

■ synthesis article

Reforming fossil fuel subsidies: drivers, barriers and the state of progress

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This article outlines the current state of affairs in fossil fuel subsidy reform, and highlights its contribution at the nexus of climate policy, fiscal stability and sustainable development. It discusses common definitions, provides quantitative estimates, and presents the evidence for key arguments in favour of subsidy reform. The main drivers and barriers for reform are also discussed, including the role of (low) oil prices and political economy challenges. Commitments to subsidy reform by the international community are reviewed, as well as the progress at the country level. Although fossil fuel subsidy reform indeed plays a critical role in climate policy, experience shows that the rationale for such reforms is determined in a complex environment of political economy challenges, macro-economic, fiscal and social factors, as well as external drivers such as energy prices. The article synthesizes the key principles for designing effective reforms and emphasizes that subsidy reforms cannot only yield fiscal relief, but should also contribute to long-term sustainable development objectives. Areas for future research are also identified.

Keywords: Environmental taxes; fiscal reform; fossil fuel subsidies

Policy relevance

There is an increasingly strong international consensus that fossil fuel subsidies are detrimental in terms of economic, social and environmental sustainability. Organizations including the Intergovernmental Panel on Climate Change and the International Energy Agency consider fossil fuel subsidy reform a critical measure for achieving any ambitious emissions mitigation target. The reason is that these subsidies not only incentivize overconsumption of carbon-intensive energy, but directly undermine any effort to impose a price on carbon (e.g. through carbon taxes). While subsidy reform is crucial from a climate change perspective, the wide range of externalities associated with fuel subsidies also underscores the fact that reform is a vital contribution to sustainable development objectives more generally. This article emphasizes that fossil fuel subsidy reform can make a substantial contribution to climate policy, but also discusses how strongly environmental objectives are intertwined with fiscal, macro-economic, political and social factors. Although the momentum for subsidy reform is building, reforms are often designed to deliver fiscal rather than environmental benefits.

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1. Introduction

Getting prices right is widely regarded to be at the heart of an effective market-based solution to the climate change challenge. This approach calls for governments to reflect the social and environmental costs of carbon-intensive activities in their prices – by removing subsidies on fossil fuels and putting a price on carbon. In fact, subsidies, which reduce the price of fossil fuels, have the polar opposite effect of carbon taxes, which aim to disincentivize the overconsumption of carbon-intensive energy.

By one estimate, between 1980 and 2010 36% of global carbon emissions were driven by fossil fuel subsidies (Stefanski, 2014). Another study suggests that reforming fossil fuel subsidies (FFSs) by 2020 could reduce global carbon emissions by 6.4% until 2050 (Schwanitz, Piontek, Bertram, & Luderer, 2014). Merrill, Bassi, Bridle, and Toft Christensen (2015) estimate that these reductions could be up to 18% if a small share of reform revenues (30%) is invested in renewables and energy efficiency. Similarly, the International Energy Agency (IEA, 2013) estimates that FFS reform could reduce carbon emission by 360 Mt by 2020; and identifies FFS reform as one of four key policy measures for limiting global warming to 2° C above pre-industrial levels.¹ In its latest Assessment Report the Intergovernmental Panel on Climate Change (IPCC, 2014; TS p.98) emphasizes that FFS reform can ‘achieve significant emission reductions at negative social cost’. Overall, this suggests that FFS reform must be an integral part of climate change mitigation efforts.

FFSs have been in the international limelight at least since the 2009 G20 summit, when heads of state announced a joint but vague commitment to the reform of ‘inefficient’ fuel subsidies. Subsequently, this commitment has been repeated in various international policy platforms, and is reflected in the UN’s Sustainable Development Goals. This international commitment is matched by efforts at the national level, with 27 countries around the world planning or implementing the reform of environmentally, socially and economically unsustainable FFSs in 2014 (IEA, 2014a).

In practice, the key rationale for implementing subsidy reform has typically been fiscal rather than environmental. However, the necessity and urgency of reform can only be fully understood when considering the complete range of adverse environmental, social and economic side-effects of FFSs. Besides driving climate change, FFSs dis-incentivize investments, innovation and efficiency, escalate fiscal burdens, crowd out funds for health, education and other public infrastructure, incentivize corruption, aggravate air pollution and reinforce poverty and income inequality. Yet the mixed track record of past reform attempts – a number of which resulted in violent street protests – illustrates how difficult reforms are in practice. Indeed experience shows that political economy obstacles can be immense – but strong government commitment, thorough preparation, careful reform design, effective communication and timing can significantly improve the success rate.

Although FFS reforms are often seen as an opportunity for quick fiscal relief in times of tight government budgets, this article emphasizes that additional measures can help to align FFS reforms with climate policy and long-term sustainable development objectives. For this purpose, this article synthesizes the evidence from a series of case studies of past FFS reforms, and distils the key principles for designing effective reforms. It shows how severe economic, environmental and social externalities act as strong drivers for reform, whereas political challenges mean that implementation can be difficult in practice. Moreover, it offers policy makers a comprehensive overview of the *status quo* with respect to the main definitions, assessment criteria, externalities, and recent reform progress.

The remainder of this article is structured as follows: Section 2 provides an outline of the existing definitions and estimates of FFSs. Section 3 summarizes the adverse effects of FFSs from economic, environmental and social perspectives. Section 4 provides an up-to-date picture of the efforts by the international community and national governments to implement subsidy reforms. Section 5 discusses how international energy prices can provide (dis-) incentives for reforming subsidies and outlines common political economy challenges. Section 6 draws on lessons learnt from past subsidy reforms, and summarizes the key principles for designing and implementing reform. Section 7 concludes.

2. Defining and estimating FFSs

The World Trade Organization (WTO, 2006) broadly defines subsidies as any government programme that confers a benefit on its recipients. More specifically, Kojima and Koplow (2015) define a FFS as any policy action that targets fossil fuels, or fossil fuel-based electricity or heat, and causes one or more of the following effects: (1) a reduction of net energy costs; (2) a reduction of energy production or distribution costs; and/or (3) an increase in the revenues of energy suppliers.

Although FFSs can take various forms, they can be broadly categorized into two types: consumer and producer subsidies (Whitley, 2013; GSI, 2010a, 2010b; IEA, 2014a). Consumer subsidies refer to fiscal measures that lower the price of fossil fuel products below their market price (e.g. the international market price, or cost-recovery threshold), thus making them more affordable to end-users. As both market prices and domestic subsidized prices can be directly observed or estimated, consumer subsidies are more easily assessed with available data than producer subsidies. Consumer subsidies generally do not account for the cost of externalities (e.g. those due to carbon emissions).

Producer subsidies are more difficult to observe and quantify, as they refer to different kinds of preferential treatment of fossil fuel exploration and extraction firms or other energy-intensive companies, industries or products (Bast, Doukas, Pickard, van der Burg, & Whitley, 2015; Bast, Makhijani, Pickard, & Whitley, 2014; GSI, 2010a). Producer subsidies could be explicit, such as grants, low-interest loans, direct payments or tax exemptions; or they may be implicit (in-kind) such as credit subsidies, government guarantees for procurement contracts or research subsidies (OECD, 2011; UNEP, 2003; Whitley, 2013). The Global Subsidy Initiative (GSI) has estimated producer subsidies for a series of countries, but estimates vary widely due to data issues (e.g. GSI, 2012). Overall, producer subsidies are thought to be in the range of US\$ 80 billion to US\$ 285 billion annually in emerging and developing countries, and US\$ 452 billion in the G20 countries (Bast et al., 2015; OECD, 2013; Whitley, 2013).

