Tackling Fossil Fuel Subsidies and Climate Change: Levelling the energy playing field


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Foreword

Consumer subsidies to fossil fuels amount to USD 550 billion annually, four times more than subsidies to renewables. Globally we are still subsidising fossil fuels causing climate change. Competing interests across governments may lead to governments sticking their heads down and dealing with one policy at a time. Too often fossil fuel subsidy reform is tackled like this by governments. But there is a golden opportunity right now. With the low oil prices governments can regroup across their different Ministries to plan on phasing out fossil fuel subsidies, on levelling the energy playing field so that new, low-carbon, energy players: renewables, energy efficiency, and public transport systems, can compete fairly and squarely against the fossil fuel incumbents.

This report describes how countries like Morocco, Jordan, and the Philippines have tackled fossil fuel subsides in the energy system, provides examples of plans for investing in renewables, energy efficiency and introduction of a tax on fossil fuels to bring in domestic resources to fund development. This research supported by Nordic Countries through the Nordic Council of Ministers and in partnership with the Global Subsidies Initiative of IISD provides governments with a new tool to measure emissions reductions from subsidy reform and the subsequent recycling of a small proportion of savings into the new energy players, with big positive emissions impacts. With average country savings in emissions of around 11%, and average yearly financial savings to governments of around USD 93 per tonne of carbon removed from the system, fossil fuel subsidy reform is one manoeuvre that policy makers

can no longer afford to ignore. Reinvesting some savings into sustainable energy for all will pass the ball over to the new energy players and help win the game for people and the planet. Nordic Countries support country efforts to this end and many are members of a group of countries "the Friends of Fossil Fuel Subsidy Reform". The Friends invite all countries to join and support an international communiqué on this issue. The research in this report supports all those countries working towards safer, more secure and sustainable energy futures through removing subsidies to fossil fuels.

Åsa Romson
Minister for Climate and the Environment,
Deputy Prime Minister

Executive Summary

Global fossil fuel subsidies to consumers stand at USD 550 billion annually: four times the level of subsidies going into renewables and four times the level of private investment into energy efficiency. This report includes new research on the impact that the reform of these subsidies could have on national greenhouse gas (GHG) emissions, by modelling this policy change in 20 countries between now and 2020. It finds an average of 11% of reductions from the removal of fossil fuel subsidies alone through pre-2020 actions. This could increase to as high as 18% if a small share of savings (30%) is reinvested into energy efficiency and renewables. The cumulative savings from across the 20 countries by 2020 amounts to 2.8Gt of CO_2e. This updates earlier global research on this issue, with a range of global and national models having previously projected emissions reductions of between 6%–13% by 2050.

As a policy tool, fossil fuel subsidy reform (FFSR) is an extremely cost effective means of carbon emissions reduction compared to other energy emission reduction tools. Most policy tools for removing carbon from national energy emission sources cost government resources. This study finds that FFSR leads to an average annual saving of close to USD 93 per tonne of GHG emissions removed. Moreover, FFSR is a foundation policy for the successful further implementation of many other energy climate policies: energy efficiency, renewables, innovation, carbon pricing and taxation, public transport infrastructure and the generation of domestic resources for the low-carbon energy transition.

Other countries around the world can look to the case studies of the Jordan, Morocco and the Philippines for useful experiences with reform. Morocco, for example, has removed subsidies to fossil fuels and turned investment and support toward solar sources.

As a result of these findings and the ongoing efforts of the Friends of Fossil Fuel Subsidy Reform a number of countries have included this policy tool within their Intended Nationally Determined Contribution (INDCs). Meanwhile, others countries, have moved forward unilaterally, including wider energy pricing and energy sector reforms. A number of countries have joined with the Friends of Fossil Fuel Subsidy Reform in supporting an international communiqué calling for transparency, ambition, and targeted support to the poorest. This report supports these country efforts.

Acronyms

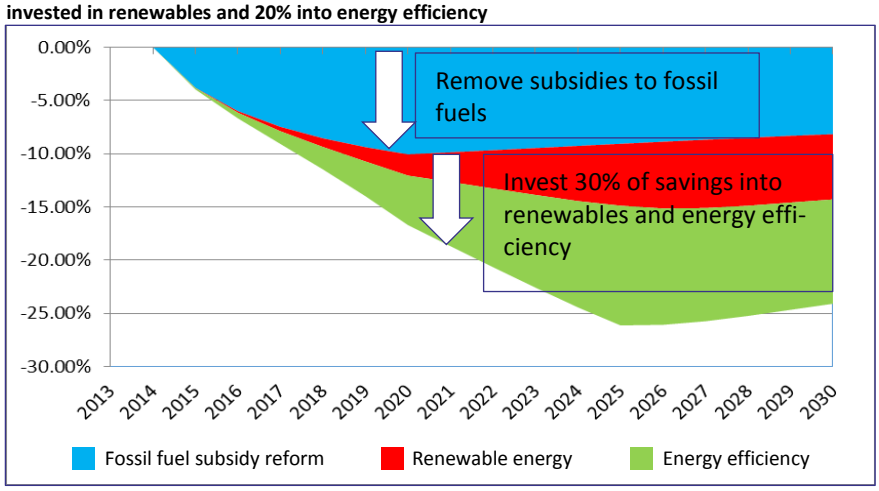
BAU	Business As Usual
CO_2-e	Carbon dioxide equivalent
FFSR	Fossil fuel subsidy reform
FFFSR	Friends of Fossil Fuel Subsidy Reform (www.fffsr.org)
GHG	Greenhouse Gas
GSI	Global Subsidies Initiative
GSI-IF model	GSI-Integrated Fiscal Model
Gt	Gigatonnes
IEA	International Energy Agency
IISD	International Institute for Sustainable Development (www.iisd.org)
IMF	International Monetary Fund
INDCs	Intended Nationally Determined Contributions
IPPC	Intergovernmental Panel on Climate Change
NCM	Nordic Council of Ministers (www.norden.org)
NPV	Net Present Value
UNFCCC	United National Framework Convention on Climate Change

1. Fossil Fuel Subsidies and National Emissions Reductions

1.1 National GHG emissions reductions from FFSR: GSI-Integrated Fiscal Model

Research from the Global Subsidies Initiative (GSI), of the International Institute for Sustainable Development (IISD) supported by the Nordic Council of Ministers (NCM), finds that, on average, across 20 countries the phased removal of fossil fuel subsidies between now and 2020 could lead to average national emissions reductions of 10.92% as against a business-as-usual (BAU) baseline. Emissions reductions would be increased to 18.15% if a small amount of the savings from subsidy reform (30%) are redirected toward renewables and energy efficiency. The cumulative savings from across the 20 countries by 2020 amounts to 2.8 gigatonnes (Gt) of CO_2e. Furthermore, because this is a policy tool that saves government resources, it is estimated that for every tonne of CO_2e removed through FFSR governments save an average of USD 92.83.

Figure 1: Average emissions reductions from FFSR across 20 countries, with 10% of savings invested in renewables and 20% into energy efficiency



Source: Authors.

These findings are discussed in more detail below and are consistent with previous GSI research supported by NCM that reviewed the international literature, finding global emissions reductions of between 6% and 13% by 2050 (Merrill, Harris, Casier, & Bassi, 2015).

1.2 Description of the GSI-IF Model

The GSI-IF model was created to analyze the effects of FFSR on greenhouse gas emissions to support national-level reform planning and enable international reporting, particularly in light of planning INDCs. The results have been shared with the policy-makers of many of the countries modelled. At the time of writing, this outreach has resulted in at least two countries refining the subsidy data and the assumptions in the model for national planning purposes and comparison or use within INDCs.

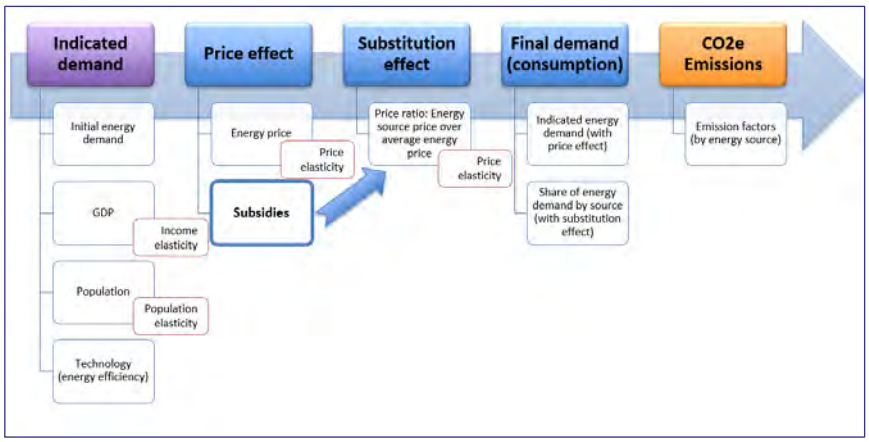
The model is an economic simulation model that tracks energy demand at the national level by sector and source. The model uses social and economic drivers to determine future energy consumption and related GHG emissions. The GSI-IF model estimates energy consumption up to 2030 by sector and source, using a baseline initial demand, and adjusting it with elasticities associated with GDP, population and energy price changes. Various energy efficiency scenarios can also be tested. Emissions factors are applied to determine total national emissions from the use of energy. GDP growth is currently based on the International Monetary Fund (IMF) Economic Outlook and population is based on the UN World Population Prospects database. Subsidy data is drawn from the International Energy Agency (IEA) and IMF.

The prices of energy sources are based on medium- to long-term trends in fossil fuel prices and the impact of subsidies. Subsidy reform, which leads to higher prices for a particular source, causes a drop in consumption due to a price response and the substitution for consumption of other, cheaper, fuels. The model includes energy consumption from the residential, commercial, and industrial and transport sectors, disaggregated into coal, petroleum products, natural gas, biofuels and waste and electricity. The model includes data from country-level or international sources depending on availability (i.e., IEA for energy consumption; IMF and UN World Population Prospects for GDP and population; GIZ for fuel prices; IPCC for emission factors; and national sources for validation of the projections).

GHG emissions are affected by both the drop in demand and the change to the fuel mix. The GSI-IF model analyzes these effects separate-

ly, evaluating the impact of fossil fuel subsidy removal on GHG emissions. A graphical representation of the process for the GSI-IF model is shown in Figure 5 below.

Figure 2: Outline of the GSI-IF model



Source: Authors.

1.2.1 Country Selection

The GSI-IF model has been applied to the following 20 countries: Algeria, Bangladesh, China, Egypt, Ghana, India, Indonesia, Iran, Iraq, Morocco, Nigeria, Pakistan, Russia, Saudi Arabia, Sri Lanka, Tunisia, United Arab Emirates, United States, Venezuela, and Vietnam. The model was developed for half of these countries based on a previous scoping and development phase focused on low and lower-middle income countries where fossil fuel subsidies accounted for a significant proportion of government budgets (Merrill, 2014). The aim is that development cooperation and technical assistance with these countries can enable the smooth reform of fossil fuel subsidies and support governments in their efforts to switch toward sustainable energy. Further countries were added on the basis of the large size of nominal consumer subsidies displayed even in very high-income countries and the potential for emissions reductions from removal of this type of government support to fossil fuels.

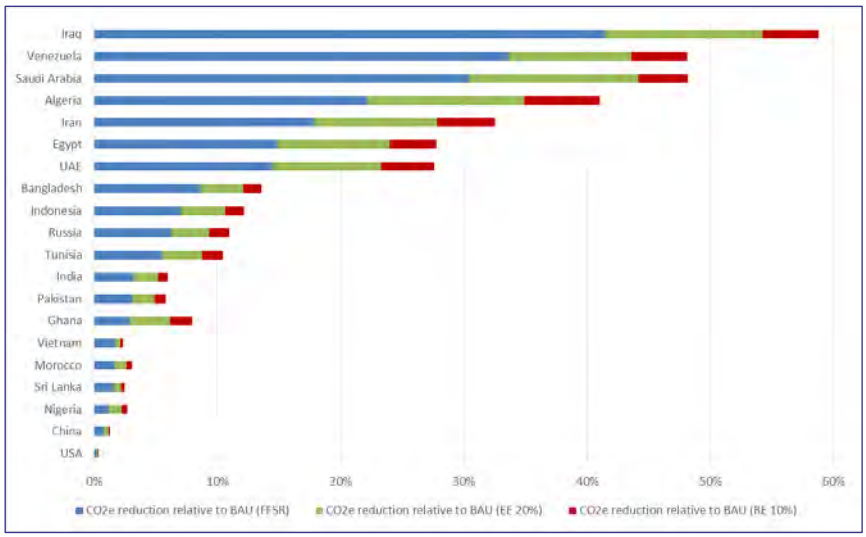
1.2.2 Average national % reduction results

The GSI-Integrated Fiscal (GSI-IF) model projected what would happen if fossil fuel subsidies were gradually removed by 20 countries, beginning in 2016 and reduced to zero by 2020. The model found an overall

average reduction in GHG emissions across 20 countries of 10.92% as against BAU scenarios at the national level.

