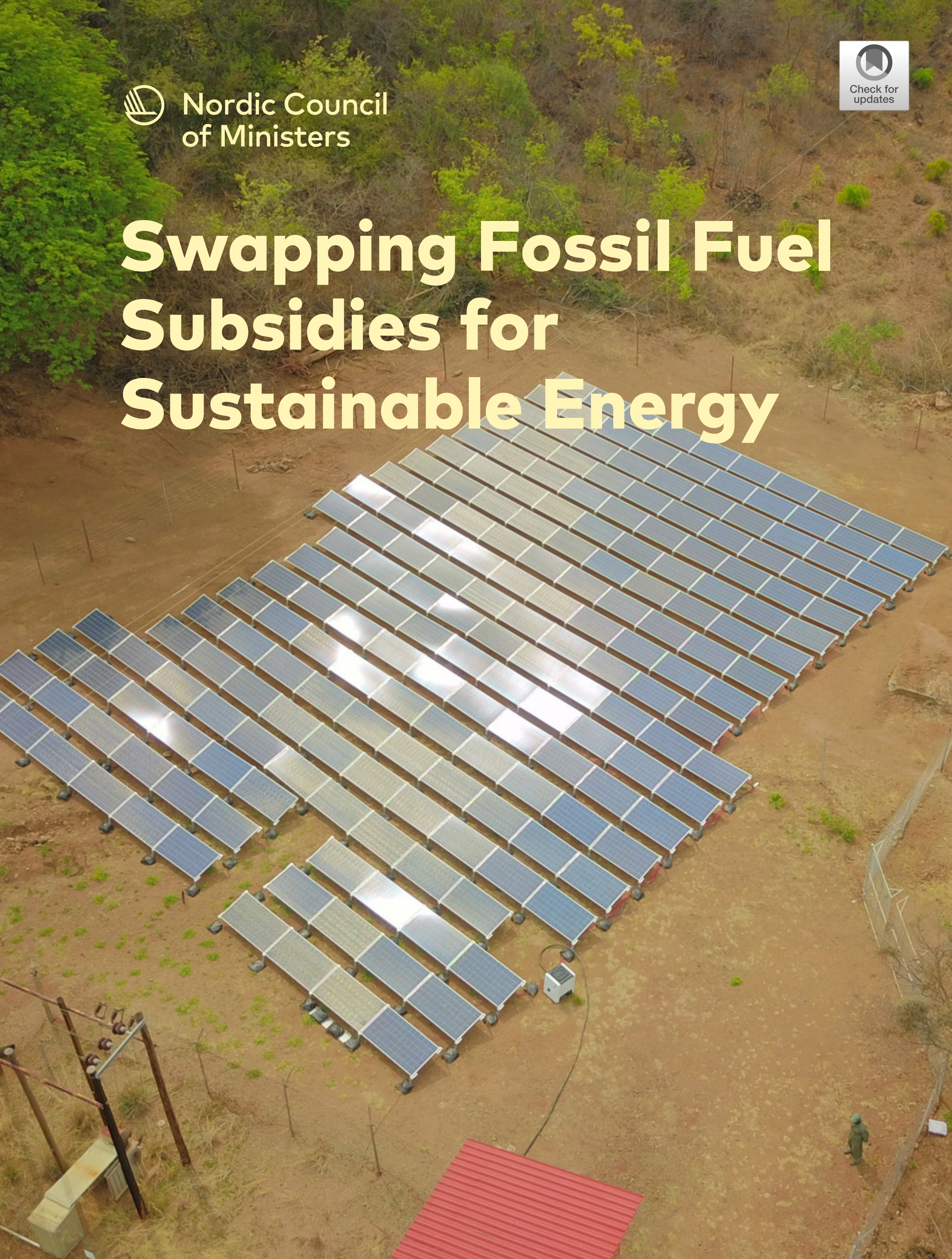

Nordic Council of Ministers

Swapping Fossil Fuel Subsidies for Sustainable Energy

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Richard Bridle, Laura Merrill, Mikko Halonen, Anna Zinecker, Markus Klimscheffskij and Paula Tommila

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Foreword

When climate change came onto the political agenda about three decades ago, economists quickly pointed to the benefits of abolishing subsidies to fossil fuels. One term used was a "no regrets" policy. As an example, the IPCC in its Second Assessment Report in 1995 referred to 10–30% energy efficiency gains over and above baseline scenarios in two or three decades, and more in the long run, at negative or no costs. The advice was clear: Just do it! Did we?

Three decades later the world economy will soon have trebled compared to then, while global population and greenhouse gas emissions have soared by about 50%. In some parts of the world much of the subsidies are indeed removed and prices are closer to reflecting costs. Pressure on state finance, a drop in fossil fuel prices for some time and climate awareness has made countries rethink their policies. In addition, there have been considerable efforts by many to analyse such subsidies and consider possible alternatives to business as usual. Some of these studies have shown that such subsidies are often not the best way to deal with socioeconomic and developmental challenges, and that resources saved from eliminating or reducing subsidies could be more usefully put to use in other ways. Still many direct and indirect subsidies through tax systems have been in place for a reason, groups are gaining from them and thus subsidies are not easily abolished.

Last year the Global Subsidies Initiative (GSI) of IISD and Gaia produced a report for the Nordic Council of Ministers (NCM) reminding us that direct and indirect subsidies are still vast. Potential gains of reducing them and swapping the revenue for other uses are still major. Modelling shows that in just a few years abolishment could reduce emissions from across 20 countries by more than 10%, and up to 18% if some revenues were to be recycled for energy efficiency and renewable energy.

In the current project, the NCM wanted to go beyond analysis and contribute to processes on the ground, and in that way assess practical and political feasibility of fossil fuel subsidy reform in chosen countries. One crucial aspect here is the issue of whether resources spent on subsidies today could be used in more beneficial ways. The concept of swaps, utilizing freed resources for more direct developmental benefits including renewable energy, has been central in this regard. The project has concentrated in particular on Zambia and also on Morocco. The project has sought to involve stakeholders, including mapping their interests as well as outlining road-maps for swaps between subsidies and support to low emissions solutions. The report thus provides examples of which types of activities could be affected, as well as how saved revenue could finance activities that would reduce emissions.

The project is funded by the Nordic Prime Ministers' Initiative, partly from Nordic working group for global climate negotiations (NOAK). The aim of NOAK is to contribute to an ambitious and effective implementation of the UNFCCC and the Paris Agreement, with a Nordic perspective. To this end, the group prepares studies and reports, conducts meetings, and organizes conferences supporting Nordic and international negotiators in the climate negotiations. I hope the project has helped laying the foundation for a move in the right direction in the focused countries, as well as serving as inspiration to other countries that are aiming at reducing or avoiding subsidies to fossil fuels and create a low emissions development path.

