the movements of subsidy figures, in real U.S. dollars, along with the ratio of fossil fuel subsidies to global GDP and the relationship between the subsidy/GDP ratio and the movements of the global crude oil price. As we show, over the 2010–2023 period that we review, the movement of the fossil fuel subsidy/GDP ratio closely tracks fluctuations in the global crude oil price. This close relationship shows that, on a global basis, the extent of subsidies are driven primarily by movements of crude oil prices rather than changes in governments' fossil fuel subsidy policies.

Section 4 reviews the extensive literature on fossil fuel subsidies. The literature examines the issues both from purely analytic perspectives as well as through empirical and historical studies. Some of the empirical and historical studies provide a global scope, while others focus on various regions and individual countries. This overall literature considers impacts in terms of income distribution and poverty reduction, energy supply for producers and consumers, the environment, and the use of public sector fiscal resources.

As we discuss in Section 4, it is clear that the benefits of fossil fuel subsidies are spread widely across all segments of society—households at all income levels, businesses within all sectors of the economy, and, not least, the fossil fuel corporations themselves. With respect to households specifically, fossil fuel subsidies are a critical resource in supporting lower-income households' efforts to meet their basic needs. This is true, even while, in terms of absolute amounts of money, the benefits of fossil fuel subsidies flow overwhelmingly to high-income consumers and fossil fuel corporations and ancillary businesses. These distributional dynamics create a complex set of obstacles that need to be addressed effectively for any subsidy phase out program to be successful. Through our critical review of this literature, we address measures such as: establishing cash or in-kind transfers for low and middle-income households as substitutes for fossil fuel subsidies; alternative forms of support for private-sector firms; and the need to focus on timing and price-smoothing during the phase-out period. We also introduce consideration of the level of generosity of the alternative cash or in-kind subsidy programs; the opportunity to channel a major share of the savings into clean energy financing; and the need to anticipate the resistance by high-income households and fossil fuel corporations losing their large-scale benefits through subsidy phase out measures.

Section 5 presents case studies on fossil fuel subsidy policies in India and Indonesia. For both countries, we begin by reviewing the evidence on the extent of fossil fuel subsidies over 2010–2023. Fluctuations in subsidy levels in both countries closely follow the patterns we present in Section 3 for the global economy. For both countries, we then provide brief summaries of their fossil fuel subsidy policies since they achieved independence—in 1947 for India and 1949 for Indonesia. Subsidy policies have undergone major changes in both countries over this period. This, along with the fact that they are both major developing economies, makes them both important individual cases from which we can extract valuable general perspectives on implementing and managing fossil fuel subsidy programs. In particular, policymakers in both countries have at times undertaken significant initiatives to phase down the subsidies. Both countries have also introduced alternative forms of cash or in-kind support for low-income groups to protect them against sharp fossil fuel price increases resulting from the subsidy phase downs.

For both countries, we work through some simple examples to illustrate ways through which alternatives to fossil fuel subsidy programs that are distributionally progressive can be implemented to protect living standards of lower- and middle-income households. We show with these examples that, even under assumptions of generous cash or in-kind alternative subsidy programs to support lower- and middle-income households, the Indian and Indonesian governments will still be able to capture large-scale savings by phasing out fossil fuel subsidies. These large-scale savings can then be rechanneled into financing these countries' respective clean energy transitions.

Section 6 offers brief concluding perspectives for both the Indian and Indonesian economies, as well as more generally. Our overall assessment is that phasing out fossil fuel subsidies and providing distributionally progressive and generous alternative subsidy programs—through either cash or in-kind subsidies—will produce major benefits. These benefits include reversing the highly regressive distributional impacts of existing fossil fuel subsidy policies and unlocking major financial resources to support a full-scale global clean energy transition.

2. Defining and Measuring Fossil Fuel Subsidies

In principle, fossil fuel subsidies can be defined in straightforward terms. They are any measure that enables either producers to supply or consumers to purchase fossil fuel products below market prices. At the same time, the specific policy tools through which these policies are implemented take a wide variety of forms. A 2019 United Nations Environmental Program (UNEP)/International Institute for Sustainable Development (IISD) study addresses this question as follows:

> A challenge for providing a global estimate of fossil fuel subsidies is the fact that they can occur in different forms. The Organization for Economic Co-operation and Development (OECD) has so far identified more than 1,000 individual policies that support the production or consumption of fossil fuels in the 43 countries it covers in its inventory of fossil fuel support measures. Energy subsidies can be classified along different dimensions, for example, between consumer and producer subsidies, as well as the nature of the instrument (i.e. how the transfer is provided) and its incidence (i.e. to which aspect of production or consumption it is targeted) as well as by type of fuel or energy carrier (Wooders et al., 2019, p. 6).

The UNEP/IISD study distinguishes four categories of fossil fuel subsidies:

- Direct transfer of funds;
- Induced transfers (price support);
- Tax expenditure, other revenue foregone and under-pricing of goods and services; and
- Transfer of risk to government.

These four categories of fossil fuel subsidies are specified to be in alignment with the requirements of SDG 12 c.1.

The International Renewable Energy Agency (IRENA) , an intergovernmental organization that is an official United Nations observer, provides a somewhat distinct, if still similar, categorization of fossil fuel subsidies (Taylor 2020). The IRENA categories include:

- Direct financial transfers;
- Preferential tax treatment;
- Trade restrictions;
- Energy-related services provided by government at less than full cost; and
- Regulation of the energy sector.

The IRENA study provides a useful summary table that includes the ways in which each subsidy type, according to IRENA's specified categories, aims to impact economic activity (p.22). We reproduce this table below, as Table 1. As we see, within each of the subsidy categories, the table lists specific measures and how each measure either lowers costs of production, lowers prices for consumers, or "raises prices to disfavored producers." This last category would include quotas, trade embargos or import duties aimed to protect domestic producers over imports.

TABLE 1. A Typology of Global Subsidies from IRENA

Type of Subsidy	Example(s)	How It Works		
		Lowers Cost of Production	Raises Price to Disfavored Producer	Lower Price to Consumer
Direct Financial Transfer	Grants to producers	✓		
	Grants to consumers			✓
	Low-interest or preferential loans	✓		
Preferential Tax Treatment	Rebates or exemptions on royalties, sales taxes, producer levies and tariffs	✓		
	Investment tax credits	✓		✓
	Production tax credits	✓		
	Accelerated depreciation	✓		
	State sponsored loan guarantees	✓		
Trade Restrictions	Quotas, technical restrictions, and trade embargoes		✓	
	Import duties and tariffs		✓	
Energy-Related Services Provided by Government at Less than Full Cost	Direct Investment in energy infrastructure	✓		
	Publicly sponsored R&D	✓		
	Liability insurance	✓		
	Free storage of waste or fuel	✓		
	Free transport	✓		
Regulation of the Energy Sector	Demand guarantees and mandated deployment rates	✓	✓	
	Price controls and rate caps		✓	✓
	Market-access restrictions and standards		✓	

Source: Taylor (2020, p. 22): https://www.irena.org/publications/2020/Apr/Energy-Subsidies-2020

Building broadly within the framework of these definitions of fossil fuel subsidies, there are three agencies that generate estimates of subsidies on a global basis—the OECD, the IEA, and the IMF. Each agency provides alternative measurement approaches and, consequently, different figures for overall subsidy levels. These alternative measurement approaches are described in the Fossil Fuel Subsidy Tracker (FFST) website.[6] Working from the FFST discussion as well as Table 1 from IRENA, we can distinguish the alternative measurement approaches along two dimensions: explicit and implicit subsidies; and within the explicit subsidy category, an inventory and price-gap measurement approach.

Explicit and Implicit Subsidies

"Explicit subsidies" refer to all the subsidy categories listed in Table 1. The OECD, IEA, and IMF all calculate estimates of explicit subsidies. In addition, the IMF alone also incorporates the category of what they term "implicit subsidies." Implicit subsidies consider the undercharging for environmental costs and general consumption taxes and are therefore higher than the "explicit" subsidy estimates. Here is how the IMF itself distinguishes between explicit and implicit subsidies[7]:

> Explicit subsidies occur when the retail price is below a fuel's supply cost. For a non-tradable product (e.g., coal), the supply cost is the domestic production cost, inclusive of any costs to deliver the energy to the consumer, such as distribution costs and margins. In contrast, for an internationally tradable product (e.g., oil), the supply cost is the opportunity cost of consuming the product domestically rather than selling it abroad plus any costs to deliver the energy to the consumer.
>
> Implicit subsidies occur when the retail price fails to include external costs and/or there are preferential consumption tax rates on energy. External costs include contributions to climate change through greenhouse gas emissions, local health damages (primarily pre-mature deaths) through the release of harmful local pollutants like particulates, and traffic congestion and accident externalities associated with the use of road fuels.

The IMF's figures on implicit subsidies serve a valuable purpose in estimating the costs of combusting fossil fuels that are not captured in market exchanges—i.e. the market failures with respect to fossil fuel combustion. At the same time, the implicit subsidy category does not measure resources that could be captured and redirected to support alternative subsidy programs for households and businesses to provide financing for clean energy investments. Given that this study does aim to measure the extent of fossil fuel subsidies such that governments can redirect these resources, we focus our analysis on the alternative measures of explicit subsidies.

Explicit Subsidies: Inventory and Price Gap Approaches

There are two ways to measure explicit subsidies, the "price gap" and "inventory" approaches.

The price gap approach compares the end-use prices paid by fuel consumers with reference prices such as import-parity prices. This is the method described by the IMF in its "explicit subsidy" category. It is also the method used by the IEA.

The inventory approach covers direct budgetary transfers and tax expenditures that in some way provide a benefit or preference for fossil fuel production or consumption relative to alternatives. It also covers measures that create enabling conditions for the fossil fuel sector through the development of private or public services, institutions and infrastructure that may benefit fossil fuel production or consumption in the long term, and fund activities to address the legacy of past mining or drilling ("general services support").[8] Measuring fossil fuel subsidies through this approach effectively entails adding up estimated amounts for the specific subsidy categories that we have listed in Table 1.

Combining OECD and IEA Measures

In a 2018 study, the OECD provided a detailed discussion of the distinctions between their inventory approach and the IEA's price gap approach. This study concluded by arguing that the two sets of subsidy estimates should be combined into one aggregate set of figures. Table 2 shows how, within the framework set out by the OECD, the two sets of fossil fuel subsidy data should be combined in practice.[9]

Fossil Fuel Subsidy Tracker Approach Derived from UNEP/IISD

The measurement approach used by the FFST, working from the UNEP/IISD methodology, is similar conceptually to the combined OECD/IEA measure. The FFST describes its methodology as follows:

> The Tracker's methodology is aligned with the one developed for reporting SDG indicator 12.c.1…and is intended to bridge any reporting gap on the indicator….The SDG methodology—and therefore the FFST—adopts the OECD Inventory approach for direct budgetary transfers and tax expenditures, and the IEA and IMF approach for induced transfers—i.e price-gap approach.[10]

TABLE 2. Components of Combined OECD/IEA Fossil Fuel Subsidy Measure

Subsidy type	Data source	Measurement methodology
Budgetary and other transfers to producers (BOT)	OECD	Inventory method
General Services Support Estimates (GSSE)	OECD	Inventory method
Transfers to consumers from taxpayers (TCT)	OECD	Inventory method
Transfers to consumers from producers (TCP)	IEA	Price-gap method
Other transfers to consumers (OCT)	IEA	Price-gap method

Source: OECD (2018), pp. 20 – 25..

Availability of Subsidy Data

In terms of practical issues of measuring and monitoring the extent of fossil fuel subsidies within specific countries, the UNEP/IISD study—the approach followed by the FFST—assesses the availability of data and the complexity involved in obtaining these data. Table 3 summarizes their main findings.

As Table 3 shows, according to UNEP/IISD, for the subsidy categories 1) direct transfer of funds, 2) induced transfers; and 3) tax expenditures, data availability is mostly either "excellent" or "good," with "low" or "moderate" degrees of complexity in accessing these data in most cases. In the one case of tax expenditures, the study finds that data access is "neutral"—i.e. somewhat less accessible—while the data availability is still either "good" or only "moderate" in difficulty.

The one exception in their assessment is with measuring the "transfer of risk." The UNEP/IISD assesses this category of subsidies as having "poor" data availability and a high degree of complexity in accessing data. Because of the difficulties in measuring this category of subsidies, the FFST does not attempt to include it in the measures it reports.

More generally, the FFST notes that the overall subsidy figures that it reports "may be underestimates of actual subsidy totals." This is because, as they write, in addition to excluding policies that entail transferring of risk, "the OECD Inventory may have not captured all support measures or because those that were captured have not been fully quantified. For some measures, values are not available or may only have partial data coverage."

Overall though, the conclusion that emerges from this review is that most categories of fossil fuel subsidies can be measured through clearly specified methods. Moreover, the two aggregated data series—OECD/IEA and FFST respectively—generally move in close correspondence with one another. The correlation coefficient is 0.98 between the two series over the full period we will examine, between 2010–2023. Given this close correspondence between the two series, from here onward, we will focus on reporting the FFST figures. We do this because the FFST figures are more readily accessible at the Fossil Fuel Subsidy Tracker website.

TABLE 3. Assessment of Fossil Fuel Subsidy Data from UNEP/IISD:
Availability and Complexity of Subsidy Data by Category

Subsidy category	Data availability	Data complexity
Direct transfer of funds	Excellent	Low degree of complexity
Induced transfers (price support)	Good	Moderate degree of complexity
Tax expenditure, other revenue foregone, and under-pricing of goods and services	Good	Neutral degree of complexity
Transfer of risk	Poor	Difficult degree of complexity

Sources: Wooders et al. (2019), p. IX.

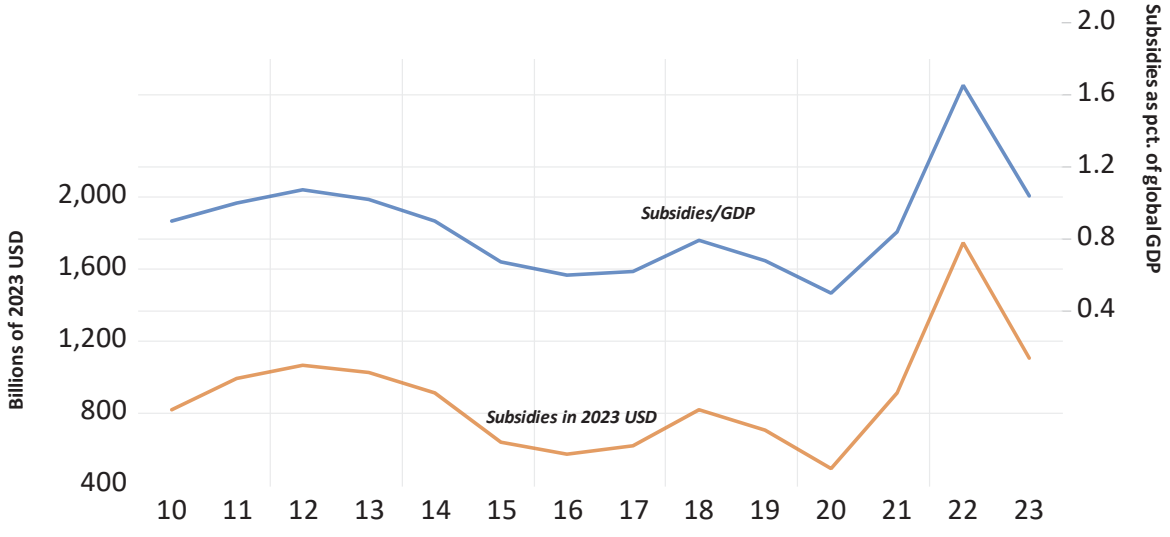
3. Global Fossil Fuel Subsidy Movements

In Figure 1, we show the FFST figure for global fossil fuel subsidies between 2010–2023 in real 2023 U.S. dollars as well as the nominal global subsidy figures as a share of global GDP.[11] As we see first, the real global subsidy figure reaches a high point of about $1.1 trillion in 2012. The figure then falls steadily until 2016, when it is at about $570 billion. The series then rises modestly upward until 2018, then declines modestly in 2019 before falling sharply in 2020, to $492 billion. The 2020 decline corresponds closely with the COVID lockdown. The global subsidy figure then begins rising sharply again in 2021 as lockdown conditions are relaxed. For 2022, the figure spikes at $1.7 trillion following the further relaxation of lockdown conditions, before declining in 2023 to $1.1 trillion. Note that even with the significant decline in global subsidies between 2022 and 2023, the 2023 figure is still significantly above any previous year over the full 2010–2023 period.

We then see that the ratio of global subsidies/GDP moves in virtual lockstep with the real value of subsidies in USD, with the correlation coefficient between the two series at 0.99. In terms of the range for the subsidy/GDP ratio, the figure reaches a high of 1.1 percent of GDP in 2012 before declining to 0.60 percent in 2016. The figure then fluctuates between 0.49 – 0.79 percent of global GDP between 2017 and the 2020 COVID lockdown. Post lockdown, the ratio then begin rising again in 2021, spiking at 1.7 percent of GDP in 2022 before declining to 1.0 percent in 2023.

FIGURE 1: Global Fossil Fuel Subsidies in Real USD and as Share of Global GDP, 2010–2023

Fossil Fuel Subsidy Tracker Figures

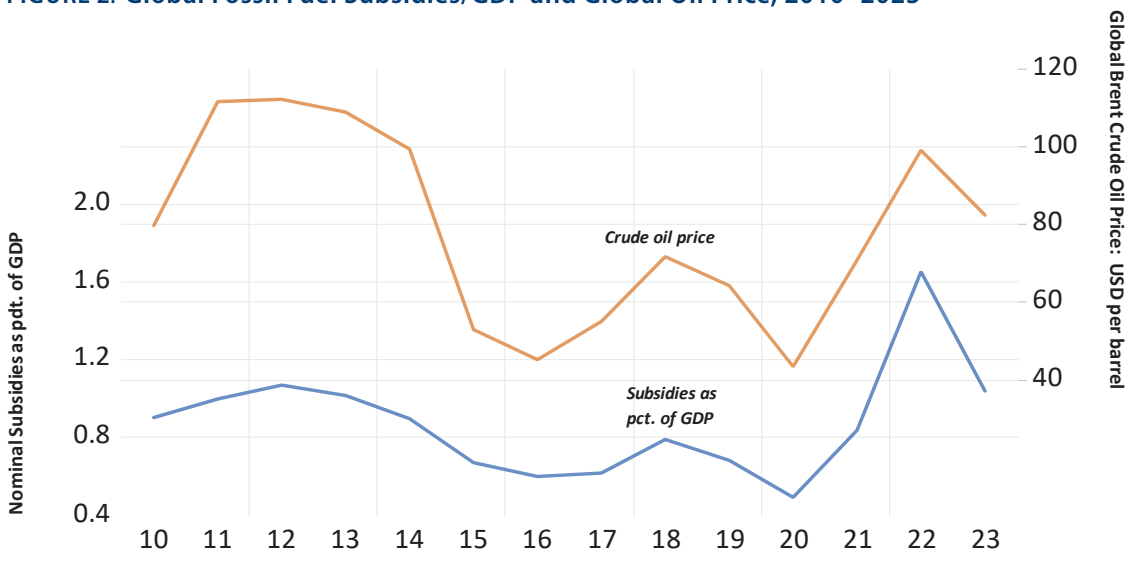


Sources: https://fossilfuelsubsidytracker.org/; https://fred.stlouisfed.org/

The critical question that emerges from Figure 1 is what explains these fluctuations, both in the real subsidy level and the subsidy/global GDP ratio. Figure 2 provides an answer, through plotting the movements in the global price of crude oil along with the movements in the subsidy/GDP ratio. As the figure shows, between 2010–2014, the global crude oil price experiences first a sharp rise and then a sharp decline, while the global subsidy/GDP ratio fluctuates only modestly, between 0.9 and 1.1 percent. But beginning in 2015, movements in the two sets of figures vary in close correspondence. Thus, between 2015–2023, the correlation coefficient between the global crude oil price and the global subsidy/GDP ratio is 0.93.

This correlation coefficient and the Figure 2 data plots suggest that movements in the global crude oil price is not the *only* factor explaining fluctuations in global fossil fuel subsidies, especially between 2010–2014. This divergence in the two series suggests that policy interventions to reduce fossil fuel subsidies have had some impact, in particular over the 2010–2014 period. Nevertheless, for the most part, the strong correspondence between the two series from 2015 onward demonstrates that, whatever policy measures have been undertaken to reduce fossil fuel subsidies, the impact of these measures has been relatively modest. Rather, to date, the situation remains that, on a global basis, the magnitude of global fossil fuel subsidies are still mostly driven not by policy changes but by the global price of crude oil.

FIGURE 2: Global Fossil Fuel Subsidies/GDP and Global Oil Price, 2010–2023



Sources: See Figure 1.