The model also looked at reallocation scenarios for each country, reallocating portions of savings from subsidy reform to households to cushion any adverse impacts of rising fuel prices (50% toward the 40% poorest of the population) at the same time as reallocation toward renewables (10%) and energy efficiency (20%), with a further 20% available for reduction of the budget deficit and debt. The reallocation of subsidy savings was assumed to take place between 2016 and 2025 only. The combined effect of both the removal of subsidies and the recycling of savings toward sustainable energy leads to emissions reductions of 18.15% compared to BAU scenarios at the national level. It also consolidates emissions reductions gains made by countries from the removal of fossil fuel subsidies over the long term. This is illustrated in Figure 3 below.

Figure 3: Country results from GSI-IF model from removal of Fossil Fuel Subsidies from across 20 countries (blue) and investment in energy efficiency (green) and renewable energy (red) (as a % of national emissions reductions), in 2020



Source: Authors.

Table 1: Country results from GSI-IF model for removal of FFSR from across 20 countries (as a % of national emissions reductions)

Country	% Reduction in GHG emissions v. BAU by 2020			% Reduction in GHG emissions v. BAU by 2025		
	Removal of fossil fuel subsidies	Recycle to energy efficiency (20%)	Recycle to Renewables (10%)	Removal of fossil fuel subsidies	Recycle to energy efficiency (20%)	Recycle to Renewables (10%)
Iraq	-41.50%	-12.74%	-4.54%	-37.33%	-28.60%	-12.34%
Venezuela	-33.65%	-9.92%	-4.57%	-30.99%	-24.86%	-14.51%
Saudi Arabia	-30.42%	-13.72%	-4.01%	-27.80%	-32.64%	-11.69%
Algeria	-22.12%	-12.80%	-6.09%	-19.43%	-30.22%	-15.93%
Iran	-17.85%	-9.96%	-4.73%	-15.87%	-25.03%	-14.85%
Egypt	-14.88%	-9.10%	-3.77%	-12.61%	-21.28%	-10.55%
UAE	-14.42%	-8.87%	-4.30%	-12.97%	-21.80%	-12.78%
Bangladesh	-8.67%	-3.44%	-1.45%	-8.66%	-8.35%	-4.11%
Indonesia	-6.97%	-3.65%	-1.53%	-6.19%	-8.84%	-4.25%
Russia	-6.25%	-3.08%	-1.64%	-5.89%	-8.20%	-5.19%
Tunisia	-5.51%	-3.27%	-1.68%	-5.24%	-8.24%	-5.06%
India	-3.20%	-1.97%	-0.78%	-2.73%	-4.88%	-2.18%
Pakistan	-3.10%	-1.82%	-0.89%	-2.90%	-4.57%	-2.63%
Ghana	-2.83%	-3.30%	-1.82%	-2.45%	-8.38%	-5.87%
Vietnam	-1.71%	-0.41%	-0.20%	-1.86%	-1.04%	-0.61%
Morocco	-1.63%	-1.00%	-0.46%	-1.04%	-2.41%	-1.21%
Sri Lanka	-1.53%	-0.65%	-0.29%	-1.37%	-1.65%	-0.84%
Nigeria	-1.18%	-1.08%	-0.40%	-0.92%	-2.64%	-1.19%
China	-0.78%	-0.38%	-0.13%	-0.69%	-0.99%	-0.36%
United States	-0.18%	-0.13%	-0.07%	-0.12%	-0.34%	-0.20%
Average	-10.92%	-5.06%	-2.17%	-9.85%	-12.25%	-6.32%
Average combined policies		-18.15%			-28.42%	

Source: Authors.

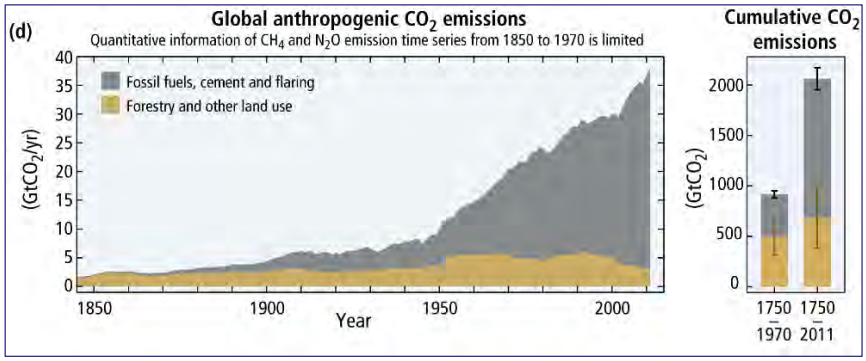
1.2.3 Average cumulative tonnes of CO_2e results

The model finds that with the phase out of fossil fuel subsidies the total cumulative emissions saved across 20 countries by 2020 amounts to 2.82 gigatonnes (Gt) of CO_2 equivalent, and this rises to approximately 6.316 Gt in total by 2025. This figure represents only a sub-set of countries that provide significant fossil fuel subsidies. The Intergovernmental Panel on Climate Change (IPCC) report (IPCC, 2014) states that in order to stay within a 2 °C warming target global emissions need to remain below a total of 2,900 Gt CO_2e. Of that total, 1,900 have already been emitted by 2011: as of 2010 there were around 49 Gt emitted per year (IPPC, 2014). Removal of subsidies to fossil fuels is a fiscal policy that enables the removal of Gt of CO_2e in the near term i.e. pre-2020.

Separate research (Stefanski, 2014) based on backward-looking estimates using historical data linked to industrial development pathways infers higher GHG emissions from carbon fossil fuel wedge patterns, i.e., "country-specific patterns in carbon emission-to-GDP ratios, known as

emission intensities" (Stefanski, 2014., p.2). This research finds that in 2010 emissions "would have be 36% lower were it not for massive fossil fuel wedges. Over the 1980-2010 period, cumulative emissions would have been 20.7% lower if countries had not subsidized fossil fuels" (Stefanski, 2014, p. 30).

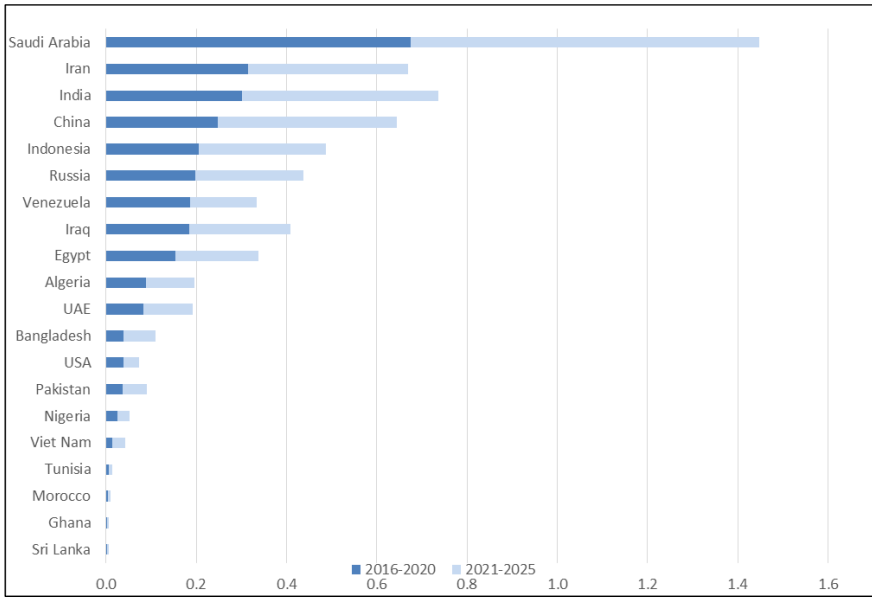
Figure 4: Global Anthropogenic CO_2 Emissions



Global anthropogenic CO_2 emissions from forestry and other land use as well as from burning of fossil fuel, cement production and flaring. Cumulative emissions of CO_2 from these sources and their uncertainties are shown as bars and whiskers, respectively, on the right hand side.

Source: IPCC (2014).

Table 2: Country results from GSI-IF model from removal of Fossil Fuel Subsidies from across 20 countries (cumulative Gt of CO_2e, by 2020 and by 2025)



Source: Authors.

Table 3: Cumulative reduction in CO_2 equivalent, 2020 and 2025 (Gt)

	CO_2 reduction cumulative	
	2020 FFSR (Gt)	2025 FFSR (Gt)
Saudi Arabia	0.675	1.447
Iran	0.314	0.669
India	0.302	0.737
China	0.248	0.645
Indonesia	0.205	0.488
Russia	0.198	0.438
Venezuela	0.186	0.333
Iraq	0.185	0.409
Egypt	0.154	0.338
Algeria	0.089	0.196
UAE	0.083	0.192
Bangladesh	0.040	0.110
United States	0.039	0.074
Pakistan	0.038	0.091
Nigeria	0.025	0.052
Viet Nam	0.014	0.042
Tunisia	0.006	0.015
Morocco	0.005	0.010
Ghana	0.003	0.007
Sri Lanka	0.003	0.007
Sum	2.820	6.316

Source: Authors.

1.2.4 Recycling of Funds to Renewables and Energy Efficiency

The model is adaptable to national priorities and policy plans and investigates how the removal of fossil fuel subsidies liberates domestic resources that can be channelled toward renewables and energy efficiency to drive emissions further downwards, enabling fuel switching and conservation. Governments often return a portion of these savings back to citizens through cash transfers to cushion the impact of higher prices on the vulnerable (the GSI-IF model also provides for a 50% return to poor households spread over 10 years, until 2025). The GSI-IF model includes an additional, modest level of recycling of savings back into the energy system to help shift national energy systems onto a low-carbon trajectory and leapfrog a significant fossil fuel development pathway: 10% to renewables and 20% to energy efficiency, until 2025. The recycling is capped at 2025 to recognize the fact that governments will not realistically earmark such expenditures beyond the medium term.

The findings show that emissions reductions can be improved further by reinvesting a percentage of the savings from FFSR into renewables and energy efficiency. The research uses the average costs of such

investments as estimated by the IEA in the World Energy Outlook (WEO). Renewable energy investments include both construction and operation and management expenses averaged across technologies. The model also includes projected cost changes, as the costs of several renewable energy options (e.g., solar PV) have halved between 2010 and 2014, becoming increasingly competitive at utility scale (IRENA, 2015). The energy efficiency measures are based specifically on interventions for buildings and industry, taking into account their full cost. It thus includes both the most effective energy efficiency measures for carbon emissions reduction (i.e., low-cost options such as energy-efficient light bulbs) as well as higher-cost options (such as building insulation).

1.2.5 Results of Emissions Savings from FFSR Are Likely Underestimates

Subsidy Data: The data on subsidies used in this model are based on publicly available and comparable figures. The data were taken from IEA and IMF pre-tax figures across fuel types (oil, gas, electricity and coal) from the GSI interactive subsidy map database (GSI, 2015). Pre-tax figures include only policies that reduce prices below the cost of supply and distribution, and as such are a conservative estimate of the true value of fossil fuel subsidies. By contrast, post-tax subsidies would estimate that a subsidy exists if prices are below an estimated benchmark efficient tax level: this captures tax breaks related to fossil fuel products, as well as instances where taxes are too low to capture externalities associated with fuel use, and results in much larger estimates of subsidies. In addition, the figures are for consumer subsidies only and are based on a price-gap approach, in which the subsidy is calculated by taking the difference between international and national prices. The price-gap method may miss subsidies that would be captured by a more detailed, bottom-up inventory approach, and it tends not to capture subsidies for fossil fuel production at all, as these generally affect producer profitability and not the sales costs of fuels. Further iteration of the analysis, where the GSI has input subsidy figures derived from a bottom-up inventory approach (and even modelling for the presence of lower oil prices in the long term), has revealed increased emissions reductions from the standard scenarios presented here.

Producer Subsidies: Furthermore, subsidy and therefore emissions estimates in this research do not include producer subsidies. Subsidies to producers are significant and often found in developed countries. There are few estimates as to the subsidies themselves because they are

complex and often opaque. Production subsidies have been estimated by the GSI to stand at around USD 100 billion globally (GSI, 2010b) and at around USD 88 billion annually across the G20 for fossil fuel exploration and production (OCI & ODI, 2014). The truth is that nobody knows the global cost of government subsidies to fossil fuel producers because, as yet, there is no international figure or assessment. The OECD does include some nationally self-reported producer subsidies within OECD country assessments of government support to fossil fuels (OECD, 2015). Producer subsidies cover a wide range of support mechanisms, including direct or potential direct transfers, government revenue forgone, government provision of government purchased goods and services, and direct income or price support (GSI, 2010a). More transparency and research are needed to measure the level and impacts of production subsidies with regard to driving exploration, production, price and demand in fossil fuels globally. It is likely that in places producer subsidies can sometimes have a profound "all or nothing" effect as to whether or not fossil fuel extraction and production is profitable and therefore goes ahead. Furthermore, the price-gap method typically identifies zero or very low subsidies for coal (for the countries modelled, only one country was estimated to have any subsidies for coal). Yet the significant subsidies identified for electricity are often driving coal use, as are other subsidies embedded within the electricity system (for example to State Owned Energy companies through "take-or-pay" and "must-run" power contracts). The way that such policies are linked back to coal-fired power stations and a central thermal grid system are neither transparent nor understood.