Oslo, October 2018

Peer Stiansen
Chair of the Nordic Working Group for Global Climate Negotiations (NOAK)

Executive Summary

Too many governments are still under-pricing fossil fuels, either by maintaining fossil fuel subsidies or by failing to adequately tax fossil fuels. Many others are reforming subsidies and starting to put in place better taxation of fossil fuels to save and raise money, as well as developing and strengthening social safety nets. All governments could consider making a swap and switching subsidies earmarked for fossil fuels in annual government budgets year on year, through direct transfers and tax breaks, into incentives and encouragement for a sustainable and low-carbon energy future. In 2017, fossil fuel subsidies stood at around USD 400 billion, with support given to both consumer and producer subsidies and often grandfathered in year after year. These subsidies now look outdated and inefficient, economically counterproductive and dangerous, as they drive consumers toward carbon-intensive consumption in an increasingly carbon-constrained world. A shift is needed to swap the subsidies away from fossil fuels and toward the benefit of people, sustainable energy and economies. A swap would help shift the equipment, the skills, the jobs and our energy consumption patterns away from a system that is built on extracting and burning fossils and toward a carbon-free energy future for all.

The technology exists to make such a future possible; the issue now concerns timing. The IPCC explains that there is a strong need for immediate action to halve emissions by 2030 and attain carbon neutrality by 2050. This will not be possible without swift and ambitious efforts to move away from fossil fuels, which implies phasing out governments' ongoing support for continued extraction and use. Timing also matters in terms of making these policy changes with political will and alongside appropriate political cycles at the national level, as well as globally, with regard to putting in place long-term reforms during periods of low oil prices, in preparation for future increases.

However, as well as timing, there is also a funding issue. Some countries may require external donor support to enable the smooth planning of such a shift and accompanying mitigation measures to protect the poor, as well as to nudge and support governments toward the investment needed in new energy systems.

This report outlines the work of the Nordic Council of Ministers (NCM) in this area and explains the overall concept of a swap, alongside reforms (Chapter 3). The report then focuses on the business case for developing a swap within the context of ongoing reforms being made in Zambia across the energy sector (Chapter 4), with a particular focus on industrial energy efficiency within mining. This case may provide potential lessons globally, given that mining operations are often significant energy users and must also respond to increasing prices via active efficiency gains.

Other swaps are also discussed, including the potential for kerosene-to-solar swaps for lighting in India, as well as other opportunities, such as investment in the agriculture sector in Morocco (Chapter 5). Plans in Zambia and other countries are very context-specific. It is clear that for reforms and the shift toward sustainable energy, no "one size fits all" approach exists. However, by working closely alongside and with the support of other governments to accelerate implementation, countries will be able to make the switch, one by one, to fairer, safer, cleaner and more sustainable energy systems.

Acronyms

ADB	Asian Development Bank
BAU	Business as usual
CO2	Carbon Dioxide
DFI	Development Finance Institutions
EHS	Environmentally Harmful Subsidies
ERB	Energy Regulation Board, Zambia
ESCO	Energy Service Company
FFFSR	Friends of Fossil Fuel Subsidy Reform
FFSR	Fossil Fuel Subsidy Reform
GHG	Greenhouse gas
GSI	Global Subsidies Initiative
GSI-IF	GSI Integrated Fiscal model
Gt	Gigatonnes
IDB	Intergovernmental Development Bank
IDC	Industry Development Corporation
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power provider
NCM	Nordic Council of Ministers
NDC	Nationally Determined Contribution
NDF	Nordic Development Fund
NEFCO	Nordic Environment Finance Corporation
NIB	Nordic Investment Bank
NOAK	Nordic working group for climate negotiations
UNE	United Nations Environment
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

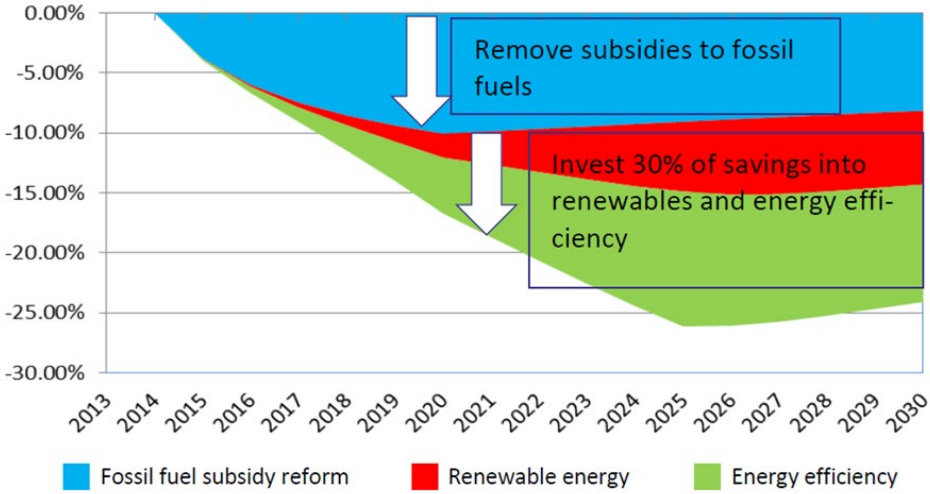
Chapter 2 explains the link between fossil fuel subsidies, reforms and carbon emissions, as well as modelling estimates of GHF emission reductions as a co-benefit of reforms. Chapter 3 describes the concept of a fossil fuel subsidy swap whereby government, via fiscal policy, implements fossil fuel subsidy reform and allocates some of the savings from the reform toward sustainable energy and development. The chapter also outlines the business case for government and the private sector consideration. Chapter 4 describes recent reforms in the Zambian energy sector and an initial feasibility study with the government to implement a complimentary mining energy efficiency scheme in parallel to electricity sector pricing reforms. Chapter 5 outlines opportunities in Morocco for the encouragement of renewables in the agriculture sector to replace butane fuel. The final chapter outlines Nordic engagement with and support for implementation efforts with countries and discusses the way forward.

2. Why the need to switch direction?

In the last few years there has been a growing awareness among governments as well as an increasing number of studies suggesting a significant link between carbon emissions and the presence or removal of fossil fuel subsidies. Research estimates that the removal of all fossil fuel subsidies would lead to a global decrease in carbon emissions of around a quarter (between 0.5 to 2 Gt or between 1 and 4%, globally by 2030) of the combined emissions reductions currently proposed by countries as part of the Paris Agreement (of between 4–8 Gt from fossil fuels and industry) (Jewell et al., 2018). Further research indicates potential reductions of between 6.4–8.2% by 2050 as against "business as usual" scenarios (BAU) (Schwanitz et al., 2014; Burniaux & Chateau,2014).