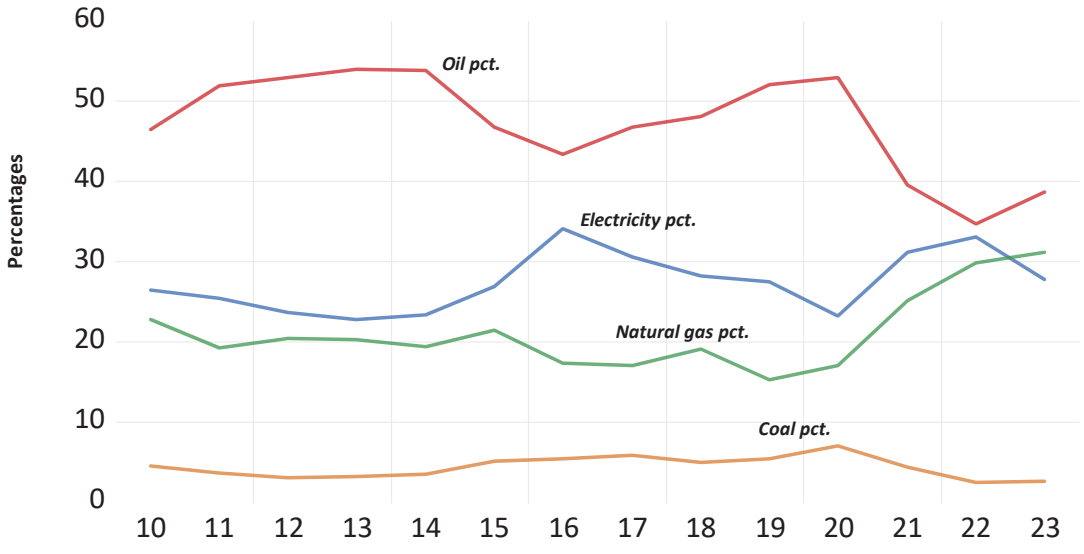
Distribution of Global Fossil Fuel Subsidies

Figure 3 shows the distribution of total global fossil fuel subsidies according to the alternative fossil fuel energy sources—i.e. oil, natural gas, coal or electricity generated by one of the three fossil fuel energy sources.[12] As Figure 3 shows, throughout the full 2010–2023 period, oil subsidies accounted for the largest share of overall fossil fuel subsidies. Oil subsidies include support for a range of products, in particular, gasoline, kerosine, diesel fuel, and liquified petroleum gas (LPG). The oil share ranges between roughly 35–54 percent of overall fossil fuel subsidies. But the share does decline steadily from the 54 percent peak in 2013–2014 to the 35 percent low in 2022. Correspondingly, the electricity and natural gas subsidy shares rise over this period. The electricity share peaks in 2022 at 33 percent while the natural gas share peaks in 2023 at 32 percent. The direct coal subsidy remains within a lower range throughout the full period, reaching a peak of 8.0 percent in 2020 and a low of 2.5 percent in 2022 and 2023. However, for the global economy, coal provides roughly 56 percent of the energy used in generating fossil fuel-based electricity.[13] The fossil fuel-based electricity subsidies are thereby primarily subsidies to support coal-generated electricity.

Overall then, as of 2023, the extent of fossil fuel subsidy support throughout the global economy was distributed in roughly equal proportions between oil, natural gas and coal, after one accounts for electricity-based subsidies. Any program to phase out fossil fuel subsidies will therefore need to be broadly focused on all three fossil fuel energy sources.

FIGURE 3: Global Shares of Overall Fossil Fuel Subsidies

Oil, Electricity, Natural Gas, and Coal



Source: https://fossilfuelsubsidytracker.org/

4. Literature Review on Fossil Fuel Subsidies

The existing literature on fossil fuel subsidy reform and removal is quite extensive and wide-ranging. The literature examines the issues both from purely analytic perspectives as well as through empirical and historical studies. Some of the empirical and historical studies provide a global scope, while others focus on various regions and individual countries. This overall literature considers impacts in terms of income distribution and poverty reduction, energy supply for producers and consumers, the environment, and the use of public sector fiscal resources.

While the scope of this literature is wide-ranging, the most basic conclusions that emerge are, for the most part, widely shared and non-controversial. Rentschler and Bazillian (2017) summarize this perspective as follows:

> There is a strong consensus emerging within the international community that fossil fuel subsidies are fundamentally unsustainable; that the economic, environmental, and social side effects are severe and include market distortions, escalating fiscal burdens, increased greenhouse gas emissions, poverty, and income inequality (2017, p. 138).

In fact, initiatives to phase out or at least significantly reduce fossil fuel subsidies have been extensive over the past decade. A detailed 2020 literature survey by Rentschler reports on reform initiatives between 2013–2015 by 37 countries, most of which are developing or middle-income economies (2020, pp. 18–21). The initiatives listed by Rentschler include commitments incorporated in the respective countries' Nationally Determined Contributions set at the 2015 Paris Climate Summit as well as other announcements and actual implementations.

Similarly, a 2021 survey by the UNDP reported that "More than 40 countries undertook some form of subsidy reform between 2015 and 2017. Global pre-tax energy subsidies fell by more than half between 2012 and 2016, supported by both declining market prices and policy measures," (UNDP 2021 p. 11). But this same UNDP report also noted that "However, overall support levels remain stubbornly high and could rise further if fossil fuel prices recover, as they did in 2017 and 2018."

Of course, as the UNDP study had anticipated and as we have reviewed above, fossil fuel subsidies did indeed spike in 2021–2022 because of the sharp increase in oil prices following the lifting of the COVID lockdown conditions. The average global oil price rose from $43 per barrel in 2020, under the COVID lockdown, to $71 in 2021 and $99 in 2022. The average global oil price did decline in 2023, but, at $82 a barrel, remained much higher than the 2015–2020 period. Fossil fuel subsidies rose correspondingly on a global scale, as described above and in Figure 2. In short, as of 2023, despite near-universal commitments and widespread actual measures throughout the global economy to phase out fossil fuel subsidies, little to no sustained progress has been achieved.

This state of affairs raises the straightforward question: why do fossil fuel subsidies persist, despite the fact that, along several dimensions, they are universally recognized as undesirable? The most general answer is also straightforward. Fossil fuel subsidies persist because multiple groups in society benefit from them. In most cases, these benefits are substantial. Not surprisingly, these groups mobilize politically to protect their self-interests, and to a large extent, have succeeded

in doing so. The challenge then becomes to identify the groups that are benefitting and then to determine how to effectively overcome their inevitable resistance to losing these benefits.

Inchuauste and Victor (2017) argue that mainstream political economy provides a well-established framework to address this challenge. This mainstream political economy framework focuses on the questions of: 1) which groups in society receive benefits from such measures; 2) whether the benefits are large or small for any given group; and 3) in cases where the benefits are large for any given group, the extent of political power such groups are able to exercise to protect their benefits. Inchauste and Victor write:

> It is well known that when the gains from political action can flow to a highly concentrated set of actors, those beneficiaries will often organize into a special interest group to express and seize those benefits through the political process. Meanwhile, when the benefits and costs of a policy are broadly diffused across many diverse stakeholders, it is often difficult to organize those stakeholders into a politically influential force (2017, p. 4).

Clearly then, we need to be able to specify the various groups that benefit from fossil fuel subsidies and the extent of the benefits received by these respective groups. We consider this issue as regards both consumer and producer subsidies and in terms of the gains received by households, businesses, and fossil fuel corporations.

Consumer Subsidy Benefits for Households and Businesses

The literature documenting the beneficiaries of fossil fuel subsidies focuses primarily on households. There are two critical points to emphasize here. The first is that fossil fuel subsidies do play a major role in enabling low-income households to meet their basic needs—that is, to the extent that low-income households are, in fact, able to meet their basic needs. At the same time, the distribution of benefits from fossil fuel subsidies are highly regressive. This is because the lower retail prices for fossil fuel energy provided by the subsidies are equally available in most cases to all energy consumers. As such, households that purchase more energy will benefit disproportionately from the lower retail prices that are equally available to them.

The result is that the disparity in benefits received by households according to their respective income cohorts is massive. In the next two sections, we review figures on benefits received by income-level groupings for India and Indonesia. For now, it will also be useful to briefly review the main findings of a general review on this issue by Arze Del Granado et al. (2012). This paper surveys the impact of fossil fuel subsidies for 20 countries in Africa, Asia, the Middle East and Latin America. The authors deploy a novel modeling approach that enables them to directly compare impacts across the 20 countries within a common framework. They consider subsidies for gasoline, kerosine, LPG and electricity, including both direct and indirect effects. Direct effects result through higher prices for energy consumed for cooking, heating, lighting and private transport. Indirect effects result through higher prices for other goods and services consumed by households, given that higher fuel costs are passed on through general increases in production costs and consumer-good prices. Arze Del Granado et al. report impacts according to household income quintiles.

Two sets of findings from Arze Del Granado et al. are central: 1) the percentage of total income received by each household quintile through fossil fuel subsidies; and 2) the share of total subsidy benefits received by each quintile. We report both of these findings from Arze Del Grando et al. in Table 4.

With respect to the percentage of income received through fossil fuel subsidies, Arze Del Grando et al. specifically measure the percentage of real income losses through an increase in fossil fuel energy prices. As column 2 of Table 4 shows, they estimate that a $0.25 per liter increase in retail prices for gasoline, kerosine, LPG and electricity will produce an average loss of real income of 5.3 percent across the five income quintiles.[14] The real income loss for the lowest quintile, at 5.6 percent, is only modestly higher than that for the higher four quintiles, where the loss ranges between 5.2 and 5.3 percent.

The authors describe this consistent decline in the percentage of real income as being "approximately neutral" across the five household income quintiles. But the notion here of 'approximate neutrality' is accurate only in terms of the *percentage of real income loss* among the various household income quintiles. At the same time, the *relative impact* of a 5 percent real income loss is not proportionate among the different income quintiles in terms of how this income loss impacts the living standards of the respective household cohorts. This is because, generally, lower-income households spend close to their entire income purchasing necessities, with food alone typically absorbing about 50 percent of these households' total income. As such, a 5 percent loss in real income for these households will entail a corresponding 5 percent reduction in their ability to purchase and consume necessities. With higher income households, the 5 percent real income loss will require them to only modestly reduce spending on non-necessities. In other words, for high-income households, the loss of fossil fuel subsidies will not impact their ability to maintain spending on food and other necessities.

TABLE 4. Impacts of Fossil Fuel Subsidies by Household Income Quintiles in 20 Developing Countries

1)	2) Fossil fuel subsidies as pct. of household incomes	3) Share of total fossil fuel subsidy benefits received
Bottom quintile	5.57%	7.2%
Second quintile	5.31%	11.4%
Third quintile	5.28%	16.2%
Fourth quintile	5.27%	22.5%
Top quintile	5.25%	42.8%
All households	5.34%	100%

Sources: Arze Del Grando et al. (2012).

With respect to the share of total benefits received by household income quintile, Arze Del Granado et al. estimate the disparity in the distribution of subsidy benefits in terms of the absolute amount of money received by the respective household quintiles. As we see in column 3 of Table 4, the bottom income quintile receives 7.2 percent of total benefits, measured in absolute dollar amounts, while the top quintile receives 42.8 percent of benefits measured in dollars. That is, the benefit of fossil fuel subsidies in these 20 developing economies—measured as absolute dollar amounts—is six times greater for the richest 20 percent of households than for the poorest 20 percent.[15]

Producer and Consumer Subsidy Benefits for Fossil Fuel Companies

The research describing the distributional impacts of production subsidies is far less extensive than that for consumer subsidies. Rentschler (2020), for example, observes that "it is striking" the studies in this area "almost exclusively cover reforms of consumer subsidies. Indeed, reforms of producer subsidies are lagging behind, and lack comprehensive analysis and documentation," (2020, p. 17).

This clearly represents a major gap in the literature. As we saw in the previous section, production subsidies represent, on average, fully one-third of total subsidies. It is also critical that the most direct beneficiaries of production subsidies are fossil fuel companies, along with the ancillary industries associated with fossil fuel production and consumption, such as pipeline construction, retail distribution and service stations. These companies benefit from production subsidies since the explicit aim of production subsidies is to lower production costs for the fuel producers. These benefits accrue equivalently, if not equally, to publicly-owned as well as privately-owned fossil fuel corporations.[16]

But it is also the case that fossil fuel corporations are major beneficiaries of consumption subsidies as well, even while the benefits here are not as direct as with production subsidies. With consumption subsidies, the corporations benefit because the subsidies underwrite consumers' fossil fuel expenditures. The subsidies therefore discourage consumers from either 1) reducing their spending on fossil fuels in response to increases in unsubsidized retail prices; or 2) shifting their energy consumption away from fossil fuel sources in favor of alternatives, including both energy efficiency investments and renewable energy sources.[17]

It is also important to recognize that the fossil fuel corporations that benefit from both production and consumption subsidies include public as well as private fossil fuel companies, given that roughly 90 percent of all fossil fuel reserves globally are publicly owned. While the publicly-owned companies do not operate with the same profit imperative as privately-owned corporations, it is still the case that producing and selling fossil fuel energy generates huge revenue flows for these companies. National development projects, lucrative careers, and political power all depend on continuing the flow of large fossil fuel revenues and, correspondingly, of fossil fuel subsidies.

How Large are Consumption Subsidy Benefits to Fossil Fuel Corporations?

To estimate the extent of benefits fossil fuel companies—including, again, public as well as private corporations—receive from consumption subsidies, we can consider the question in terms of the price elasticity of demand for fossil fuels in the retail market. Working with demand elasticity figures, we can estimate how much the retail fossil fuel market would contract if retail prices were set at market prices rather than at the reduced subsidized prices. At relatively high price elasticities, the benefit to fossil fuel producers will be large, since it means that, in the absence of consumer subsidies, the producers would lose significant sales when retail prices rise. Correspondingly, the benefit to producers of consumer subsidies will be negligible at relatively low price elasticities.

In fact, the relevant literature reports a wide range of demand elasticity figures, depending on the country and the baseline level from which prices rise. One extensive survey by Huntington et al. finds that for gasoline, the short-run price elasticity is -0.33 and the long-run elasticity is -0.61. Huntington et al. document in detail that beyond these averages, "there exists a very wide range in the country-by-country estimates for gasoline use within the transportation sector," (2019, pp. 8-9).

Given this range of elasticity estimates, the extent to which producers benefit from consumption subsidies will always be highly context specific. Nevertheless, it will be useful to consider an illustrative example that can provide a rough midpoint estimate of the extent of benefits that producers receive through consumption subsidies. In developing this example, we refer again to the evidence reported in the Rentschler study cited above (2020, pp. 18–20). Rentschler shows the extent to which retail prices have risen between 2013–2015 in individual countries when these countries have reduced or eliminated consumption subsidies. We focus on the 12 country cases in which Rentschler provides data on explicit retail price increases per se, as opposed to the cases in which he provides data only on the extent of the subsidy reductions, but not the resulting price increases. For these 12 country cases, the average price increase by country was 48 percent. This represents the average price increases by country for all subsidies within the country, including those for gasoline, diesel, kerosine, LNG and electricity. For our illustrative purposes, we round this average price increase figure to 50 percent.

If we then work with the average long-run elasticity figure of -0.61 reported by Huntington et al., we can estimate how much a 50 percent increase in retail fossil fuel prices would generate a contraction in long-run consumer demand. Assuming that the 50 percent price increase is indeed sustained over a long-run period, that would imply an average demand contraction of about 30 percent.[18] But even if the fossil fuel prices were maintained only over a short-run, with an average short-run price elasticity of -0.33, the 50 percent price increase would imply a 17 percent fall in demand. Overall, taking account of both short- and long-run elasticity figures, we can estimate, as a rough low-end figure, that fossil fuel price increases in the range of 50 percent will lead to demand contractions in the range of 20 percent. To further illustrate the point, we can scale this loss of demand within the context of the 2023 global market for crude oil. Within this 2023 global crude oil market, a 20 percent global demand contraction would amount to lost revenues for oil producers of about $520 billion. This amount of lost revenue would be equal to roughly 0.5 percent of 2023 global GDP.[19]

Macroeconomic Benefits of Fossil Fuel Subsidies

A final consideration that has been almost entirely overlooked in the literature is the benefit that fossil fuel subsidies provide for an economy's overall macroeconomic stability, most especially with respect to inflation control. In virtually all contemporary economies, the largest single source of spikes in overall inflation is sharp increases in the global market price of oil (see, e.g. Cheikh et al. 2023 and Aharon et al. 2023). Establishing price controls for the energy sector thereby contributes to maintaining the overall economy's inflationary trajectory at lower rates than would result in the absence of the controls (Weber et al. 2024). As such, any program to phase out fossil fuel subsidies must recognize this important benefit of energy price controls as one specific fossil fuel subsidy policy tool, and include alternative measures of dampening excessive inflationary pressures generated by oil price spikes.

However, identifying viable and desirable alternative control policies is itself a major challenge. For decades now, the dominant inflation control policy is to impose macroeconomic austerity, mostly through raising short-term interest rates to the point at which aggregate demand in an economy falls and unemployment rises. This approach creates its own set of severe costs, certainly as significant in most cases, if not more so, than maintaining fossil fuel subsidies via price controls. The challenge then becomes, more specifically, to implement effective inflation control policies through measures other than *either* maintaining fossil fuel price controls or imposing macroeconomic austerity. Exploring how to accomplish this is, clearly, a formidable question. Within this paper, we cannot do more than reference the issue here and offer a few brief observations at various points below.[20]

Advancing Viable Fossil Fuel Subsidy Phase-Out Programs

As we see, the benefits provided by fossil fuel subsidies are spread widely across all segments of society—households at all income levels, businesses within all sectors of the economy, and, not least, the fossil fuel corporations themselves. These benefits then also extend to the full range of enterprises that are ancillary to fossil fuel production and distribution. With respect to households specifically, the key fact is that fossil fuel subsidies are a critical resource in supporting lower-income households' efforts to meet their basic needs. This is true, even while, in money terms, the benefits from fossil fuel subsidies flow overwhelmingly to high-income consumers along with the fossil fuel corporations and ancillary businesses. As noted above, fossil fuel subsidies also can provide significant macroeconomic benefits by dampening the overall inflationary impacts of oil price shocks.

The distributional dynamics in particular of fossil fuel subsidies clearly create a complex set of obstacles that need to be addressed effectively for any fossil fuel phase out program to be successful. Several authors have outlined programs that are aimed at addressing these obstacles. Rentschler and Bazilian (2017) provide a review of these proposals. The steps that Rentschler and Bazilian emphasize from their review include the following.

1. *Cash or in-kind transfers for lower-income households.* Cash transfers are the most direct way to compensate lower-income households for the loss of fossil fuel subsidies. But the effectiveness with which cash transfers can be disbursed depends on a country's existing social protec-

tion infrastructure. In some settings, the policy infrastructure may be better able to administer in-kind transfers, in particular food subsidies. As a general rule, either cash or in-kind transfers will be more effective than simply lowering tax rates, since tax reductions will not consistently reach a large percentage of low-income households.

2. *The alternative compensation programs cannot be short-run stop-gap measures only.* The cash or in-kind transfers programs need to be maintained at least as long as fossil fuels remain as the primary source of energy supply and that lower-income households will be paying market prices for their energy provisions.

3. *Compensation for private-sector firms.* Rentschler and Bazilian write that "It may be difficult for small businesses and energy intensive industries to quickly adjust their operations to the energy price shock associated with subsidy reduction. Without adequate support measures in place, economic activity and jobs may be at risk," (2017, p. 147). This could be especially impactful for export-oriented firms, under scenarios whereby one given country phases out its fossil fuel subsidies while its export-market competitors do not. With respect to compensation for businesses, unlike that for households, in most cases this support could be provided through tax reductions. Where people are operating informal enterprises that do not file tax returns, business owners will still be receiving compensation through the consumer support provisions.

4. *Revenue redistribution and reinvestment in the long-term.* Rentschler and Bazilian recognize that, because fossil fuel subsidies are often very large as a share of a country's public sector budget, the revenues that governments will recapture by phasing out these subsidies will be correspondingly large. Rentschler and Bazilian note that this recaptured revenue can be redirected into long-term programs for financing infrastructure, health and education as well as alternative subsidy programs such as cash transfers. Reducing taxes, including, as noted above, for small business owners, is another alternative use in rechanneling the fossil fuel subsidy funds. The choices that governments make among these possibilities will obviously depend on conditions in a given country and the political forces at play. The one critically important option that Rentschler and Bazilian do not explicitly address is investments to build countries' clean energy infrastructure as their fossil fuel infrastructure is phased out. This is the option on which we focus in our next sections, in combination with alternative direct compensation support for low- and middle-income households.