Based on these definitions, there have been several estimates of the global magnitude of subsidies and their implications.² These estimates, by the World Bank, the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), IEA, GSI and others range from US\$250 billion to more than US\$5 trillion (Kojima & Koplow, 2015). The wide range illustrates the differences in scope, definitions and methodology. For instance, the IEA estimates that consumer subsidies in 2013 amounted to US\$ 548 billion (Figure 1), but this figure increases to almost US\$1 trillion if producer subsidies are included.

While international market prices are a common benchmark for estimating subsidization rates, in oil producing countries the cost of domestic production is often used as the reference point for setting

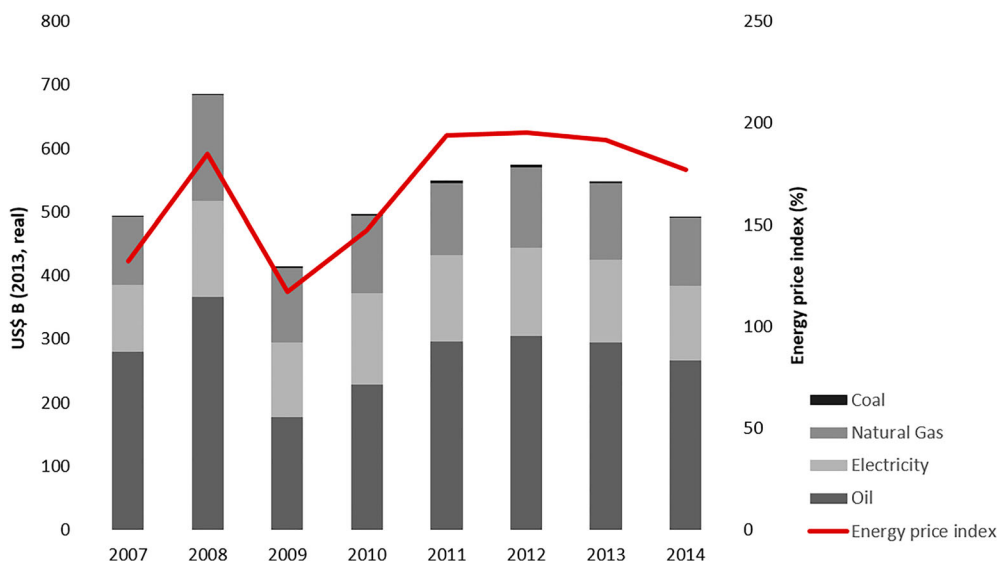


Figure 1. Global consumer subsidies for fossil fuels amounted to US\$ 493 billion in 2014. Subsidies generally move in line with energy prices (red line, indexed on right axis). Subsidies are likely to be even lower for 2015 due to low energy prices. (IEA, 2014a).

prices.³ Countries in the Middle East and North Africa have particularly high subsidies relative to the cost of supply; in 2014 Saudi Arabia (78.9%), Iran (73.8%), Iraq (62.4%), Libya (80.2%), Algeria (56.7%) and Egypt (53.7%) had some of the highest subsidization rates in the world (IEA, 2014b).⁴ The World Bank estimates that 48% of global FFSs are paid in this region (Devarajan et al., 2014). Figure 2 shows the 20 largest providers of fossil fuel consumption subsidies.

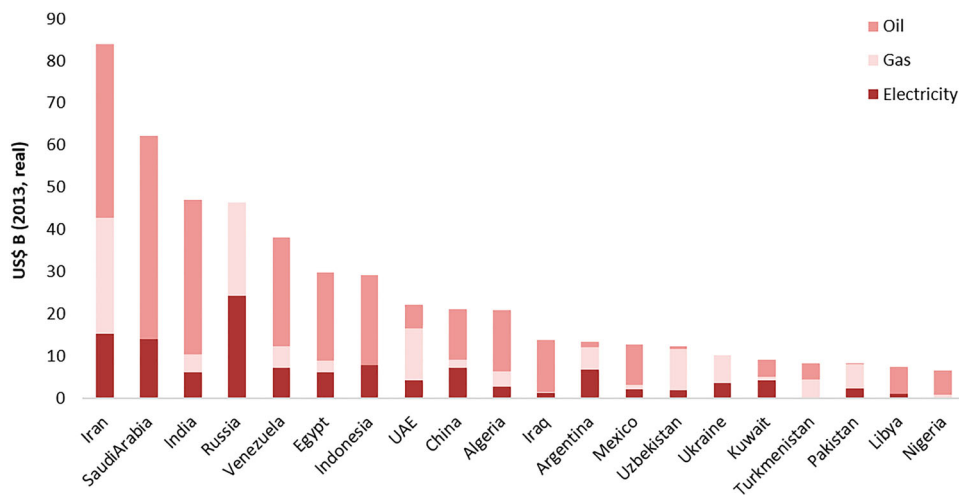


Figure 2. The 20 largest subsidizers of energy consumption (IEA, 2014a).

Comparing national diesel prices as a proxy for consumer subsidies offers a complete picture: aside from countries in the Middle East and North Africa, oil and gas exporting economies in Africa, Latin America and Southeast Asia can be identified as heavy subsidizers of consumption (Figure 3). It is important to bear in mind that while consumer subsidies are mostly paid in resource-rich developing countries, numerous developed economies have large producer subsidy schemes in place, such as the UK (US\$9.0 billion), Germany (US\$2.8 billion), Australia (US\$5.0 billion) and the US (US\$20.5 billion) in 2014 (Bast et al., 2015).⁵

In addition to the conventional definition of FFSs, the IMF (2013a; Coady, Parry, Sears, & Shang, 2015) provides the measure of ‘post-tax subsidies’. This not only accounts for consumer and producer subsidies, but also for governments’ failures to price negative externalities from fossil fuel usage (including the social cost of carbon, local pollution and road congestion). This definition also includes reduced energy tax rates, such as in the UK where energy is taxed at a reduced rate from other consumption goods (5% VAT rather than 20%; HMRC, 2014). Following this definition, the IMF estimates the cost of FFSs at US\$5.3 trillion, where environmental impacts constitute more than 75% of total costs (Coady et al., 2015). This emphasizes that removing conventionally defined subsidies alone is unlikely