National–level research, funded by the Nordic Council of Ministers, enabled the modelling of country consumer subsidy reforms on carbon emissions across 20 individual countries using the GSI-Integrated Fiscal (GSI-IF) model. The research found that across 20 subsidizing countries, an average overall drop of 11% in country emissions would be achieved through a phase-out of fossil fuel consumer subsidies by 2020. This suggested average annual savings to governments of close to USD 93 per tonne of greenhouse gas (GHG) emissions removed, or a total (across just 20 countries) of 2.8 gigatonnes (Gt) of CO2 by 2020 (Merrill & Bassi et al., 2015). The model then allocated a modest 30% of savings from subsidy reform toward energy efficiency and renewable measures, with 50% allocated for social spending (see Figure 1). The results found that the overall average emissions drop increases to 18%. Modelling research on the global phase-out of subsidies to producers found that this could result in an additional 37 Gt of reduction by 2050 (Gerasimchuk et al., 2017).

Figure 1: Estimated effect of subsidy removal and reallocation on greenhouse gas emissions



Note: Average emissions reductions from fossil fuel subsidy reform across 20 countries with 10% of savings invested in renewables and 20% in energy efficiency (as against business as usual [BAU]).

Source: Merrill & Bassi et al., (2015).

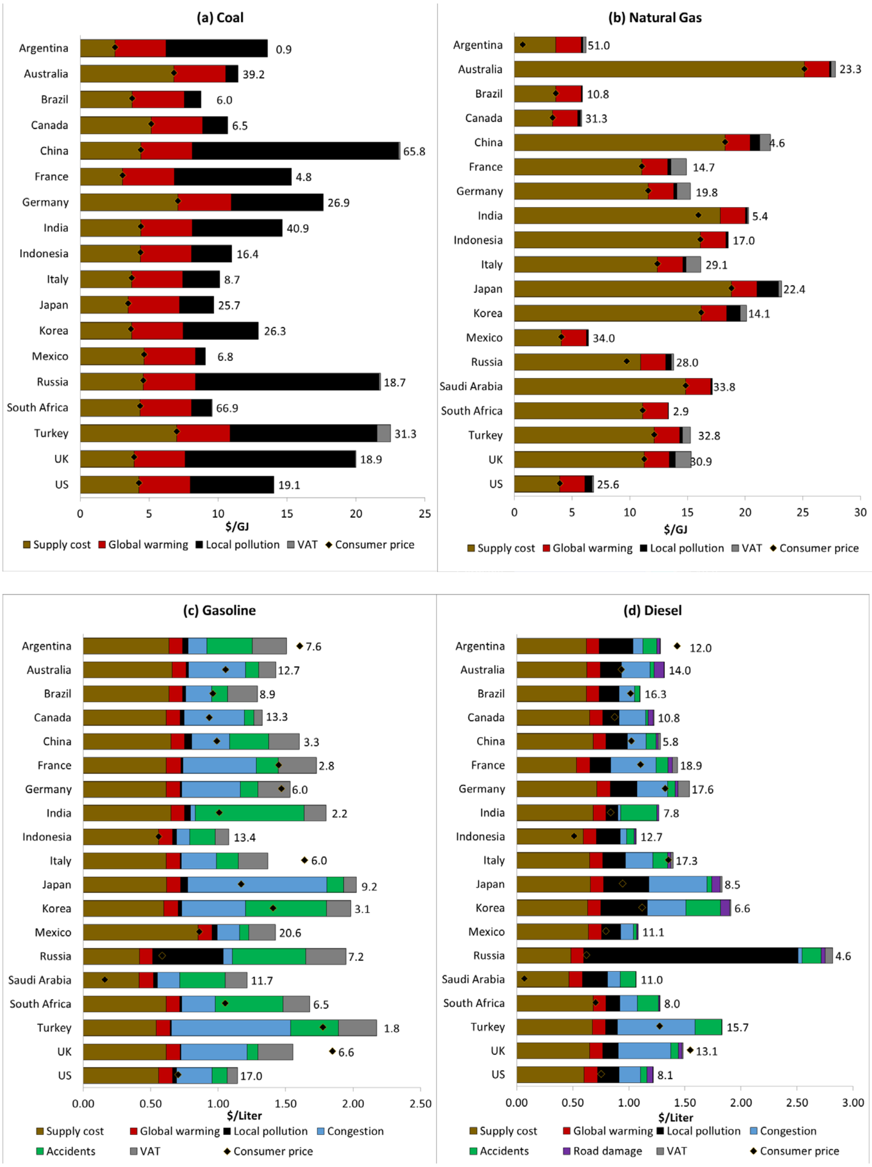
The range of emissions reductions from the phase-out of consumer fossil fuel subsidies globally is very broad depending on the scenarios used, the countries included in the modelling, the scale of the subsidies and the time frame for phase-out. For example, OECD research finds that reform and removal of these subsidies could lead to co-benefits such as global emissions reductions of around 3% by 2020, rising to around 8% by 2050 (Durand-Lasserve, Campagnolo, Chateau, & Dellink, 2015; Burniaux & Chateau, 2014). The IEA (2015a) found a 10% reduction in energy sector emissions by 2030 from accelerating the partial phase-out of subsidies to fossil fuel consumption.

Others observe that in the long term, "all phase-out scenario emissions are returning to the same level as the reference case, since the effects of the phase-out [of fossil fuel subsidies] are less important than other effects that drive emissions like population, GDP growth, or resource depletion" (Schwanitz et al., 2014, p. 886).

Research on the relationship between the phase-out of consumer fossil fuel subsidies and emissions reductions also stresses that, although the removal of subsidies to consumers 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 and clear climate policies (IEA, 2015a; Merrill & Bassi et al., 2015; Burniaux & Chateau, 2014; Schwanitz et al., 2014). For example, fossil fuel subsidy reform in the presence of an emissions cap increases emissions reductions from around 8% to 10% and maintains the reductions from reforms in the long term (Burniaux & Chateau, 2014). This point is critical. In practice, it means that if countries want to benefit from ongoing and permanent emissions reductions from fossil fuel subsidy reform, they likely need to do three things. First, countries need to undergo fossil fuel subsidyreforms; and second, make the "switch" or the "swap" to cleaner, low-carbon or zero-carbon fuels (Merrill et al., 2017). Governments can choose to invest in energy efficiency, renewable energy, public transport schemes and other mitigation measures in order to help move away from energy systems built on fossil fuels and toward those based on sustainable energy. Finally, countries can also start to tax fossil fuels correctly (see Figure 2 below for G20 countries from 2017) in that the removal of fossil fuel subsidies combined with the correct taxation of fossil fuels could reduce CO_2 emissions by a much larger 23% globally (Parry et al., 2014).

For a fuller review of modelling studies on the impact of fossil fuel subsidy reform and equivalent emissions reductions, see Gerasimchuk et al., 2017 and Merrill et al., 2017.

Figure 2: Current and efficient energy prices in G20 countries



Note: Reproduced with permission.