5. *Public communication of policy changes.* As we have discussed above, fossil fuel subsidies are significant determinants of spending decisions for households and businesses in a large number of countries. This is the case even while households and businesses do not typically recognize the extent to which these subsidies impact how much they pay for a wide range of products. Given this reality, any program to phase out fossil fuel subsidies must be explained effectively to the public so that the public understands that, with effective compensatory programs in place, alternative forms of support will counteract the rise in fossil fuel energy prices. Rentschler and Bazilian write "In order to generate public support for fossil fuel subsidy reforms, transparent, credible and clear communication and public outreach campaigns play a central role. Such campaigns must detail the reasons for and benefits of reform and address the public's concerns with realistic plans for mitigating adverse effects on energy affordability and poverty," (2017, p. 146).[21]

6. *Timing and price smoothing*. The process of phasing out fossil fuel subsidies needs to be implemented incrementally such that the removal of subsidies will not produce price shocks or other significant economic disruptions. To achieve this, the full set of complementary measures will need to be in place and demonstrably effective before the fossil fuel retail prices are allowed to rise significantly. Rentschler and Bazilian write that "effective fossil fuel subsidy reform includes (stepwise) subsidy removal, but also depends on the careful timing of complimentary measures (such as communication and compensation)," (2017, p. 151).[22]

These proposals outlined by Rentschler and Bazilian provide some valuable guidelines for implementing a successful fossil fuel phase out program. But they still do not examine adequately some of the most critical features of such a program—features that need to be understood fully for the phase-out program to succeed. These additional features include the following:

1. *How generous are alternative subsidy programs?* It is not sufficient to establish the general point that alternative forms of support will be provided as fossil fuel subsidies are phased out. Rather, what must be recognized is that the *extent* of alternative support will need to *at least* fully compensate low- and middle-income households for the higher fossil fuel energy costs that they will face.
2. *Channeling subsidy support to building clean energy infrastructure*. The level of alternative support for households and businesses will need to be explicitly tied to the development of a country's clean energy-dominant infrastructure. That is, to a significant extent, compensation for the rise of retail fossil fuel energy prices should take the form of clean energy substitutes that are easily available at low costs. Investments to achieve high energy efficiency standards as well as an abundance of renewable energy supplies will be critical for keeping energy costs low within a clean energy-dominant infrastructure. Correspondingly, this will increasingly diminish the inflationary impacts of any future spikes in the global price of oil.
3. *Facing opposition from high-income households and fossil fuel corporations*. It needs to be understood that, however well-designed the phase-in of a country's alternative compensation measures, the elimination of fossil fuel subsidies will still face heavy political opposition. This opposition will come from high-income households and businesses tied to the fossil fuel industry. These are the two sectors of society that are, as we have discussed, the largest beneficiaries of fossil fuel subsidies. These sectors cannot possibly be fully compensated for the income losses they will face when fossil fuel subsidies are phased out. The only way to overcome these sources of opposition will be to ensure that the support for the phase-out will be sufficiently strong among other social sectors—that is, in particular, low- and middle-income households and businesses that are not directly connected to the fossil fuel industry.

Given these distributional and political dynamics, the challenge for enacting a sustainable phase out of fossil fuel subsidies is to design programs that can ensure that the living standards of lower- and middle-income households will be at least maintained, if not improved, as the fossil fuel subsidies are phased out. The subsidy phase out needs to also be focused on supporting the development of clean energy infrastructures in all country settings. This emerging clean energy infrastructure can then become the means through which energy will become more accessible and affordable, especially in low- and middle-income economies. Of course, this clean energy transition will also be the main factor in driving down global CO_2 emissions.

5. Fossil Fuel Phase-Out Case Studies: India and Indonesia

OVERVIEW

Our presentations of case studies for India and Indonesia include both quantitative and qualitative discussions. With both case studies, we begin by reviewing the evidence on the extent of fossil fuel subsidies over 2010–2023. As we will see, with both India and Indonesia, the movement of fossil fuel subsidies over this period closely follows the patterns we reviewed above for the global economy. That is, fluctuations in the extent of subsidies in India and Indonesia largely mirror movements in the global price of oil. As with the global economy overall, we can interpret this pattern to mean that, despite significant initiatives at times to reduce fossil fuel subsidies, neither India nor Indonesia has succeeded to a significant extent as yet in reducing these subsidies through means other than a decline in the global oil price. This becomes especially clear with recent spike in subsidy levels over 2021–2022 and the continuing elevated level for 2023. The sharp increases in subsidy levels for both countries correspond closely with the rise in the average crude oil price over these years.

With both country case studies, we then provide a brief review of their fossil fuel subsidy policies since they achieved independence—in 1947 for India and 1949 for Indonesia. Both countries have changed their fossil fuel subsidy policies over time. In particular, in both countries, policymakers have pursued significant efforts to phase down fossil fuel subsidies. In India, these efforts started in the early 1990s as one component of the country's broader policy shift toward neoliberalism. In Indonesia, the efforts to phase down fossil fuel subsidies followed the country's severe economic downturn resulting from the Asian Financial Crisis. In both countries, policies have also been introduced to provide alternative forms of support for lower-income population groups, to protect them from sharp increases in their living costs that would result to the extent that fossil fuel subsidies are cut but no alternative subsidy programs are enacted as substitutes.

These alternative policy initiatives in both countries have not been fully successful in providing adequate compensation to lower-income households when the fossil fuel subsidies were cut. However, these efforts do provide a template for establishing viable alternative subsidy programs to compensate for the phase-out of fossil fuel subsidies. These alternative subsidy measures could take the form of cash or in-kind support, such as with food subsidies. The critical factors in providing such alternative forms of subsidy support are that: 1) the alternative subsidy programs remain in operation over the full period in which fossil fuel subsidies are phased down; 2) the alternative subsidies are targeted for those households that truly need such support; and 3) the level of support provided is at least comparable what lower-income households would have received through fossil fuel subsidies.

For both India and Indonesia, we work through some simple examples to illustrate ways through which alternatives to fossil fuel subsidy programs can be implemented consistent with these criteria. These examples include two sets of illustrative phase-out and alternative compensation scenarios for both the Indian and Indonesian cases. Scenario 1 for both countries is a *limited compensation program*, in which only households up to the 60th–70th income decile receive cash

or food subsidies to compensate for the loss of their fossil fuel subsidy support. Scenario 2 is a *universal compensation program,* in which all households, including those in the 3 highest income deciles, would receive the same level of alternative subsidy support.

We also review the relative strengths and weaknesses of the alternative compensation scenarios for both India and Indonesia. The conclusions we reach here mirror closely the more general findings within the extensive literature on the relative merits in developing countries of universal benefit programs, such as basic income grants, versus targeted benefit programs. But examining these more general questions on the relative strengths of universal versus targeted transfer programs is beyond the scope of this study.[23]

For our purposes, the critical broader point that we illustrate is that, even under assumptions of generous cash or in-kind subsidies provided for lower-income households, the Indian and Indonesian governments will still be able to capture large-scale savings relative to maintaining fossil fuel subsidies at anything like their existing levels. As we discuss, a substantial share of these newly available government savings can then be rechanneled to provide major support for both countries' clean energy transitions.[24]

FOSSIL FUEL SUBSIDY POLICIES IN INDIA

Evolution of India's Fossil Fuel Subsidy Policies

Since achieving independence in 1947, India has pursued a wide range of policy approaches with respect to subsidizing fossil fuel production and consumption. This includes varying positions on whether fossil fuel energy production and consumption should be subsidized at all; and, if they should be subsidized, what would constitute the most effective ways to implement these subsidies.

The major changes that have occurred over time in India's fossil fuel subsidy policies reflect varying responses to the basic underlying reality that, without question, energy supply and demand considerations play a critical role within India's economy. The key issues at play include:

1. As with all economies, the supply and price of energy products in India exert a major influence on the costs of producing virtually everything in the economy and, correspondingly, on consumer prices and living standards of Indian households. Among the most basic concerns is that energy prices are highly impactful for the capacity of lower-income households to meet their basic needs. Energy prices in India, as elsewhere, are also a major factor influencing fluctuations in the economy's inflation rate, and, consequently, in determining the economy's macroeconomic performance and growth prospects.
2. As of 2023, overall energy consumption in India amounted to about 36 Q-BTUs. Of this total, coal was the most important energy source, accounting for 59 percent of total consumption. Oil accounted for 29 percent of overall consumption, and natural gas for 6 percent. Nuclear energy and the full set of renewables accounted for the remaining 6 percent.[25]

3. Since independence, India has been able to meet most of its demand for coal through its domestic resources. As of 2023, domestically-produced coal accounted for 78 percent of total consumption. By contrast, India has always been heavily dependent on imports as sources of oil and gas supply. As of 2023, India was importing 87 percent of its petroleum supply and 48 of natural gas.
4. Tax revenues generated through the fossil fuel energy sector provide a major source of overall government tax revenue in India. Thus, alongside the various subsidy policies in support of fossil fuel production and consumption in India, it is still the case that, as of fiscal year 2023, total government receipts (including central, state and union territory) on petrol and diesel fuel amounted to 14 percent of overall government revenue. Government receipts from the coal sector provided an additional 2.5 percent to total government revenue. In sum then, as of 2023, India's fossil fuel industries contributed 16.5 percent of overall tax revenue received by the economy's combined public sector entities (Raizada et al. 2024).

These considerations establish the broad framework for assessing fossil fuel subsidy policies in India and the prospects for replacing them with alternative forms of support for the country's energy consumers. We consider developments over time with oil and gas subsidies and then examine coal subsidies.

Oil and Gas Subsidies

Oil and gas subsidies in India have primarily been implemented with respect to four main petroleum products. These are petrol (gasoline) and diesel fuel, used primarily as automobile fuel and, with diesel, to also operate agricultural machinery; and LPG and kerosene, used primary for household consumption. The subsidies on petrol and diesel have been provided through price controls, while those for LPG and kerosene were implemented through what became known as the Public Distribution System (PDS) Kerosene and domestic LPG Subsidy Scheme (RIS, 2010, p. 2).

The 2009 study by Bandyopadhyay summarizes the centrality of petroleum in the Indian economy at that time and the framework within which oil price setting and subsidy policies had been enacted.

> India has persistently been depending on imported crude oil (primarily from the oil and petroleum exporting countries in the Middle East) to meet the lion's share of its requirement. The import dependence for crude and the consequent vulnerability of the country to oil price shocks has exacerbated over the recent past owing to rapid growth of the Indian economy post-1991 that has fueled a rapid growth in oil consumption.
>
> Given the paramount importance of petroleum for the Indian economy and its increasing import dependence on this front, domestic pricing of crude oil and petroleum products assumes enormous significance for the country. The pricing regime not only influences the cost of energy for the economy as a whole but also has significant implications on economic growth and welfare, (2009, p. 3).

These considerations continue to remain central at present within India's economy.

Evolution of Petroleum Product Pricing

Prior to India gaining independence in 1947, there were no government controls on the pricing of petroleum products. Beginning in 1947, the government enacted regulations based on a framework of import parity pricing—i.e. the price at the border of petroleum and its products. Indian oil companies were permitted to set prices within the domestic Indian economy based on the import parity price while also allowing the companies to incorporate shipping, refining, distribution, taxes and other related levies and charges.

This price-setting framework was maintained until 1973, when the global price of crude oil tripled in a matter of months. In response to this global oil price spike, in 1974, the Indian government constituted an Oil Price Committee which recommended the replacement of the import parity framework with what was termed an Administered Pricing Mechanism (APM) for pricing petroleum products. The formula set for the APM was: *crude oil cost + refining cost + 15% return on capital employed*.

The overarching aim of the APM was to stabilize the supply of petroleum products to Indian industry and consumers. This meant, among other things, according to Bandyopadhyay "making products available at subsidized rates for lower-income sections of the society and priority sectors in the industry through cross-subsidization," (2009, p. 9).

The APM policy framework was maintained in India, with periodic adjustments, through the early 1990s. But in 1991, India's overall economic policy regime shifted decisively toward liberalization.[26] The APM framework was clearly out of alignment with this policy regime shift. Maintaining the APM framework also faced increased pressures due to the sharp increase in energy demand resulting from the economy's accelerating growth trajectory beginning in the early 1990s. Thus, between 1991 and 2019, India's GDP growth rate averaged 6.4 percent per year. Over this period, energy consumption increased by an average of 5.1 percent per year, with overall consumption rising from 7.8 to 31.7 Q-BTUs.[27]

It was within these circumstances that Indian policymakers increasingly perceived major problems resulting through the APM framework. These included the inconsistent pricing of petroleum products as inputs for industry and resulting sub-optimal substitution of various petroleum products. In turn, these factors created increased difficulties for the government in administering the APM pricing system. As a result an Expert Technical Group was formed to develop a program for dismantling the APM system. This group recommended phasing out the APM system over 4–5 years, beginning in 1997. (Bandyopadhyay 2009, 4–5).

In practice, the APM system was relaxed after 1997, but was never fully phased out. The resistance to phasing out fully the system of price controls and subsidies reflected the government's concern that unregulated petroleum product prices would have negative impacts on the country's vulnerable population groups.[28]

In particular, the four major petroleum products—petrol, diesel, kerosene and LPG—continued to be subsidized and insulated from international price fluctuations. According to a 2012 study by GSI/IISD, total subsidies for these four petroleum products amounted to about $18 billion at that time. The distribution of the subsidy shares were: diesel 43 percent ($7.6 billion), LPG 29 percent

($5.2 billion), kerosine 25 percent ($4.5 billion), and gasoline 3 percent ($490 million). For the most part, the subsidies took the form of under-recoveries. This is when petroleum products are sold to final consumers at below benchmark international prices by domestic oil marketing companies (OMCs). The OMCs then received cash compensation for the under-recoveries both from the government and the upstream oil companies. However, the compensation received by the OMCs was only partial. For 2010, the overall shares of subsidy provision broke down as: government, 54 percent; upstream oil companies, 37 percent; and OMCs, 9 percent.[29]

These ongoing subsidy programs did also experience significant problems, in particular, with respect to their distributional impacts. With respect to the price controls on petrol and diesel, the main problem was the historic built-in subsidy in favor of diesel, which aimed to keep the price of diesel depressed. The argument in support of this policy was that petrol was the fuel consumed disproportionately by higher-income consumers. But the asymmetric pricing program incentivized all households to transition into owning diesel-powered automobiles. At the same time, the largest share of individual transportation vehicles were two-wheelers, which were powered by petrol. Two-wheelers are owned primarily by lower-income consumers.

There were also large differences in the benefits that accrued to rural versus urban households. This is because rural households continued to rely primarily on biomass (firewood or dung cakes) as the primary energy source for cooking, while LPG and kerosine were much more prevalent for urban households. Thus, between 1990–2006, roughly 75 percent of rural households relied on biomass for cooking, while between 5–10 percent used LPG and 1–3 percent used kerosine. By contrast, with urban households, 44 percent relied on LPG for cooking as of 1990, with this share rising to 57 percent as of 2006. The share of urban households relying on kerosine for cooking declined from 24 percent to 9 percent between 1990–2006, while the share of households utilizing biomass for cooking remained fairly stable, at between 20–23 percent, between 1990–2006. Overall, given these figures, the benefits of subsidies for LPG and kerosine necessarily flowed disproportionately to urban households, even while the relative use of LPG for cooking increased in both rural and urban regions while the reliance, respectively, on kerosine declined in both regions.[30]

It was in recognition of these major distributional problems with the ongoing APM subsidy framework that, in 2013, the Indian government established the Direct Benefit Transfer (DBT) scheme for LPG. Under this new subsidy framework, LPG cylinders were sold at a common market price throughout the Indian economy. The subsidies were then provided directly into households' bank accounts for a maximum of 12 cylinders (of 14.2 kilograms) each per household per year. In its initial roll-out in 2013, the program did face significant administrative problems. This included the requirement that households needed to have a 12-digit identification number (Aadhaar number) to be able to receive the cash subsidy in their bank accounts.[31] This requirement, in particular, was widely criticized by Indian researchers and policy analysts.

In light of these problems, the APM program was suspended and redesigned in 2014, and then relaunched in 2015, under the name PaHaL (Pratyaksha Hastaantarit Laabh). Under the modified program, access was simplified while the system was able to still maintain control over the distribution of funds to their intended recipients. The revised program included three key features:

1) it allowed households to become eligible for LPG subsidies even if they did not have Aadhaar numbers, while also expanding efforts to minimize fraudulent accounts; 2) it launched a "Give it Up" campaign in March 2015, which encouraged higher-income households to voluntarily relinquish their LPG subsidies; and 3) from January 2016, it formally excluded households with annual incomes of more than 1 million rupees from eligibility for LPG subsidies (Mittal et al. 2017).

A 2018 study by Jain et al. assessed the effectiveness of the modified subsidy DBT program. They found that the modified program "fared well in both implementation and objectives." This assessment is especially significant, given the scope of the program. As of October 2015, the program covered about 139 million households, making it the largest benefit transfer scheme in the world (Jain, 2018 p. 212). At the same time, Jain et al. found that improvements in the program were still needed due to ongoing "delays in the subsidy transfer, information gaps, and lack of financial inclusion," (p. 226).

These and related problems with the DBT program identified by Jain et al. are described further in a 2019 study by Sharma et al., *Gender and Fossil Fuel Subsidy Reform in India*. This study, as its title implies, focuses on deficiencies in delivering LPG subsidy support for rural women in India. Like the Jain et al. study, the Sharma et al. conclusions are based on household surveys that they conducted throughout India on the effectiveness of the LPG subsidies. More specifically, Sharma et al. found that about half of the women that they surveyed did not benefit from LPG subsidies because they continue to cook with biomass.

In fact, as Sharma et al. write, India has two large subsidy programs linked to LPG. In addition to the PaHal program is the Pradham Mantri Ujjwala Yojana (PMUY) program, introduced in 2016. The PMUY has aimed to subsidize the upfront costs of switching to LPG. As such, it is a "connection" subsidy, as opposed to the PaHal "consumption" subsidies. Sharma et al. found that only 48 percent of the PMUY beneficiaries were among the poorest 40 percent of households. They cite three factors which have inhibited PMUY take-up rates among the poor: the cost of the LPG connections or cylinder refills are still too high for some households; LPG is not always locally available; and poor households may be ineligible for the subsidies, due to operational deficiencies.[32]

Sharma et al. discuss a series of measures for improving the targeting of LPG subsidies, with respect to both the consumption and connection subsidy measures. Most pertinent within the framework of a broader program of phasing out fossil fuel subsidies is their proposals to "target subsidies away from fuels and toward outcomes." This proposal implies, as they write, "shifting to cash transfers based on gender empowerment outcomes. In terms of energy, this could imply better targeting technology-neutral subsidies to households and women who need them most.," (2019, p. 4). Their suggestion that cash transfers could work effectively as "technology-neutral subsidies," could be extended further to become 'technology-biased' in favor of clean renewable energy sources while fossil fuel energy sources are phased out entirely. Of course, pursuing such a technology-biased approach is the only approach that is fully consistent with the climate imperative of phasing out fossil fuels, in India as elsewhere.

Coal and Electricity Subsidies

Subsidies for coal have been provided in India since 1957 under the auspices of the Coal Price Revision Committee. The mines were fully nationalized between 1971–1973 (Kumar 1981). Within this framework, there are two primary channels through which the industry receives subsidies. One channel is through providing concessionary tax rates to coal-producing companies for their cess tax obligations with respect to both mining and development of transportation infrastructure in coalfield areas. The other is through establishing below-market prices for electricity and providing direct financial support to electricity distribution companies (DISCOMS).

The direct support to the coal companies has been negligible for many years. As we show below in Figure 6, between 2010–2022, this subsidy channel ranged between only 1-2 percent of overall fossil fuel subsidies in India. By contrast, the subsidies in terms of electricity generation and distribution ranged between 7–35 percent of overall fossil fuel subsidies, with this share rising sharply from the 7 percent low in 2012 to the 35 percent peak in 2021. The most recent 2022 share was 30 percent of India's total fossil fuel subsidies.

In principle, the subsidies provided via electricity pricing and support for DISCOMS are neutral with respect to electricity-generating sources—i.e. the same level of subsidy support regardless of whether electricity is being generated from natural gas, solar, wind, or coal. However, coal has long been the dominant energy source for generating electricity in India. As of 2022, coal's share of electric power generation totaled to 72 percent.[33]

Most Recent Policy Developments

A 2024 study by the Asian Development Bank presents a favorable overview of developments with fossil fuel subsidy reform in India since 2010, concluding that "India has made noteworthy progress on fossil fuel subsidy reform." They write:

> By carefully balancing the combined effects of three key policy levers—retail prices, tax rates and subsidies on selected petroleum products—the country was able to reduce its fiscal subsidy by 85 percent from an unsustainable peak of $25 billion in 2013 to $3.5 billion in 2023. India gradually phased out the subsidy on petroleum and diesel and carried out incremental tax increases (from 2010 to 2017) which created fiscal space to increase support for renewable energy, electric vehicles, and strengthening of electricity infrastructure. The additional tax revenue from increases in excise duty on petrol and diesel from 2014 to 2017, a period of low international crude prices, were also redirected to improve access and target subsidies for expanding the use of liquefied petroleum gas (LPG) among the rural pool….From 2010 to 2017, the Government of India introduced a cess (tax) on coal production and imports (p. 136).

These have been positive developments. But as we will review in detail below, these developments also need to be placed with the broader recent patterns with fossil fuel subsidy outlays in India. These include: 1) After having fallen from 2013–2016 and remained at a relatively low level through 2019, overall fossil fuel subsidies rose sharply from 2020–2023; 2) the 2021–2023 subsidy levels are comparable to those in 2013–2014; and 3) throughout the full period 2010–2023, move-

ments of subsidy levels as a share of India's GDP correlates strongly with the average global crude oil price.