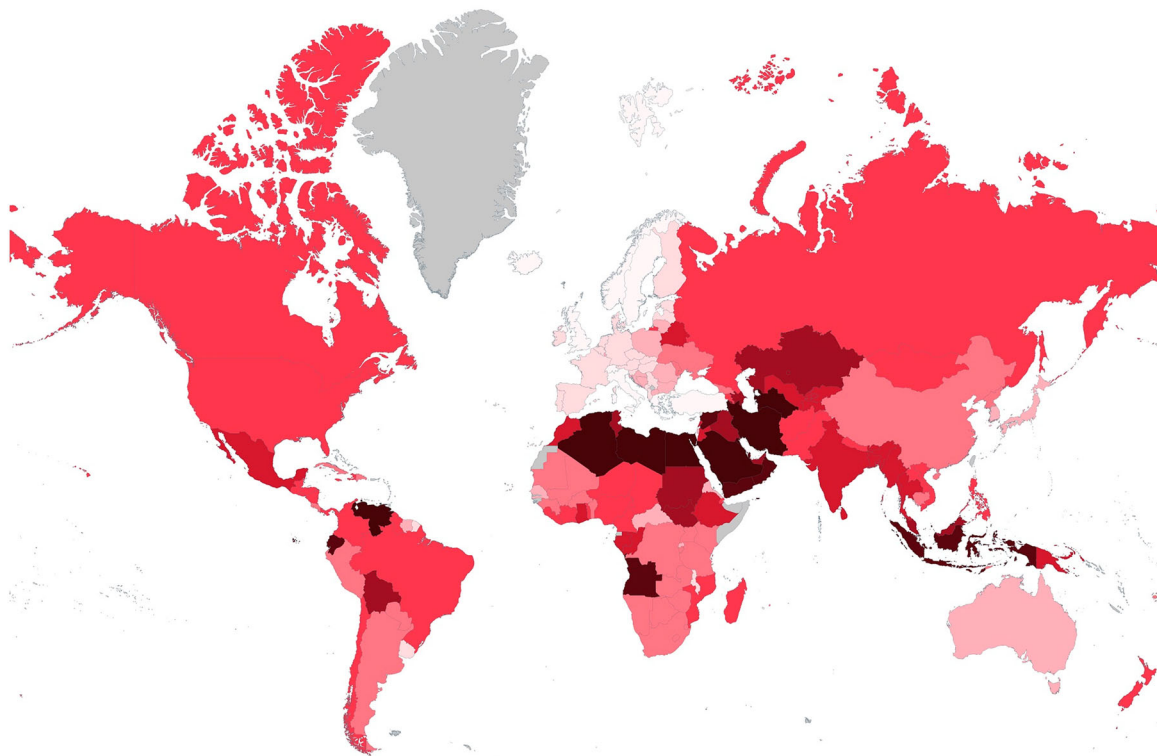


Figure 3. Diesel pump prices around the world in 2012–2013, ranging from US\$0.11 in Venezuela to over US\$2.50 in Norway (darker colours indicate lower prices). A similar pattern emerges for other fossil fuels, including petrol, kerosene and LNG. (GIZ, 2014).

to bring fuel prices to their social optimum. The IMF definition is thus particularly relevant from an environmental perspective, as it draws attention to the substantial external costs of FFSs (e.g. pollution, carbon emission) – but cannot be interpreted as an exact and fully robust quantification of externalities.

3. Fiscal, economic, environmental and distributional costs of FFSs

Subsidies are typically implemented with the justification of alleviating poverty, redistributing national wealth or promoting economic development by supporting energy-consuming industries (e.g. Commander, 2012; Strand, 2013). However, evidence suggests that FFSs perform poorly at achieving these objectives, and are generally detrimental to the economic, social and environmental dimensions of sustainable development.

In many emerging economies, the primary objective behind fuel subsidy policies has been the promotion of industrialization. Examples include Nigeria and Brazil, where the key objective in maintaining low energy prices was to facilitate industrialization by conferring an advantage on domestic energy-intensive firms (De Oliveira & Laan, 2010). While these objectives are well-intentioned, FFSs engender excessive energy use, and perpetuate inefficient technologies and behaviour. In the longer term, this reduces private sector competitiveness, thus having an adverse effect on the overall growth prospects (IMF, 2013a).

FFSs have also been shown to distort prices, aggravate fiscal imbalances and reduce aggregate welfare, regardless of whether the country is an oil importer or exporter (Plante, 2014). In addition, FFSs have particularly adverse effects on the balance of payments in oil-importing countries, as they exacerbate the difficulties in mitigating the effects of international energy prices (Gelb, 1988; IMF, 2008, 2013a). Overall, soaring oil prices have turned FFSs into an unsustainable financial burden to governments. The Ukraine, Venezuela and Uzbekistan allocate approximately 10%, 20% and 30% of their annual GDPs to FFS, respectively (IEA, 2014a). Moreover, the IMF (2013a) and IEA (2014a) provide evidence that subsidies eliminate the incentives and financial sources for investments in the energy sector, as low consumer prices do not warrant sufficient returns, thus leading to severe inefficiency and energy shortages.

In addition, fuel subsidies have been shown to have a wide range of other unintended consequences including fuel adulteration and smuggling (Calvo-Gonzales, Cunha, & Trezzi, 2015; IEA, 2010; Victor, 2009). Evidence from Egypt and Yemen shows that fuel subsidies cause substantial external costs through traffic congestion, local pollution and associated health impacts, but also deplete scarce water resources in the agricultural sector (Coady et al., 2015; Commander, Nikoloski, & Vagliasindi, 2015). Moreover, subsidies crowd out other productive public investments (e.g. in health, education or transport infrastructure) more generally. In Uzbekistan and Turkmenistan for instance, subsidy expenditure in 2012 exceeded public spending on health and education by a factor of 10 (IMF, 2013a).

Much of the public discourse on fuel subsidies in developing countries has focused on the impact on the poor (e.g. Adam & Lestari, 2008; Dube, 2003; Gangopadhyay, Ramaswami, & Wadhwa, 2005; IEA, 2011; IMF, 2013a; Mourougane, 2010; Narasimha, 2012; Ruggeri-Laderchi, Olivier, & Trimble, 2013; World Bank, 2010). Although a common political justification for FFSs is to support the poor through subsidized energy supply, the literature is clear in showing that most subsidies are regressive,

i.e. in absolute terms most subsidies are received by the rich. Yet relative to income, the adverse effects of subsidy removal are likely to be greatest for the poor (Arze del Granado, Coady, & Gillingham, 2012; Dickinson, 2015; IEA, OPEC, OECD & World Bank, 2010; Ruggeri-Laderchi et al., 2013; World Bank, 2010).

Arze del Granado et al. (2012) show for 20 developing countries that the poorer households consume a disproportionately small fraction of the total fuel and electricity supply. In fact, households in the top income quintile spent nearly 20 times more (per capita) on most energy goods than households in the bottom quintile. Kerosene is the only exception, with relatively evenly distributed consumption across income quintiles. This implies that the bottom income quintile receives on average about 7% of the overall subsidy benefit. In contrast, the richest quintile alone receives on average almost 43% of the overall subsidy volume.

This is illustrated by household data from Nigeria (Figure 4): while overall expenditure on energy products is spread across different energy goods, a disproportionate share of certain energy sources is consumed by the highest income quintile. The top income quintile, for instance, accounts for 75% of overall petrol consumption, whereas the lowest income quintile accounts for 1%. This stark ratio can be attributed to vehicle ownership, and highlights how petrol subsidies disproportionately benefit the rich.

Apart from economic and social costs, FFSs are associated with severe negative externalities on the environment – which in turn can adversely affect human and economic development in the long term. By artificially lowering the price of fossil fuel products, governments incentivize overconsumption and remove incentives for investing in energy efficiency, modern electricity infrastructure and low-carbon energy sources (including renewables) (IEA, 2014a). The IEA (2014a) identifies the reform of FFSs as one of the key measures for stabilizing global warming at 2 °C above pre-industrial levels, and estimates that even a partial removal of FFSs could reduce global GHG emissions by 360 Gt. The IEA, OECD and World Bank (2010) estimate that removing global fuel subsidies would result in a 5% net reduction in the global use of energy within 10 years.