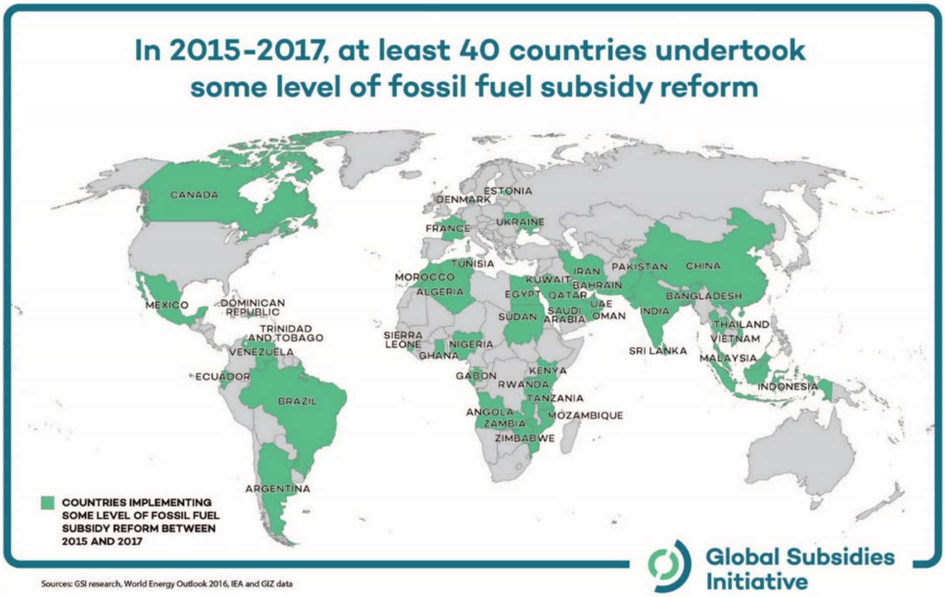
Source: IMF (2017).

Further, countries could potentially tax fossil fuels via a carbon tax or more conventionally via basic Value Added Taxation (VAT) or a Goods and Services Tax (GST). This point is important because, moving forward, we must address a wider problem – or rather opportunity – linked to the basic taxation of fossil fuels globally. Namely, not only must we remove existing subsidies to fossil fuels, but we must deal with the chronic under-taxation of fossil fuels throughout the global economy (motor gasoline, motor diesel, natural gas and especially coal) (see Figure 2 above and Parry & Heine et al., 2014). This is particularly urgent considering the current period of lower oil prices, which encourage over-consumption.

2.1 Size of fossil fuel subsidies and recent reforms

The last few years have seen impressive progress by a number of governments in phasing out fossil fuel subsidies and investing instead in social safety nets, education, health care and development priorities. Investment in renewables is also increasing. To mitigate the impact of gasoline and diesel subsidy reforms, Indonesia used a basket of social protection policies covering education, health insurance, food subsidies, cash transfers and infrastructure programs. Indeed, Indonesia's first large-scale unconditional cash transfer system was created in only six months in order to compensate for subsidy reforms. Brazil started to gradually increase prices on fossil fuels in the early 1990s with deregulation in 2002 across gasoline, diesel and liquefied petroleum gas (LPG). From 2001 onward, Brazil developed better-targeted LPG voucher subsidies and a national conditional cash transfer scheme aimed at covering education and energy outcomes (Adeoti, Chete, Beaton & Clarke, 2016). Ghana reformed subsidies to gasoline and diesel: it also developed a livelihoods program to support families. India put in place a direct benefit transfer for LPG, which has since become one of the largest cash transfer programs in the world (Adeoti et al., 2016). Morocco expanded a national conditional cash transfer, education and health insurance scheme at the same time as reforming (Merrill et al., 2016). The Philippines used targeted cash transfers to help build a national safety net and lifeline tariffs to protect the poor in the process of reforms (Mendoza, 2014). Peru expanded a conditional cash transfer program and introduced an improved cook stove distribution scheme (Merrill et al., 2016).

Figure 3: Countries that implemented some level of fossil fuel subsidy reform between 2015–2017



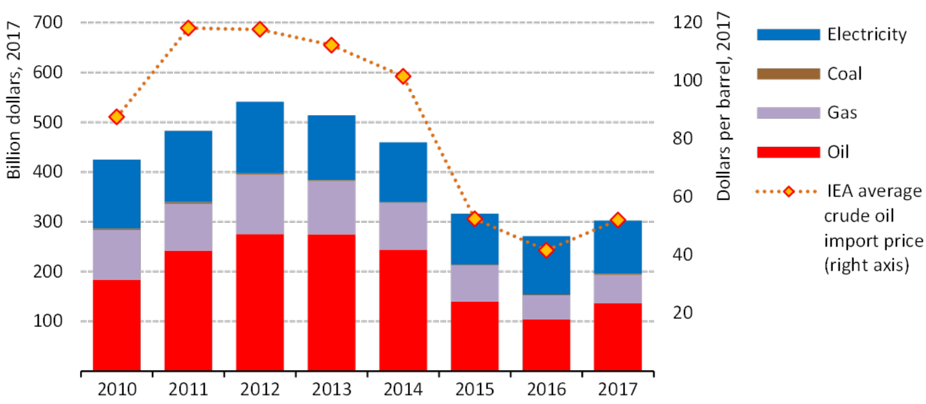
Source: GSI research, World Energy Outlook (2016), IEA and GIZ data.

With low oil prices, countries that export fossil fuels receive lower incomes from this resource. As a result, pressure has built on fiscal budgets, exacerbated where fuel subsidies are also maintained to domestic consumers. Oil exporters can also no longer afford to maintain such subsidies, and the last few years have seen significant domestic reforms from countries such as the United Arab Emirates and Saudi Arabia. In contrast, there are examples of increased pressure on governments to provide more subsidies upstream to fossil fuel producers in times of low oil prices (Gerasimchuk et al., 2017; Whitley et al., 2017 & OECD 2018a), such as commercially marginal oil and coal fields, and gas networks. It is unclear whether reforms to date have structurally eliminated fossil fuel subsidies or if such subsidies will return when oil prices rise (see Figure 4 below), as they have started to in Indonesia for fuel oil and LPG (Satyagraha, 2018). Even where mechanisms are in place to automatically pass through future price increases, political pressure may force policy-makers to reintroduce subsidies. Properly structured reforms – with entrenched, transparent pricing mechanisms and additional appropriate taxation levels – will help prevent the return of fossil fuel subsidies in the presence of high oil prices. It is key for countries to share lessons between one another on how to implement smooth reforms.

The scale of subsidies to fossil fuels is massive at around USD 400 billion in total in 2017 (USD 300 billion per year for consumer, and at least USD 70 billion for producer subsidies [across the G20, Bast et al., [2015]]). In 2017, the IEA estimated that subsidies to consumers across 40 IEA countries came to USD 300 billion, up from USD 260 billion in 2016 (IEA, 2018a). The OECD found more than 1,000 individual policies that support the production or consumption of fossil fuels in these countries (OECD, 2018). A joint OECD and IEA inventory of subsidies identified USD 373 billion in subsidies in 2015 (OECD, 2018a), with most measures having been in place since the year 2000. Whilst a quarter of the total number of measures have been phased out over the last twenty years, the OECD noted that 21 measures to support fossil fuels have actually been introduced in the last two years (OECD, 2018a).