India's Fossil Fuel Subsidy Trends, 2010–2023

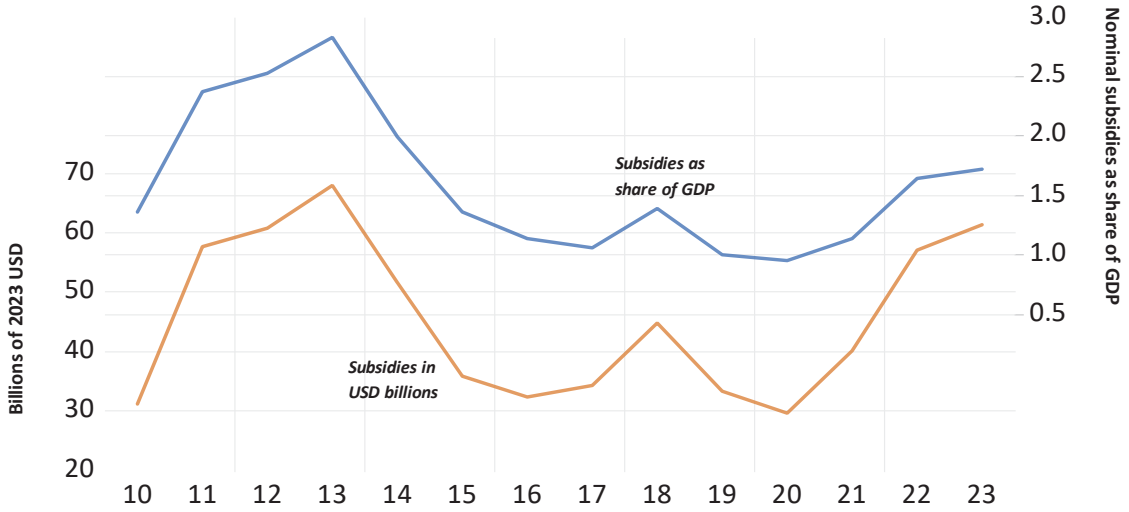
Figures 4–6 present the movements of India's overall fossil fuel subsidies between 2010–2023. Working with the Fossil Fuel Subsidy Tracker data series, we see with these figures that the same basic patterns emerge as those that we reviewed above for the global economy.

Thus, Figure 4 reports the real level of India's fossil fuel subsidies in 2023 USD and the subsidy level (in nominal dollars) as a share of India's GDP. The figure shows that the real subsidy level and the subsidy/GDP ratio move in nearly identical patterns—and these patterns are, in turn, similar to the relative movements globally in these two series that we saw in Figure 2. That is, real subsidies rise between 2010–2013, to a peak of $68 billion in 2013. The figure then trends downward to a low during the COVID lockdown of $30 billion, before rising sharply to $57 billion in 2022 and again in 2023, to $61 billion. The subsidy/GDP ratio follows the same pattern. It peaks at 2.8 percent of GDP in 2013, then trends downward until 2020, and finally rises to 1.6 percent of GDP in 2022 and 1.7 percent in 2023.

Figure 5 plots the movements of the subsidy/GDP ratio along with the global crude oil price. Again, the patterns of these two series correspond closely with the movements of the global subsidy/GDP ratio and the global crude oil price. With the India specific figures, the correlation coefficient between the subsidy/GDP ratio and the global crude oil price is 0.89 for the full 2010–2023 period.

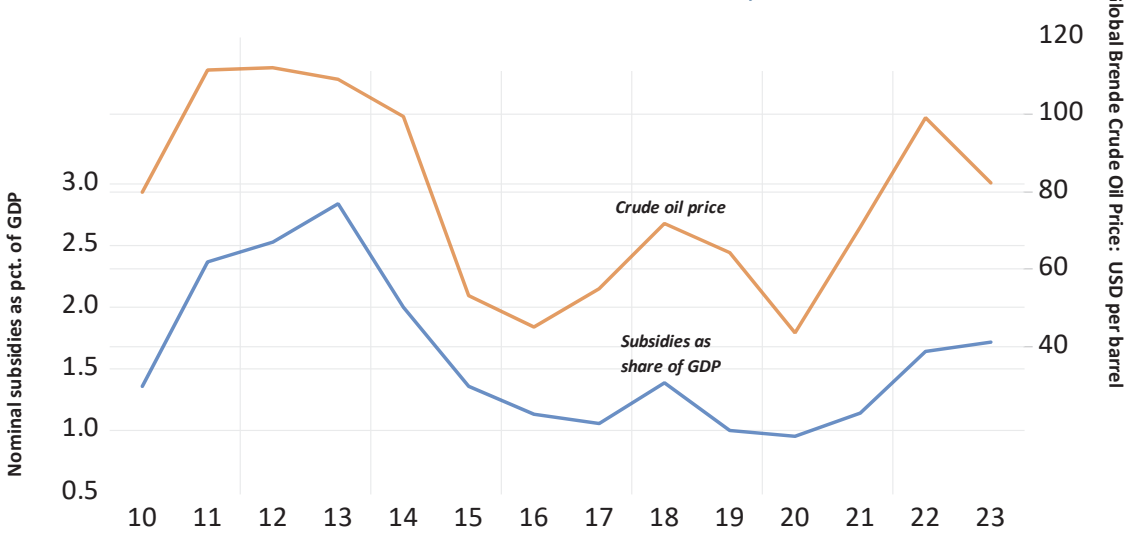
FIGURE 4: India Fossil Fuel Subsidies, 2010–2023

Fossil Fuel Subsidy Tracker Figures



Sources: See Figure 1.

FIGURE 5: India Fossil Fuel Subsidies/GDP and Crude Oil Price, 2010–2023



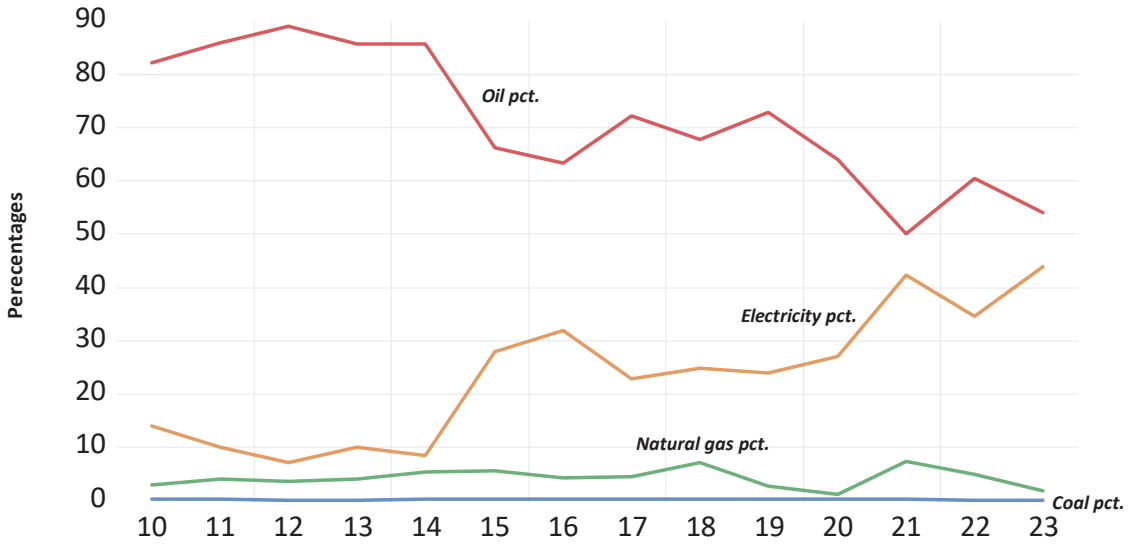
Sources: See Figure 1.

Thus in India, as with the global economy, fluctuations in the government's fossil fuel outlays and the subsidy/GDP ratio are dominated by movements in the global crude oil price. This result implies that the policy measures in India that we reviewed above to reduce fossil fuel subsidies have had only a modest impact relative fluctuations in the global crude price.

Figure 6 shows the distribution within India in the shares of total fossil fuel subsidies by the alternative fossil fuel energy sources. The subsidies provided for oil-based products—including gasoline, diesel, LPG and diesel—constitute by far the largest share of overall subsidies throughout the full 2010–2023 period. But this oil subsidy share does decline from a peak of 89.2 percent in 2012 to a low of 50.0 percent in 2021 ending the full period in 2023 at 54.0 percent. Electricity is the only other area of significant fossil fuel subsidy support in India. Electricity's share rises from a low of 7.1 percent in 2012 to a peak of 43.9 percent at the end of the period in 2023. As with the overall global economy, the predominant fossil fuel source for electricity generation in India is coal, with coal combustion producing 94 percent of the economy's fossil-fuel generated and 71 percent of India's overall electricity supply.[34] In effect, therefore, India's electricity subsidies to date are underwriting the economy's ongoing dependence on coal as an electricity generator.

FIGURE 6: India: Shares of Overall Fossil Fuel Subsidies

Oil, Electricity, Natural Gas, and Coal



Source: See Figure 3.

Distribution of Fossil Fuel Subsidy Benefits

In Tables 5–8, we review data on the distribution of fossil fuel subsidies in India by household income deciles. The data we present in Tables 5–8 are reported in Mittal et al. (2017, p. 8). These figures reported by Mittal et al. are derived from the 2009–10 Household Consumer Expenditure Survey conducted by India's National Sample Survey Office (NSSO), with the specific estimates having been generated, as stated in Mittal et al. by the "IMF staff."

India's NSSO has since produced a more recent household survey in 2022–2023. However, to date, no studies have been published which estimate the distribution of fossil fuel subsidy benefits based on this most recent household survey. To at least partially address this literature gap, we have generated estimates on the distribution of overall *energy consumption* by household deciles from the 2022–23 survey and compared these estimates with the comparable energy consumption figures from the 2009–10 survey. We review these comparable energy consumption figures by household deciles in Appendix 2. From these comparative household energy consumption figures, it is reasonable to assume that the distribution of fossil fuel subsidy support likely shifted modestly as of 2022–23 relative to 2009–10, becoming somewhat less regressive as of the most recent household survey period. Another factor that could have further reduced regressivity in fossil fuel subsidy distributional shares between 2009–10 and 2022–23 is the set of policy changes that we have discussed above. These include the reduction in the petroleum and diesel subsidy programs and the efforts to more effectively target lower-income households through LPG subsidies.

Nevertheless, in the absence to date of studies that provide direct evidence on fossil fuel subsidy distributional shares as of 2022–2023, we therefore work primarily here with results from the 2009–2010 survey, as reported by Mittal et al. while also recognizing that the current subsidy distributional shares will have likely become somewhat less regressive relative to the figures we review from the Mittal et al. study. Keeping this consideration in mind, the central finding that emerges from Tables 5–8—that would remain robust even after accounting for the likely modest shifts in households' relative subsidy distributional shares—is that the benefits from fossil fuel subsidies in India are skewed heavily in favor of high-income households. This is the case, straightforwardly, because, in 2022–23 as in 2009–10: 1) fossil fuel subsidies in India are provided to all consumers; and 2) higher-income households consume much greater absolute amounts of fossil fuel energy than lower-income households.

More specifically, working with the Mittal et al. results for 2009-10, we see in Table 5 that the poorest 10 percent of households in India received 3.4 percent of total fossil fuel subsidies, while the richest 10 percent of households received 27.4 percent. That is, the richest 10 percent of households received 8 times more government support through fossil fuel subsidies than the poorest 10 percent of households.

In Table 6, we present these same results in terms of amounts of money received per household within each of India's 10 household deciles, expressed in 2023 U.S dollars. For this illustrative exercise, we do not allocate the total $61.3 billion of India's 2023 fossil fuel subsidies. We rather include *consumption subsidies only*, which amounted to $47.4 billion, or 77 percent of total fossil

TABLE 5. INDIA: Fossil Fuel Consumption Subsidy Distribution by Household Income Deciles 1:
Household consumption subsidy shares in percentages

Income deciles from poorest to richest	
Poorest 10%	3.4%
11th- 20th percentile	4.2%
21st - 30th percentile	4.7%
31st -40th percentile	5.7%
41st -50th percentile	6.4%
51st -60th percentile	8.0%
61st -70th percentile	9.7%
71st – 80th percentile	13.2%
81st -90th percentile	17.5%
Richest 10%	27.4%

Sources/notes: Mittal (2017), p. 8. All subsidy and income share figures estimated by measuring the length of barplots.

TABLE 6. INDIA: Fossil Fuel Subsidy Distribution by Household Income Deciles 2:

Household 2023 consumption subsidy shares in U.S. dollars

Figures estimated from:

- 294 million Indian households, with 4.2 people per household:
- Each household decile = ~30 million households
- Total 2023 fossil fuel consumption subsidies = $47.4 billion
  - 77.3% of $61.3 billion in total 2023 fossil fuel subsidies

Income deciles from poorest to richest	
Poorest 10%	$54
11th- 20th percentile	$66
21st - 30th percentile	$74
31st -40th percentile	$90
41st -50th percentile	$101
51st -60th percentile	$126
61st -70th percentile	$153
71st – 80th percentile	$209
81st -90th percentile	$277
Richest 10%	$433

Sources/notes: See Table 5. Household demographic figures from Estimated number of households, average household size and sex ratio (no. of female per 1000 male) | Ministry of Statistics and Program Implementation | Government Of India; consumption subsidy figure from https://www.iea.org/data-and-statistics/data-product/fossil-fuel-subsidies-database; total subsidy figure from https://fossilfuelsubsidytracker.org/

fuel subsidies, as the subsidy level provided for India's households that year.[35] The remaining $13.9 billion in 2023 subsidies, 23 percent of the $61.3 billion in total subsidies, were provided for India's fossil fuel producers.

We then incorporate the Indian population figure to complete these estimates—i.e. there were, as of 2022–2023, a total 294 million households in India with a total population of 1.4 billion.[36] Thus, each of the country's income deciles includes roughly 30 million households. The average size of households was 4.2 people.

Of course, the figures that emerge through these calculations portray the same disparities as the figures expressed in the previous figures on shares of total subsidy funds received. That is, as of 2023, the average household in India's poorest 10 percent cohort received an average of $54 while the average subsidy for the richest 10 percent was $433. That is, again, the richest 10 percent of Indian households are receiving 8 times more support through fossil fuel subsidies than the poorest 10 percent.

Tables 7 and 8 show the same data on subsidy distribution with larger household income cohort groupings, with the Table 7 figures in percentages and the Table 8 figures in 2023 U.S. dollars.

Thus, in the upper half of Table 7, we see that the poorest 30 percent of Indian households received only 12.3 percent of all fossil subsidies while the richest 30 percent received 58.1 percent. In the lower half of Table 7, we divide all 294 million Indian households into two groups, each comprised of 50 percent of total households—thus, a lower 50 percent and an upper 50 percent grouping of households. With these groupings for all Indian households, we see that the lower half of the distribution received 24.4 percent of total fossil fuel subsidies while the upper half received 75.8 percent. In short, these broader groupings of Indian income cohorts show the same overall result as the figures by household income deciles—that the benefits of fossil fuel subsidies in India have been skewed heavily in favor of high-income households.

Table 8 then expresses these same findings in terms of U.S. dollar amounts. Focusing still on the total level of *consumption subsidies* only for 2023 of $47.4 billion, we find that the lower 30 percent

TABLE 7. INDIA: Fossil Fuel Consumption Subsidy Distribution by Larger Household Income Cohorts 1:
Household subsidy shares in percentages

Shares received by lower 30% of households	12.3%
Shares received by upper 30% of households	58.1%
Shares received by lower 50% of households	24.4%
Shares received by upper 50% of households	75.8%

Source: See Table 5.

TABLE 8. INDIA: Fossil Fuel Consumption Subsidy Distribution by Larger Household Income Cohorts 2:
Household subsidy shares in 2023 U.S. dollars

- Total 2023 fossil fuel consumption subsidies = $47.4 billion
  - 77.3% of $61.3 billion in total 2023 fossil fuel subsidies

Average subsidy per household for lower 30% of households	$65
Average subsidy per household for upper 30% of households	$306
Average subsidy per household for lower 50% of households	$77
Average subsidy per household for upper 50% of households	$239

Source: See Table 6.

of households received an average of $65 in fossil fuel subsidies, while the upper 30 percent received $306—nearly 5 times more than the lower 30 percent. Dividing the population into upper- and lower 50 percent household cohorts, we see that the lower 50 percent of households received an average of $77 in subsidies while the upper 50 percent received $239—over 3 times more.

Overall, these results illustrate the point that eliminating fossil fuel subsidies and replacing them with cash or food subsidies that are targeted to vulnerable households will have a significant equalizing impact on income distribution in India. This will be true if we focus only on redistributing the $47.4 billion in 2023 consumption subsidies on a more egalitarian basis. But the equalizing impact will be greater still, of course, if all $61.3 billion in fossil fuel subsidies—including now production as well as consumption subsidies as of 2023—were redistributed on an egalitarian basis.

To this point, if we allow that all fossil fuel subsidies are to be phased out—not only fossil fuel consumption subsidies—it follows that all $61.3 billion in subsidies as of 2023 will become available for rechanneling into alternative uses. Among such alternative uses, this total subsidy amount can then be utilized either to provide in-kind or cash transfers to a subset of households that require this level of support or to subsidize clean energy investments. Of course, additional uses of the newly available funds are also options. But these other uses would not be serving either to compensate lower-income households for their loss of fossil fuel subsidy support or to advance India's clean energy transition. As such, we focus here on two key alternative reallocation options—cash or in-kind subsidies and supporting the expansion of India's clean energy infrastructure.

Alternative Subsidy Phase-Out Scenarios

We sketch here two illustrative fossil fuel subsidy phase out scenarios. As briefly described above for both the Indian and Indonesian cases, Scenario 1 is a *limited compensation* program, in which only households up to the 60th–70th income percentile receive cash or food subsidies to compensate for the loss of their fossil fuel subsidy support. Scenario 2 is a *universal compensation* program. Under the universal compensation program, all households, including those in the 3 highest income deciles, would receive the same level of alternative subsidy support.

For both Scenarios 1 and 2, we assume that the level of alternative subsidy compensation provided will be equal to the total level of fossil fuel subsidies in 2023, including here production as well as consumption subsidies. Thus, as Table 9 shows, based on the total fossil fuel subsidy figure of $61.3 billion in 2023, the share of this total subsidy received by households in the 41st–50th percentile would be $131.[37]

As such, if total fossil fuel subsidy support is $61.3 billion, then, under Scenario 1, all households up to the 61st–70th percentile will receive $131 in alternative subsidy compensation when fossil fuel subsidies are eliminated. In Scenario 2, all households—including those in the highest three income deciles—receive $131. Of course, we could work through the same conceptual framework with alternative assumptions both on the level of total fossil fuel subsidy support and the distribution of alternative subsidy compensation. These specific numerical examples we provide here are meant to be illustrative only.

TABLE 9. INDIA: Illustrative Scenarios for Alternative Subsidy Compensation after Fossil Fuel Subsidy Phase Out

Figures estimated from:

- $61.3 billion in total 2023 fossil fuel subsidies
  - ($47.4 billion in consumption subsidies)
- Compensation at 41st – 50th household percentile of total fossil fuel subsidy support; = $131 per household

1) Income deciles from poorest to richest	2) 2023 household subsidy support through consumption subsidies only	Limited compensation of total subsidies: Lower 70% of households only receive $131		Universal compensation of total subsidies: All households receive $131	
		3) Compensation amount	4) Net change in subsidy support (= columns 3-2)	5) Compensation amount	6) Net change in subsidy support (= columns 5-2)
Poorest 10%	$54	$131	+$77	$131	+$77
11th- 20th percentile	$66	$131	+$65	$131	+$65
21st - 30th percentile	$74	$131	+$57	$131	+$57
31st -40th percentile	$90	$131	+$41	$131	+$41
41st -50th percentile	$101	$131	+$30	$131	+$30
51st -60th percentile	$126	$131	+$5	$131	+$5
61st -70th percentile	$153	$131	-$22	$131	-$22
71st – 80th percentile	$209	0	-$209	$131	-$78
81st -90th percentile	$277	0	-$277	$131	-$146
Richest 10%	$433	0	-$433	$131	-$302

Source: See Table 6.

We can observe in Table 9 the income benefits that would accrue to lower-income households under both the limited and universal compensation scenarios. For example, for households in the lowest income decile, the $131 in alternative compensation would increase by roughly 140 percent relative to the $54 they received in 2023 through their share of fossil fuel consumption subsidies. This same $131 going to households in the 11th–20th income percentile would nearly double the $66 they received in 2023 in fossil fuel consumption subsidies. All households up to the 51st–60th percentile would be better off through receiving the alternative subsidies that combine funding from production as well as consumption subsidies relative to what they had received from fossil fuel consumption subsidies only.

Of course, with the limited subsidy compensation program, households in the upper half of the distribution will experience a net loss, with households up to the 61st–70th percentile only receiving $131, while households above that threshold receiving no alternative subsidy support. The net loss ranges from $22 for the 61st–70th percentile to $433 for the richest 10 percent of households.

In moving to the universal compensation program, in which all households will receive $139, the net losses for the upper three income deciles is diminished, ranging now between $78 in net loss for the 71st–80th decile to a $302 loss for the richest 10 percent of households.