Price-Gap Approach: For this modelling, GSI has used a conservative subsidy definition based on a price-gap approach from IEA sources, and very similar to the IMF pre-tax measurement of a subsidy. As a result, the subsidy data used in the model do not take include the cost of externalities – the additional costs on society from the use of fossil fuels – such as pollution, congestion, accidents, under-taxation and the costs of global warming. Recent research such costs are far higher with pre-tax and post-tax subsidies, at around USD 5.2 trillion in 2015 and make a compelling case for the appropriate pricing of carbon (Coady, Parry, Sears, & Shang, 2015). Perversely, although low oil prices have driven down pre-tax expenditure on fuel subsidies (to around USD 548 billion in 2013) (IEA, 2014), the broader costs to society from the use of fossil fuels have been revised upwards. Indeed, the key findings from the IMF Working Paper were very clear: "energy subsidies are very large; their removal would generate very substantial environmental, revenue, and

welfare gains; and their reform should begin immediately, albeit gradually, given the uncertainty over the precise level of energy taxes required" (Coady, Parry, Sears, & Shang, 2015, p. 6).

Box 1

Country data for fossil fuel subsidy figures

- IMF: http://www.imf.org/external/pubs/ft/survey/so/2015/new070215a.htm
- OECD: http://www.oecd.org/site/tadffss/
- IEA: http://www.iea.org/subsidy/index.html
- GSI: http://www.iisd.org/gsi/interactive-maps
- ODI/OCI: http://www.odi.org/g20-fossil-fuel-subsidies (producer G20)
- Two page description of the different figures and methods used to measure fossil fuel subsidies: https://www.iisd.org/gsi/sites/default/files/ffs_methods_estimationcomparison.pdf

1.2.6 The Price of Oil

Since the model is based on the link between the price of fossil fuels increasing due to removal of subsidies (and a resulting reduction in demand and switch to different fuels), the overall oil price within the model matters. While a low oil price is good for reform – in that it is easier to dismantle subsidies because pass-through costs to consumers are reduced – in the long term such a low oil price works against using fossil fuels efficiently and reducing emissions. The GSI-IF model assumes the oil price to grow at a rate of 7% per year, starting from the price of USD 50/barrel in 2015. This results in a price of USD 70/barrel in 2020 and USD 98/barrel in 2025. Given that taxation and subsidies differ across countries, an index for oil price growth is applied to estimate national prices (e.g., the price in 2020 is 1.4 times its value in 2015).

One impact of a low oil price is lowering of the nominal pre-tax fossil fuel subsidy inputs to the model. A low oil price means that the price gap between the international price of fuels and the national price is reduced. For importing countries, such as Bangladesh, this means that national oil companies exhibiting subsidies in a high oil price situation are now no longer producing losses. On the other hand, for those exporting countries (such as Nigeria and UAE) that have also been maintaining significant subsidies across the population, the situation becomes critical in that governments are receiving lower incomes from oil exports and can no longer maintain such subsidies.

The GSI-IF model investigated scenarios based on such lower IMF pre-tax 2015 subsidy data. It found lower average national reductions across the 20 countries of around 6% by 2020. This means that the exact impact of FFSR on emissions reductions can be significantly affected by the price of oil, because of the impact of the price of oil on the subsidy input figures themselves. Moreover, while subsidies may decrease due to low world oil prices one year, it is possible – particularly if countries do not develop long-term solutions to subsidies while prices are low – that subsidies will return again when world oil prices next rise. For many countries, 2015 nominal pre-tax figures do likely not represent real reductions in subsidies due to the fact that the underlying causes of subsidies to fossil fuels have not changed.

However, modelling for a long-term low or high oil price matters less in the model than the quality and quantity of subsidy data inputted for different fuel types. The research looked in depth at Morocco regarding subsidy figures and found that projected 2015 pre-tax nominal figures were a significant underestimate on current national data. Yet for some countries where significant policy change and reform has occurred, 2015 figures are a representation of previous reform efforts and therefore reflect an actual lowering of direct subsidies. In order to establish robust estimates for national planning purposes, there is no substitute for working directly with countries to measure existing subsidies to fossil fuels using an inventory approach. This would serve as an important complement to the existing data on subsidies, published by the IEA, OECD and IMF, which is generally intended to allow for cross-country comparison, rather than to help direct national reform efforts (IEA, WB, OECD, IMF, & GSI, 2014).

Box 2. Detailed description of the GSI-IF model

Boundaries: Energy consumption and emissions from energy use, but not other sectors such as land cover.

Granularity: The model is customized to represent national energy consumption, and it is not disaggregated spatially at the subnational level. On the other hand, it includes energy consumption from the (1) residential, (2) commercial, (3) industrial and (4) transport sectors, disaggregated into (a) coal, (b) petroleum products, (c) natural gas, (d) biofuels and waste, and (e) electricity.

Time horizon: The model is built to analyze medium to long-term trends. Simulations start in 1990 and extend up to 2030.

Structure: The model is relatively discrete, and it uses the following key exogenous drivers: GDP, population, energy efficiency (as an annual percent in-

crease) and energy prices. Users can also modify the energy mix for electricity generation, change default values for price and income elasticity, as well as emission factors.

Dataset: Several data series and data inputs are required to customize and simulate the GSI-IF model:

- Energy consumption and electricity supply data: IEA's World Energy Balances (2014 edition); GDP and population: IEA or from World Bank's World Development Indicators (WDI) and UN World Population Prospects database.
- Energy prices: Primarily collected from national government sources, as well as from Energypedia.
- Fossil fuel subsidies: Extracted from GSI's Interactive Subsidy Database Map from publicly available data from the IEA, OECD and IMF.
- Cost of renewable energy (RE) electricity generation capacity and energy efficiency (EE) interventions are obtained from the IEA.
- Price and income elasticities were determined based on literature review and model calibration to historical trends.

External (user-driven) inputs:

- The future growth of GDP, currently based on the IMF World Economic Outlook.
- The future growth of population, currently based on the UN World Population Prospects database (medium variant).
- Future energy prices, currently assumed to follow their 10-year historical trends concerning fossil fuels (coal, petroleum and natural gas); biofuels and waste energy price is assumed to remain constant in real terms; and the electricity generation cost is assumed to be directly influenced by the price of the energy sources used to generate electricity.
- Baseline energy efficiency improvement, currently projected to improve by 1.5% every year.

Internal (structural) assumptions:

- Final energy consumption is estimated considering (1) indicated demand (including the effect of GDP, population and energy efficiency); (2) the price effect; and (3) the substitution effect. Items (1) and (2) are used to estimate demand for energy services.

- The potential for fuel substitution is represented by the ratio of an energy price over the national weighted average energy price. This implies that an energy source will become more attractive if its price increases less than others when subsidies are removed.
- It is assumed that price effects require a one-year delay to influence energy consumption.

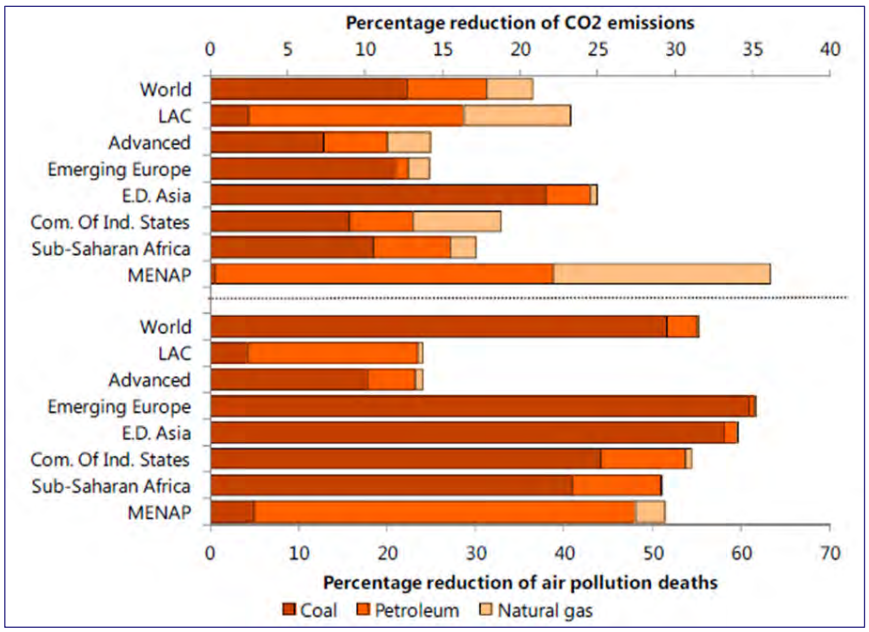
1.3 International Research

A significant number of studies have modelled the impact of removal of fossil fuel subsidies on emissions reductions for individual countries and globally. An updated overview of this research, first presented in early 2015 (Merrill *et al*., 2015), is presented below. For a full discussion of the literature, including price elasticities, substitution effects, carbon leakage, the rebound effect and the importance of an overall cap or agreement on emissions see this earlier source. The report concluded that although the removal of subsidies does lead to domestic and international reductions in GHG emissions, it is no substitute for a global climate agreement with a clear cap on emissions. FFSR in the presence of a cap increases emission reductions from around 8 to 10% and maintains the reductions from reform in the long term. Further, correct taxation of fossil fuels would take this higher to around a 23% reduction. Parties should seriously consider including emissions reductions from FFSR within their INDCs, within the UNFCCC agreement (especially regarding early action in that this policy tool is one that countries are utilizing now), within NAMAs [Nationally Appropriate Mitigation Actions], and within a TEM [Technical Experts Meeting] that covers fiscal instruments (subsidy reform, carbon pricing, taxation, etc.) to share lessons and increase understanding (Merrill *et al*., 2015, p. 18).

Table 4: Emissions Reductions Scenarios

Emissions Reduction	Description
18.1–22.9%	A 18.1–22.9% decrease in carbon dioxide emissions based on global removal of consumer pre- and post-tax fossil fuel subsidies (Coady, Parry, Sears, & Shang, 2015). (See figure below).
10% by 2030 (energy sector emissions only)	A 10% reduction in energy sector emissions by 2030, from accelerating the (partial) phaseout of subsidies to fossil fuel consumption (part of the IEA's Bridge Scenario, which also includes energy efficiency [49%], limiting construction and use of least-efficient coal-fired plants [9%], minimizing methane emissions from upstream oil and gas production [15%] and renewables investment [17%]) (IEA, 2015). FFSR moderating the growth in demand as well as supporting energy efficiency, and the only end user price considered in this scenario of energy sector measures.
8% by 2050	An 8% reduction in global GHG emissions more than or 6.1 gigatonnes of carbon dioxide (by 2050) from a staggered removal of consumer fossil fuel subsidies based on 2008 subsidy figures (including an emissions cap on OECD countries and Brazil increases the reduction to 10%) (Burniaux & Chateau, 2014).
6.4% by 2050	A 6.4% GHG emissions reduction by 2050 based on removing all consumer subsidies by 2020 (Schwanitz *et a.l*, 2014).
20.7% between 1980 and 2010	36% lower emissions in 2010 without fossil fuel subsidies. 20.7% lower global carbon emissions between 1980 and 2010 if countries had not subsidized fossil fuels (Stefanski, 2014).
8%	An 8% reduction in carbon dioxide emissions from a phaseout of coal subsidies (production and consumption) in OECD and non-OECD countries (Anderson & McKibbin, 1997).
Country-specific estimates	Country-specific reductions: China, a 3.72% carbon dioxide reduction between 2006 and 2010 (Lin & Ouyang, 2014); India, a 1.3 to 1.8% reduction, 2031 (Asian Development Bank [ADB], in press), Indonesia, a 5.3 to 9.3% reduction by 2030 (ADB, in press); Thailand, a 2.8% reduction by 2025 (ADB, in press); Ukraine, 3.6% reduction or 15 million tonnes of CO_2e (Ogarenko & Hubacek, 2013), Mexico, 34 million tonnes of CO_2e saved every year between 2014–2035 from a mix of Green Growth transport measures including FFSR giving a NPV of USD 193,300 million between that period (Ibarrarán, Bassi, & Boyd, 2015).
Average of 11% in 2020 from 20 countries	Average of 11% in 2020 from across 20 countries (Algeria, Bangladesh, China, Egypt, Ghana, India, Indonesia, Iran, Iraq, Morocco, Nigeria, Pakistan, Russia, Saudi Arabia, Sri Lanka, Tunisia, UAE, US, Venezuela, and Vietnam) rising to 18% by 2020 with recycling of saved revenues toward renewables (10%) and energy efficiency (20%).This report.