Furthermore, this IEA estimate does not take in account subsidies to producers of fossil fuels that also exist in the form of tax breaks and other incentives. There are few estimates as to the subsidies themselves because they are complex and often opaque. The GSI has estimated production subsidies at around USD 100 billion globally (GSI, 2010). Bast et al., (2015) estimate that G20 governments spent a total of USD 70 billion in average annual subsidies to fossil fuel production in 2013 and 2014.

Figure 4: Estimates for global fossil fuel consumption subsidies



Note: Reproduced with permission.

Source: IEA (2018).

In other words, although fossil fuel subsidies to consumers are lower globally due to a combination of active reforms and lower oil prices, fossil fuel subsidies still represent a huge sum. Because of lower oil prices, consumer subsidies to fossil fuels have dropped, which has opened a window of opportunity for reform. However, IEA figures do not take into account upstream producer subsidies, which are likely to increase. Nonetheless, the IEA does highlight the real risk for backsliding: "The battle in this area is far from over; governments could come under pressure to reinstate subsidies for gasoline and diesel when oil prices start to rise" (IEA, 2017).

Indeed, research finds that globally the price of fossil fuels actually *fell* by 13.3% from 2003–2015 even with a combination of subsidy reform and taxation (Ross, Hazlett and Mahdavi, 2017). Therefore, some governments are missing an important fiscal "triple win". First, they could save and raise domestic finance through the reform of fossil fuel subsidies and taxation; second, the combined impact that reform and taxation have on increasing the price of fossil fuels hence could encourage energy efficiency or a switching toward cleaner fuels, which would lead to a reduction in carbon emissions; and third, the provision of domestic finance could enable governments to reinvest in development or sustainable energy systems. In other words, governments could take this opportunity to deliver a swap away from fossil fuel subsidies and toward investment in sustainable energy.

3. What is a fossil fuel subsidy swap?

A fossil fuel subsidy swap is where a government, via fiscal policy, implements fossil fuel subsidy reform (FFSR) and allocates some of the savings from the reform toward sustainable energy and development. Potential swaps are outlined in Chapters 4 and 5 for Zambia and Morocco.

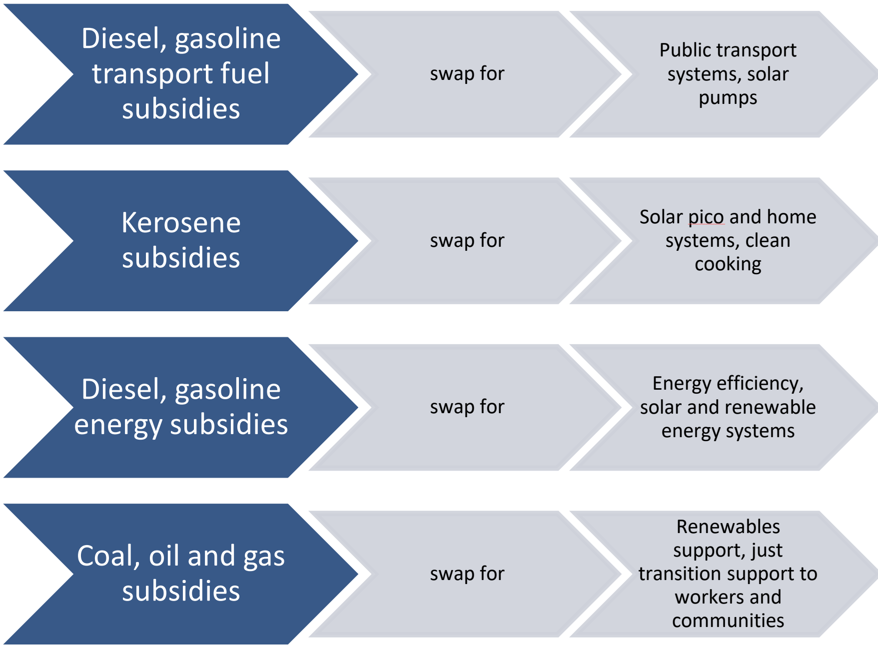
Subsidy Swap Examples

A fossil fuel subsidy swap is the process of a government changing fiscal incentives and policy and reforming fossil fuel subsidies, with a parallel increase in investment towards sustainable, low-carbon measures such as energy efficiency, solar and renewable energy, and public transport systems.

Ideally, governments should be able to fund and support such schemes sustainably via savings made from reforms and from taxes raised on fossil fuels to support low-carbon energy objectives. Nudging – via support for planning and technical feasibility work from international institutions such as Intergovernmental Organisations and bilateral or regional organizations – may also encourage a swap. For example, governments deliver a swap when they shift policies and fiscal instruments away from subsidizing fossil fuels and toward:

- Energy efficiency: e.g. within heavy industry with electricity sector reforms;
- Solar power: e.g. for pico or home solar systems, and for water pumping for irrigation; with reforms in prices for kerosene, diesel (used in generators) and butane;
- Public transport: e.g. for tram, metro, rapid bus transit and cycle route systems with reforms and subsequent increases in diesel and gasoline prices;
- Renewable energy incentives and social support schemes: e.g. with a reduction in production subsidies to coal or oil and gas, and the development of cleaner energy industries with support and training.

Figure 5: Examples of swaps



3.1 Swaps for public transport

Building or upgrading public transport schemes costs significant resources, whether it be for a subway, light rail or bus rapid transit scheme. Delhi's metro cost USD 163 million per kilometre (Pedestrian Observation, 2011), Bangalore's cost USD 164 million per kilometre (Pedestrian Observation, 2011) and Jakarta's Mass Rapid Transit system at least USD 1.78 billion (Railway Technology, undefined). Other megacities such as Karachi (upgrading cost USD 200 million, [GeoNews, 2017]) and Dhaka (USD 2.8 billion [The Straits Times, 2013]) are in the process of being upgraded or delivered. And whilst it is recognized that financing such schemes requires a mix of public, donor and private financing, domestic resources often play a large part in delivering them.

For some governments, the liberation of domestic resources due to the removal of government subsidies to fossil fuels could go a long way towards financing the massive upfront costs needed to build and renew public transport schemes around the world. Opportunities abound for swapping government subsidies away from fossil fuels and toward government finance for large-scale public investment schemes, including transport. Less costly and more affordable sustainable transport infrastructure interventions, such as cycle lanes, following a Danish model, could also have large emission benefits (23 Mt CO_2e by 2025 globally [Nordic Green to Scale, 2018]) as well as safety and mobility benefits.

It has been estimated that following Indonesian reforms in 2015, savings of USD 15.6 billion or 10% of the state budget were realized (Pradiptyo et. al., 2016). Savings were used to increase government resources to meet infrastructure needs, including the Ministry of Transportation's budget, which increased by 45%, with a focus on transportation to remote areas (Pradiptyo et al., 2016). Both access to public transport and the reduction of fossil fuel subsidies are included within the Sustainable Development Goals (United Nations, 2016) and see box below. Fossil fuel subsidy reform was included within the SDGs as a means of Implementation (i.e. to help fund and deliver the rest of the SDGs).