Overall Impacts of Alternative Scenarios

Table 10 shows summary figures on total expenditures from the alternative subsidy programs and the savings generated through operating each of these programs as opposed to maintaining India's existing set of fossil fuel subsidies. Through these calculations, we are able to also observe the differences in overall costs of the limited versus the universal compensation programs. Finally, with these calculations, we can compare the cost savings through either the limited or universal compensation programs—and thus, the funds potentially available to be channeled into clean energy investments in India—with the $12 billion that was spent on renewable energy in India in 2023. Through this metric, we can gauge the potential for redeploying a share of India's current fossil fuel subsidy budget to advancing India's clean energy transition.

We first see in column 2 of Table 10 that the limited subsidy compensation scenario, in lines 1–4 of column 2, would require $27.5 billion in government expenditures. In turn, this would generate $33.8 billion in savings, which could be channeled into clean energy investments. The $33.8 billion would amount to about 0.9 percent of India's 2023 GDP. It is also 182 percent greater than the $12 billion spent on clean energy investments in India in 2023.

In considering Scenario 2 results for the universal alternative subsidy compensation program in lines 5–8 of column 2, we see that the costs of this program do rise substantially, to $39.3 billion, as opposed to $27.5 billion under Scenario 1. It follows that under Scenario 2, the savings generated relative to India's existing fossil fuel subsidy program will fall. The savings are now at $22.0 billion. Still, this $22.0 billion in savings are still 83 percent larger than the $12 billion devoted to renewable energy investments in India in 2023.[38]

TABLE 10. INDIA: Total Funding for Alternative Subsidy Compensation Programs and Savings Generated through Fossil Fuel Subsidy Phase Out

India Economy Reference Figures:
2023 GDP = $3.6 trillion
2023 renewable energy investment spending = $12 billion

	2023 Fossil Fuel Subsidy Assumption = $61.3 billion
1) Scenario 1: Limited Subsidy Compensation	
▪ 2) Total expenditures	$27.5 billion = *~0.8% of GDP*
▪ 3) Savings generated relative to fossil fuel subsidies	$33.8 billion = *~0.9% of GDP*
▪ 4) Savings relative to India 2023 renewable clean energy investments: *$12 billion*	$21.8 billion = *~182% greater than renewable investments*
5) Scenario 2: Universal Subsidy Compensation	
▪ 6) Total expenditures	$39.3 billion = *~1.1% of GDP*
▪ 7) Savings generated relative to fossil fuel subsidies	$22.0 billion = *~0.6% of GDP*
▪ 8) Savings relative to India 2023 clean energy investments: *$12 billion*	$10 billion = *~83% greater than renewable investments*

Sources/notes: Renewables 2023, https://zerocarbon-analytics.org/archives/energy/renewable-energy-in-india-is-ambition-being-realised;

FOSSIL FUEL SUBSIDY POLICIES IN INDONESIA

Evolution of Indonesia's Fossil Fuel Subsidy Policies

Oil has been produced in the Indonesian archipelago since the late 19th Century, when it was still under Dutch colonial rule and known as the Dutch East Indies. Indonesia won independence in 1949, under the leadership of its first President Sukarno. The Indonesian economy's energy sector was led by two major nationally-owned corporations: the oil company Pertamina and the electric utility company, PLN (Perusahaan Listrik Negara). The Sukarno government established energy subsidies, for gasoline, diesel, and kerosene, as part of the newly independent country's overall development strategy. They were among a broader set of subsidies implemented at that time, including rice support for consumers along with production support in the areas of irrigation, electric power, industry, mining, and education. In 1965, the fuel subsidies alone absorbed 20 percent of the state's total revenue (Beaton and Lontoh 2010).

The Sukarno government was ousted in 1968, following a U.S. supported coup in 1965. The new military government was led by General Suharto. The Suharto government did initially increase energy prices as part of a U.S.-designed economic liberalization program. But these energy price increases were lower than the concurrent energy production cost increases. As such, the newly-installed government did reduce, but did not eliminate altogether, the energy subsidy programs that had been implemented by the previous Sukarno government. Moreover, energy prices continued to be set by the nationalized companies, Pertamina and PLN.

Indonesia was a member of OPEC and a major oil exporter in the 1970s and early 1980s. This enabled the government to provide energy within the country's domestic market at much lower rates than world market prices, without these energy subsidies creating major stresses on the government's budget. However, the burden to the government from the subsidies increased later in the 1980s as Indonesia's oil exports began to decline. Production costs also increased due to widespread corruption at Pertamina.[39]

Nevertheless, energy subsidies in Indonesia remained largely intact until the emergence of the Asian Financial Crisis in 1997. The Indonesian economy experienced the most severe effects of the crisis relative to the other Asian developing economies. The Suharto government was forced in 1997 to seek financial assistance from the IMF. The IMF required the government to greatly reduce its subsidies for all commodities, including for fuel and electricity, as one of the conditions for providing Indonesia with an emergency loan ((Beaton and Lontoh 2010). As a result, Indonesian consumers faced price increases in 1998 of 70 percent for gasoline and 58 percent for diesel. The ensuing protests over the sharp increases in fuel prices contributed to Suharto's resignation in 1998.

Between 1998–2003, i.e. the years immediately following the Asian Financial Crisis, energy prices continued to rise sharply in Indonesia: gasoline prices rose by 81 percent, diesel by 200 percent and kerosine by 114 percent. In turn, these energy price increases were a main driver of the economy's overall rise in consumer price inflation of 67 percent in these years.

It is within this context that the government began to also introduce concurrent policies to compensate Indonesian households and businesses for the sharp increases in energy prices resulting from the subsidy cuts. Among other impacts, these compensatory policies succeeded in reducing the resistance by Indonesian energy consumers to the energy subsidy cuts.

Table 11, originally published in a 2015 Asian Development Bank study, summarizes the main compensatory programs enacted by the Indonesian government between 2005–2013 along with the energy subsidy reductions. These measures are in addition to ongoing social welfare spending programs in the areas of health care, food assistance, and support for children, the elderly and disabled (e.g. Asian Development Bank 2015, p. 38). For this discussion, we focus on the programs designed explicitly to compensate for reductions in fossil fuel subsidy support and/or fossil fuel price increases not matched by increased fossil fuel subsidies.

To begin with, in 2005, under the newly-established presidential democratic government (Liddle and Mujani 2006), fossil fuel subsidies were cut sharply. This led to price increases for households, relative to 2003 levels, of 149 percent for gasoline, 160 percent for diesel and 185 percent for

TABLE 11. Indonesia: Social Assistance Policies Associated with Fossil Fuel Subsidy Reforms

Policy Name	Description	Beneficiaries	Budget
2005 Reforms			
Direct Cash Assistance (Bantuan Langsung Tunai)	Unconditional cash transfers of Rp1,200,000 delivered in four installments	19 million, about 35% of the total population	Rp23.0 trillion (25% of subsidy savings)
School Operational Assistance (Bantuan Operational Sekolah)	Rp25,000 to primary schools and Rp35,000 to junior high schools on the basis that they reduce fees accordingly		Rp12.0 trillion
Healthcare for the Poor	Cards entitling holders to free health care at public clinics and hospitals	16 million households	Rp2.9 trillion
Rural Infrastructure Support Project (Infrastruktur Perdesaan)	Rehabilitation and renewal of infrastructure in low-income and often remote villages in poor provinces	1,840 villages	Rp569.0 billion
2008 Reforms			
Direct Cash Assistance (Bantuan Langsung Tunai)	Unconditional cash transfers of Rp900,000 divided into three payments	18.4 million households	Rp14.1 trillion
Rice Subsidy for the Poor (Raskin), supplementary allocation	Subsidized rice program		Rp4.2 trillion
Loan-interest subsidy for small enterprises			Rp1.0 trillion
2013 Reforms			
Temporary Community Direct Assistance (Bantuan Langsung Sementara Masyarakat)	Unconditional cash transfers of Rp600,000 per household delivered over 4 months	15.5 million households	Rp9.3 trillion
Hopeful Family Program (Program Keluarga Harapan), supplementation	Average benefit level will increase from Rp1.4 million to Rp1.8 million per year per household	Expanded from the 2012 level of 1.5 million households to 2.4 million households in 2013 and 3.2 million households in 2014.	Rp0.7 trillion
Scholarships for the Poor (Bantuan Siswa Miskin), supplementation	Benefits increase for a primary school student from Rp360,000 per year to Rp450,000 and for a junior secondary student from Rp550,000 per year to Rp750,000	Increase from 8.7 million to 16.6 million beneficiaries	Rp7.5 trillion
Rice Subsidy for the Poor, Raskin supplementation	Additional 15 kilograms of subsidized rice per month for 3 months to households eligible for Bantuan Langsung Sementara Masyarakat		Rp4.3 trillion
Infrastructure funding	Infrastructure for communities including potable and irrigation water		Rp7.5 trillion

Source: Asian Development Bank (2015).

kerosine. For industrial consumers, energy prices were allowed to rise to the international market levels.

In turn, as Table 11 shows, the compensatory policies that were enacted in 2005 included an unconditional Direct Cash Assistance Program, known as the Bantuan Langsung Tunai (BLT). This amounted to transfers of Rp 1.2 million per household (equal to roughly $70 in 2005 USD) delivered in four installments to 19 million households. This covered about 35 percent of the country's population. The total budget for this program was Rp 23 trillion (roughly $1.8 billion in 2005 USD), equal to about 25 percent of what the government was saving through reducing fossil fuel subsidies at that time. In addition to the direct cash transfer program, the government also increased spending on healthcare, education and rural infrastructure. In all, these compensatory programs amounted to about Rp 39 trillion ($1.8 billion in 2005 USD), equal to roughly 40 percent of the savings from the fossil fuel subsidy cuts and about 1 percent of 2005 GDP.

These programs were therefore substantial in the level of support they provided. But these forms of support were also mostly temporary. In particular, the cash assistance program ended after recipients received Rp 1.2 million ($70 in USD) in four installments. After the compensatory programs ended, Indonesian households had to still cover their higher energy costs resulting from the subsidy reductions.

As Table 11 shows, a second Direct Cash Assistance Program was enacted in 2008, when the government raised energy prices. The price increases in 2008 were initially about 33 percent, but then were reduced when global oil prices fell. With the 2008 cash transfer program, about 40 million households received Rp 900,000 (roughly $55 in 2008 USD) in three payments. In addition, the government also enacted rice subsidies and a low-interest loan program for small enterprises. These programs in total amounted to Rp 19.3 trillion ($1.5 billion in 2008 USD), with the cash transfer program supporting 18.4 million households. This totaled to about 0.3 percent of 2008 GDP.

With global oil prices falling as a result of the 2007–09 Great Recession, Indonesia did not raise domestic energy prices again until 2013 and 2014. The price increases in 2013 were 40 percent for both gasoline and diesel fuel. The following 2014 price increases were 31 percent for gasoline and 36 percent for fuel.

As Table 11 shows, the government did also implement a new series of temporary compensatory measures in 2013. These included a new Cash Transfer Program of Rp 600,000 per household ($37 in 2013 USD) for 15.5 million households, delivered over four months. In addition, the government also introduced new support in the areas of primary education, health care, rice subsidies and community infrastructure. These policies totaled to Rp 29 trillion ($2.7 billion in 2013 USD), equal again to about 0.3 percent of 2013 GDP. The cash subsidy program was for Rp 9.3 trillion (roughly $900 million) total, about one-third of the total new support introduced in 2013.

Most recently in response to the 2022 spike in global oil prices, the government enacted a new round of compensatory programs to offset the rise in energy prices. The December 2022 World Bank publication *Indonesia Economic Prospects* describes this latest round of compensatory support as follows:

> The cash transfer program [to alleviate the impact of the 30 percent rise in diesel and gasoline prices] will be distributed to around 20 million beneficiaries. Each beneficiary will receive a total of IDR600,000 [roughly $38 in 2022 USD] in two installments from September to December 2022 and the total cost is IDR 12.39 trillion (68 percent of savings from the energy subsidy, or slightly less than 0.1 percent of GDP) [roughly $1.3 billion in 2022 USD]. Estimates indicate that this program will mitigate the loss for the bottom 40 and reverse the poverty impact, yielding a net improvement of the poverty rate by 0.28 percentage points. As a one-off cash transfer, however, the positive poverty contribution may not be sustained, (2022, p. 21).

As a separate but related initiative, Indonesia launched in November 2022 its Just Energy Transition Partnership (JETP) program, in conjunction with working groups from the IEA, World Bank, Asian Development Bank, and United Nations Development Program.[40] Similar programs were also launched then in South Africa, Vietnam and Senegal. The Indonesia JETP describes its broad aims as follows:

> For Indonesia, energy transition is a key step to mitigate the impact of the climate crisis, meet the Nationally Determined Contribution targets, and realise its ambition to build a low-carbon economy. This transition actively supports Indonesia's industrialization trajectory while decoupling the long-standing historical correlation between economic growth and emissions. To do this, energy transition must decarbonize both the power sector and its interdependent demand-side sectors and industries (JETP Partnership Indonesia 2023, p. 1).

The first major initiative of Indonesia's JETP was to publish in November 2023 an initial Comprehensive Investment and Policy Plan.[41] This 344-page study includes detailed discussions on advancing clean energy investment projects in Indonesia and strategies for mobilizing the combination of public and private financing for these projects. However, this study includes no focused discussion on the status of fossil fuel subsidies in Indonesian, and only a few brief mentions of any sort on the topic.

Despite this major omission in the government's initial Comprehensive Investment and Policy Plan, we nevertheless conclude, overall, from our review that the Indonesian government certainly has the administrative capacity and experience to implement effective alternative subsidy programs to compensate the Indonesian people fairly as the country phases out all fossil fuel subsidies.[42]

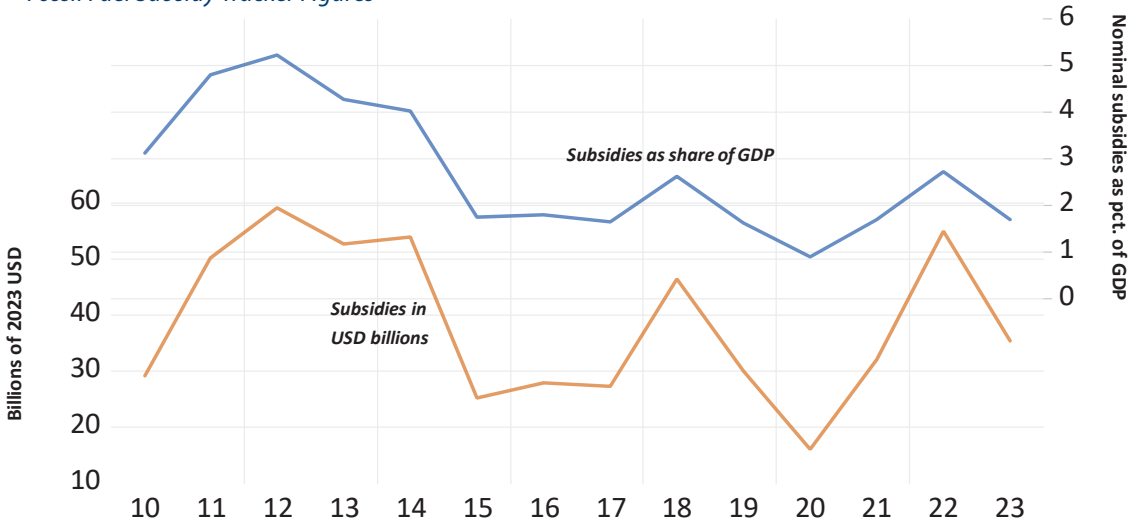
Indonesia's Fossil Fuel Subsidy Trends, 2010–2022

Figures 7–9 present the movements of Indonesia's overall fossil fuel subsidies between 2010–2023. These figures follow the same basic pattern as those we have reviewed both for the global economy and India.

Figure 7 reports the real level of Indonesia's fossil fuel subsidies in 2023 USD and the subsidy level (in nominal dollars) as a share of Indonesia's GDP. The figure shows that the real subsidy level and the subsidy/GDP ratio move in nearly identical patterns—and these patterns are, in turn, similar to the relative movements globally and for India with these two series. That is, real subsidies in

FIGURE 7: Indonesia Fossil Fuel Subsidies, 2010–2023

Fossil Fuel Subsidy Tracker Figures



Sources: https://fossilfuelsubsidytracker.org/; https://databank.worldbank.org/source/world-development-indicators

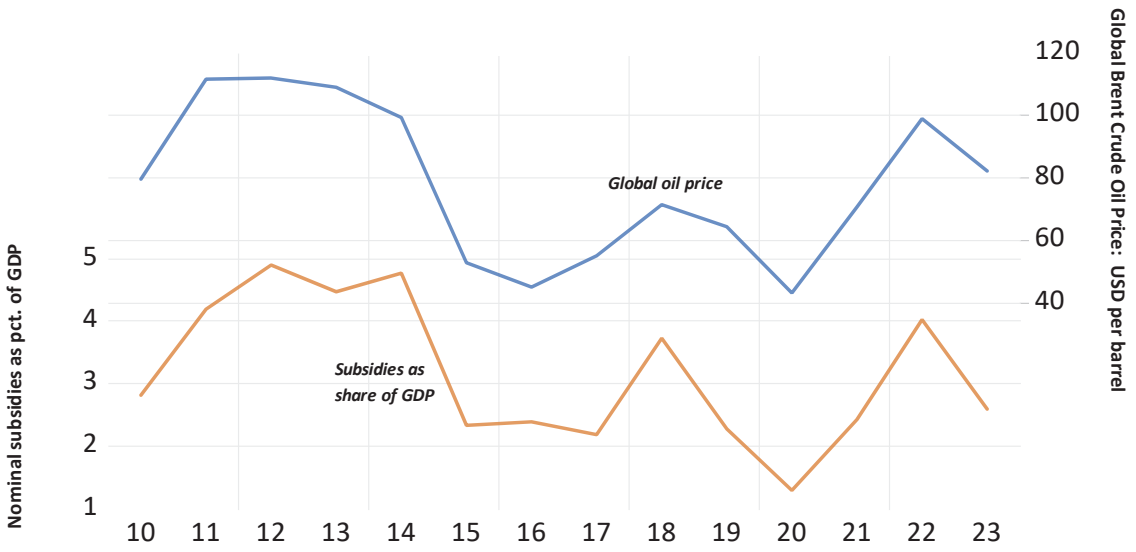
Indonesia rise between 2010–2012, to a peak of $59.0 billion in 2012. The figure then trends downward to a trough during the COVID lockdown of $15.9 billion, before rising back sharply to $54.9 billion in 2022. Fossil fuel subsidies do then fall again in 2023, but remain at a high level of $35.4 billion.

The subsidy/GDP ratio follows the same pattern. It peaks at 4.9 percent of GDP in 2012, then trends downward to 1.3 percent of GDP in 2020, then rises back up to 4.0 percent of GDP in 2022. The 2023 subsidy/GDP ratio remains high in 2023, at 2.6 percent. The correlation coefficient between these two series over the full 2010–2023 period is 0.97.

Figure 8 plots the movements of the subsidy/GDP ratio along with the global crude oil price over 2010–2023. Again, the patterns of these two series correspond closely with the movements of the global subsidy/GDP ratio and the global crude oil price as well as the patterns for India with these two series. With the figures for Indonesia, the correlation coefficient between the subsidy/GDP ratio and the global crude oil price is 0.91. Thus in Indonesia, as was true both with the India and the global economy overall, fluctuations in the government's fossil fuel outlays and the subsidy/GDP ratio are dominated by movements in the global crude oil price. It also follows that the measures that the Indonesian government has implemented to reduce its fossil fuel subsidies have had only a small impact relative to effects on subsidy levels of global crude oil price fluctuations.

Figure 9 shows the distribution for Indonesia in the shares of total fossil fuel subsidies by the alternative fossil fuel energy sources. Over the full 2010–2023 period, the largest share of subsidies are provided for oil products. But oil's share of overall subsidies varies significantly over this full period, ranging between 33 percent in 2016 and 82 percent most recently in 2023. Over these

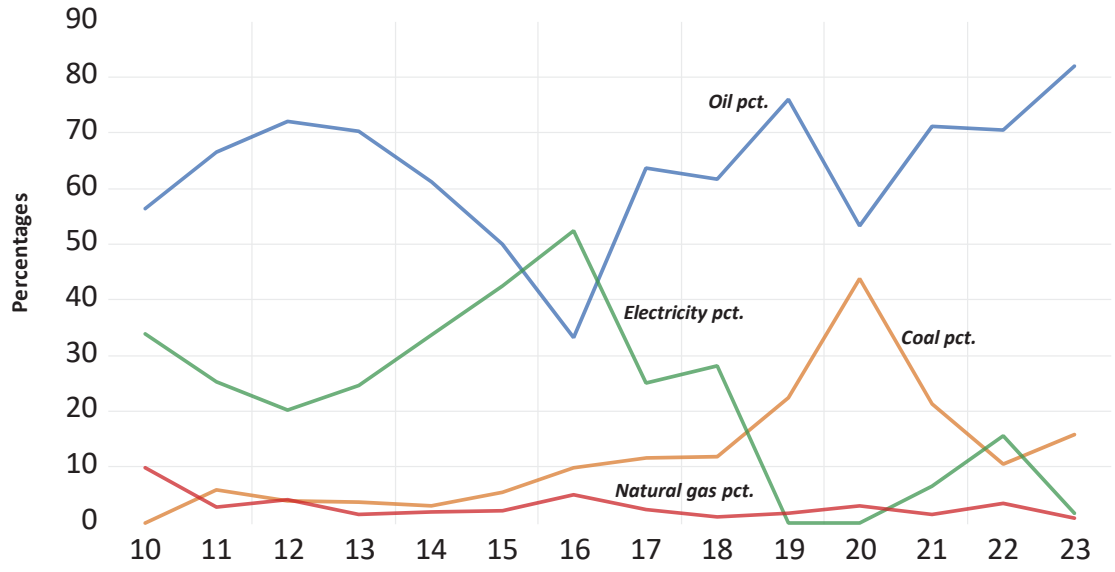
FIGURE 8: Indonesia Fossil Fuel Subsidies/GDPand Global Crude Oil Price, 2010–2023



Sources: https://fossilfuelsubsidytracker.org/; https://data.worldbank.org/; https://fred.stlouisfed.org/

FIGURE 9: Indonesia: Shares of Overall Fossil Fuel Subsidies

Oil, Electricity, Natural Gas, and Coal



Source: See Figure 3.

same years, electricity's subsidy share ranged between 53 percent in 2016 down to zero in 2019 and 2020.