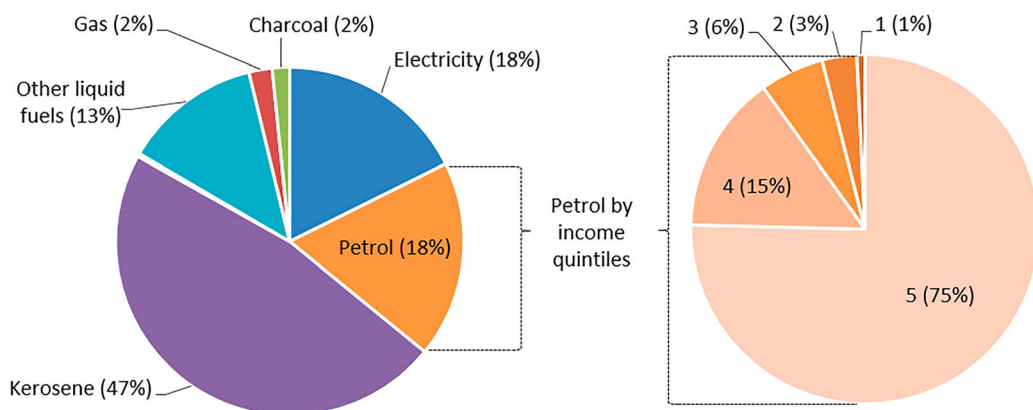


Figure 4. Left, Composition of average household energy expenditure in Nigeria. Right, Petrol expenditure broken down according to income quintiles, with 5 representing the top income quintile (NBS, 2011).

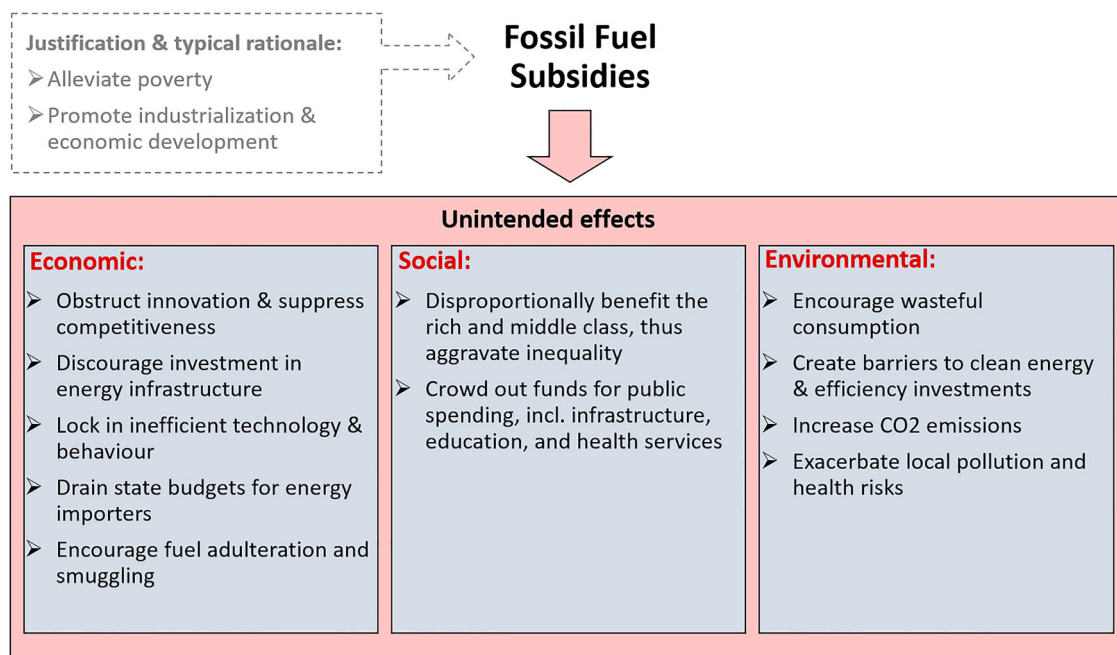


Figure 5. FFS have severe adverse effects on all three dimensions of sustainable development. This figure provides an overview of the most prominent effects.

For India, UNEP (2003) estimates that subsidy removal would reduce long-term energy usage by 34%. In Indonesia, Durand-Lasserve, Campagnolo, Chateau, and Dellink (2015) found that fossil fuel-related GHG emissions could be cut by up to 12.6% by 2020 if subsidies are removed. Merrill et al. (2015) estimated the potential savings from FFS reform in the G20 at 2.8 Gt of CO₂-equivalent (CO₂e) emissions by 2020. At the local level, removing subsidies can help curb traffic congestion, pollution and associated health threats (Coady et al., 2015; Commander et al., 2015; Davis, 2014; IMF, 2013a) (Figure 5).

4. Reform progress: what's being done?

4.1. Galvanizing action: international communities and institutions

FFSs gained international attention at the G20 summit in 2009.⁶ In the Pittsburgh Joint Ministerial Declaration (G20, 2009), the G20 governments committed to phasing out FFSs while providing protection to the poor. Subsequently, this commitment has been reaffirmed repeatedly by governments of both developing and developed countries. Although energy security and climate change provided the main rationale for initial commitments, the arguments increasingly include the goals of poverty reduction, social equity and sustainable development (Fay et al., 2015; Hallegatte, Fay, & Vogt-Schilb, 2013; Hallegatte et al., 2014). For instance, this was highlighted through declarations of the UN Rio + 20 convention in 2012, which recognized the importance of FFS reforms as a vital

element of sustainable development. Subsequent multinational conventions, including the Asia-Pacific Economic Cooperation (APEC) Leaders' Summit in 2013, the 2014 G20 summit in Brisbane, or the 'Friends of Fossil Fuel Subsidy Reform' group of 40 governments also reflect this notion (APEC, 2013; FFFSR, 2010; G20, 2014).

Several international organizations, including the UN, World Bank, IMF, IEA and IPCC have become strong proponents of subsidy reform in support of climate change mitigation and sustainable development. The UN's (2015a) Sustainable Development Goals for the post-2015 development agenda also includes FFS reform as a subgoal:

Goal 12.c: Rationalise inefficient fossil-fuel subsidies that encourage wasteful consumption, [...] [while] 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. (UN, 2015a, p. 19)

At the UN's 2015 Financing For Development Summit in Addis Ababa, governments reaffirmed their commitment to phasing out FFSs and curbing wasteful consumption while supporting the needs of the poor (UN, 2015b). Although such commitments include both consumer and producer subsidies, policy attention has focused on the reform of consumer subsidies in resource-rich developing countries. Commitments by the G20 have thus far failed to galvanize action on reforming producer subsidies (Bast et al., 2015).

Although the UNFCCC's 2015 Paris Agreement on climate change makes no explicit reference to fossil fuels or subsidies, it signals the strong commitment to a low-carbon energy transition, and provides a framework for accelerated action on FFS reform. In particular the Nationally Determined Contributions (NDCs), outlining country-level commitments on climate change policy actions, demonstrate that FFS reforms and other green fiscal measures could play a critical role in implementing the Agreement. Table 1 lists all 13 countries that explicitly integrate FFS reform into their climate policy packages. Terton, Gass, Merrill, Wagner, and Meyer (2015) further emphasize that 67 countries refer to green fiscal reforms (including FFS reforms) for implementing NDCs.

Following the G20 Summit in 2009 a range of international organizations and think-tanks have played an important role in analysing subsidies and advocating reforms (e.g. CFR, 2015; GSI, 2012; IEA, 2014a; IMF, 2010; OECD, 2011; World Bank, 2014). These contributions have included definition and quantification of FFS, the socio-economic, environmental and sectoral impacts of removing subsidies, the role of transitional policies and case studies to highlight lessons on how to implement reforms. Whitley and van der Burg (2015, p. 41) provide an overview of the institutional support for FFS reform processes, including efforts by the IMF, GSI, IEA, World Bank and OECD.