Inclusion of fossil fuel subsidy reform and sustainable transport within the SDGs

Source: UN, (2016).

11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport.
12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption … and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts.

3.1.1 Swaps for energy efficiency

With low energy prices supported through subsidies or under-taxation, there is little incentive to focus on efficiency and reducing wastage. In Saudi Arabia, in 2014 and prior to recent reforms, the payback for a more fuel-efficient car would take 16 years to recover through lower spending on fuel, yet this payback period would drop to an only three years without subsidized gasoline (IEA, WEO, 2014). The IEA also finds that "subsidised prices also affect the demand and supply of electricity. Saudi Arabia's electricity consumption has now reached the same level as that of Italy, despite having a population half its size and per-capita income that is 35% lower" (IEA, 2018b). For example, prior to recent reforms, in 2015 Ukraine's energy subsidies were costing between 7 and 8% of the country's GDP. Reforms in 2015 and 2016 were significant, with an overall price increase of 470% for gas and 193% for district heating. With such price increases, the poor were protected through an expanded targeted subsidy program. Work from ESMAP in 2014 also identified the need for significant investment into energy efficiency measures and proposed the setup of an energy efficiency revolving fund or national energy service company (ESCO) as part of support (ESMAP, 2018). Where fossil fuel subsidies exist that depress energy prices there is also likely little interest in investment or in the purchase of fuel-efficient vehicles, heating systems and the like, from consumers of energy, including in other energy efficiency measures like insulation. Where energy prices increase, and subsidies switch towards incentivizing energy efficiency measures by helping to make products more affordable, this can reduce payback periods for individual consumer purchases and shift consumer decisions towards the more efficient use of energy.

3.1.2 Swaps for renewable energy

There are opportunities to switch away from kerosene, which is still heavily subsidized in some countries, and toward cleaner portable solar lamp equivalents. The government of India is gradually removing subsidies to kerosene and there is potential to reinvest a share of subsidy savings into supporting poor households to gain access to off-grid solar technologies (IISD, 2018). Research in India has found that a large number of available products present a practical replacement for kerosene lamps at similar cost or lower than existing kerosene subsidies. As supply chains improve, solar is already replacing kerosene in some places, but kerosene use for lighting is widespread and could be replaced by pico solar products (IISD, 2018). In terms of a potential swap, it is estimated that government expenditures on kerosene subsidies could fund the full capital cost of 350 million entry-level solar lanterns over 1.5 years or 97 million mid-level solar lanterns over two years (Garg, Sharma, Clarke & Bridle, 2017).

There are also opportunities to move away from irrigation pumps powered by subsidized but still expensive diesel (Bangladesh) or butane (Morocco) and toward solar irrigation pumps. Chapter 5 describes opportunities in Morocco. In Bangladesh it is estimated that over 11 million farmers use diesel to operate irrigation pumps, consuming around 1 million tons per year (ADB, 2018).

3.2 Building the business case for swaps

3.2.1 Creating the enabling environment for an energy shift

Subsidies create distortions in markets. Sometimes these are justified, as they achieve policy objectives, including promoting strategically important industries, boosting economic output, reducing activities that create social or environmental harm or increasing access to certain goods and services. When removing fossil-fuel subsidies and swapping them for incentives that promote low-carbon, climate-resilient development, ideally such incentives should strive for technology neutrality and equitable affordability for different solutions to minimize the distortion and, as far as possible, retain a level playing field for producers and consumers. Policies must also take into account that the financial and technological landscape is constantly evolving. For example, rapid technological development and innovation is making renewable energy solutions increasingly competitive.

In parallel, and in addition to removing distorting subsidies, a number of potential other barriers need to be tackled to ensure that the proposed business models are viable and in particular that private investments are mobilized toward low- or no-carbon energy solutions at the required pace and scale. Many of the barriers holding back the sought-for investments are related to real or perceived risks. For example:

- Regulatory and legal barriers related to investors (e.g. some regulation hinders investment from certain investors);
- Regulatory and legal barriers related to target markets (e.g. funding organizations may be unable to invest in attractive projects in certain countries or jurisdictions due to local legislation and limited ownership rights for foreigners);
- Information and data barriers (e.g. investors may be unable to conduct due diligence processes or assess the risks related to investments due to lack of credible data);
- Financial barriers (e.g. investors consider the risk-return profile of investment unattractive due to either too-high risks or too-low expected returns);
- Behavioural barriers (e.g. investors' perception of risk is not in line with the actual risk related to investments; attitudes and prejudice may hinder investments).

3.2.2 Tackling financial barriers

In most cases, a combination of tools is required to support and accelerate the implementation of swaps, including partnerships involving public and private actors and blended finance approaches (OECD, 2018b). To this aim, direct forms of subsidy (Figure 6) may be complemented and enhanced by further tailored financing models (Figure 7). These may include de-risking arrangements with the aim of making the subsidy scheme more self-sustaining and accessible, especially to small actors with limited access to capital, who are often the original target group of fossil-fuel subsidies. Notwithstanding the approach and the combination of instruments applied, crucial elements for mobilizing private sector expertise and finance in support of swaps include sufficient stability of the enabling environment as well as predictability and transparency of any foreseen changes in the enabling environment.