Figure 5: Environment gain from removing energy subsidies, 2013



Per cent reductions in CO_2 on top axis;% reductions in air pollution deaths on bottom axis. CIS = Commonwealth of Independent States; ED Asia = Emerging and Developing Asia, LAC = Latin America and the Caribbean; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

Source: Coady, Parry, Sears, & Shang (2015).

2. Energy and Climate Policy Coherence, Effectiveness and Efficiency

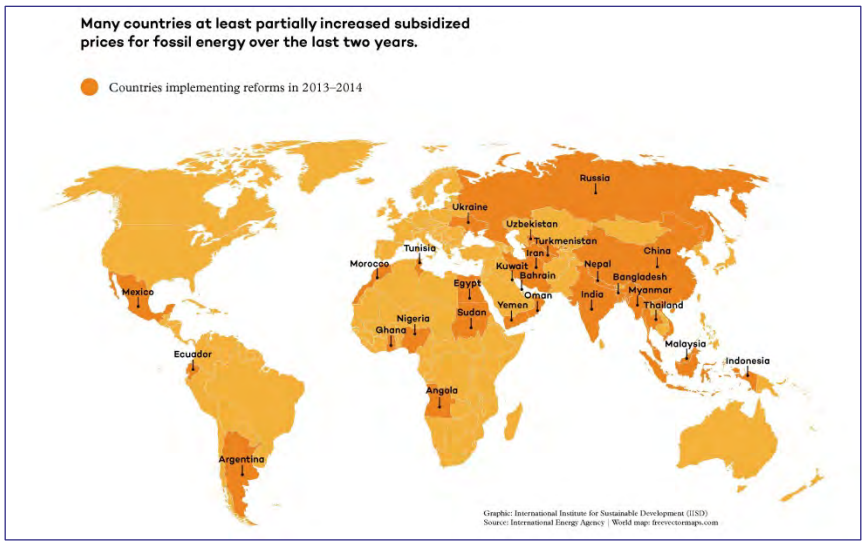
2.1 Energy and Climate Policy, Pre-2020 action and Intended Nationally Determined Contributions

Fossil fuel subsidy reform can support climate change policy and goals. It can be recognized as part of a package of measures to implement Intended Nationally Determined Contributions (INDCs), because reform can both reduce emissions and liberate resources to invest in sustainable energy systems.

INDCs are intended for *post-2020* action, but FFSR is a policy change that can be – and is being – deployed today. In 2015 alone we have seen reforms in Indonesia (GSI/IISD, 2015), India (Clarke, 2015), Egypt (James, 2015) and the UAE (MacCarthy, 2015). This is particularly the case for consumer subsidies, in the context of the current low oil price, which lowers the short-term impact of reforms on consumers. The test will come when oil prices rise and whether or not previously high-subsidizing countries such as Indonesia can then maintain reforms by implementing an appropriate fuel pricing system (Beaton, Christensen and Lontoh, 2015).

Jakob *et al*. (2014) point to FFSR, along with decentralized modern energy for rural areas and fuel switching in the energy sector, as one of three feasible mitigation policy instruments to help reach a 2 ℃ target. The IEA (2015) points to FFSR as one of five key measures to help bridge the gap between current commitments and the emissions reductions needed from the energy sector to stay within the 2 ℃ degrees warming target. The IEA encourages the reform of consumer subsidies by 2030. Figure 6 below illustrates where countries have been reforming fossil fuel subsidies recently:

Figure 6: Countries partially increasing subsidized prices to fossil fuels (2013–2014)



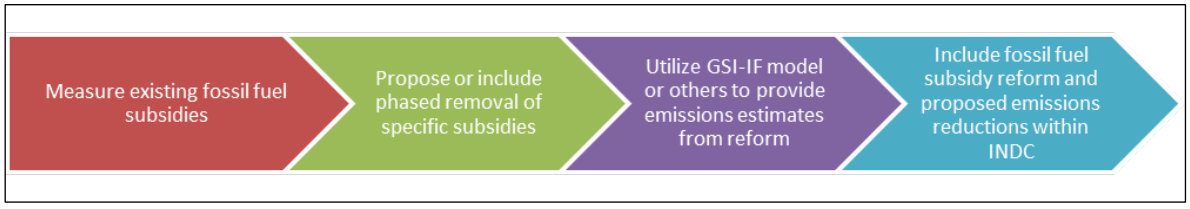
Source: IISD (2015) based on IEA (2014 d).

Throughout 2015 countries have been submitting their Intended Nationally Determined Contributions to the UNFCCC. FFSR can be and has been included in INDCs in a number of ways:

- Within the INDC directly itself as a means of past action and toward the implementation of national emissions reductions.
- As a fiscal policy tool that governments can utilize to support domestic emissions targets, and in a short time frame (pre-2020) but also INDC (post-2020) aims.

The following diagram explains how countries can utilize FFSR to support pre-2020 action and INDCs.

Figure 7: Process for including FFSR within INDCs



Source: Merrill and Gagnon-Lebrun (2015) based on Merrill *et al.* (2015).

A number of countries have included the issue of fossil fuel subsidies explicitly within their INDCs, or the issue of energy sector reform in general. It is clear there is a growing interest from countries in utilising and understanding fiscal instruments such as subsidy reform and carbon taxation in the context of delivering emissions reductions. Country submissions are listed in the box below.

Box 3. Inclusion of fossil fuel subsidies and energy sector reform within INDCs

Inclusion of fossil fuel subsidies and energy sector reform within INDCs

In relation to early and continued action	
Ethiopia (2015) INDC of the Federal Democratic Republic of Ethiopia (2015), pp. 7–8	"Ethiopia has already removed fossil fuel subsidies to enable enhanced generation and use of clean and renewable energy."
India (2015) "India's Intended Nationally Determined Contribution: Working towards climate justice" p.27	"India has cut subsidies and increased taxes on fossil fuels (petrol and diesel) turning a carbon subsidy regime into one of carbon taxation. Further, in its effort to rationalize and target subsidies, India has launched "Direct Benefit Transfer Scheme" for cooking gas, where subsidy will be transferred directly into the bank accounts of the targeted beneficiaries. In fact, over the past one year India has almost cut its petroleum subsidy by about 26%."
Morocco (2015) INDC Under the UNFCCC, Morocco p. 4	Via transformation of the energy sector to: "Substantially reduce fossil fuel subsidies, building on reforms already undertaken in recent years."
Singapore (2015) Singapore's Intended Nationally Determined Contribution and Accompanying Information (2015) p. 2	In that subsidies have been removed: "Singapore prices energy at market cost, without any subsidy, to reflect resource scarcity and promote judicious usage. On top of this, and despite the challenges, the government is significantly increasing the deployment of solar photovoltaic (PV) systems."
Viet Nam (2015) Intended Nationally Determined Contribution of Viet Nam p.6	"Apply market instruments to promote structural change and improve energy efficiency; encourage the use of clean fuels; support the development of renewable energy; implement the roadmap to phase out subsidies for fossil fuels;"
With regard to effective carbon pricing and energy sector reform	
China (2015)	"To advance the reform in the pricing and taxation regime for energy- and resource-based products."
Mexico (2015) Intended Nationally Determined Contribution	As part of the planning process linked to both a "Carbon Tax (2014) and Energy reform (laws and regulations) (2014)."
In relation to support of the issue as linked to emissions reductions	
New Zealand (2015) New Zealand's Intended Nationally Determined Contribution	In relation to NZ's role as member of the Friends of Fossil Fuel Subsidy Reform.

From a search across submissions as of beginning October 2015.

More countries that have removed subsidies to fossil fuels or that are planning to do so could raise the issue within their INDCs and quantify emissions reductions from these efforts utilizing models such as the GSI-IF model.

2.2 Policy Efficiency and Effectiveness

The GSI-IF model projects that a phased removal of fossil fuel subsidies (from now until 2020) will lead to average annual government savings of between USD 86.78 to USD 98.87 per tonne of carbon emissions equivalent removed. This estimate assumes that 50% of savings will be reallocated to poor households. Most GHG emission reduction policies cost government resources to implement (e.g., renewables and energy efficiency policies) (OECD, 2013). Very few climate policies actually save government funds at the same time as effectively removing CO_2 from the atmosphere. Fossil fuel subsidies can be thought of as a "negative" form of carbon pricing, and their removal is a necessary step toward policies that seek to correct carbon pricing, such as carbon taxes or emissions trading systems. Indeed, the IEA calculates that currently 13% of all energy-related CO_2 emissions are linked to an average subsidy of USD 115 per tonne of CO_2 emitted. On the other hand only 11% of global energy-related CO_2 emissions are subject to carbon pricing, with an average cost of only USD 7 per tonne of CO_2 (IEA 2015). The IMF finds that the implementation of a carbon tax is the most efficient policy tool to reduce carbon emissions in comparison to seven other policy tools (IMF, 2014). A carbon tax was found to be even more effective than a combination of policies that included standards for CO_2 per kWh of electricity generated, the efficiency of buildings and appliances and the efficiency of vehicle fuel.

FFSR is an efficient policy tool for removing carbon emissions from the system. Furthermore, if the full cost of carbon from the use of fossil fuels on society is taken fully into account, then maintaining fossil fuel subsidies is doubly inefficient. In the first instance, governments are paying for the subsidies directly in the form of either upstream tax and regulation breaks to producers or through lowering the cost of fossil energy below international prices downstream to consumers. In the second instance, someone in society will pay the price of externalities from the use of fossil fuels somewhere. These come in the form of climate change impacts and the early loss of life or other health impacts related to local air pollution and traffic accidents, as well as the economic costs

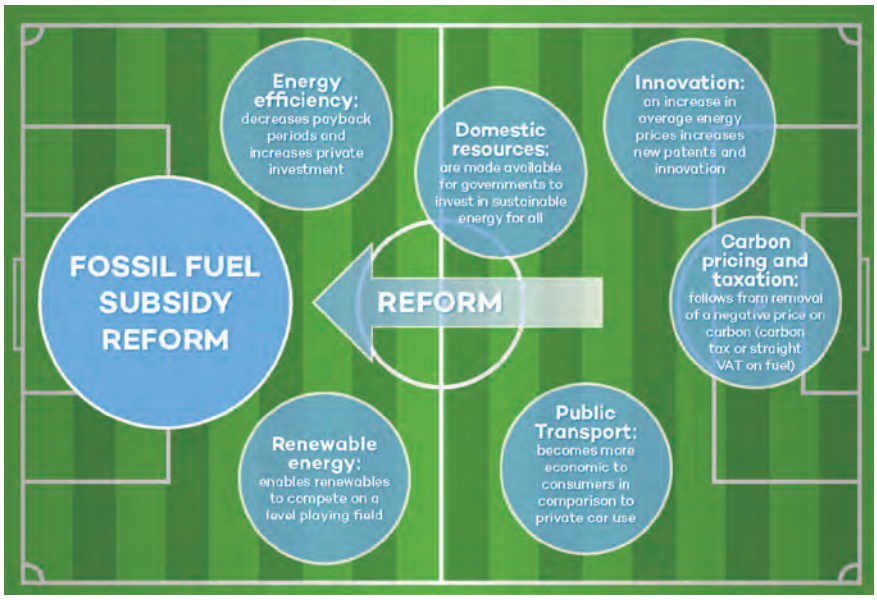
of congestion. So governments are, in effect, paying the price of subsidies twice: first for the direct subsidies themselves and second for the negative impacts from the use of these fuels.

Socially, the maintenance of blanket or so called "universal" fossil fuel subsidies has also been demonstrated to be inefficient at targeting and benefiting the poor. Subsidies lead to lower GDP growth and the benefits of subsidies are captured mostly by the wealthier sections of society, who can afford to purchase large volumes of energy products. Research finds that on average, the top income group receives about six times more in subsidies than the bottom quintile, and that for gasoline 97 out of every 100 dollars of subsidy "leaks" to the top four richer quintiles (Arze Del Granado, Coady & Gillingham 2010). Economically, governments find that fossil fuel subsidies can become a huge burden on the public purse, spiralling out of control in the face of high oil prices. There can be efficient and smart subsidies but these are not universal, blanket subsidies to fossil fuels. Efficient subsidies are targeted at specific groups of people, such as free energy-efficient light bulbs to poor households.

2.2.1 Policy Coherence

FFSR also supports other low-carbon energy policies. The feedback loops between different fiscal policies are not well understood: for example, cross substitution between fuels as a result of price changes is often not included within economic models. In other words, they fail to account for the level of increase or decrease in demand and use of other fuel types as a result of changes in price of fossil fuels. This paper proposes that FFSR acts as a base or foundation fiscal policy for the take-off and success of low-carbon fiscal tools, and that policies linked to public transport systems, energy efficiency, renewables and carbon pricing are likely to be more effective and therefore have more success after FFSR has taken place.