4.2. Implementing FFS reforms: country-level action

Despite strong drivers for FFS reforms – fiscal strains on national budgets, adverse environmental impacts and international commitments – overall progress at the country level has been limited and the track record is mixed. In reviewing 22 case studies of recent reforms the IMF (2013b) finds that only 12 reform endeavours succeeded in permanently removing consumer subsidies without causing major economic or social disruptions. The successes and failures of past subsidy reforms

Table 1. FFS reform are explicitly integrated into the NDCs of 13 countries though concrete data is often missing (Terton et al., 2015).

	Estimated potential GHG reduction relative to baseline (%)		
	2020	2025	2030
Burkina Faso			
China	0.8	0.7	
Egypt	14.9	12.6	
Ethiopia			
Ghana	2.8	2.5	
India	3.2	2.7	
Morocco			6.6
New Zealand			
Senegal			
Sierra Leone			
Singapore			
UAE	14.4	13.0	
Vietnam	1.7	1.9	

illustrate the economic and political complexities and underscore the need for country-specific reform designs. However, despite the lack of a coordinated international approach, a number of governments – primarily driven by fiscal imbalances – are making significant progress in phasing out fuel subsidies ([Appendix 1](#)).

As the momentum for FFS reform builds, governments can draw on the lessons of a rich collection of case studies of attempted subsidy reforms. Although case studies of resource-rich developing countries predominate, analyses include countries of all sizes and levels of development, resource-rich and poor economies and cover all continents. In-depth reviews and analyses are offered by Vagliasindi (2012) for 20 FFS reform case studies, and more recently by Kojima (2015) for 35 countries. The IMF (2013b) also provides a comprehensive account of recent FFS reform efforts, covering the fuel, electricity and coal sectors, and including both successful and failed reforms. Further regional reviews have analysed recent progress with FFS reforms in sub-Saharan Africa, the Middle East and North Africa (IMF, 2013c; Sdravovich, Sab, Zouhar, & Albertin, 2014). In addition to multicountry reviews, various single-country analyses have reviewed specific reform experiences in detail, such as Salehi-Isfahani, Stucki, and Deutschmann (2015) for Iran. The GSI (e.g. 2012) and IEA (2014a) also provide a rich collection of individual case-study analyses.⁷ It is striking that these studies almost exclusively cover reforms of consumer subsidies. Indeed, reforms of producer subsidies are lagging behind, and remain to be insufficiently documented.

Especially for consumer subsidies, there is an up-to-date and thorough literature on reform experiences, based on which key lessons have been learnt and which strategies for future reforms can be distilled. Several countries have successfully put other countries' lessons learnt into practice, and

implemented effectively designed and publically accepted FFS reforms. The Philippines and Iran effectively managed the downside risks of FFS reforms, by using reform revenues to compensate vulnerable households with cash transfers and support energy-intensive firms in implementing energy efficiency measures. These compensation measures played a key role in catalysing public support for the reform process (IMF, 2013a; Salehi-Isfahani et al., 2015).

The IEA (2014a) reports that in 2014 there were 27 governments actively pursuing FFS reforms (Appendix 1). Notably, some of the most recent and comprehensive reforms were being implemented in Asia: following gradual increases, India fully liberalized diesel prices in 2014 and halved gas subsidies; Indonesia increased gasoline, diesel and electricity prices by up to 44% in 2014; further subsidy reforms were implemented in 2013 and 2014 in Malaysia, Nepal, China, Bangladesh, Myanmar and Thailand (Fay et al., 2015; IEA, 2014a). In an attempt to cut a fiscal deficit, the United Arab Emirates (UAE) have also moved to remove all subsidies on transport fuel in 2015 (Carpenter & Khan, 2015). Overall, the last few years have shown encouraging signs that FFS reforms are being debated or implemented (even under challenging political conditions) in developing and emerging economies around the world, including those with some of the largest subsidy schemes (such as Russia, Ukraine, Egypt and Iran). However, developed economies with large producer subsidies (e.g. the US and the UK) are notable absences among ongoing FFS reform efforts.

The above reform efforts refer to the removal or reduction of active subsidy schemes. In addition, the World Bank (2014) reports that about 40 national and 20 subnational jurisdictions are introducing or operating carbon pricing schemes – in the Pigouvian sense, the next step following subsidy removal.

5. Reforms: drivers and barriers

5.1. The role of prices in driving reforms

Whether policy makers are willing to take on the political challenges of a FFS reform is often determined by the gravity of fiscal imbalances and the urgency of the economic costs of FFS (e.g. Jordan in 2005–2008; Vagliasindi, 2012). In practice, this implies that international energy prices can be the key drivers of action and complacency. For importers in particular, high oil prices increase the need for reform, thus galvanizing action, but also aggravate the political obstacles, thus prolonging inaction. On the other hand, low oil prices reduce political obstacles, making it easier to remove subsidies – but they also remove the fiscal urgency to do so.

Since the early 2000s, increasing fossil fuel prices have turned FFSs into an unaffordable commitment, especially for cash-strapped developing countries with high subsidization rates. FFSs move in line with energy prices (Figure 2), and accordingly 2008 saw peaks in oil prices and subsidy bills alike. Many governments that are committed to FFS schemes allocate substantial shares of their public budgets to subsidies, and increasing energy prices can exacerbate this burden – especially under precarious fiscal and economic conditions. Rising energy prices can drive reform, or even make it inevitable.

However, high fossil fuel prices also increase the political stakes of FFS reform – which has typically been the main reason for inaction (Benes, Cheon, Urpelainen, & Yang, 2015). With high free market prices, subsidy removal is more likely to result in a substantial energy price shock domestically. Thus, the higher energy prices are, the stronger the opposition from low- and high-income households

and political interest groups is likely to be. If economically possible, policy makers are tempted to leave such difficult and unpopular reforms to their successors.

As oil prices fell around 70% between Q3 2014 and Q1 2016 the political stakes of subsidy reform were significantly reduced (Baffes, Kose, Ohnsorge, & Stocker, 2015; World Bank, 2015). Several countries capitalized on this opportunity: Malaysia (December 2014), India (September 2014) and Indonesia (November 2014) implemented partial or full FFS reforms without triggering notable public opposition (Benes et al., 2015). In fact, low international energy prices meant that diesel prices in India fell by 5.7% as a consequence of price liberalization, thus entirely avoiding adverse price shocks on consumers – for the time being (Michael, 2014). However, particularly in energy importing countries, low energy prices also relieve governments of high FFS bills and remove the urgency of subsidy reform. As the *Economist* (2015) puts it, ‘whether low [oil] prices help to galvanise reform or simply make it easier for governments to procrastinate still remains up in the air’.

In several fossil fuel-exporting countries low energy prices in fact increased fiscal pressures – not due to increasing FFSs, but due to dwindling export revenues. For these countries the opportunity costs of FFSs (i.e. foregone export revenues) are the highest under high energy prices. However, fiscal pressures due to reduced resource exports during low international energy prices can outweigh the fiscal pressures due to subsidy payments during high prices. This has pushed the UAE, Bahrain and Oman to remove subsidies in 2015–2016 (Carpenter & Khan, 2015).