Coal combustion generated about 64 percent of Indonesia's overall electricity supply as of 2023, with natural gas generating about 16 percent, hydro and bioenergy, as renewable sources, each contributed about 7 percent to Indonesia's total electricity generation. Coal's share of *fossil fuel-generated* electricity was 78 percent in 2023, with natural gas at 19 percent and oil the remaining 3 percent.[43] Thus, within Indonesia's existing electricity-generating framework, subsidies for electricity consumption mostly amount to indirect coal subsidies.

The direct coal subsidy itself was negligible, at between 0 – 6 percent of total fossil fuel subsidies between 2010–2015. But the direct coal subsidy share then rises sharply, peaking at 44 percent in 2020 during the COVID lockdown. As of 2023, the direct coal subsidy share was still relatively high, at about 16 percent.

Overall then for the Indonesian case, oil and coal have been subsidized in roughly proportional shares over 2010–2023. The natural gas subsidy share has been relatively low throughout this period, peaking in 2010 at 10 percent but then never again rising above 5 percent between 2011–2023.

Distribution of Fossil Fuel Subsidy Benefits

As we have seen, the Indonesian government has already developed the basic framework of a workable fossil fuel subsidy phase-out approach. That is to increase the provision of other subsidy programs that the government has effectively administered in the past, including its cash subsidy and rice subsidy programs. These alternative subsidy programs can be expanded in conjunction with the phasing out of fossil fuel subsidies.

There would still be two main differences in reviving and expanding these alternative subsidy programs relative to previous experiences. To begin with, the alternative subsidy programs should be maintained in operation continuously until Indonesia has established its low-cost clean energy infrastructure. As we discussed above, when the Indonesian government introduced these programs previously, in 2005, 2008, 2013, and 2022 respectively, they were maintained for only a limited time period. Further, the costs to the government of the alternative subsidies can be less than what the government is spending now in total on fossil fuel subsidies. A significant share of these savings should then be channeled into building the country's clean energy infrastructure.

In order to advance such a workable program, it is important to first review evidence on the distribution of support that is received according to household income levels from fossil fuel subsidies. We review this evidence in Tables 12–15.

The evidence shown in these tables comes from two separate sources, a 2015 study by Durand-Lasserve et al. and the December 2022 study by the World Bank. The Durand-Lasserve et al. study is more comprehensive, in that it includes both fuel and electricity subsidies, while the World Bank study covers fuel subsidies only. Still, the subsidy distribution patterns that emerge from the two studies are similar. Specifically, the basic finding that emerges from both studies is that the

benefits from fossil fuel subsidies in Indonesia are skewed heavily in favor of high-income households. This result follows from the facts, noted above, that: 1) fossil fuel subsidies in Indonesia are provided equally to all consumers when they purchase fossil fuel energy in any given market—i.e. for gasoline, diesel, or electricity—and that 2) higher-income households consume much greater absolute amounts of fossil fuel energy than lower-income households.

More specifically, as we see in Table 12, according to Durand-Lasserve et al., the poorest 10 percent of households in Indonesia received 2.5 percent of total fossil fuel subsidies, while the richest 10 percent of households received 22.1 percent. That is, the richest 10 percent of households received nearly 9 times more government support through fossil fuel subsidies than the poorest 10 percent of households. This disparity is even greater with the World Bank's 2022 study for fuel subsidies, in which the richest 10 percent of households received 29.5 percent of total subsidies while the poorest 10 percent received 2.6 percent. In other words, according to these 2022 figures, the richest 10 percent of households received over 11 times more government support through fossil fuel subsidies than the poorest 10 percent.

In Table 13, we present these same results in terms of amounts of money received per household within each of Indonesia's 10 household deciles, expressed in 2023 U.S dollars. For this illustrative exercise, as with our comparable discussion above for the Indian case, we do not allocate the total $35.4 billion of Indonesia's 2023 fossil fuel subsidies. We rather include *consumption subsidies only*,

TABLE 12. INDONESIA: Fossil Fuel Subsidy Distribution by Household Income Deciles 1:

Household subsidy shares in percentages

Income deciles from poorest to richest	Shares of total fuel and electricity subsidies (Durand-Lasserve et al. 2015)	Shares of fuel subsidies only (World Bank 2022)
Poorest 10%	2.5%	2.6%
11th- 20th percentile	4.1%	4.1%
21st - 30th percentile	5.5%	5.2%
31st -40th percentile	7.0%	6.2%
41st -50th percentile	7.9%	7.5%
51st -60th percentile	9.4%	8.3%
61st -70th percentile	11.6%	9.6%
71st – 80th percentile	13.8%	11.6%
81st -90th percentile	16.2%	15.5%
Richest 10%	22.1%	29.5%

Sources/notes: All subsidy and income share figures estimated by measuring the length of barplots. Total fossil fuel subsidy shares calculated as the weighted average of electricity and fuel subsidy shares. Each decile comprises about 7.1 million households, based the Indonesian population and 4.0 members per households. Data sources: Authors calculations based on Durand-Lasserve et al. (2015) and World Bank (2022); Indonesia household data: https://www.statista.com/statistics/728231/number-of-households-indonesia/#:~:text=As%20of%20 2022%2C%20the%20number,Indonesia%20reached%20approximately%2070.6%20million

TABLE 13. INDONESIA: Fossil Fuel Subsidy Distribution by Household Income Deciles 2:
Household 2023 consumption subsidy shares

Figures estimated from:

- Fuel subsidy shares in 2022 World Bank Study
- 71 million Indonesian households, with ~4.0 people per household
- Each household decile = ~7 million households
- Total 2023 fossil fuel consumption subsidies = $29.3 billion
  - 82.8% of $35.4 billion in total 2023 fossil fuel subsidies

Income deciles from poorest to richest	
Poorest 10%	$110
11th- 20th percentile	$174
21st - 30th percentile	$221
31st -40th percentile	$262
41st -50th percentile	$317
51st -60th percentile	$351
61st -70th percentile	$407
71st – 80th percentile	$491
81st -90th percentile	$656
Richest 10%	$1,248

Sources/notes: Table 12; consumption subsidy figure from https://www.iea.org/data-and-statistics/data-product/fossil-fuel-subsidies-database; total subsidy figure from https://fossilfuelsubsidytracker.org/

which amounted to $29.3 billion, or 83 percent of total fossil fuel subsidies, as the subsidy level provided for Indonesia's households that year.[44] The remaining $6.1 billion in 2023 subsidies, 17 percent of the $35.4 billion in total subsidies, were provided for Indonesia's fossil fuel producers.

We incorporate the Indonesian population figure to complete these estimates—i.e. there were, as of current estimates, a total of roughly 71 million households in Indonesia with a total population of 282 million.[45] Thus, each of the country's income deciles includes approximately 7.1 million households. The average size of households is 4.0 people.

Of course, the figures that emerge through these calculations portray the same disparities as the figures expressed in the previous figures on shares of total subsidy funds received. We see that the average household in Indonesia's poorest 10 percent cohort received an average of $110 in consumption subsidies, while the average consumption subsidy for the richest 10 percent was $1,248. Thus again, by this measure expressed in USD per household, the richest 10 percent of households are receiving 11 times more support through fossil fuel subsidies than the poorest 10 percent.

Tables 14 and 15 show the same data on subsidy distribution with larger household income cohort groupings, with Table 14 showing figures in percentages and Table 15 reporting figures in USD.

Thus, with Table 14, working with the Durand-Lasserve et al. figures, we see that the poorest 30 percent of Indonesian households received only 12.1 percent of all fossil subsidies while the richest 30 percent received 52.1 percent. The World Bank's 2022 figures on fuel subsidies only are similar, with the poorest 30 percent of households receiving 11.9 percent of fossil fuel subsidies while the richest 30 percent received 56.6 percent.

In the lower half of Table 14, we divide all 71 million Indonesian households into two groups, each comprised of 50 percent of total households—thus, a lower 50 percent and an upper 50 percent grouping of households. With these groupings for all Indonesian households, we see that, with the 2015 data, the lower half of the distribution received 27.0 percent of total fossil fuel subsidies while the upper half received 73 percent. With the 2022 figures on fuel subsidies only, the lower half of the distribution received 25.6 percent of subsidies while the upper half received 74.4 percent. In short, these broader groupings of Indonesian income cohorts show the same overall result as the figures by household income deciles—that the benefits of fossil fuel subsidies in Indonesia have been skewed heavily in favor of high-income households.

Table 15 then expresses these same findings in terms of U.S. dollar amounts. We find that the lower 30 percent of households received an average of $168 in consumption subsidies, while the upper 30 percent received $798—nearly 5 times more than the lower 30 percent. Dividing the population into upper- and lower 50 percent household cohorts, we see that the lower 50 percent of households received an average of $271 in consumption subsidies while the upper 50 percent received $631—nearly 3 times more.

TABLE 14. INDONESIA: Fossil Fuel Subsidy Distribution received by Larger Household Income Cohorts 1:

Household subsidy shares in percentages

	Shares of total fuel and electricity subsidies (Durand-Lasserve et al. 2015)	Shares of fuel subsidies only (World Bank 2022)
Shares received by lower 30% of households	12.1%	11.9%
Shares received by upper 30% of households	52.1%	56.6%
Shares received by lower 50% of households	27.0%	25.6%
Shares received by upper 50% of households	73.0%	74.4%

Sources: See Table 12.

TABLE 15. INDONESIA: Fossil Fuel Consumption Subsidy Distribution by Larger Household Income Cohorts 2:
Household subsidy shares in 2023 U.S dollars

- Total 2023 fossil fuel consumption subsidies: $29.3 billion
  - 82.8% of $35.4 billion in total 2023 fossil fuel subsidies

Subsidy share figures from 2022 World Bank study

Average subsidy per household for lower 30% of households	$168
Average subsidy per household for upper 30% of households	$798
Average subsidy per household for lower 50% of households	$217
Average subsidy per household for upper 50% of households	$631

Source: See Table 13.

Overall, these results illustrate the point that eliminating fossil fuel subsidies and replacing them with cash or food subsidies that are targeted to vulnerable households will have a significant equalizing impact on income distribution in Indonesia while also advancing the transition to building the country's green energy infrastructure.

Alternative Subsidy Phase-Out Scenarios

We sketch here the same two illustrative fossil fuel subsidy phase out scenarios as we presented above for India. As with the India case, Scenario 1 is a *limited compensation* program, in which only households up to the 60th–70th income percentile receive cash or food subsidies to compensate for the loss of their fossil fuel subsidy support. Scenario 2 is a *universal compensation* program. Under the universal compensation program, all households, including those in the 3 highest income deciles, would receive the same level of alternative subsidy support.

For both Scenarios 1 and 2, we assume that the level of alternative subsidy compensation provided will be equal to the share of subsidy support received by the 41st–50th percentile decile of households, i.e. 7.5 percent of total subsidies, as reported by the 2022 World Bank study. As with the India case above, here we assume that households will receive their subsidy shares based on the amount of *total* fossil fuel subsidies in 2023, including here $6.1 billion in production subsidies as well as $29.3 billion in consumption subsidies, with the total subsidy level at $35.4 billion. Thus, given the total fossil fuel subsidy level of $35.4 billion for 2023, the subsidy amount that could be rechanneled into alternative subsidies for households in the 41st–50th percentile would be $381.[46]

As such, if total fossil fuel subsidy support is $35.4 billion, then, under Scenario 1, all households up to the 61st–70th percentile will receive $381 in alternative subsidy compensation when fossil fuel subsidies are eliminated. In Scenario 2, all households—including those in the highest three income deciles—receive $381.

Table 16 then shows the income benefits that would accrue to lower-income households under both the limited and universal compensation scenarios. For example, for households in the lowest income decile, the $381 in alternative compensation would be $271 higher—i.e. about 2.5 times as much—as these households received in 2023 through fossil fuel consumption subsidies. This same $381 going to households in the 11th – 20th income percentile would provide them with $207 more than the $174 they received in 2023 through consumption subsidies. All households up to the 51st–60th percentile would be better off through receiving their share of support based on dividing total fossil fuel subsidies equally up through the 61st–70th household percentile.

At the 61st–70th household percentile, the total subsidy of $381 would be $26 less than the $407 they would receive through their share of fossil fuel consumption subsidies in 2023. Under the limited compensation framework, the three richest households would no longer receive any subsidies. They would therefore experience net losses equal to what they had received in consump-

TABLE 16. INDONESIA: Illustrative Scenarios for Alternative Subsidy Compensation after Fossil Fuel Subsidy Phase Out

Figures estimated from:

- $35.4 billion in total 2023 fossil fuel subsidies
  - ($29.3 billion in consumption subsidies)
- Compensation at 41st – 50th household percentile of total fossil fuel subsidy support; = $381 per household

1) Income deciles from poorest to richest	2) 2023 household subsidy support through consumption subsidies only	Limited compensation of total subsidies: Lower 70% of households only receive $381		Universal compensation of total subsidies: All households receive $381	
		3) Compensation amount	4) Net change in subsidy support (= columns 3-2)	5) Compensation amount	6) Net change in subsidy support (= columns 5-2)
Poorest 10%	$110	$381	+271	$381	+271
11th- 20th percentile	$174	$381	+$207	$381	+$207
21st - 30th percentile	$221	$381	+160	$381	+160
31st -40th percentile	$262	$381	+$119	$381	+$119
41st -50th percentile	$317	$381	+64	$381	+64
51st -60th percentile	$351	$381	+$30	$381	-$30
61st -70th percentile	$407	$381	-$26	$381	-$26
71st – 80th percentile	$491	0	-$491	$381	-$110
81st -90th percentile	$656	0	-$656	$381	-$275
Richest 10%	$1,248	0	-$1,238	$381	-$867

Source: See Table 13.

tion subsidies under the existing fossil fuel subsidy distributional framework. Those losses would range between $491 for the 71st–80th household percentile to $1,238 for the richest 10 percent of households.

In moving to the universal compensation program, in which all households, including those in the highest income deciles, will receive $381, the net losses for the upper three income deciles are diminished, ranging now between $110 for the 71st–80th percentile to a $867 loss for the richest 10 percent of households.

Overall Impacts of Alternative Scenarios

Table 17 shows summary figures on total expenditures from the alternative subsidy programs and the savings generated through operating each of these programs as opposed to maintaining Indonesia's existing set of total fossil fuel subsidies. Through these calculations, we can also observe the differences in overall costs of the limited versus the universal compensation programs. Finally,

TABLE 17. INDONESIA: Total Funding for Alternative Subsidy Compensation Programs and Savings Generated through Fossil Fuel Subsidy Phase Out

Indonesia Economy Reference Figures:
2023 GDP = $1.4 trillion
2023 renewable energy investment spending = $1.5 billion

	2023 Fossil Fuel Subsidy Assumption = $35.4 billion
1) Scenario 1: Limited Subsidy Compensation	
▪ 2) Total expenditures	$18.9 billion *= ~1.4% of GDP*
▪ 3) Savings generated relative to fossil fuel subsidies	$16.5 billion *= ~1.2% of GDP*
▪ 4) Savings relative to Indonesia 2023 renewable energy investments: $1.5 billion	$15.0 billion *= ~10.0 times larger than renewable investments*
5) Scenario 2: Universal Subsidy Compensation	
▪ 6) Total expenditures	$27.1 billion *= ~1.9% of GDP*
▪ 7) Savings generated relative to fossil fuel subsidies	$8.3 billion *= ~0.6% of GDP*
▪ 8) Savings relative to Indonesia 2023 renewable energy investments: $1.5 billion	$6.8 billion *= ~4.5 times larger than renewable investments*

Sources/notes: See Table 13. https://www.statista.com/statistics/992956/indonesia-investment-in-renewable-energy/ (2023 renewable energy investment level).

with these calculations, we can compare the cost savings through either the limited or universal compensation programs –and thus, the funds potentially available to be channeled into clean energy investments in Indonesia—with the $1.5 billion that was spent on clean energy in Indonesia in 2023. Through this metric, we can gauge the potential for redeploying a share of Indonesia's current fossil fuel subsidy budget to advancing Indonesia's clean energy transition.

We first see in column 2 of Table 17 that the limited subsidy compensation scenario, in lines 1–4 of column 2, would require $18.9 billion in government expenditures. In turn, this would generate $16.5 billion in savings, which could be channeled into renewable energy investments. The $16.5 billion would amount to approximately 1.2 percent of Indonesia's 2023 GDP. It is also *10 times larger* than the $1.5 billion spent on renewable energy investments in Indonesia in 2022.

In considering Scenario 2 results for the universal alternative subsidy compensation program in lines 5– 8 of column 2, we see, not surprisingly, that the patterns that emerge closely mirror those for India. That is, the costs of this program do rise substantially, to $27.1 billion, as opposed to $18.9 billion under Scenario 1. It follows that under Scenario 2, the savings generated relative to Indonesia's existing fossil fuel subsidy program will fall. The savings are now at $8.3 billion. Nevertheless, this $8.3 billion in savings are still nearly 5 times greater than the $1.5 billion devoted to clean energy investments in Indonesia in 2022.

Some Implications of Summary Results

A first overall finding that emerges from these summary figures is that the costs are high of implementing a universal compensation program relative to implementing a limited compensation program. The Indonesian public and policymakers will have to evaluate whether the benefits in terms of lower administrative burdens and potentially less political resistance are worth the higher costs.

In addition, regardless of which scenario is pursued, there will be, in all cases, significant savings generated by converting the existing set of fossil fuel subsidies into subsidies for cash or food. These savings can then be channeled into greatly expanding the resources in Indonesia devoted to a clean energy transition. Converting the existing fossil fuel subsidy programs into cash or food subsidies will also mean replacing what is, at present, a highly regressive subsidy program into a progressive subsidy program.

Thus, in general, under all of the scenarios and assumptions on existing fossil fuel expenditures that we have considered, the transition to an alternative compensation subsidy program will generate major benefits both in terms of equalizing Indonesia's income distribution as well as advancing the country's clean energy transition.

6. Conclusions

Strengths and Weaknesses of Alternative Scenarios

The two scenarios we present for fossil fuel subsidy phase-outs with concurrent alternative subsidy programs in India and Indonesia have distinct strengths and weaknesses. More specifically, the relative strengths and weaknesses of the two alternative compensation programs are the mirror image of the other.

With respect to the limited compensation Scenario 1, its first straightforward strength is that its costs are significantly lower. As we saw with India in Table 10, overall expenditures under Scenario 1 are at roughly $28 billion as opposed to $39 billion for the Scenario 2 universal compensation case. The $11 billion in additional costs for Scenario 2 represents about 0.3 percent of India's 2023 GDP. The proportional cost differences are still larger for Indonesia. As we saw in Table 17, the costs of Scenario 1 are at $19 billion while Scenario 2 are $27 billion. This $8 billion difference in the Indonesian case amounts to about 0.6 percent of 2023 GDP.

This difference in the relative costs of Scenarios 1 and 2 for both India and Indonesia follows from another advantage of Scenario 1. For the most part at least, Scenario 1 provides support only to households whose living standards would be reduced significantly through the loss of fossil fuel subsidies. The lower overall cost to the government that would result through this scenario also means that more public funds would become available to channel into clean energy investments. The disadvantage of Scenario 1 is that it would require significant administrative resources to establish the threshold point at which households are either eligible or ineligible for subsidy support. Providing no alternative subsidy compensation for high-income households could also engender political resistance from these higher-income households. But it is still almost certain that higher-income households will oppose the elimination of their fossil fuel subsidies in any case. Even under Scenario 2, the extent of the alternative subsidy support provided for higher-income households will be significantly less than support they have been receiving through the regressive framework of fossil fuel subsidies.

The major advantage of Scenario 2 is that the administrative demands for this program will be lower. This is because, again, the government will not be required to establish eligibility for subsidy support according to each households' income level and then implement the distribution of support according to these eligibility limitations. The major disadvantage is that subsidies will be provided to high income households even though these high-income households do not need this support for meeting their basic needs. Because the high-income households would be receiving this support nonetheless, a smaller amount of savings from eliminating fossil fuel subsidies will be remain available for the Indian and Indonesian governments to channel into clean energy investments.