Figure 8: How subsidies to fossil fuels hold back new energy players



2.2.2 How Subsidies to Fossil Fuels hold back new energy players….

Energy efficiency

Fossil fuel subsidies (USD 548 billion in 2013) stood at four times the level of subsidies to energy efficiency (USD 120 billion). Payback periods for efficiency improvements are decreased with their removal (IEA, 2014b; IEA, 2014d). Gasoline prices in Saudi Arabia are one tenth of the average price in Europe, so it takes about 16 years to recoup the cost of upgrading to a higher efficiency vehicle from a vehicle with average fuel economy; removing subsidies would cut the payback period of the same investment to just three years (IEA/WEO 2014).

Renewable Energy: electricity

Renewable energy targets until 2020 in the Middle East and North Africa could cost up to USD 200 billion, less than one year's worth of fossil fuel subsidies in the region (USD 237 billion) (Bridle, 2014). Fossil fuel subsidies affect renewable electricity generation in that they reduce the costs of fossil fuel-powered electricity generation, impair the cost competitiveness of renewable energy, reinforce the incumbent advantage of fossil fuels within the electricity system and favour investment in fossil fuel-based technologies over renewable alternatives (Bridle & Kitson, 2014; Bridle, Kitson, & Wooders, 2014).

Research suggests that carbon reductions can be gained by placing a cost on polluting power generators, leading to fuel switching within the electricity sector in the long-term (Van den Bergh & Delarue, 2015). An increase in the costs of emitting CO_2 increases the cost of operating fossil-fuelled power generators and encourages a switch toward cleaner generators and fuels. The marginal abatement cost curves depend on the fossil fuel prices imposed on the power system. Within Europe fuel switching occurs between fossil fuels from EUR 0 to 35 EUR/tCO_2. Beyond this price, the economic case for investment in renewable technologies, notably wind power, becomes compelling (Van den Bergh & Delarue, 2015).

Therefore, removal of subsidies to fossil fuels is a first step to ensure the merit order reflects the true financial costs of fuels. To address the social and environmental impacts of energy use, a focus is needed on external costs including the cost of carbon emissions. Funds raised from environmental charges and reform of subsidies can be reinvested in renewables to overcome the issue of carbon leakage (for a longer discussion of this see Merrill *et al.*, 2015).

Renewable energy: lighting

Kerosene subsidies for lighting kerosene lamps undercut solar-lighting systems. This is especially concerning as kerosene consumption is a key cause of respiratory diseases. A United Nations Environment Programme (UNEP) report for ECOWAS explains that hypothetically redirecting one year's worth of kerosene subsidy (at 40%) toward kerosene-free lighting systems (e.g., solar) would eliminate the need for all subsequent subsidies for the service life of those new systems (UNEP, 2014).

Public transport

Blanket subsidies to petroleum and diesel transport fuels encourage private car use over public transport. Public transport systems require significant infrastructure investments and are often in competition for space with private vehicles. A removal of subsidies to motor fuels and a redistribution toward investment in public transport can reduce emissions, congestion and local air pollution. Subsidy reforms in Iran reallocated savings from a reduction in subsides to liquid fuels into public transportation systems (Hassanzadeh, 2012).

However, in the short term subsidy reforms can also affect public transport systems, forcing fare price rises. Reforms must strike a balance between cost recovery in the short term and investment in rapid bus transit, metro and rail systems in the long term.

Carbon pricing and taxation

Fossil fuel subsidies act as harmful incentives to consumers and companies alike. 13% of global CO_2 emissions currently receive an incentive of USD 115 per tonne in the form of fossil fuel subsidies while only 11% are subject to a carbon price, with an average cost of only USD 7 per tonne of CO_2 (IEA, 2015). Subsidies to fossil fuels act as a negative price on carbon, removing them would help to increase the effective cost of carbon intensive activities at a negative cost.

Domestic resources

By removing subsidies and taxing carbon, we could reduce global CO_2 emissions by 23% and raise government revenue through savings and taxation, equivalent to 2.6% of global GDP (IMF, 2014, "Getting Energy Prices Right"). Removal of fossil fuel subsidies creates fiscal space for governments. Some of the savings could be focused back into the energy sector through investment in low-carbon energy policies, as above.

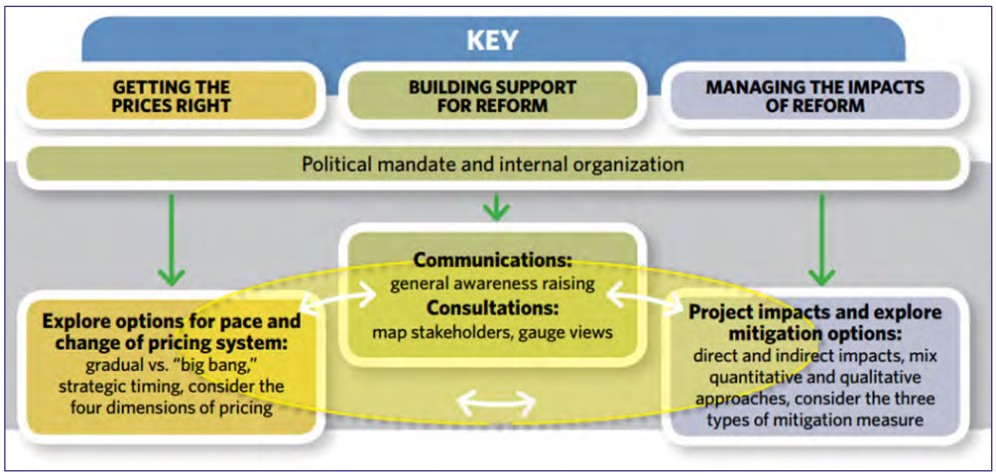
Innovation

The prospect of attractive energy prices for renewable technologies is key "market pull" factor that is undermined by the downward pressure created by fossil fuel subsidies. Research finds that a 10% increase in average energy prices leads to a 2.75% and 4.5% increase in the number of green patents and the share of green patents on non-green patents (2013, Ley *et al*.).

3. International Efforts

This section describes three different country experiences with FFSR, viewing the reforms from an emissions-reduction perspective. The GSI and others usually focus on evaluating reforms from a fiscal policy or social impact assessment perspective – the most common motivation for countries reforming their subsidies. Rarely are emissions reductions considered, nor how to maximize a shift toward low-carbon energy measures alongside the process of reform. The GSI recommends a three-pillared approach to FFSR as outlined below: getting energy prices right, building support for reform and managing the impacts of reform (Beaton *et al.*, 2013). This report makes the case to governments to also evaluate investment in sustainable energy, when undergoing energy sector reforms.

Figure 9: Three Pillars of Fossil Fuel Subsidy Reform



Source: Beaton, C., Gerasimchuk, I., Laan, T., Lang, K., Vis-Dunbar, D., & Wooders, P. (2013).

4. Philippines

The Philippines removed various fossil fuel subsidies between 1996 and 2001 and experienced fuel price increases. As a result, it has been able to invest more in safety nets and renewable sources of energy, and now taxes fuels. Since reform, the Philippines has experienced a decline in the consumption of oil products, stabilized emissions per kWh generated, increased energy efficiency and reduced the energy intensity of the overall fuel mix. This is likely due to a mixture of reasons including subsidy reform, the downturn from the Asian Financial crisis and higher oil prices being passed through to consumers, as well as active government policy to invest in renewables.

The Philippines is a country from which lessons for FFSR can be learned. The country has removed all consumer energy subsidies, successfully phasing out price subsidies in the late 1990s as a result of wider structural reform to deregulate both the downstream oil and electricity sectors, crucially with the removal of the Oil Price Stabilization Fund and privatization of the National Power Corporation. The Philippines is an importer of energy, and with rising energy prices the transition was managed through the use of targeted cash transfers and other regulated subsidies aimed at low-income households, specific sectors and certain socially sensitive fuels. These included a range of measures including: a transition period where prices were adjusted monthly; a lifeline rate for marginalized and low-income electricity users; a senior citizens' discount on electricity; and a one-off cash transfer (or *Pantawid Kuryente*, meaning to enable to buy electricity) aimed at marginalized electricity consumers (those with a monthly consumption of 100 kWh or less) to cushion the impact of rising electricity and fuel prices, funded from a value-added tax (VAT) levied on oil (also known as *katas ng VAT*, meaning juice or benefit of VAT). Overall, 6.8 million households benefited, and the cost to the government was around USD 82 million. However, transaction and disbursement costs, leakage and exclusion rates were all high. Furthermore a Public Transport Assistance Programme (*Pantawid Pasada*) disbursed through debit and smart cards was targeted at

jeepney and motorized tricycle operators whose fares are regulated and were unable to move with fuel price changes.

The Philippines has managed to turn energy from a drain on the government budget to a gain, by removing heavy fossil fuel subsidy expenditure and turning it into tax revenue. In 1996, direct government subsidy to the Oil Price Stabilization Fund stood at PhP 15 billion[1] (~USD 343.5 million). The process of fossil fuel subsidy removal has also led to three independent inquiries (2005, 2008 and 2012), each reviewing the high domestic price of energy, but each time taking the decision to remain with market-based pricing and a deregulated regime, and no return to the Oil Price Stabilization Fund. The story of electricity pricing is similar: in 2001, when electricity privatization was enacted, the total financial obligations of the National Power Corporation were more than PhP 900 billion (~USD 20.7 billion), with about 65% due to obligations from one-sided "take-or-pay" contracts with independent power producers. In both cases the major objectives of reform were to reduce the fiscal burden of energy subsidies, to introduce competition, increase private sector participation and ensure an efficient and reliable energy supply.

Energy sector and subsidy reform occurred alongside the Philippines' efforts to shift from fossil fuel-based sources to more renewable forms of energy, a key part of the government's strategy to provide energy supply for the country, reduce the country's dependence on imports and exposure to price fluctuations in international markets, and enhance environmental protection in pursuit of "greener" economic growth. Geothermal and hydro resources already account for a significant portion of power generation. The government has since targeted subsidies and policies toward expanding electricity networks and renewable forms of energy in the following ways:

- *A major reform of VAT in 2005* to finance short-term income support to the poor and long-term infrastructure, health and education programs. VAT was raised to 12% on gasoline, an excise tax added to gasoline, and a tax incentive created by setting VAT at 0% for renewables.
- *An expanded Rural Electrification Program* aiming for 90% household electrification by 2017. Extension of the grid and electrification is being developed through a mixture of measures, including a universal service obligation on distribution utilities

[1] Philipine peso. At time of writing 1 PhP = USD 0.022.

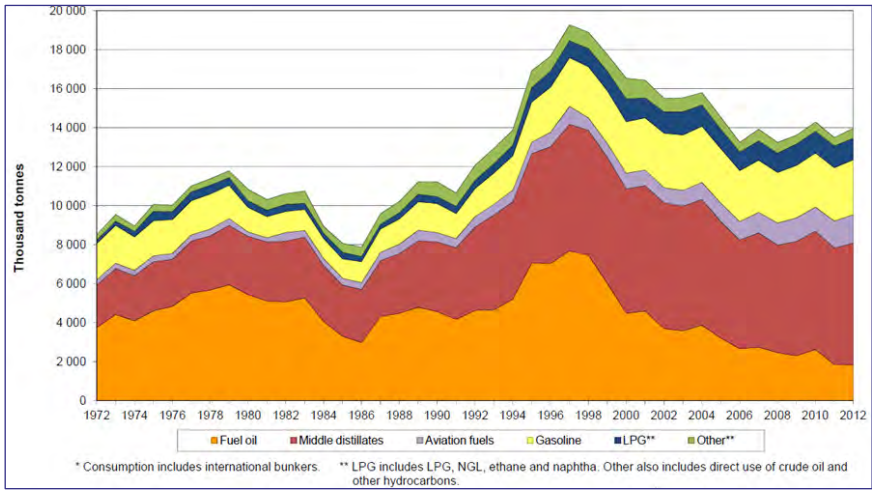
within franchise areas, a universal charge for missionary electrification on all electricity customers, and opening of unconnected areas to qualified third parties for electrification services. Third parties have been active in promoting renewable energy sources such as solar, wind and mini-hydro, especially to off-grid areas. In 2010 the Energy Regulatory Commission also approved PhP 2.763 billion (~USD 62.6 million) per year for 2010 to 2013 for the Small Power Utilities Group operations to support missionary electrification efforts.