Energy prices matter not only in terms of the level, but also in terms of volatility. By running a FFS system, governments introduce the volatility of international markets into their national accounts and obstruct forward-looking budgeting. This means that increased energy price volatility can also act as a driver of FFS reforms (Kojima, 2009, 2015; Vagliasindi, 2012). By deregulating energy prices governments pass on price volatility to firms and households, who will then incorporate price signals into their decisions – e.g. by substituting away from volatile energy sources (see Section 6 for how governments can smoothen price shocks).

Overall, experience suggests that FFS reforms are most likely to be implemented when they are needed as a fiscal relief measure in the face of mounting fiscal burdens; and evidently fiscal burdens due to subsidies tend to be the largest when fuel prices are high. However, successful subsidy reforms in the past have been implemented under both high and low oil prices, suggesting that low oil prices are a conducive opportunity but not necessity for reform.

5.2. Public opposition and political economy

Experience shows that political economy challenges create some of the most serious barriers to reforming both producer and consumer subsidies (Cheon, Lackner, & Urpelainen, 2015; Dansie, Lanteigne, & Overland, 2010; Fattouh & El-Katiri, 2013, 2015; Kojima, Bacon, & Trimble, 2014; Koplou, 2014). Often this is aggravated by the fact that policy designs tend to be focused on being technically sound and administratively feasible – rather than politically supportable (Pritchett, 2005; Strand, 2013). Consumption subsidies in particular tend to be paid in countries with weak institutional capacity and poor governance, and are a common political tool for luring voters or influential interest groups, rather than being sound economic policy (Cheon, Urpelainen, & Lackner, 2013; Commander, 2012). In addition, Lockwood (2014) notes that FFSs play a key role in manifesting and centralizing a state’s political power. This resonates with Kim & Urpelainen (2015), who argue that autocratic

states with low-density urbanization tend to implement FFSs to secure power. Overall, the political economy obstacles to reforming fuel subsidies and raising prices to cost-recovery levels are closely linked to those of carbon taxes (Fay et al., 2015; Hammar, Lofgren, & Sterner, 2004).

The recent case of Nigeria's attempted fuel subsidy removal illustrates the immense political challenges of subsidy reforms as discussed by Victor (2009): in 2012 the government's decision to remove subsidies on fossil fuel imports caused fuel prices to more than double. The extensive strikes and public protests that followed prompted the government to immediately reintroduce subsidies (Bazilian & Onyeji, 2012; Siddig, Aguiar, Grethe, Minor, & Walmsley, 2014). Similarly, the governments of Bolivia (2010), Cameroon (2008), Venezuela (1989) and Yemen (2005 and 2014) were all forced to abandon reform attempts following heavy public protests, particularly by low-income population groups (IEA, 2014a; Segal, 2011).

Reforms of subsidies and pricing mechanisms can have various adverse effects, particularly in the short-term, requiring careful attention from policy makers. Without adequate measures for mitigating these effects, and without comprehensive consultation and communication, reforms are likely to face significant resistance. Past reform attempts have shown that political economy challenges can have a range of reasons (World Bank, 2010), including:

- Hardship on the poor and vulnerable. Subsidy reforms risk inflicting significant hardship on poor and vulnerable groups who might be heavily dependent on the subsidies, particularly in the case of kerosene or gas.
- Influential stakeholders. FFSs benefit the upper and middle classes and industry disproportionately; these influential stakeholders tend to be strongly opposed to subsidy reforms, and are often better organized to exert political pressure.
- Macroeconomic impacts. The inflationary impacts of FFS reforms can be significant as energy prices are a critical input to the cost of production for most sectors, and cost increases may be passed onto consumers.
- Reduced competitiveness. Energy-intensive industries could face reduced competitiveness as a result of reduced subsidies. Higher fuel and electricity prices may necessitate costly energy-efficiency investments, affecting costs and output in manufacturing.
- Employment impacts. Structural shifts that may result from the loss of competitiveness of energy-intensive industries may cause job losses. However, in the longer term jobs may also be created, as investments increase in energy systems, renewable energy and energy efficiency.
- Substitution with unsafe, inferior fuels. The reduction of FFSs may force poor and middle-income households to shift towards cheaper and lower-grade energy sources, with significant health and environmental impacts.
- Poor governance, accountability, and service quality. Governments may struggle to reduce subsidies and increase prices, while service quality remains poor and key sectors continue to lack accountability and transparency.

Crucially, the above adverse effects (and associated political challenges) may vary significantly depending on the type of subsidy. In many developing countries petrol is predominately consumed by the rich, whereas kerosene is an essential cooking and lighting fuel for the poor (Soile & Mu, 2015). Rentschler (2015) demonstrates that adverse price shocks due to subsidy removal vary

significantly not only across income groups, but also across different types of fuel subsidies, across geographical regions and between urban and rural sectors. This emphasizes that the nature, location and extent of political economy challenges and political opposition can vary for the reform of different (consumer) subsidies, thus requiring tailored compensation measures, e.g. through flexible cash transfer schemes.

These challenges also highlight the crucial role played by political and administrative institutions, which must possess the authority to initiate and oversee reforms, but also the diligence to consider and mitigate potential adverse reform effects (Acemoglu & Robinson, 2010). Behind such institutions, a strong political will and the credibility of the government form the foundation for successfully implementing a FFS reform and safeguarding livelihoods.

6. Principles for designing effective subsidy reforms

The specific features of any FFS reform must be determined by a thorough analysis of country characteristics, the nature of current subsidies and the potential impacts of a reform on households and firms. Yet, the lessons learnt from past reform attempts – both failed and successful – converge towards several guiding principles and measures, which are essential for designing and implementing effective FFS reforms. This section summarizes these reform principles, drawing on Rentschler and Bazilian (in press), who offer a more detailed account.

The most common driver of past FFS reforms have been mounting fiscal pressures, which make subsidy reform an attractive rescue measure (Vagliasindi, 2012). Environmental objectives have at most played a secondary role. As a result, past reforms efforts (and their evaluations) have focused strongly on managing the downside risks of FFS reform, for instance through communication and compensation strategies (IMF, 2013a, 2013b). Although these measures are indeed indispensable, they do not necessarily guarantee that the development potential and environmental benefits of a subsidy reform are maximized. Hence the success of a subsidy reform should not only reflect whether a subsidy was successfully removed – but whether it ensures a contribution to long-term economic development objectives, rather than mere short-term fiscal relief.

Figure 6 provides an overview of key elements of a FFS reform. The basis of any reform effort is a thorough assessment of existing subsidies (Figure 6, first column). This includes a coherent subsidy definition and a precise understanding of the quantity of subsidies and their beneficiaries. Based on this, decision makers can prioritize the reform of certain subsidy types, determine a suitable reform timeline and assess the likely impacts of a reform. Most importantly, this includes simulating the effect of energy price shocks on small businesses and low-income households.

Moreover, case studies show that timely and transparent communication, public engagement and consultation processes are critical (IMF, 2013a, 2013b; Vagliasindi, 2012). Whether a reform can win public and political support typically hinges on how effectively the benefits of reform are communicated to the population (Figure 6, second column).