Figure 6: Examples of more traditional financing models to help advance swaps

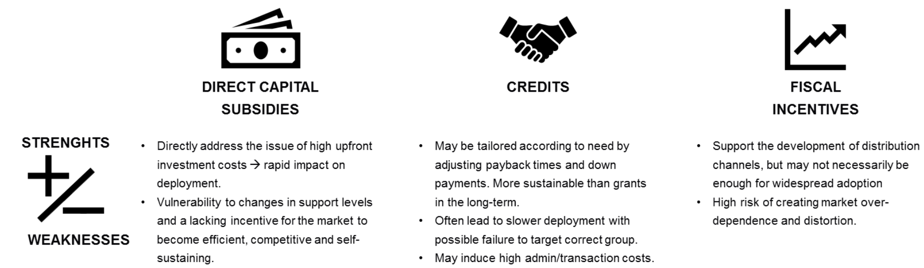


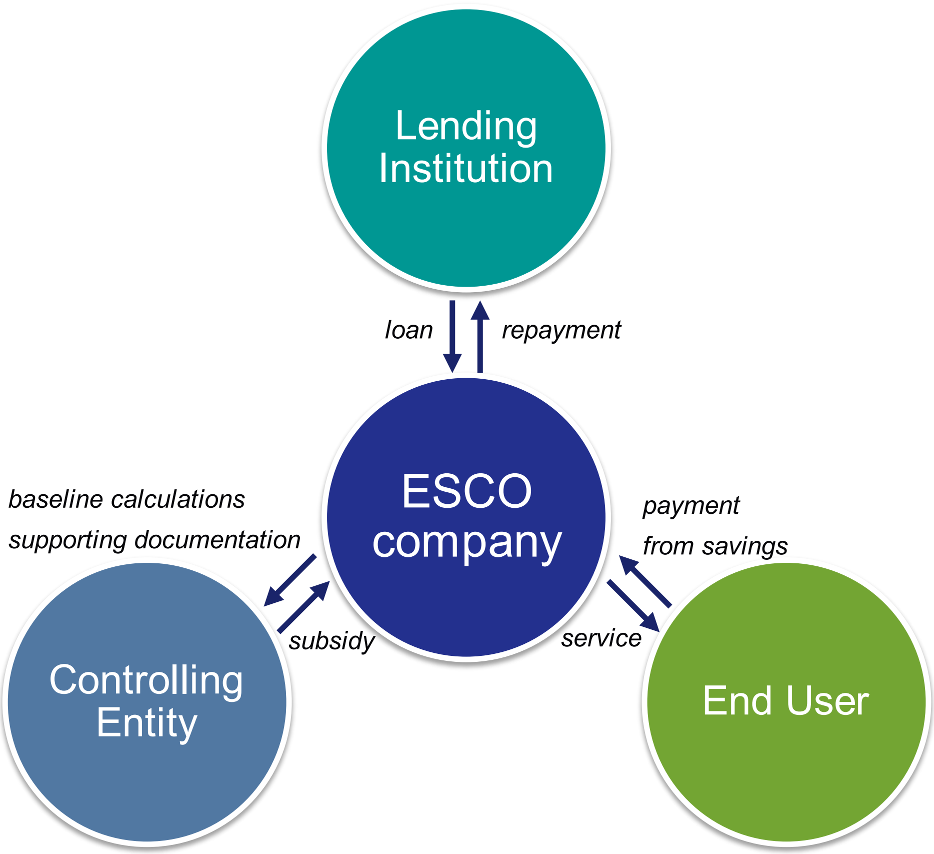
Figure 7: Examples of other financing models that could be used to accelerate and enhance swaps

Source: Compiled from IRENA (2016), UNEP (2015) and FAO (2018).

Service Model: Snapshot

The Energy Service Company (ESCO) model aims specifically to remove the barrier of high initial investment. In a typical ESCO model, a company installs, owns and operates a renewable energy or energy efficiency system and provides energy service to its customers. Its remuneration is directly tied to the energy savings generated, which allows it to sell the service at or below the old unit price while making a profit. The ESCO company can either finance the investment itself or assist in seeking finance by providing a savings guarantee. The role of governmental authorities can also be substantial in promoting and supporting the model, by acting as a source of capital subsidy, a certifier of ESCO companies or a verifier of baseline calculations.

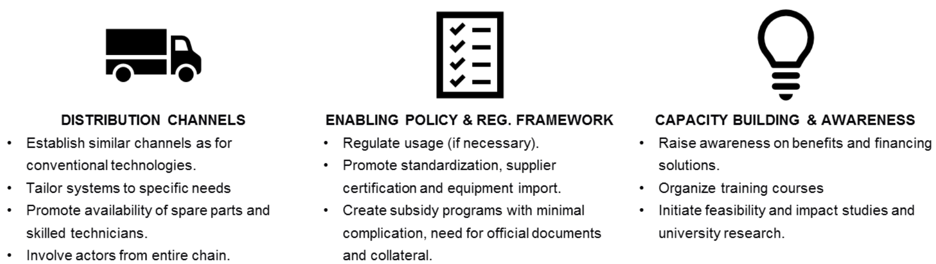
Figure 8: Simple illustration of ESCO model



3.2.3 Tackling other barriers

It should be noted, however, that the appropriate business model, including technical support and financing options need to be specifically tailored to take account of the socio-economic context, sector and technology-specific requirements as well as the financing environment in the country. As noted above, within the swaps, efforts should systematically be directed into creating an enabling ecosystem for the widespread adoption and upscaling of the proposed more sustainable solutions. According to IRENA (2016), optimally the enabling environment would have the following four main elements in place: distribution channels, delivery model and access to financing, policy and regulatory framework, and capacity-building and awareness-raising. While delivery models and funding are addressed above, the other three elements are described in Figure 9 below.

Figure 9: Building blocks of an enabling ecosystem (based on IRENA, 2016)



Following a description of potential business models and financing options in this section, Chapter 4 below presents a suggestion for potential energy efficiency-based business models for advancing a swap in the Zambian mining sector.

3.2.4 Donor support for swaps

Overall, Nordics have been a major contributor of climate related finance in the past years, with their contribution amounting to almost 10% of total climate related ODA. Nordic support has often targeted certain sectors (e.g. general environmental protection, government and civil society) that can be considered generally conducive to building capacity and strengthening enabling environments. Hence it is not surprising that Nordic countries have typically been important partners in promoting fossil fuel subsidy reform (FFSR) nationally and internationally (Halonen et al., 2017).

Nordic countries, through their development cooperation and joint Nordic finance institutions (including the Nordic Development Fund (NDF), Nordic Environment Finance Corporation (NEFCO) and Nordic Investment Bank (NIB) and their respective Development Finance Institutions (DFIs), can be expected to remain relevant partners in supporting and financing the shift towards sustainable energy. Other potential donors include the World Bank, African Development Bank, DFID and the German Development Corporation. While the government is mainly responsible for removing fossil fuel subsidies and developing the enabling environment, other development partners can support this reform, and in particular private sector investors can contribute with required expertise and financing.

4. Zambia Swap

Zambia's rising debt has created a growing pressure to reduce public spending. This pressure must be balanced with the need to ensure access to energy, including the provision of lifeline tariffs to promote access to electricity, and the need to transition towards sustainable energy. Zambia includes a target in their NDC to switch from the use of conventional and traditional energy sources to sustainable and renewable energy sources (Government of Zambia, 2016).

Reductions in spending and subsidy reform must therefore take into account these competing needs to respect social priorities and to protect the environment. There is considerable potential to reform subsidies in such a way as to reduce overall spending and promote a transition to clean energy. This section describes the system of subsidies in Zambia and explores how a subsidy swap could be developed to balance these objectives.

4.1 Fossil Fuel and Electricity Subsidies in Zambia

Zambia successfully eliminated its consumption subsidies on petroleum products in 2016.[1] The International Monetary Fund (IMF) estimates that in 2015 there were approximately USD 2 billion "pre-tax" subsidies to fossil fuel consumption, including in the electricity sector. Under the IMF definition, pre-tax subsidies exist where consumers pay prices below the cost of supply. In addition, foregone tax revenue in 2015 totalled a further USD 270 million (IMF, 2015). In 2016 the World Bank reported that, between September 2015 and May 2016, fuel subsidies in Zambia averaged close to USD 36 million per month and electricity subsidies around USD 26 million per month,

[1] The nationally applied definition of the term "subsidies" in Zambia is limited to direct transfers. The costs of purchasing fossil fuels and the revenues generated from consumer sales and shortfalls are recorded as subsidies by the finance ministry. However, internationally applied definitions of subsidies typically include foregone tax revenues, provision of goods or services below market rates and market price support through tariff regulation in addition to direct transfers (Global Subsidies Initiative, 2014). The difference in the definition applied explains the variation in estimates from various international observers.

costing a combined total of USD 576 million over the period (World Bank, 2016). Price increases for petroleum products in October 2016 and the adoption of a cost-plus pricing methodology have effectively eliminated these direct transfers for liquid petroleum fuels.