- *Introduction of the Renewable Energy Act of 2008* which offered incentives for renewable energy projects, including income tax breaks (first seven years), duty-free imports for equipment (first 10 years), accelerated depreciation on equipment and a minimum percentage requirement. Furthermore, it also offered a 0% VAT rate on the sale of power from renewable generation, tax exemption on carbon credits and further tax credits on the purchase of domestically produced renewable equipment.
- *Introduction* of an initial feed-in tariff (FIT) system for electricity produced from renewables. A target of 760 MW to be covered by FIT rates over three years (or around 5% of the 2011 total installed capacity of the Philippines).
- *Investment* in domestically produced electric tricycles to reduce pollution with a grant from the Asian Development Bank and co-financing from the Clean Technology Fund, expected to deliver savings to operators (from the switch in fuel type), domestic jobs and reduced pollution.
- *Financing* the rehabilitation of the hydropower facilities in 2012.
- *A small universal charge* on grid electricity to support the management of watersheds.

Throughout this period of reform (2000–2009) energy efficiency improved. Energy use per capita declined and GDP per unit of energy use increased. At the same time, per capita electricity consumption increased. Carbon dioxide emissions per unit of GDP have declined by 10.4% from 1990 (IEA, 2014a) and the energy intensity of the Philippines' fuel mix has also decreased by 2% TPES/GDP (IEA, 2014a). Full market-based pricing of oil (i.e., complete removal of the subsidy and dismantling of the Oil Price Stabilization Fund) started in 1998. Since 1998 there has been a steep decline in consumption of oil products within the Philippines. However, this is likely linked to both a reduction in

demand due to the Asian financial crisis of 1997, (in 1998 the Philippines' growth rate dropped to virtually zero) coupled with the increasing price of oil on the world market from 1999 onwards, which was effectively passed through to the population due to dismantling of subsidies to oil products. These factors combined led to a reduction in demand for oil products.

Figure 10: Consumption of oil products, Philippines*



Source: Drawn from Mendoza and GSI (in press), Lessons Learned: Fossil-Fuel Subsidies and Energy Sector Reform in the Philippines, with additional research.

OECD/IEA (2014c). Based on IEA data from IEA Energy Statistics ©OECD/IEA 2014, IEA Publishing; modified by Global Subsidies Initiative. Licence: https://www.iea.org/t&c/termsandconditions/#d.en.26167

Reforms in the electricity sector in 2001 led to competition in generation and supply, open access to transmission and distribution networks, more consumer choice, unbundling of electricity tariffs and elimination of cross subsidies between different classes. Qualified third parties have been active in promoting renewable energy sources such as solar, wind and mini-hydro, especially in off-grid areas. Since the reforms generation of electricity from natural gas has increased significantly, while the generation of electricity from oil has shrunk considerably, renewables maintaining its share of the mix. As a result of this the carbon dioxide emissions per kWh from electricity generation have remained roughly constant within the Philippines since 2001, despite the growth of electricity generation. Drawn from Mendoza and GSI (in press), Lessons Learned: Fossil-Fuel Subsidies and Energy Sector Reform in the Philippines, with additional research.

5. Morocco

Subsidies rose in Morocco following the suspension of a mechanism to index domestic prices of food and fuel to international prices – and in 2013 a major subsidy reform program was launched to address the high cost of the subsidies. The reforms began with a reduction in gasoline and diesel subsidies. To manage the impacts of reforms, fuels that place a disproportionate burden on the poorest were originally excluded. The reduction in subsidies to fossil fuels has been coupled with a commitment to increasing the role of renewable energy, particularly solar energy. The experience of Morocco shows the importance a structured approach to subsidy reform and the need for high-level political engagement with reforms.

Table 5: Morocco subsidy reform timeline

Date	Reform	Fuels
1995–2000	Indexation of petroleum products to international market prices	Petroleum products
September 2000	Suspension of indexation	Petroleum products
2012	Subsidy costs reach 6.6% of GDP	All
2013	System of partial indexation re- introduced Electricity and butane excluded from indexation	Petroleum products
January 2014	Government decides to remove subsidies to Gasoline and industrial fuels. Timeline for diesel subsidy reform put in place. Subsidies remain for butane, diesel and petroleum products for ONEE. Electricity tariffs raised by 5%	Petroleum products, Electricity
July 2014	Rises of electricity tariffs of 2.9 -6.1 % announced. No price rise for those consuming less than 100kWh per month.	Electricity
2008–present	Public utility ONEE continues to make operating losses which will eventually have to be covered. A number of direct payments (subsidies) have been made to address this.	Electricity
July 2015	Morocco includes pledge in INDC to “Substantially reduc(e) fossil fuel subsidies, building on reforms already undertaken in recent years”	All

From 1995 to 2000 the prices of liquid petroleum products were indexed to international market prices. In September 2000 indexing was suspended as it became politically difficult to sustain due to high international prices (Verme, El-Massnaoui, & Araar, 2014). In the absence of

indexing the gap between national and international prices grew, leading to subsidy costs of 6.6% of GDP in 2012.

Subsidies were provided on basic food products as well as petroleum products including gasoline, diesel, fuel oil and LPG. The justification for subsidies was to ensure price stability, consumer purchasing power, and the promotion of selected industrial sectors.

In 2013 a system of partial indexation was reintroduced on petroleum products. In the electricity sector, the price of fuels for the *Office nationale de l'électricité et de l'eau* (ONEE) was excluded from the indexing system, so subsidies remained unreformed in this sector. Butane gas was also excluded from the system.

In January 2014 the *Cour des Comptes* published a review of the Moroccan subsidy system and made a series of proposals for reform (Cour des Comptes, 2014). On the January 16, 2014 the government decided to remove subsidies to gasoline and industrial fuels and reduce the subsidies to diesel according to a predefined timeline. These reforms had a significant impact on the overall subsidy level but left some of the most significant subsidies in place including most of the diesel subsidies, subsidies to butane and petroleum fuels. In 2014 the total allocation was DH 41.6 billion[2] (~4.2 USD billion) of which DH 36.6 billion (~USD 3.843 billion) was allocated to petroleum products. Between 2012 and 2014 the overall subsidy cost fell by around 25% (see table 2).

Table 6: Subsidy costs by product in million DH

Year	Petroleum products	Sugar	Flour	Total
2009	7,417	2,649	2,175	12,241
2010	24,282	3,263	2,467	30,012
2011	43,499	4,998	3,366	51,863
2012	48,237	5,027	3,000	56,264
2013	38,800	3,600	2,000	44,400
2014	36,650	3,000	2,000	41,650

Source: Cour des Comptes (2014).

Prime Minister Abdelilah Benkirane has been reported to have embarked on a comprehensive communications plan to convince the public of the need for reform. Nizar Baraka, Morocco's minister of General Affairs and Governance was quoted as saying "The prime minister explained it to the people, continuously" (Daragahi, 2015).

The electricity sector is primarily affected by subsidies on those petroleum products that ONEE uses as fuels. The fuel provided to ONEE was

[2] As of 17th February 2015 1 Moroccan Dirham (DH) is equal to USD 0.105 Dollars.

subsidized by around DH 5.1 billion in 2013, around 13% of the total cost of subsidies. In addition, as a publicly owned company, losses made by ONEE will eventually have to be covered by public funds. ONEE has reported losses every year since 2008 due to regulated tariffs below cost-recovery levels. To address this, a price rise of 5% on retail tariffs was reported in January 2014 and a rise of 2.9 to 6.1% was announced in July 2014. These rises do not apply to those consuming less than 100 kWh per month (Laaboudi, 2014; Bladi.net, 2014). The goal of these increases was to improve the financial situation of the ONEE. In addition, a number of direct payments are reported to have been made to ONEE since 2009, including a grant for "recapitalization of the Office" in 2012 of DH 1 billion (Lahbabi, 2014). There are no subsidies for coal or other fuels. The rise of fuel subsidies to ONEE has been driven by increase investment spending due to increasing demand for electricity, starting in 2006, which has placed pressure on the finances of ONEE. The evolution of subsidies to fuel for ONEE is shown in Table 7.

Table 7: Consumption and subsidies to ONEE fuel

Label	Product	2008	2009	2010	2011	2012	2013
Consumption (in thousand tonnes)	Normal fuel ONEE	578	887	1,096	1,052	1,041	1,017
	Special Fuel ONEE	-	67	186	592	581	303
Subsidies (in million DH)	Normal fuel ONEE	1,127	986	2,331	3,643	4,313	3,650
	Special Fuel ONEE	0	131	526	2,676	2,883	1,500
Total Subsidies ONEE		1,127	1,117	2,857	6,319	7,196	5,150

Source: Cour des Comptes (2014).

The Moroccan government has adopted a dual approach to mitigating the adverse impacts of energy price increases on low-income households. Firstly, two existing nationwide social safety nets were significantly enlarged. The TAYSSIR conditional cash transfer program targeting poor rural households expanded from 80,000 families in 2009 to 466,000 families in 2014. Similarly, a health insurance scheme for the poor, RAMED, increased its coverage from 5.1 million beneficiaries in mid-2013 to 8.4 million beneficiaries in early 2015. Secondly, reforms have been decidedly "pro-poor" in that the most regressive subsidies – those that benefit the poor the least – have been eliminated.

Since 2000, total electricity production has approximately doubled to over 25 terawatt hours (TWh), with the vast majority supplied from coal, gas and oil. Despite the increase in electricity generation, coal generation has remained constant at around 12 TWh since 2000 with much of the increase coming from gas, oil and an interconnector to Spain which has been in place since 2005 (IEA, 2014c) (IEA, 2014a). To

tackle the challenge of rising energy consumption, dependence on imports and increasing carbon emissions the Moroccan Solar Plan aims to establish a USD 9 billion investment plan to install at least 2,000 MW of solar concentrating generation capacity by 2020 (MASEN, 2015). Building the four power plants of the Ouarzazate complex in particular will lower the cost of concentrated solar power worldwide. Already, each successive tender has brought prices down, sending production costs down to USD 0.15 per kilowatt in the latest bid, and the technology is claimed to be approaching "grid parity" (Yaneva, 2015; Reuters, 2015). Morocco has ambitious renewables targets of 2 GW of wind power, 2 GW of solar power and to increase hydropower by 2 GW of capacity by 2020. This should represent 42% of installed capacity by 2020 (OECD/IEA, 2014).

A key impact of the reforms is the reduction in the subsidy cost by one quarter since 2012. This has created fiscal space and freed resources for spending in other areas. Subsidy reform has been an enabling factor for the planned expansion of renewable energy.

In terms of macroeconomic indicators, it is still too early to evaluate the impact of the 2013 and 2014 subsidy reforms on environmental and economic performance. The most recent data available has shown 4.4% GDP growth in 2013 and 2.6% in 2014, higher than the MENA average of 0.5% in 2013 and 2.2% in 2014, perhaps showing better than average management of the economy.

It may take some time before a full analysis of the reforms can be completed. However, the increase in energy prices that is likely to accompany a removal of subsidies may help to slow the upward trend of primary energy use and carbon emissions. Total primary energy use in Morocco rose by 146.7% between 1990, and 2012 and total carbon emissions were estimated to be 51.84 $mtCO_2$ in 2012 and have increased by 76% since 2000 (IEA, 2014a).

Even before the recent subsidy reforms, the energy intensity index, a measure of the total primary energy supply per unit of GDP, has fallen by 4.5% since 2000, indicating energy is being used more efficiently. RCREEE reports that Morocco is more efficient than the regional average (Missaoui, Ben Hassine, & Mourtada, 2012). The increase in fossil fuel prices caused by fossil fuel subsidy reform is expected to reduce demand for these fuels, encourage fuel switching and further reducing energy intensity.

The planned increase in solar energy capacity will also displace imports, reduce fossil fuel subsidies and improve the overall environmental performance of the electricity sector.

6. Jordan

Jordan is a clear example of the link between reforms of consumer fossil fuel subsidies and emissions reductions due to an initial demand decrease. However, it perhaps also represents a missed opportunity to utilize savings from FFSR toward energy efficiency and renewables to maintain emissions reductions for the long term.

Despite significant solar resources, most of Jordan's energy needs – 97 % in 2011 – are met through imports of natural gas and oil. As of today, petroleum products in Jordan are cost-reflective, with prices adjusted on a monthly basis to reflect international prices (Vagliasindi, 2013) and Jordan's efforts to reform fossil fuel subsidies are widely thought of as successful.

In 2005, energy subsidies reached 5.8% of GDP, and represented a considerable and increasing burden on the national budget (Bridle, Kitson, & Wooders, 2014). In absolute figures, subsidies increased from USD 60 million in 2002 to USD 711 million in 2005 (Vagliasindi, 2013), mainly caused by rising oil prices in the wake of the U.S. invasion of Iraq in 2003 which – among other things – meant a stop to cheap oil imports. In an attempt to alleviate this burden, the government introduced a wide-ranging reform of subsidies, encompassing both petroleum products and electricity (Bridle, Kitson, & Wooders, 2014). The reforms were implemented via an ambitious three-stage plan designed to phase out fossil fuel subsidies between 2005 and 2008 (Vagliasindi2013).