In addition, communication strategies must clearly indicate how subsidy removal will be paired with effective social protection and compensation schemes that mitigate adverse effects on the population and affected firms (Figure 6, third column). Several studies have shown that income shocks due to subsidy removal can be substantial, resulting in significant increases of poverty rates if

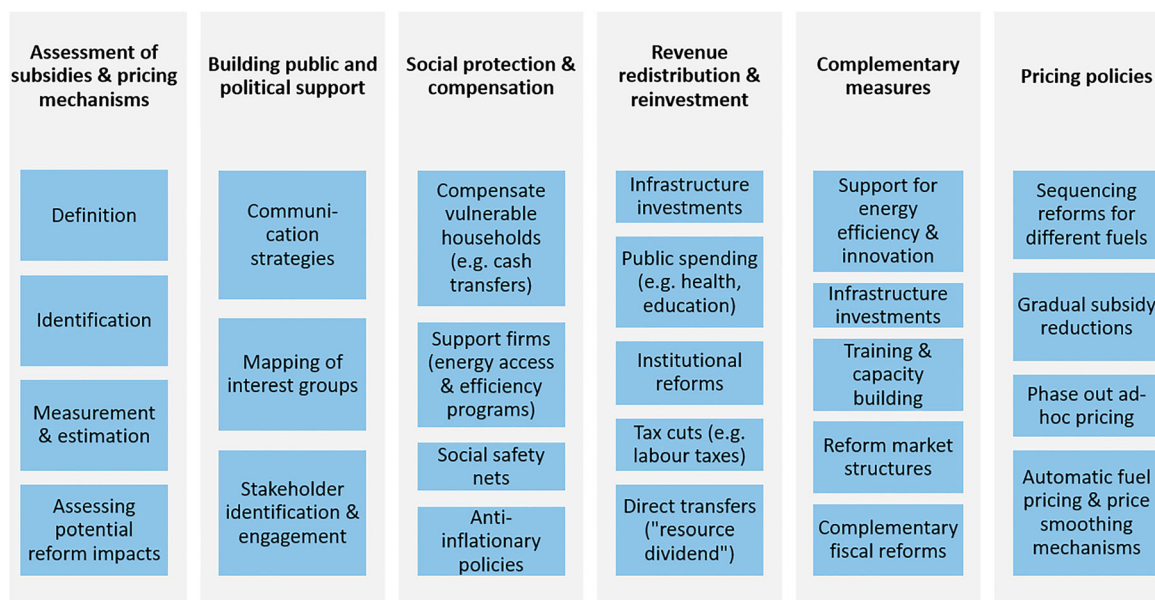


Figure 6. Key elements of an integrated fossil fuel subsidy reform (adapted from Rentschler & Bazilian, 2016).

uncompensated (Araar, Choueiri, & Verme, 2015; Rentschler, 2015). Hence, policy makers must strike a careful balance between raising reform revenues while ensuring affordability and protecting livelihoods (Ruggeri-Laderchi et al., 2013).

Cash transfers have proven to be one of the most effective and practical instruments for compensating low-income households vulnerable to energy price hikes (IMF, 2013b). Such cash transfers are either issued universally to the whole (or majority) of a population, or targeted to selected recipients – typically the most affected households (Salehi-Isfahani et al., 2015). How exactly such a cash compensation scheme is designed and delivered depends greatly on a country's characteristics and needs (e.g. the level of vulnerability of households, their location, the availability of poverty data with nation-wide coverage and attributable identification and the existence of appropriate financial infrastructure). In the case of producer subsidies in particular, targeted measures for strengthening competitiveness and energy efficiency can help firms to cope with price shocks.

In order for a FFS reform to contribute to sustainable development and climate change mitigation, sustainable management, reinvestment and redistribution of reform revenues are critical (Figure 6, fourth column). FFS reforms create an opportunity to implement transparent institutions and prudent public finance strategies for reinvesting reform (and natural resource) revenues in line with long-term development goals.

Moreover, while subsidy removal will help to relieve national budgets, further actions will probably be needed to trigger investments in more efficient technology or changes in behaviour (Figure 6, fifth column). The reason is that in practice, even if subsidies are reduced and fuel prices are increased, significant barriers may exist (including information, capacity and financial constraints) preventing households and firms from adjusting their behaviour or investing in more efficient technologies.

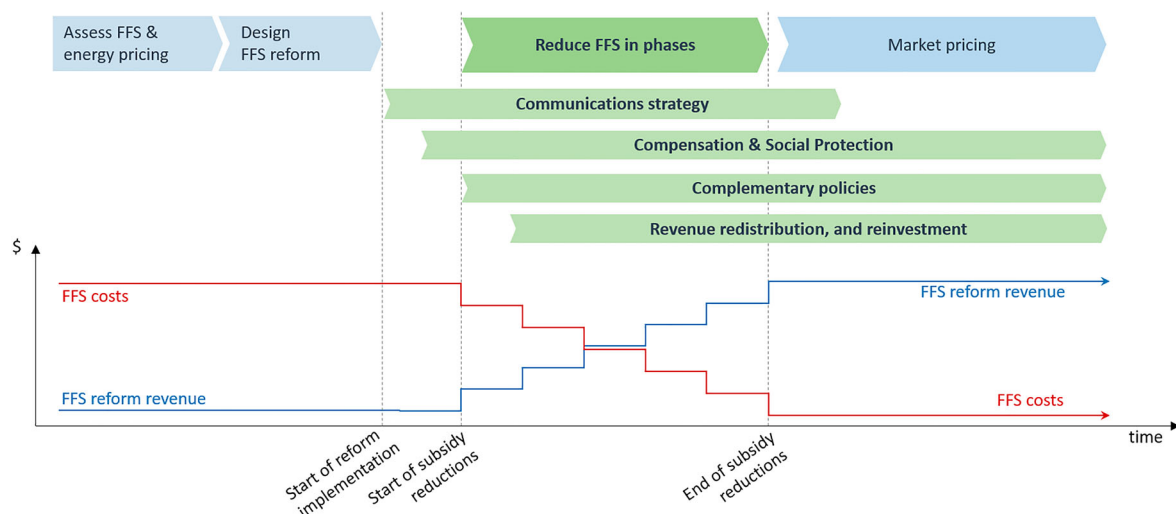


Figure 7. Effective FFS reform includes not only subsidy removal, but also a range policy measures – all of which must be carefully timed (adapted from Rentschler & Bazilian, 2016).

Governments can address these barriers with complementary measures that facilitate and stimulate low-carbon innovation and investments and ensure that subsidy reforms contribute to low-carbon development. Such complementary measures have been argued to be crucial for ensuring the effectiveness of price-based environmental instruments – i.e. FFS reforms and carbon taxes (Fay et al., 2015).

Overall, the insights derived from past experiences highlight that a complete FFS reform is not only about removing subsidies, but also requires an integrated strategy featuring a range of carefully designed and sequenced policy measures (Figure 7). Indeed, issuing compensation payments before subsidies are removed, and phase-wise reduction of subsidies can be critical for signalling political commitment to social protection and the mitigation of price shocks. Despite differing priorities and political dynamics, these principles are applicable to both producer and consumer subsidy reforms. For instance, regardless of which type of subsidy is removed, both households and firms are likely to face price shocks – albeit to different degrees (e.g. depending on firms' pass-through of price changes).

7. Areas for future research

The existing literature has focused on documenting the wide-ranging adverse effects of FFSs. More research is required to better understand the determinants of successful reforms. We identify at least four areas requiring further research:

- Concrete country-level studies for all major subsidising economies are needed to inform the design of specific subsidy reforms. Such analyses need to shed light on the distributional and socio-economic effects of reforms, and evaluate existing social protection schemes for their suitability to mitigate price shocks. Potential price shocks need to be understood with respect to their variability across income groups, geographical locations, and occupations.