Pace of Phase-In/Phase-Out Programs

The fact that both the Indian and Indonesian governments have operated extensive levels of social welfare support demonstrates that they are capable of phasing out fossil fuel subsidies entirely while still protecting and even raising living standards for the great majority of their respective populations. Moreover, because these two governments do already have extensive experience in administering alternative compensatory subsidy programs, it would be realistic for them to eliminate their existing fossil fuel subsidy programs within a relatively short time period. But it is also true that the scenarios we have laid out can be phased in over somewhat longer time periods. A somewhat longer phase-out period provides more time for ensuring that the alternative compensation programs—either through cash or in-kind subsidies—are operating effectively. It is especially critical to establish that these alternative compensation programs are successful in improving overall living standards for low-income households and at least maintaining those for middle-income households. A somewhat longer phase-out period will also create more time for alternative inflation control measures to be enacted and stress-tested when global oil price spikes recur, as they surely will. Of course, the longer the phase-in period, the longer it will therefore take for the Indian and Indonesian economies to gain the benefits of the alternative subsidy compensation framework, assuming they can be implemented to work effectively.

Subsidy Costs Fall as Clean Energy Supply Expands

One benefit that will result as energy consumption shifts from fossil fuels to renewables is that the extent of alternative compensation support needed to match what households would have received through fossil fuel subsidies will decline. As an example as to how this factor comes into play, assume that aggregate energy demand in Indonesia is at its 2023 level, but that 10 percent of fossil fuel energy demand is replaced by renewable energy. The basics are as follows: Total energy consumption in Indonesia in 2023 was 10.5 Q-BTUs, including 5.4 Q-BTUs of coal, 3.2 Q-BTUs of petroleum, and 1.5 Q-BTUs of natural gas.[47] Total fossil fuel consumption was therefore 10.1 Q-BTUs, equal to 96 percent of total consumption. Renewables accounted for the remaining 0.4 Q-BTUs, amounting to 4 percent of total consumption. Reducing fossil fuel consumption by 10 percent would then mean a fossil fuel consumption level at 9.1 Q-BTUs. Renewable consumption would correspondingly rise to 1.4 Q-BTUs.

At this point, Indonesian households will benefit from the expanding supply of renewable electricity, since the costs of renewables are, on average, already lower than those for fossil-powered electricity. Renewable energy costs are also steadily falling with time, in absolute terms and relative to those for fossil fuels. Thus, the 2022 study by IRENA, *Renewable Power Generation Costs in 2021,* reports that, increasingly since 2018, renewable have been achieving cost points at which they are cheaper than the lowest cost fossil fuel alternative. The IRENA study reports as follows for countries, such as Indonesia, in which electricity markets are growing:

> In economies where electricity demand is growing and new capacity is needed, these renewable power generation projects will significantly reduce electricity system costs over the life of their operation. In 2022, in non-OECD countries, the 109 GW of projects with costs lower than the cheapest fossil

> fuel-fired cost option will reduce costs in the electricity sector by at least USD 5.7 billion annually relative to the long-term cost of adding the same amount of fossil fuel-fired generation….Between 2010 and 2021, inclusive, globally, around 645 GW of renewable power generation capacity has been added in non-OECD countries that had costs lower than the cheapest fossil fuel-fired option in that year.[48]

In short, the Indonesian government's expenditure level for alternative subsidy compensation—either through food or cash as alternatives to fossil fuel subsidies—will fall as the country's supply of renewable energy expands as a share of the overall energy mix. Of course, the transition in India—and in other countries as well—out of fossil fuels and into a renewables-dominant energy infrastructure will have a comparable impact on the costs of both energy and alternative subsidy programs.

****

Overall then, a first finding that emerges here is that the costs are high in both India and Indonesia of implementing a universal alternative compensation program—via either cash or food subsidies—relative to implementing a limited alternative compensation program. These relative cost differences will almost certainly be comparable in most countries that currently operate with significant fossil fuel subsidy programs.

Still, regardless of whether a universal or limited alternative compensation program is implemented, there will be large-scale savings generated by converting the existing set of fossil fuel subsidies into subsidies for cash or food. These savings can then be channeled into expanding a country's level of support for its clean energy transition. Converting existing fossil fuel subsidy programs into cash or food subsidies will also mean replacing what are highly regressive subsidy programs into progressive programs. Thus, contrary to the SDG Target 12.C to which we referred at the outset, there is no basis, in any specific country setting, for equivocating on a full phase-out of fossil fuel subsidies.

Of course, as we stated at the outset, there have been, and will continue to be, major obstacles to overcome in advancing the transition from the existing global fossil fuel-dominant global energy infrastructure to an infrastructure dominated by high efficiency and renewable energy sources. But none of these obstacles are insurmountable in any settings in which an effective policy environment is established. The global phase-out of fossil fuel subsidies is, in turn, one of the most critical policy measures that must be enacted in support of a successful global climate stabilization project. This is because, as a general proposition, the transition to an alternative subsidy program will generate major benefits both in terms of equalizing income distribution—in India, Indonesia and elsewhere—as well as advancing these countries' clean energy transitions.

APPENDIX 1.
Specifying and Reconciling the Differences between the OECD and IEA Approaches to Measuring Fossil Fuel Subsidies

The OECD study specifies the conceptual difference between its approach to measuring fossil fuel subsidies and that of the IEA as follows:

$$OECD\ subsidies\ (TSE) = BOT + GSSE + \overbrace{TCT + \underbrace{(TCP + OTC)}_{equivalent\ IEA\ measure}}^{OECD\ consumer\ support\ (CSE)}$$

where

TSE = total support estimate
BOT = budgetary and other transfers to producers
GSSE = general services support estimates
TCT = transfers to consumers from taxpayers
TCP = transfers to consumers from producer
OTC = other transfers to consumers
CSE = TCT + TCP + OTC = consumer support estimate

It is clear that only the sum of TCP and OTC measure a decline in prices to consumers, i.e. the equivalent of what the IEA measures with its price gap approach. As such, in an 'ideal' measurement setting, the OECD measures of TCP + OTC would be equal to the IEA's consumer subsidy measure. Moreover, the OECD's overall subsidy measure, TSE, could not be smaller than the IEA measure and would usually be larger. This is because the OECD measure includes the subsidy categories "budgetary and other transfers to producers" (BOT), "general services support estimates" (GSSE) and "transfers to consumers from taxpayers" (TCT) that are in addition to "transfers to consumers from producers" (TCP) and "other transfers to consumers" (OCD). In practice, however, the OECD figures are consistently lower than the IEA figures, despite the fact that the OECD includes a broader set of subsidy categories.

The OECD (2018) offers the following reasons as to why, in practice, the differences emerge between the OECD and IEA measures:

1. The OECD may be missing price-reducing measures from its inventory measurement method.
2. Measurement errors in either IEA or OECD, and the IEA could miss VAT reductions only for certain (e.g. low-income) groups of consumers.
3. Difference in opinion about the exact nature of the support measure since:
    a. The definition of a support measure depends on a counterfactual baseline that may differ between OECD and IEA.
    b. Support policies can be nuanced and not all nuances can receive the same attention.
4. The OECD measure are mainly based on figures released on a fiscal year basis, so that certain transfers may be delayed; the IEA could miss subsidy changes because of delays in fossil-fuel price pass through

With these sources of possible discrepancies in mind, the OECD (2018) advises that for countries where both measures are available, the higher of the two measures IEA vs TCP+OTC should be used and added to the other OECD measures.[49]

APPENDIX 2.
Indian Household Energy Consumption by Household Deciles, 2009–10 and 2022–23

Table A2.1 presents figures on the distribution of energy consumption in India by household deciles. We derived these figures from the NSSO's Household Consumer Expenditure Surveys for 2009–10 and 2022–23. As the table shows, the relative shares of energy consumption do mostly remain fairly stable between the two surveys. Thus, for the lowest three deciles, the shift in consumption shares between surveys is only 0.2 percentage points—with a 0.2 percentage point share decline for the poorest 10 percent between 2009–10 and 2022–23 and a 0.2 percentage point share increase for the next two lower deciles. The consumption shares continue to increase for all household deciles in 2022–23 relative to 2009–10 up until the richest 10 percent of households. The share increases are somewhat larger for the middle 5 household deciles, ranging between 0.6 and 1.0 percentage points. The richest 10 percent of households do then experience a significant consumption share decline of 4.7 percentage points in 2022–23 relative to 2009–10.

This is, of course, within a broader context in which overall household energy consumption rose by approximately 20 percent between the 2009–10 and 2022–23 surveys, and in which the overall share of the richest 10 percent of households still consumed nearly 25 percent of overall consumption. This consumption level for the richest 10 percent of households is roughly 7 times greater than the poorest 10 percent and 3 times more than the average Indian household. Nevertheless, as we note in the main text, the increased consumption shares for the middle household deciles and the nearly 5 percentage point share decline for the richest 10 percent of households does suggest that the fossil fuel subsidy shares received by Indian households will have become modestly less regressive than the figures derived from the 2009-10 survey, as reported by Mittal et al.

As we also note in the main text, it is likely that some of the various subsidy reform measures noted in the main text, including aiming to target lower-income households through the LPG subsidy program, will have also modestly reduced the regressivity of India's fossil fuel subsidy policies relative to the figures we cite from the 2009–10 survey.

TABLE A2.1. Distribution of Energy Consumption in India by Household Deciles, from 2009–10 and 2022–23 Household Consumer Expenditure Surveys

1)	2) 2009-10 Survey results, *percentages*	3) 2022-23 Survey results, *percentages*	Consumption share change, *percentage points* (= columns 3-2)
Poorest 10%	3.7%	3.5%	-0.2%
11th- 20th percentile	4.6%	4.8%	+0.2%
21st - 30th percentile	5.4%	5.6%	+0.2%
31st -40th percentile	6.0%	6.6%	+0.6%
41st -50th percentile	6.9%	7.7%	+0.8%
51st -60th percentile	8.0%	9.0%	+1.0%
61st -70th percentile	9.5%	10.4%	+0.9%
71st – 80th percentile	11.6%	12.4%	+0.8%
81st -90th percentile	15.2%	15.5%	+0.2%
Richest 10%	29.1%	24.4%	-4.7%
Average per capita household energy consumption in 2023 USD	$81	$99	Average per capita consumption increase = 22.2%

Source: India Household Consumer Expenditure Surveys for 2009-10 and 2022–2023, National Sample Survey Office (NSSO).

Endnotes

1 Of course, both the extent of literature and the current range of policy initiatives addressing this transition are formidable. See Mathews and Oquaby (2025) for a wide-ranging series in-depth perspectives. Pollin et al. (2015) and Pollin (2020, 2023) consider issues with respect to industrial policies, financial requirements and employment impacts. Prentiss (2015) and Jacobson (2023), among others, examine the technical viability of operating a global energy infrastructure powered fully by renewable sources.

2 Unless explicitly noted otherwise, all U.S. dollar figures throughout the study are expressed in constant 2023 dollars.

3 https://sdg12hub.org/sdg-12-hub/see-progress-on-sdg-12-by-target/12c-fossil-fuel-subsidies

4 https://unctad.org/publication/trade-and-development-report-2023. A recent study that examines some of the complexities involved in advancing fossil fuel subsidy phase-out policies is van Asselt et al. (2023).

5 The case for policies to protect the well-being of consumers and communities, especially those in lower-income cohorts, while phasing out fossil fuel subsides is parallel to one in support of carbon fees or quantitative caps accompanied by cash rebates provided to consumers on an egalitarian distributive basis. Such approaches to carbon pricing are presented clearly in Boyce (2019). Proponents refer to this policy framework as 'cap and dividend' or 'fee and dividend.'

6 https://fossilfuelsubsidytracker.org/. The 2023 UNCTAD Trade and Development Report (pp. 163 – 64) also provides a useful overview of issues in defining and measuring fossil fuel subsidies

7 https://www.imf.org/en/Topics/climate-change/energy-subsidies#:~:text=Implicit%20subsidies%20occur%20when%20the,consumption%20tax%20rates%20on%20energy.

8 FFST: https://fossilfuelsubsidytracker.org/methodology/#:~:text=The%20Fossil%20Fuel%20Subsidy%20Tracker,from%20source%20organisations%20become%20available.

9 Appendix 1 presents further detail on the OECD's method for combining the two approaches.

10 https://fossilfuelsubsidytracker.org/methodology/

11 Nominal USD are deflated based on the U.S. Implicit GDP price deflator: https://fred.stlouisfed.org/series/GDPDEF

12 The electricity subsidy figure excludes subsidies provided for generating electricity with nuclear power or one of the renewable sources.

13 https://www.eia.gov/international/data/world

14 Arze Del Granado et al. do not specify the year, or years, to which the U.S. dollar prices reported by them refer. Suffice it to say that the figures must be referring to US dollars at the 2012 price level or somewhat earlier. Between 2012 and 2022, the Consumer Price Index for the U.S. rose by approximately 27 percent.

15 Coady et al. (2015) provide an updated but somewhat less detailed version of the Arze Del Grando et al. (2012) study. According to Coady et al., their study extends "the cross-country evidence reviewed by Arze del Grando, Coady and Gillingham (2012) to include more recent studies for a larger number of countries. Arze del Grando, Coady and Gillingham (2012) reviewed estimates of welfare impacts for 20 countries from Africa, Asia, the Middle East, and Latin America, undertaken between 2005 and 2009. This paper extends the survey to 32 countries up to 2014. In some instances, more recent studies for countries already covered became available so the number of new studies reviewed is larger than the number of countries added to the sample (p. 3)." We report the results of the earlier 2012 study in Table 4 because that study includes figures on fossil fuel subsidies as a percentage of household incomes by quintiles (column 2), while the 2015 study does not include this specific detailed breakdown. In any case, the figures in the 2015 study on the share of total fossil fuel subsidy benefits received by quintiles (p. 23) are nearly identical to those reported in the 2012 study (and shown in column 3 of Table 4).

16 Pollin (2015), pp. 99 – 104 describes the comparable incentive structures that guide the operations of large-scale publicly-owned and privately-owned fossil fuel corporations. Pollin also examines the prospects for significant shifts in incentive structures through alternative small-scale enterprises, which can be organized through various combinations of public, private, and cooperative ownership structures.

17 Li et al. (2024) present evidence on how fossil fuel subsidies in China significantly reduce investments in energy saving technologies.

18 Specifically: (50 percent price increase) x (-.61 price elasticity) = ~30 percent demand contraction.

19 We generate this $520 billion figure given that the global crude oil market for 2023 amounted to $2.6 trillion. $520 billion = 20 percent of $2.6 trillion. (https://www.alliedmarketresearch.com/crude-oil-market#:~:text=The%20global%20crude%20oil%20market,1.5%25%20from%202024%20to%202033.&text=Crude%20oil%2C%20also%20known%20as,deposits%20and%20other%20organic%20materials).

20 Some recent discussions on this broader set of questions are in Ghosh (2023) and Pollin and Bouazza (2024).

21 In support of this conclusion, a survey by Hoy et al. (2024) of 37,000 respondents across 12 middle-income countries found that around 30 percent of respondents favored reducing fossil fuel subsidies in recognition of the environmental impacts of burning fossil fuels. Most of these supporters of reducing subsidies in response to environmental concerns perceived themselves to be middle class. But Hoy et al. also found that the share supporting fossil fuel subsidy reductions rose to over 95 percent if the cuts in fossil fuel subsidies were accompanied by policies to compensate consumers for the subsequent rise in fossil fuel prices.

22 These same considerations on timing and price smoothing have also been emphasized in the parallel literature on the effective implementation of carbon taxes. For example, Gong et al. (2024) develop proposals that introduce "pre-existing reward-based climate policies." They find that support for carbon tax policies increases significantly when such "reward-based" climate policies are introduced prior to implementing the carbon tax, and when "the innate connection between the two policies is made salient," (2024, p. 1).

23 For alternative perspectives on the relative merits of targeted versus universal programs in developing economies, see, e.g. Ravallion (2017), Hanna and Olken (2018), and Majoka and Palacios (2019). Thus, Ravallion concludes that "Whether we see universal Basic Income Grants in future or not, the current policy debates will hopefully lead us to be less reliant on finely targeted social policies that focus on avoiding leakage to the 'non-poor' yet rarely have the kind of information needed to do this credibly, are often based on an incomplete accounting of the costs incurred (not least by poor people), and end up excluding many who are in real need." By contrast, Hanna and Olken, whose empirical research focused on Indonesia as one of its case studies, find that "Our evidence from Indonesia and Peru shows that existing targeting methods in developing countries, while imperfect, appear to deliver substantial improvements in welfare compared to universal programs, because they can transfer much more on a per-beneficiary basis to the poor as compared with universal programs. The primary downside of these programs is horizontal equity—because targeting is imperfect, there will be a substantial number of poor households who slip through the cracks and are excluded. Nevertheless, for many developing countries, our simulations suggest the welfare gains from targeting may be substantial." Majoka and Palacios attempt to define a middle ground between targeting and universality.

24 Bridle et al. (2019) present a valuable case in support of what they term "fossil fuel to clean energy subsidy swaps." Their study includes brief discussions focused on the cases of India and Indonesia.

25 https://www.eia.gov/international/overview/country/ind

26 See, e.g. Chandrasekhar and Ghosh (2004), Ghosh (2020) Chandrasekhar (2021), Rajagopalan (2021), and Frontline Team (2022) for alternative perspectives on the history of economic liberalization policies overall in India.

27 https://www.eia.gov/international/data/country/ind

28 The likelihood that such negative distributional effects would result has been confirmed in various research studies. For example, Ganguly and Das (2016) found that any removal of subsidies on petrol, diesel and LPG would lead to increased poverty rates, even if the subsidies were removed during periods when crude oil prices are falling.

29 https://www.iisd.org/publications/report/indias-fuel-subsidies-policy-recommendations-reform, p. 4.

30 These figures are from Bandyopadhyay (2010), p. 3. Bandyopadhyay reports the figures for biomass use as consisting entirely of "firewood" as opposed to firewood and dung cakes. But in fact, dung cakes as well as firewood are both widely-used energy sources for cooking in India's rural areas. The heavy dependence on biomass for energy in India's rural areas has further distributional impacts, in that women in rural areas experience the lack of access to LPG and kerosine subsidies most acutely. Thus, a 2014 study by Merrill writes that, at that time period, "rural women in India have benefitted very little from fossil fuel subsidies over the years: two-thirds of the population still use biomass…as their main source of cooking fuel. Use of such fuels leads to many deaths from indoor air pollution every year…Fossil fuel subsidies have largely ignored women, who gather make, and cook with biomass fuels," (2014, p. 2). See also Anand (2012).

31 Criticism of the Aadhaar numbers requirement to qualify for government subsidy support includes an extensive 2021 report by the Ministry of Electronics and Information Technology of the Union Government, *Report of the*

Comptroller and Auditor General of India on Functioning of Unique Identification Authority of India, See, e.g. https://rethinkaadhaar.in/blog/2022/4/11/cag-report-confirms-criticism-of-aadhaar-time-to-end-project.

32 Nigam (2024) presents a similar critique of the program.

33 https://www.eia.gov/international/data/country/ind

34 https://www.eia.gov/international/data/country/IND

35 As reported by the International Energy Agency, at: https://www.iea.org/data-and-statistics/data-product/fossil-fuel-subsidies-database.

36 India population and household figures citation in Table 6.

37 As we show in Table 6, households in the 41st to 50th income percentile would receive $101 in fossil fuel consumption subsidies, corresponding to their 6.4 percent share of total consumption subsidies. For these households to receive an equivalent share of the $13.9 billion in production subsidies for 2023 would amount to an additional roughly $30 for each household in India's 41st – 50th decile (i.e. $13.9 billion x 0.064 = $890 million; $890 million/30 million households = ~$30).

38 Viswanathan et al. (2021) review recent developments and prospects for energy subsidy reform in India, including both the phasing-down of fossil fuel subsidies and increasing support for renewable subsidies.

39 Beaton and Lontoh (2010) estimated that, by the time of the 1997 Asian Financial Crisis, the corruption associated with the oil production in Indonesia amounted to about 1 percent of Indonesian GDP.

40 https://jetp-id.org/

41 https://jetp-id.org/cipp

42 See also Beaton et al. (2018) and Suharsono and Lontoh (2022) for further perspectives on Indonesia's trajectory with fossil fuel subsidies.

43 https://www.eia.gov/international/data/country/IDN

44 As reported by the International Energy Agency, at: https://www.iea.org/data-and-statistics/data-product/fossilfuel-subsidies-database.

45 Indonesia population figures are from: https://data.worldbank.org/indicator; The figure on number of households as of 2021 is from: https://www.statista.com/statistics/728231/number-of-households-indonesia/

46 As we show in Table 13, households in the 41st to 50th income percentile would receive $317 in fossil fuel consumption subsidies, corresponding to their 7.5 percent share of total consumption subsidies. For these households to receive an equivalent share of the $6.1 billion in production subsidies for 2023 would amount to an additional roughly $64 for each household in Indonesia's 41st – 50th decile (i.e. $6.1 billion x 0.075 = $458 million; $458 million/7.1 million households = ~$64).