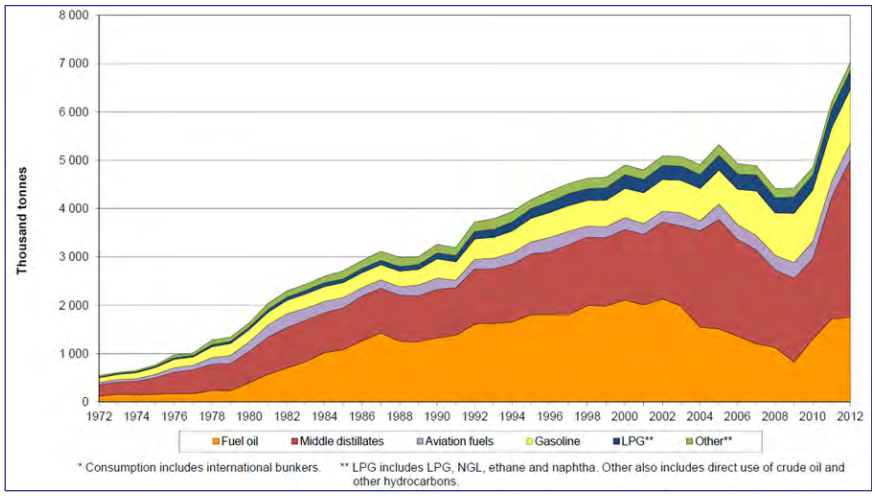
In July and September 2005, the government of Jordan raised fuel prices, with gasoline prices increasing by around 10%, fuel oil for power by 33% and fuel oil for industry by 59%. However, as international oil prices continued to increase steadily, initial reform efforts did not prevent subsidies from growing, and the government was forced to increase prices again in April 2006. By 2008 subsidies were fully removed, which resulted in price increases ranging from 16% for gasoline to 76.5% for LPG (Bridle, Kitson, & Wooders, 2014).

The reform was a qualified success until 2011. Energy subsidies declined from 5.8% of GDP in 2005, to 2.6% in 2006, to 0.4% in 2010 (Fattouh & El-Katiri, 2012). However, in 2011 protests against rising living

costs and unemployment led the government to reduce fuel prices and to temporarily suspend the automatic fuel adjustment mechanism. By 2012 the suspension was lifted and in November 2012 the government of Jordan announced that it had removed the remaining subsidies on oil products (Bridle, Kitson, & Wooders, 2014).

The graph below shows a consistent decline of overall oil consumption in Jordan during the 2005 to 2008 reform period. However, the graph also shows that Jordan saw a steep increase in overall oil consumption when it reintroduced fossil fuel subsidies in 2011. It should also be noted, though, that the increase in overall oil production from 2009–2012 is partly influenced by developments in Jordan's electricity sector. These are described more fully below.

Figure 11: Consumption of oil products, Jordan*



OECD/IEA (2014a) Based on IEA data from IEA Energy Statistics ©OECD/IEA 2014, IEA Publishing; modified by Global Subsidies Initiative. Licence: https://www.iea.org/t&c/termsandconditions/#d.en.26167

Source: Drawn from Mendoza and GSI (in press), Lessons Learned: Fossil-Fuel Subsidies and Energy Sector Reform in the Philippines, with additional research.

In the electricity sector, the government followed a separate reform, liberalizing the sector and setting up an independent regulator (the Electricity Regulatory Commission) to regulate the tariffs that the system operator (the National Electric Power Company [NEPCO]) and distribution companies can charge end users (Bridle, Kitson, & Wooders, 2014). Largely cost-reflective electricity tariffs meant that subsidies were reduced through to 2009. However, in 2010 subsidies rose due to continued interruption of Egyptian gas supplies, which forced NEPCO to use

internationally priced fuel oil for generation, while selling power at regulated prices (Bridle, Kitson, & Wooders, 2014). In August 2012 the Electricity Regulatory Commission announced increases in electricity tariffs aimed at reducing the disparity between costs of generation and user end charges, thereby improving cost recovery in the electricity sector (Hazaimeh, 2012).

Jordan is rightly considered one of the most successful cases of implementing FFSR in the MENA region. However, while the driver for reform has primarily been fiscal pressure, a key element of FFSR is also its impact on the environment and the opportunity to promote sustainable growth. In this regard, the longer-term impacts of Jordan's reform efforts are more ambiguous. While energy intensity in Jordan decreased sharply from 2005 to 2010 in parallel to domestic reform efforts, energy intensity levels has been stagnating since. This suggests that the initial benefits from reform – in terms of energy efficiency – have levelled out despite further efforts to increase energy prices.

IEA data also shows that Jordan's CO_2 emissions per kWh of electricity generated are to some degree linked to the level of cost reflectivity of domestic tariffs. CO_2 emissions decreased steadily from 660 tonnes in 2005 to 584 tonnes in 2009 during the reform period; however, they subsequently increased to 636 tonnes in 2012 (IEA, 2014a). Similarly, Jordan's CO_2 emissions per GDP saw a significant decline between 2005 and 2010. However, from 2010–2012 CO_2 emissions per GDP have been steadily increasing, reversing initial environmental benefits. It is still too early to conclude that Jordan's reform efforts have led to a significant change in its energy mix and the country is still heavily reliant on imported oil and gas. Nonetheless, the removal of subsidies have helped to create a more level playing field for the deployment of renewable energy capacity which might in the longer term pave the way to a more CO_2-efficient energy sector.

7. Conclusion

This report finds that the reform of fossil fuel subsidies is a policy tool that governments have at their disposal that will lead to emissions reductions as well as government savings. Modelling across 20 countries finds that early phase-out by 2020 leads to average national emissions reductions of between 6 and 11%. This national country-level research fits with broader models at a global level that find global reductions of between 6 and 10%. Moreover, FFSR is an efficient policy tool for the removal of GHG emissions: for every tonne of GHGe removed, around USD 93 is saved annually. Wider research also points to the case of FFSR as a "foundation" policy on which to build energy efficiency and renewable energy policies.

Working closely with governments to properly account for and understand existing subsidies using a bottom-up national inventory approach is key to eliminating them and measuring potential emissions reductions. Furthermore, by investing a modest portion of savings back into renewable and energy efficiency measures, emissions reductions can be increased further to a national average of around 18%. A growing number of countries are recognizing this as a potential tool that has been (and could be further) utilized regarding implementing Intended Nationally Determined Contributions (INDCs).

Technical assistance should be made available not only toward the work of economic and policy reform of subsidies but also toward understanding the emissions implications of such policy changes. The Nordic Council of Ministers has enabled the development of a model to enable countries to measure potential emissions reductions from this fiscal tool (the GSI-Integrated Fiscal model). The focus now must be on working with countries to understand and utilize all those tools, including fiscal tools such as subsidy reform, basic fuel taxation and carbon pricing, as well as regulatory tools, in order to shift energy pathways toward a more secure low-carbon trajectory.

The presence of fossil fuel subsidies is holding new energy players back, like renewables and energy efficiency; while the removal of such subsidies, and a transfer of savings to new energy players, increases their chance of success on the energy playing field. The period of low oil prices that has continued throughout the first three quarters of 2015 is a short window of opportunity for countries to tackle subsidies once and for all – will countries make the play?

8. References

Anderson, K. & McKibbin, W. J. (2000). Reducing coal subsidies and trade barriers: Their contribution to greenhouse gas abatement. *Environment and Development, 5*(2000), 457–81.

Arze Del Granado, J., Coady, D., & Gillingham, R. (2010). *The unequal benefits of fuel subsidies: A review of evidence for developing countries* (IMF Working Paper 10/22). Retrieved from http://www.imf.org/external/pubs/ft/wp/2010/wp10202.pdf

Asian Development Bank (ADB). (in press). Policy report: Fossil fuel subsidies in Asia: Trends, Impacts and reforms. ADB.

Beaton, C., Christensen, L., & Lontoh, L. (2015). An Input to Indonesian Fuel Price System Reforms. Winnipeg/Geneva: IISD/GSI. Retrieved from http://www.iisd.org/gsi/sites/default/files/ffs_indonesia_pricing.pdf

Beaton, C., Gerasimchuk, I., Laan, T., Lang, K., Vis-Dunbar, D., & Wooders, P. (2013). *A guidebook to fossil fuel subsidy Reform for policy-makers in Southeast Asia.* Retrieved from http://www.iisd.org/gsi/sites/default/files/ffs_guidebook.pdf

Bladi.net. (2014, July 25). *Après l'essence, le prix de l'électricité augmente au Maroc*. Retrieved from http://www.bladi.net/prix-electricite-maroc,39957.html

Bridle, R. (2014). *The annual cost of energy subsidies is greater than the total cost of meeting 2020 renewable energy targets in the Middle East and North Africa*. BSI's Subsidy Watch Blog, Retrieved from http://www.iisd.org/GSI/news/annual-cost-energy-subsidies-greater-total-cost-meeting-2020-renewable-energy-targets-middle

Bridle, R. & Kitson, L. (2014). *The impact of fossil-fuel subsidy reform on renewable electricity generation*. Retrieved from https://www.iisd.org/gsi/sites/default/files/ffs_rens_impacts.pdf

Bridle R., Kitson, L. & Wooders, P. (2014). *Fossil-fuel subsidies: A barrier to renewable energy in five Middle East and North African countries.* Retrieved from http://www.iisd.org/gsi/sites/default/files/fossil-fuel-subsidies-renewable-energy-middle-east-north-african-countri%20%20%20.pdf

Burniaux, J. & Chateau, J. (2011). *Mitigation potential of removing fossil fuel subsidies: A general equilibrium assessment* (OECD Economics Department Working Papers No. 853). Retrieved from http://dx.doi.org/10.1787/5kgdx1jr2plp-en

Burniaux, J. & Chateau, J. (2014). Greenhouse gases mitigation potential and economic efficiency of phasing-out fossil fuel subsidies. *International Economics*, 140, 71–88. http://dx.doi.org/10.1016/j.inteco.2014.05.002

Clarke, K. (2015). *Diesel subsidy reform in India: Lessons learned*. Winnipeg/Geneva:IISD/GSI. Retrieved from http://www.iisd.org/gsi/sites/default/files/ffsr_india_lessons%20learned_may_2015.pdf

Coady, D., Parry, I., Sears, L., & Shang, B. (2015). *How large are global energy subsidies?* (IMF Working Paper WP/15/105). Retrieved from https://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf

Cour des Comptes. (2014). *Rapport sur Le système de compensation au Maroc Diagnostic et propositions de réforme*. Royame du Maroc.

Fattouh, B. & El-Katiri, L. (2012). *Energy subsidies in the Arab world* (Arab Human Development Report, Research Paper Series). United Nations Development Programme, Regional Bureau for Arab States. Retrieved from http://www.arabhdr.org/publications/other/ahdrps/Energy%20Subsidies-Bassam%20Fattouh-Final.pdf

Global Subsidies Initiative (GSI)/International Institute for Sustainable Development (IISD). (2015). *Indonesia Energy Subsidy Review* 1(2). Retrieved from http://www.iisd.org/gsi/sites/default/files/ffs_indonesia_reviewi2v1_english.pdf

GSI. (2015). Interactive maps. http://www.iisd.org/gsi/interactive-maps

Hassanzadeh, E. (2012). *Recent developments in Iran's energy subsidy reforms*. Winnipeg/Geneva: IISD/GSI. Retrieved from https://www.iisd.org/gsi/sites/default/files/pb14_iran.pdf

Hazaimeh, H. (2012). Gov't to raise electricity tariffs to address budget crisis – senior official. *Jordan Times*. Retrieved from http://jordantimes.com/govt-to-raise-electricity-tariffs-to-address-budget-crisis----senior-official

Ibarrarán, M. E., Bassi, A.M, & Boyd, R. (2015). *Integrating SD + CGE models to assess green economy policies: Methods and Application to Mexico*.

Intergovernmental Panel on Climate Change (IPCC). (2014). *Climate Change 2014 Synthesis Report Summary for Policymakers*. Retrieved from http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

International Energy Agency (IEA). (2014a). *CO_2 emissions from fuel combustion* (2014 edition).

IEA. (2014b). *Energy efficiency market report 2014*. Retrieved from https://www.iea.org/bookshop/463-Energy_Efficiency_Market_Report_2014

IEA. (2014c). *Morocco 2014 energy policies beyond IEA countries*. Retrieved from http://www.iea.org/bookshop/482-Morocco_2014

IEA. (2014d). *World energy outlook 2014*. Retrieved from http://www.worldenergyoutlook.org/publications/weo-2014/

IEA. (2015). *Energy and climate change* (World Energy Outlook Special Report). Retrieved from http://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf

IEA, WB, OECD, IMF, & GSI (2014). *Comparison of fossil fuel subsidy and support estimates*. Retrieved from https://www.iisd.org/gsi/sites/default/files/ffs_methods_estimationcomparison.pdf

International Monetary Fund (IMF). (2014). *Getting energy prices right*.