- While experience is building on how to tackle the short-term political economy challenges of reform, a better understanding is needed on how fuel subsidy reforms can be integrated into long-term sustainable development objectives. Rather than just offering immediate fiscal benefits, subsidy reforms can offer a range of opportunities, e.g. for sustainable management and reinvestment of natural resource rents, institutional reform or effective social protection schemes.
- The evidence (and public awareness) has been disproportionately focused on consumption subsidies, whereas producer subsidies – particularly in developed countries – remain insufficiently researched (and reformed). Coherent definitions and quantifications are needed, alongside analyses of political economy challenges, case studies of past reforms and estimates of potential reform impacts.
- There is a need to evaluate the role of FFS reforms as part of comprehensive climate change policy packages. A better understanding is needed of the potential contribution of FFS reforms to emission reduction commitments (under the NDCs) and how they may pave the way for implementing fuel or carbon taxes.

8. Conclusion

Fossil fuel subsidies (FFS) have garnered international attention since the G20 summit, when governments committed to the reform of unsustainable fuel subsidies. Although subsidy reform is crucial for achieving any ambitious carbon emission reduction, the wide range of negative externalities associated with fuel subsidies emphasizes the fact that reform is a vital contribution to sustainable development objectives more generally. With the inclusion of FFS reform in the UN's Sustainable Development Goals, it has fully entered the mainstream sustainable development agenda.

This article provides a policy-oriented overview of the current state of affairs in FFSs. It shows how severe economic, environmental and social externalities act as strong drivers for reform, while political economy challenges mean that implementation can be difficult in practice. It offers decision makers an overview of the main definitions, assessment criteria, externalities and recent reform progress. Moreover, it synthesizes the evidence from a series of case studies of past FFS reforms, and distils the key principles for designing effective reforms, applicable to both producer and consumer subsidies. Overall, this article offers several important insights for policy makers implementing reform.

For designing targeted reform measures, policy makers must clearly define, identify and estimate relevant subsidies (e.g. consumer or producer subsidies, or different fuel types). This is critical for understanding the magnitude of potential reform benefits and adverse side-effects (on both firms and households), as well as designing adequate reform features.

FFS have detrimental effects on all three dimensions of sustainable development: economic, environmental and social. For policy makers it is critical to exactly understand the adverse effects of subsidies specific to their country. This should extend beyond short-term fiscal considerations.

There is an increasing momentum for reforming FFS. Although this has been particularly true for consumer subsidies, there has been little progress in reforming producer subsidies in developed countries. As subsidies uphold inefficient and uncompetitive industries, policy makers should consider the implications of inaction, including the risk of declining international competitiveness.

Low oil prices are a conducive opportunity but no necessity for reform. Experience suggests that the key driver of most reforms are escalating fiscal burdens. Policy makers should prepare a foundation for subsidy reform through careful planning, as this allows swift implementation once an opportunity presents itself (e.g. in the form of low oil prices).

Political economy challenges are substantial and complex. Effective communication and compensation are crucial for managing these challenges. Moreover, reform case studies show that an effective fuel subsidy reform requires policy makers to implement a package of dedicated and carefully timed measures. They include (step-wise) subsidy removal, communication, compensation, revenue redistribution measures and further complementary policies. Smart timing and price smoothing can further mitigate price shocks. This approach can minimize the downside risks of subsidy removal (e.g. due to price shocks) while maximizing the contribution to sustainable development.

Lastly, this article suggests several areas for future research; in particular, (1) country case studies of the distributional effects of FFS removal; (2) the reform of producer subsidies; (3) exploring opportunities to align FFS reform with sustainable development objectives (e.g. through institutional reforms, or sustainable management of natural resource rents); and (4) the contribution of FFS reform to national GHG emission reduction targets (e.g. as part of NDCs).

Notes

1. For a detailed discussion of these estimates see Burniaux and Chateau (2014).
2. Stefanski (2014) takes an entirely different approach: he infers global subsidies volumes theoretically by using a structural transformation model and comparing the predictions with observed emission intensities.
3. Note that this notion acknowledges the break-even price, but does not account for the opportunity cost of export revenues.
4. See Chattopadhyay and Jha (2014) for an overview for Southeast Asian countries.
5. See Johnston, Heffron, and McCauley (2014) for a detailed discussion of energy subsidies in the UK.
6. Members of the G20 include Argentina, Australia, Brazil, Canada, China, the EU, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the UK and the US.
7. The GSI provides in-depth country studies as part of its 'Fossil fuel subsidies: At what cost?' series (GSI, 2012). Also see GIZ (2014), who publish International Fuel Prices Observatory factsheets focused on various regions.

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Appendix 1

Table A1. FFS reforms between 2013 and 2015: announcements, commitments, NDCs and implementation (based on IEA, 2014a; Terton et al., 2015).

	Status	Energy type	Price increase (subsidy reduction)
Angola	Completed	Gasoline	25%
		Diesel	25%
Argentina	Implementation ongoing	Natural gas	(20%)
Bahrain	Completed	Petrol	56%
		Diesel	(100%)
		Kerosene	(100%)
Bangladesh	Implementation ongoing	All refined oil products	(67%)
		Electricity	64%
Burkina Faso	NDC commitment		
China	Planning and piloting (NDC)	Energy pricing reform	
Ecuador	Ongoing	Electricity	
Egypt	Completed	Gasoline	41%
	Further actions under NDC	Diesel	63%
		Natural gas	30–70%
		Electricity	
Ethiopia	NDC commitment		
Ghana	Completed	Gasoline	(100%)
	Further actions under NDC	Diesel	(100%)
India	Completed	Diesel	(100%)
	Further actions under NDC	LNG	(50%)
Indonesia	Completed	Gasoline	44%
		Diesel	
		Electricity	
Iran	Implementation ongoing	Gasoline	75%
		Diesel	40%
		LNG	32%
Kuwait	Completed	Diesel	(100%)
		Kerosene	(100%)
Malaysia	Implementation ongoing	All fuels	(100%)
Mexico	Ongoing	Gasoline	
		Diesel	
Morocco	Completed	Gasoline	(100%)
	Further actions under NDC	Diesel	
Myanmar	Planning	Electricity	

Continued

Table A1. Continued

	Status	Energy type	Price increase (subsidy reduction)
Nepal	Implementation attempted & ongoing	All fuels	
New Zealand	NDC commitment		
Nigeria	Planning	All fuels	
Oman	Implementation ongoing	Petrol	(64%)
		Diesel	
Russia	Planning	Natural gas	5%
Saudi Arabia	Completed	Gasoline	66%
		Diesel	79%
		Natural gas	67%
Senegal	NDC commitment		
Sierra Leone	NDC commitment		
Singapore	NDC commitment		
Sudan	Completed	Gasoline	68%
		Diesel	75%
		LPG	66%
Thailand	Implementation ongoing	Diesel	
		CNG	
Tunisia	Completed	Gasoline	6%
Turkmenistan	Implementation ongoing	Natural gas	
Ukraine	Implementation ongoing	Natural gas	29%
United Arab Emirates	Further actions under NDC		
Uzbekistan	Implementation ongoing	Diesel	11%
Yemen	Implementation attempted & ongoing	Gasoline	60%
		Diesel	95%
Vietnam	NDC commitment		

Notes: For details on each case study refer to Kojima (2015).