47 https://www.eia.gov/international/data/country/IDN

48 IRENA (2022), pp. 36 – 37 and passim. The 2024 instalment of IRENA's annual *Renewable Power Generation Costs* study affirms this previous result. It's overall assessment as of 2023 is that "Globally, between 2010 and 2023, around 1,091 GW of renewable power generation capacity was added in non-OECD countries that had costs lower than the weighted average fossil fuel-fired LCOE in the year of commissioning," (IRENA 2024, p. 43).

49 https://www.oecd-ilibrary.org/docserver/9789264286061-en.pdf?expires=1680126846&id=id&accname=ocid53005155&checksum=DB73DBF4CB26593B18CE3D087E3EF779, pp. 22 – 23.

References

Ahron, David Y., Mukriz Izraf Azamon Aziz and Ido Kallir (2023) "Oil Price Shocks and Inflation: A Cross-National Examination in the ASEAN5+3 Countries," *Resources Policy*, 82/May, https://doi.org/10.1016/j.resourpol.2023.103573

Anand, Mukesh Kumar (2012) "Diesel Pricing in India: Entangled in a Policy Maze," New Delhi: National Institute of Public Finance and Policy, Working Paper No. 2012-108, October, https://econpapers.repec.org/paper/npfwpaper/12_2f108.htm

Asian Development Bank (2015) *Fossil Fuel Subsidies in Indonesia: Trends, Impacts and Reforms,* Manila, ADB, http://hdl.handle.net/11540/5244

Asian Development Bank (2024) Asia-Pacific Climate Report 2024: Catalyzing Finance and Policy Solution, Manila, ADB, https://www.adb.org/publications/asia-pacific-climate-report-2024

Arze del Granado, F.J., D. Coady, and R. Gillingham (2012) "The Unequal Benefits of Fuel Subsidies: A Review of Evidence from Developing Countries," *World Development,* 40(11), pp. 2234 – 2248, https://doi.org/10.1016/j.worlddev.2012.05.005

Bandyopadhyay, Kaushik Ranjan (2009) *Petroleum Pricing in India: Transition from APM to MDPM*, Munich Personal RePEc Archive, https://mpra.ub.uni-muenchen.de/25905/

Bandyopadhyay, Kaushik Ranjan (2010) *Fossil Fuel Subsidy Reform in India: Addressing the Challenges*, RIS Policy Briefs #45, Delhi: Research and Information System for Developing Countries, https://www.ris.org.in/policy-briefs?page=6

Beaton, Christopher and Lucky Lontoh (2010) *Lessons Learned from Indonesia's Attempts to Reform Fossil-Fuel Subsidies*, Winnipeg, Canada: International Institute for Sustainable Development, October, https://www.iisd.org/publications/report/lessons-learned-indonesias-attempts-reform-fossil-fuel-subsidies

Beaton, Christopher, Lucky Lontoh, and Matthew Wai-Poi (2018) "Indonesia: Pricing Reforms, Social Assistance, and the Importance of Perceptions," in J. Skovgaard and H. Van Asselt eds. *The Politics of Fossil Fuel Subsidies and their Reform*, Cambridge, UK: Cambridge University Press, pp. 133 - 207.

Boyce, James (2019) *The Case for Carbon Dividends*. New York: Polity Press.

Bridle, Richard, Shruti Sharma, Mostafa Mostafa and Anna Geddes (2019) *Fossil Fuel to Clean Energy Subsidy Swaps: How to Pay for an Energy Revolution,* Winnipeg, Canada: International Institute for Sustainable Development, https://www.iisd.org/system/files/publications/fossil-fuel-clean-energy-subsidy-swap.pdf.

Chandrasekhar, CP (2021) "Indian Neoliberalism: A Toxic Gift from Global Finance," Frontline, *The Hindu*, Indian neoliberalism: A toxic gift from global finance - Frontline (thehindu.com)

Chandrasekhar, C.P. and Jayati Ghosh (2004) *The Market that Failed: A Decade of Neoliberal Economic Reforms in India*, Leftword Books, New Delhi. Revised edition.

Cheikh, Nidhaladdine Ben, Younes Ben Zaied, and Wided Mattoussi (2023) "Oil Price Shocks in the Age of Surging Inflation," *Energy Economics*, 128/December, https://doi.org/10.1016/j.eneco.2023.107128

Coady, David, Valentina Flamini, and Louis Sears (2015) "The Unequal Benefits of Fuel Subsidies Revisited: Evidence for Developing Countries," Washington, DC: IMF Working Paper WP/15/260, https://www.imf.org/external/pubs/ft/wp/2015/wp15250.pdf

Durand-Lasserve, Olivier, Lorenza Campagnolo, Jean Chateau, and Rob Dellink (2015) "Modeling of Distributional Impacts of Energy Subsidy Reforms: An Illustration with Indonesia," Fondazione Eni Enrico Mattei, FEEM Working Paper No. 068.2015, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2633472#

Frontline Team (2022) "1991: Economic Reforms," The Hindu 1991: Economic reforms - Frontline (thehindu.com)

Ganguly, Amrita and Koushik Das (2016) "Effect of Reduction of Fuel Subsidies on Poverty and Inequality in Developing Countries—The Case of India," *SIBM Pune Research Journal*, pp. 32 – 41, June, http://dx.doi.org/10.53739/samvad%2F2016%2Fv11%2F98180

Ghosh, Jayati (2020) "Hindutva, Economic Neoliberalism and the Abuse of Economic Statistics in India," *South Asia Multidisciplinary Academic Journal,* https://doi.org/10.4000/samaj.6882

Ghosh, Jayati (2023) "The Social Consequences of Inflation in Developing Countries," *The Economic and Labor Relations Review*, 34, 203 – 211, https://doi.org/10.1017/elr.2023.11

Gong, Yuanchao, Yang Li, Jiejiano Liu, and Yan Sun (2024) "Overcoming Public Resistance to Carbon Taxes: A Cost-Efficient Solution Built On a Pre-existing Reward-based Climate Policy, *Journal of Environmental Management* 352, https://doi.org/10.1016/j.jenvman.2024.120025

Hoy, Christopher, Yeon Soo Kim, Minh Nguyen, Rariano Sosa, and Sailesh Tiwari (2024) "Attitudes Towards Reducing Fossil Fuel Subsidies: Evidence Across 12 Middle-Income Countries, September, https://ssrn.com/abstract=4945420 or http://dx.doi.org/10.2139/ssrn.4945420

Huntington, Hillard G., James J. Barrios, and Vipin Arora (2019) "Review of Key International Demand Elasticities for Major Industrializing Economies," *Energy Policy* (133), https://doi.org/10.1016/j.enpol.2019.110878

Inchauste, G., and Victor, D. (2017) *The Political Economy of Energy Subsidy Reform*, Washington, DC: The World Bank Group, https://ppp.worldbank.org/public-private-partnership/library/political-economy-energy-subsidy-reform

International Panel on Climate Change (IPCC) (2018) *Global Warming of 1.5^{0}C,* https://www.ipcc.ch/sr15/

International Renewable Energy Agency (IRENA) (2022) *Renewable Power Generation Costs in 2021,* IRENA, https://www.irena.org/publications/2022/Jul/Renewable-Power-Generation-Costs-in-2021

International Renewable Energy Agency (IRENA) (2024) *Renewable Power Generation Costs in 2023,* IRENA, https://www.irena.org/Publications/2024/Sep/Renewable-Power-Generation-Costs-in-2023

Jacobson, Mark Z. (2023) No Miracles Needed: How Today's Technology Can Save Our Climate and Clean Our Air, Cambridge, UK: Cambridge University Press.

Jain, Abhishek, Shalu Agrawal, and Karthik Ganesan (2018) "Lessons from the World's Largest Subsidy Benefit Transfer Scheme: The Case of Liquified Petroleum Gas Subsidy Reform in India," in J. Skovgaard and H. Van Asselt eds. *The Politics of Fossil Fuel Subsidies and their Reform*, Cambridge, UK: Cambridge University Press, pp. 212 – 228.

Just Energy Transition Partnership Indonesia (2023) *Comprehensive Investment and Policy Plan,* Jakarta: Government of Indonesia, November, https://jetp-id.org/cipp

Hanna, Rema and Benjamin A. Olken (2018) "Universal Basic Incomes versus Targeted Transfers: Anti-Poverty Programs in Developing Countries," *Journal of Economic Perspectives*, 32:4, Fall, pp. 201-226, DOI: 10.1257/jep.32.4.201

Kumar, Rajiv (1981) "Nationalization by Default: The Case of Coal in India," *Economic and Political Weekly,* May 2, pp. 824 – 830, https://www.jstor.org/stable/pdf/4369782.pdf

Liddle, William R. and Saiful Mujani (2006) "Indonesia in 2005: A New Multiparty Presidential Democracy," *Asian Survey*, 46(1), pp. 132 – 139, https://doi.org/10.1525/as.2006.46.1.132.

Li, Zhi, Qing Zhao, Hong Guo, and Ruting Huang (2024) "Impact of Fossil Fuel Subsidies on Energy-Saving Technological Change in China," *Energy*, 286, January, https://doi.org/10.1016/j.energy.2023.129265

Majoka, Zaineb and Robert Palacios (2019) "Targeting versus Universality: Is There a Middle Ground?" Policy & Technical Note, Social Protection & Jobs, World Bank Group, October, No. 22, http://documents.worldbank.org/curated/en/748311574398803352/Targeting-versus-Universality-Is-There-a-Middle-Ground

Mathews, John A. and Arkebe Oquabay eds. (2025 forthcoming) *The Oxford Handbook on the Greening of Economic Development*, Oxford, UK: Oxford University Press.

Merrill, Laura (2014) *Power, Gender and Fossil-fuel Subsidy Reform in India*, Winnipeg, Canada: International Institute for Sustainable Development, https://www.iisd.org/publications/report/power-gender-and-fossil-fuel-subsidy-reform-india

Mittal, Neeraj, Anit Mukherjee and Alan Gelb (2017) *Fuel Subsidy Reform in Developing Countries: Direct Benefit Transfer of LPG Cooking Gas Subsidy in India*, Washington, DC: Center for Global Development, https://www.cgdev.org/publication/fuel-subsidy-reform-developing-countries-india

Nigam, S.K. (2024) "The Dark Truth of PM Ujjwala Scheme," *Congress Sandesh*, January 8, The Dark Truth of PM Ujjwala Scheme

OECD (2018) *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018*, Paris, OECD Publications, https://doi.org/10.1787/9789264286061-en

Pollin Robert (2015) *Greening the Global Economy*. Cambridge, MA: MIT Press.

Pollin, Robert (2020) "An Industrial Policy Framework to Advance a Global Green New Deal, in Arkebe Oquabay, Christopher Cramer, Ha-Joon Chang, and Richard Kozul-Wright eds, *The Oxford Handbook of Industrial Policy*, Oxford, UK: Oxford University Press, DOI: 10.1093/oxfordhb/9780198862420.013.16

Polin, Robert (2023) "The Political Economy of Saving the Planet," *The Japanese Political Economy*, 49:2-3, October, pp. 1411 - 168, https://doi.org/10.1080/2329194X.2023.2262531.

Pollin, Robert, Heidi Garrett-Peltier, James Heintz, and Shouvik Chakraborty (2015), *Global Green Growth: Clean Energy Industrial Investments and Expanding Job Opportunities*, United Nations Industrial Development Organization and Global Green Growth Institute, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.unido.org/sites/default/files/2015-05/GLOBAL_GREEN_GROWTH_REPORT_vol1_final_0.pdf

Pollin, Robert and Hanae Bouazza (2024) "Considerations on Inflation, Economic Growth and the 2 Percent Inflation Target," *Review of Keynesian Economics*, 12:4, pp. 453 - 74, https://doi.org/10.4337/roke.2024.0006

Prentiss, Mara (2015) *Energy Revolution: The Physics and the Promise of Efficient Technology*, Cambridge, MA: Harvard University Press.

Ravallion, Martin (2017) "Straw men in the Debate on Basic Income versus Targeting," *VOXEU*, 5/5, https://cepr.org/voxeu/columns/straw-men-debate-basic-income-versus-targeting

Raizada, Swasti, Deepak Sharma, Tara Loan, and Saumya Jain (2024) *Mapping India's Energy Policy 2023: A Decade in Action*, Winnipeg, Canada: International Institute for Sustainable Development (IISD), https://www.iisd.org/publications/report/mapping-india-energy-policy-2023

Rajagopalan, Shruti (2021) "The 1991 Reforms and the Quest for Economic Freedom in India," *Capitalism & Society*, 15(1), https://ssrn.com/abstract=3985599 https://ssrn.com/abstract=3985599

Rethink Aadhaar Blog (2022) "CAP Report Confirms Criticism of AADHAAR: Time to End Project?," April, https://rethinkaadhaar.in/blog/2022/4/11/cag-report-confirms-criticism-of-aadhaar-time-to-end-project

Sharma, Shruti, Chandreshekhar Singh, Christopher Beaton, Ashutosh Sharma, Laura Merrill, Tara Laan, Anna Zinecker, and Lucy Kitson (2019) *Gender and Fossil Fuel Subsidy Reform in India: Findings and Recommendations*, Winnipeg, Canada: International Institute for Sustainable Development, https://www.energia.org/cm2/wp-content/uploads/2019/05/RA4_Gender-and-fossil-fuel-subsidy-reform_without-Annex-2.pdf

Suharsono, Anissa and Lucky Lontoh (2022) *Indonesia's Energy Policy Briefing*, Winnipeg, Canada, International Institute for Sustainable Development, February, https://www.iisd.org/publications/brief/indonesia-energy-policy-briefing-february-2022

United Nations Conference on Trade and Development (UNCTAD) (2023) *Trade and Development Report 2023*. https://unctad.org/publication/trade-and-development-report-2023

United Nations Department of Economic and Social Affairs, *Sustainable Development Goals*, https://sdgs.un.org/goals https://sdgs.un.org/goals

United Nations Development Programme (2021) *Fossil Fuel Subsidy Reforms: Lessons and Opportunities*, New York: UNDP, https://www.undp.org/publications/fossil-fuel-subsidy-reform-lessons-and-opportunities#:~:text=October%2026%2C%202021,poorest%20and%20trigger%20social%20unrest.

Weber, Isabella, Jesus Lara Lauregui, Lucas Teixeira, and Luiza Nassif Pires (2024) "Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input-Output Perspective," *Industrial and Corporate Change*, 33(2), February, https://doi.org/10.1093/icc/dtad080.

Wooders, Peter and Kerryn Lang (2012) *India's Fuel Subsidies: Policy Recommendations for Reform*, Winnipeg, Canada, International Institute for Sustainable Development, https://www.iisd.org/publications/report/indias-fuel-subsidies-policy-recommendations-reform

Wooders, Peter, Ronald Steenblik and Anna Zinecker (2019) *Measuring Fossil Fuel Subsidies in the Context of the Sustainable Development Goals*, UNEP and IISD, https://www.iisd.org/publications/report/measuring-fossil-fuel-subsidies-context-sustainable-development-goals

World Bank (2022) *Indonesia Economic Prospects: Trade for Growth and Economic Transformation*, Washington, DC: World Bank Group, December, https://www.worldbank.org/en/country/indonesia/publication/indonesia-economic-prospect#2

Rentschler, J. (2020) *Fossil Fuel Subsidy Reforms: A Guide to Economic and Political Complexity*, London: Routledge Studies in Energy Policy, 2nd edition.

Rentschler, J., & Bazilian, M. (2017) "Reforming Fossil Fuel Subsidies: Drivers, Barriers and the State of Progress." *Climate Policy*, *17*(7), 891–914, https://doi.org/10.1080/14693062.2016.1169393

Taylor, Michael (2020) *Energy Subsidies: Evolution in the Global Energy Transformation to 2050,* International Renewable Energy Agency (IRENA), https://www.irena.org/publications/2020/Apr/Energy-Subsidies-2020

van Asselt, Harro, Jonas Kuehl, Natalie Jones and Jakob Skovgaard (2023) "How the UNFCCC Can Tackle Fossil Fuel Subsidies at COP 28 and Beyond," Winnipeg, Canada, International Institute for Sustainable Development, https://www.iisd.org/articles/insight/unfccc-tackle-fossil-fuel-subsidies-cop-28

Viswanathan, B., A. Viswamohanan, P. Aggarwal, D. Narayanaswamy, A. Geddes, T. Betty Sumarno, M. Schmidt, C. Beaton, S. Goel, A. Dutt, and K. Hanesan (2021) *Mapping India's Energy Subsidies 2021: Time for Renewed Support for Clean Energy,* Winnipeg, Canada, International Institute for Sustainable Development, https://www.iisd.org/publications/mapping-india-energy-subsidies-2021

Acknowledgments

This study was commissioned by UN Trade and Development (UNCTAD). It is being published now by our own organization, the Political Economy Research Institute (PERI). This paper represents the personal views of the authors and is not to be seen as the opinion of the United Nations or its members.

We are grateful for the support for this project provided by UNCTAD. We especially want to acknowledge the encouragement of Dr. Richard Kozul-Wright, former Director of the Globalization and Development Strategies Division at UNCTAD and the active engagement of Dr. Diana Barrowclough, a Senior Economist at UNCTAD's Globalization and Development Strategies Division. Diana conceived of this project with Robert Pollin from its inception and has contributed valuable insights and strong guidance throughout all stages of the project's long gestation period. This final version of the study has also benefitted from valuable comments on previous drafts by four anonymous readers arranged entirely through communications with UNCTAD.

Kim Weinstein, Communications Director at PERI, produced this wonderfully readable final version of the style out of our cyber-piles of text, tables, and figures.

About the Authors

Robert Pollin is Distinguished University Professor of Economics and Co-Director of the Political Economy Research Institute (PERI) at the University of Massachusetts Amherst. He is also the founder and President of PEAR (Pollin Energy and Retrofits), an Amherst, MA-based green energy company operating throughout the United States. His books include *The Living Wage: Building a Fair Economy* (co-authored 1998); *Contours of Descent: U.S. Economic Fractures and the Landscape of Global Austerity* (2003); *An Employment-Targeted Economic Program for South Africa* (co-authored 2007); *A Measure of Fairness: The Economics of Living Wages and Minimum Wages in the United States* (co-authored 2008), *Back to Full Employment* (2012), *Greening the Global Economy* (2015), and *Climate Crisis and the Global Green New Deal: The Political Economy of Saving the Planet* (co-authored 2020). In 2018, he co-authored *Economic Analysis of Medicare for All*. He has worked as a consultant for the U.S. Department of Energy, the International Labour Organization, the United Nations Industrial Development Organization and numerous non-governmental organizations in several countries and in U.S. states and municipalities on various aspects of building high-employment green economies. He has also directed projects on employment creation and poverty reduction in sub-Saharan Africa for the United Nations Development Program. He has worked with many U.S. non-governmental organizations on creating living wage statutes at both the statewide and municipal levels, on financial regulatory policies, and on the economics of single-payer health care in the United States. Between 2011–2016, he was a member of the Scientific Advisory Committee of the European Commission project on Financialization, Economy, Society, and Sustainable Development (FESSUD). He was selected by *Foreign Policy* magazine as one of the "100 Leading Global Thinkers for 2013."

Shouvik Chakraborty is a an Assistant Research Professor at the Political Economy Research Institute. His research focuses on the employment impacts of green energy investments. This work also examines issues at the intersection of inequality, climate change and environmental justice, especially with respect to developing countries. Separately, he researches subjects related to international trade between advanced countries and developing countries. He is the co-author of the 2015 study *Global Green Growth: Clean Energy Industrial Investments and Expanding Job Opportunities*. In 2019, he co-edited a broad-ranging book on the current political economic situation in India, *A Quantum Leap in the Wrong Direction?* He is a member of the UNESCO Inclusive Policy Lab, a global initiative dedicated to knowledge crowdsourcing and its translation into policy. He is also a contributor to the blog of the International Growth Centre, a research organization affiliated with the London School of Economics and the Institute for New Economic Thinking (INET). He is a member of the Indian Society of Ecological Economics (INSEE), the International Society for Ecological Economics (ISEE), and the Eastern Economic Association (EEA).

Gregor Semieniuk was an Assistant Research Professor at PERI and the Department of Economics at University of Massachusetts Amherst when he contributed to this report. He subsequently became a Senior Climate Change Economist at the World Bank. The findings, interpretations and conclusions expressed in this report are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

POLITICAL ECONOMY RESEARCH INSTITUTE

The Political Economy Research Institute (PERI) promotes human and ecological well-being through our original research. Our approach is to translate what we learn into workable policy proposals that are capable of improving life on our planet today and in the future. In the words of the late Professor Robert Heilbroner, we at PERI "strive to make a workable science out of morality."

Established in 1998, PERI is an independent unit of the University of Massachusetts, Amherst, with close ties to the Department of Economics. PERI staff frequently work collaboratively with faculty members and graduate students from the University of Massachusetts, and other economists from around the world. Since its founding, PERI has become a leading source of research and policy initiatives on issues of globalization, unemployment, financial market instability, central bank policy, living wages and decent work, and the economics of peace, development, and environmental sustainability.

PERI.UMASS.EDU • GORDON HALL, 418 N. PLEASANT ST., SUITE A, AMHERST, MA 01002 • TEL: 413-545-6355