International Renewable Energy Agency (IRENA). (2015, January). Renewable Power Generation Costs in 2014. Retrieved from http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=494

Jakob, M., Steckel, J. C., Klasen, S., Lay, J., Grunewald, N., Martínez-Zarzoso, I. *et al*. (2014). Feasible mitigation actions in developing countries. *Nature Climate Change*, 4, 961–968. doi:10.1038/nclimate2370

James, L. M. (2015). *Recent developments in Egypt's fuel subsidy reform process*. Retrieved from https://www.iisd.org/gsi/sites/default/files/ffs_egypt_lessonslearned.pdf

Khansker, S. R., Samad, H. A. , Sadeque, Z. K. M. , Asaduzzaman, M. , Yunus, M., & Enamul Haque, A. K. (2014). *Surge in solar-powered homes experience in off-grid rural Bangladesh*. World Bank.

Laaboudi, J. (2014, January 1). *L'électricité et l'eau seront plus chères au Maroc en 2014*. Retrieved from http://www.bladi.net/electricite-eau-cheres-maroc.html

Lahbabi, A. (2014). *Project of energy pricing and renewable energy deployment*.

Ley, M., Stucki, T., & Woerter, M., (2013). *The impact of energy prices on environmental innovation*. Zurich: KOF Swiss Economic Institute. Retrieved from http://kof.ethz.ch/en/publications/p/kof-working-papers/340/

Lin, B. & Jiang, Z. (2011). Estimates of energy subsidies in China and impact of energy subsidy reform. *Energy Economics*, 33 (2011), 273–283.

Lin, B. & Ouyang, X. (2014). A revisit of fossil-fuel subsidies in China: Challenges and opportunities for energy price reform. *Energy Conversion and Management*, 82 (2014), 124–134.

MacCarthy, A. (July 2015). United Arab emirates reforms fossil fuel subsidies. *GSI/IISD Subsidy Watch Blog* http://www.iisd.org/gsi/news/united-arab-emirates-reforms-fossil-fuel-subsidies

Missaoui, R., Ben Hassine, H., & Mourtada, A. (2012). *Energy efficiency indicators in the Southern and Eastern Mediterranean countries*. RCREEE.

Moroccan Agency for Solar Energy (MASEN) MASEN. (2015). Retrieved from http://masen.org.ma/index.php?Id=5&lang=fr#/_

Merrill, L. (2014). *Reform of fossil-fuel subsidies, Nordic Cooperation on fossil-fuel subsidies reform in developing countries: assessing options and opportunities*. Global Subsidies Initiative/IISD. Retrieved from http://www.norden.org/en/publications/publikationer/2014-903

Merrill, L., & Gagnon-Lebrun (2015). Carbon Subsidies + climate change – Morocco Includes Fossil fuel subsidy reform within National Contributions towards UNFCCC. *Subsidy Watch Blog, GSI/IISD*.

Merrill, L. Harris, M., Casier, L., & Bassi. M. A. (2015). *Fossil-fuel subsidies and climate change: Options for policy-makers within their Intended Nationally Determined Contributions GSI for the Nordic Council of Ministers*. http://dx.doi.org/10.6027/NA2015-905

Ogarenko, I. ,& Hubacek, K. (2013) Eliminating Indirect energy subsidies in Ukraine: Estimation of environmental and socioeconomic effects using input-output modeling. *Journal of Economic Structures* (2013) 2:7

Oil Change International (OCI) and Overseas Development Institute (ODI) (2014). *The fossil fuel bailout: G20 subsidies for oil, gas and coal exploration*. Retrieved from http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9234.pdf

Organisation for Economic Co-operation and Development (OECD). (2013). *Effective carbon prices*. Paris: OECD. DOI: http://dx.doi.org/10.1787/9789264196964-en

OECD. (2015). *Support to fossil fuels remains high and the time is ripe for change*. Retrieved from http://www.oecd.org/environment/support-to-fossil-fuels-remains-high-and-the-time-is-ripe-for-change.htm

OECD/IEA. (2014a). *Consumption of oil products: Jordan*. Retrieved from http://www.iea.org/stats/WebGraphs/JORDAN1.pdf

OECD/IEA (2014c). *Consumption of oil products: Philippines*. Retrieved from http://www.iea.org/stats/WebGraphs/PHILIPPINE1.pdf

OECD/IEA (2014). *Morocco 2014- Energy Policies Beyond IEA Countries*. Retrieved from http://www.iea.org/Textbase/npsum/morocco2014sum.pdf

Reuters. (2015, January). *Saudi's ACWA Power wins $2bn Morocco solar power deal*. Retrieved from https://www.thebig5hub.com/news/2015/january/saudis-acwa-power-wins-2bn-morocco-solar-power-deal/

Schwanitz, V.J., Piontek, F., Bertram, C., & Luderer, G. (2014). Long-term climate policy implications of phasing out fossil fuel subsidies. *Energy Policy*, 67 (2014), 882–894.

Stefanski, R. (2014). *Dirty little secrets: Inferring fossil-fuel Subsidies from patterns in emissions intensities*. Retrieved from http://www.oxcarre.ox.ac.uk/files/OxCarreRP2014134(1).pdf

United Nations Environment Programme. (2014). *Lifting the darkness on the price of light: Assessing the effect of fuel subsidies in the off-grid lighting market*. UNEP/NONE/2014/1/REV.1. Retrieved from http://global-off-grid-lighting-association.org/wp-content/uploads/2015/01/Lifting-the-Darkness-Effects-of-Fuel-Subsidies.pdf

Vagliasindi, Maria (2013). *Implementing Energy Subsidy Reforms, Evidence from Developing Countries*. Washington, D.C.: World Bank. Retrieved from http://elibrary.worldbank.org/doi/abs/10.1596/978-0-8213-9561-5

Verme, P., El-Massnaoui, K., & Araar, A. (2014, February). *Reforming subsidies in Morocco*. Retrieved from http://siteresources.worldbank.org/EXTPREMNET/Resources/EP134.pdf

Yaneva, M. (2015). *Morocco sees solar grid parity just around the corner - report*. Retrieved from http://renewables.seenews.com/news/morocco-sees-solar-grid-parity-just-around-the-corner-report-490305#

Van den Bergh, K., & Delarue, E. (2015). Quantifying CO_2 abatement costs in the power sector. *Energy Policy*, 80, 88-97.

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The Global Subsidies Initiative (GSI) of IISD works to reduce and eliminate unsustainable energy subsidies in ways that promote sustainable development: to improve economic growth, encourage low-carbon fiscal policies, reduce poverty, build sustainable energy systems and improve environmental quality. The GSI works alongside international processes and organisations that support sustainable fossil fuel reforms; with government policy-makers to help them plan, prepare, and maximise the benefits of reform; and with national partners (CSOs and Research Institutes) to improve transparency, and create the environment for long-term, sustainable, energy subsidy reform. For more information see www.iisd.org/gsi

10. Sammanfattning

Subventionerna till fossila bränslen till konsumenter uppgår globalt till 500 miljarder US-dollar per år, vilket är fyra gånger så mycket som subventionerna till förnybara energikällor och fyra gånger så mycket som de privata investeringarna i energieffektivitet. Den här rapporten innehåller ny forskning om effekterna som en reform av dessa subventioner skulle ha på de nationella utsläppen av växthusgaser genom en modellering av denna policyförändring i 20 länder från nu fram till år 2020. Enligt undersökningen skulle den genomsnittliga minskningen bli 11 % enbart genom att slopa subventionerna till fossila bränslen genom att vidta åtgärder före 2020. Denna siffra kan öka till hela 18 % om en liten andel av besparingarna (30 %) återinvesteras i energieffektivitet och förnybara energikällor. Den sammanlagda besparingen i samtliga 20 länder fram till 2020 uppgår till 2,8 Gt koldioxidekvivalenter. Det förändrar tidigare global forskning på området, då en rad globala och nationella modeller tidigare har visat på utsläppsminskningar på mellan 6 och 13 % fram till 2050.

Som politiskt verktyg är reformen av subventionerna till fossila bränslen (fossil fuel subsidy reform, FFSR) ett extremt kostnadseffektivt sätt att minska koldioxidutsläppen jämfört med andra verktyg för att minska utsläppen. De flesta politiska verktyg för att få bort koldioxid från de nationella utsläppskällorna medför kostnader för ländernas regeringar. Enligt den här undersökningen medför FFSR en genomsnittlig årlig *besparing* på nästan 93 USD per ton minskade växthusgasutsläpp. Vidare är FFSR en *grundläggande policy* för att framgångsrikt kunna införa många andra policyer inom energi och klimat: energieffektivitet, förnybara energikällor, innovation, prissättning och beskattning av koldioxid, infrastruktur för allmänna kommunikationer och för att generera inhemska resurser för en övergång till energikällor med låga koldioxidutsläpp.

Andra länder i världen kan titta på fallstudierna i Jordanien, Marocko och Filippinerna för användbara erfarenheter av reformen. Marocko har exempelvis tagit bort subventionerna till fossila bränslen och vänt investeringar och stöd mot solenergi.

Som ett resultat av denna undersökning och Friends of Fossil Fuel Subsidy Reforms pågående ansträngningar har en rad olika länder in-

kluderat detta politiska verktyg i sina bidrag, Intended Nationally Determined Contributions (INDC). Samtidigt har andra länder gått vidare gemensamt och inkluderat mer omfattande reformer inom energiprissättning och energisektorn. En rad länder har gått med i Friends of Fossil Fuel Subsidy Reform till stöd för en internationell kommuniké som efterlyser genomsynlighet, ambition och riktat stöd till de fattigaste. Denna rapport stöder dessa länders satsningar.

10.1 Förord

Subventionerna till fossila bränslen uppgår till 550 miljarder USD per år, vilket är fyra gånger så mycket som subventionerna till förnybara energikällor. På global nivå subventionerar vi fortfarande fossila bränslen som orsakar klimatförändringar. Konkurrerande intressen mellan regeringarna kan leda till att de sticker huvudet i sanden och hanterar en politisk åtgärd åt gången. Alltför ofta hanteras reformer av subventioner av fossila bränslen på det sättet av regeringar. Men nu har man ett gyllene tillfälle. Med de låga oljepriserna kan regeringarna gruppera om bland sina olika ministerier för att planera för en utfasning av subventioner till fossila bränslen genom att skapa likvärdiga förutsättningar på energiområdet så att nya spelare med låga koldioxidutsläpp, som förnybara energikällor, energieffektivitet och kollektivtrafiksystem, kan konkurrera på ett rättvist sätt mot de befintliga aktörerna inom fossila bränslen.

Den här rapporten beskriver hur länder som Marocko, Jordanien och Filippinerna har hanterat subventioner av fossila bränslen i energisystemet, ger exempel på planer för investeringar i förnybara energikällor, energieffektivitet och införandet av en skatt på fossila bränslen för att få in pengar till staten för att finansiera utvecklingen. Denna forskning, som stöds av de nordiska länderna via Nordiska ministerrådet och i partnerskap med IISD:s initiativ Global Subsidies Initiative, ger regeringarna ett nytt verktyg för att mäta utsläppsminskningar. Det görs genom en reform av subventionerna och efterföljande återvinning av en liten andel av besparingarna till de nya spelarna på energiområdet, med stora positiva effekter på utsläppen. Med årliga utsläppsminskningar på omkring 11 % och genomsnittliga ekonomiska besparingar på omkring 93 USD per ton koldioxid som avlägsnas från systemet, är en reform av subventionerna till fossila bränslen en åtgärd som politikerna inte längre har råd att ignorera. Att återinvestera en del av besparingarna i hållbar energi för alla kommer att innebära att man lämnar över bollen till de nya energispelarna och hjälper dem att vinna spelet om männi-

skorna och vår planet. De nordiska länderna stödjer länders satsningar på detta och många är medlemmar i en grupp länder kallad ”the Friends of Fossil Fuel Subsidy Reform”. Gruppen välkomnar alla länder att gå med och stödja en internationell kommuniké i denna fråga. Forskningen i denna rapport stödjer alla de länder som arbetar mot en säkrare, tryggare och mer hållbar framtid inom energi genom att avskaffa subventionerna till fossila bränslen.

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vice statsminister

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Tackling Fossil Fuel Subsidies and Climate Change: Levelling the energy playing field

This report presents a model that analyses fossil fuel subsidy reform across 20 countries showing an average reduction in national GHG emissions of 11% by 2020, and average annual government savings of USD 93 per tonne of CO_2 abated. With a modest recycling of resources to renewables and energy efficiency, emissions reductions can be improved to an average of 18%. Some countries have included reforms in Intended Nationally Determined Contributions, toward a climate agreement. The report presents case studies from Morocco, Philippines and Jordan. Authored by the Global Subsidies Initiative of IISD, as part of the Nordic Prime Ministers' green growth initiative www.norden.org/greengrowth and www.nordicway.org

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