The main subsidies left in Zambia are therefore in the electricity sector. Electricity tariffs have historically been set at rates lower than the cost of supply, creating a shortfall between the revenues from customers and operating costs. As of June 2017 most of the electricity capacity in Zambia was hydro (82.9%), followed by coal (10.4%), diesel (3.1%), heavy fuel oil (3.6%) and solar (0.002%) (Energy Regulation Board, 2017). Electricity tariffs tend to be higher than the operating cost of hydropower but lower than the costs of the other generators. At times of high demand or restricted availability of hydro the ability of the sector to cover its cost is reduced.

Zambia indicated intentions to move to cost-reflective tariffs in 2017, in line with the regional targets of the Southern African Development Community (RECP, n.d.). To address this, two price increases for electricity consumers were implemented in 2017 – a 50% increase in May followed by a 25% increase in September. However, these price increases did not apply to the mining sector, by far the largest single consumer of electricity in Zambia. These price increases are expected to have significantly reduced the cost of electricity subsidies; the exact extent of the remaining subsidies will be evaluated as the cost-of-service study is published.

To address the underpricing of electricity for the mining sector, following a process of negotiation that began in December 2016, it was agreed that, effective January 1, 2017, mining tariffs would increase to 9.30 USD cents per kWh up from of individually negotiated rates that averaged 6 USD cents/kWh (Reuters, 2017). Thereafter, mining tariffs would be determined based on the results of the cost-of-service study, which is being undertaken countrywide. Further to this, the Electricity Act and the Energy Regulation Act are being revised to address issues such as power purchase agreements with the mines.

The transition to higher prices for the mines is controversial. In January 2017, seven mining companies in the North-Western and Copperbelt provinces started paying the revised electricity tariffs; however, in late 2017, there was a standoff between Mopani Copper Mines Plc and the CEC, the grid operator for the mining region. CEC cut supply to Mopani to 94 MW from 130 MW. Following the threat of job losses, the

CEC and Glencore's Mopani Copper Mines eventually reached an agreement to restore full power supply to the mine. This indicates that further price increases may face opposition from the mining sector.

In addition, there may be subsidies to power generation, given the high tariffs paid to diesel generators, particularly temporary diesel generators installed during 2015 and 2016, which are reported to have received USD cents 14–18 per kWh, reflecting the high operating costs of these technologies (Federal Ministry For Economic Affairs and Energy, 2016). One approach to measuring the effective subsidy paid to these Independent Power Producers (IPPs) is to compare the prices paid to IPPs to a benchmark tariff.

Choosing an appropriate benchmark is a challenge, especially where a large amount of the generation capacity has long ago depreciated, as the majority of Zambia's hydro plants have. This renders the average cost of existing generation far lower than the cost of adding any new capacity to the system. A subsidy analysis that selects an average cost of current generation as a benchmark will conclude that all new IPPs are subsidized. In Zambia, the cost of operating existing hydropower plants, which tend to be low-cost, is of little use in determining the price that should be paid to new generators. Instead the cost recently constructed generators can give a good indication of current costs. The cost of power purchase from IPPs ranged from USD cents 7 per kWh to USD cents 15 per kWh (ERB, 2015), which provides an indication of the levelized costs from recently constructed hydro, coal or diesel generators. Similarly, a number of recent renewable energy auctions have resulted in bids significantly below the price of some of the more expensive IPPs. For example, in 2016 the World Bank group launched the Scaling Solar program. The power price for generators was determined by reverse auctions. The first round of auctions yielded bids of USD cents 6–7 per kWh (Industrial Development Corporation, 2016). As of June 2018, a further auction for 100 MW of solar PV is underway as part of the Global Energy Transfer Feed-In Tariff program Get FiT (Get FiT Zambia, 2018). The prices achieved in Get Fit auctions will give a further indication of current renewable energy prices. It seems that wind and solar energy are increasingly competitive with other available new generators, as costs paid to IPPs and the renewables auction results attest. Power purchase agreements signed with tariffs above the cost of renewable generation could therefore be considered as fossil fuel subsidies.

4.2 Building Support for Reform

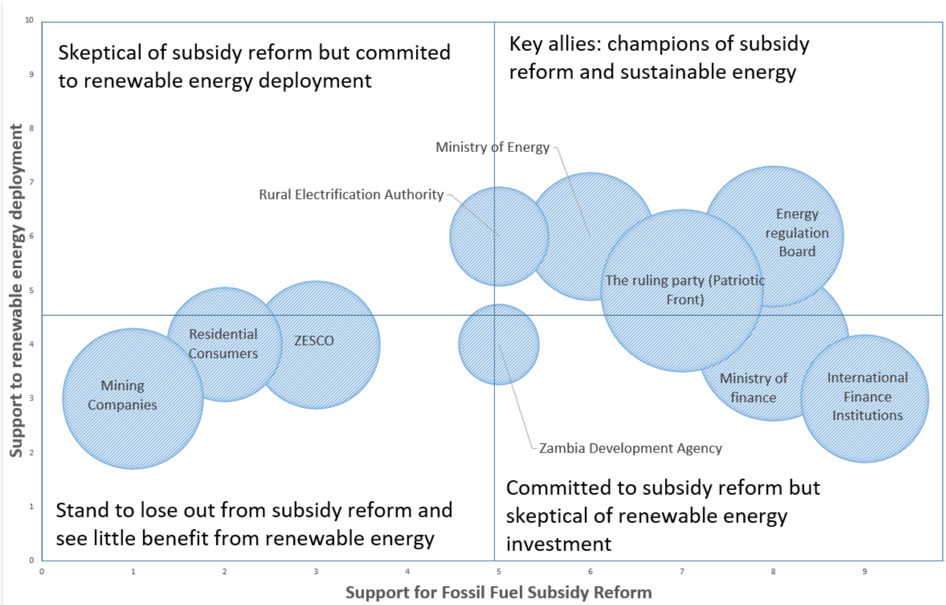
A stakeholder mapping exercise was undertaken to explore the perceived attitudes toward fossil fuel subsidy reform and renewable energy deployment among key stakeholder groups. The review assessed the interests of each group and produced an estimate of the support for renewable energy deployment, support for fossil fuel subsidy reform and an indication of their perceived influence on both issues. The stakeholder analysis is based on interviews with key institutions as well as desk-based research. While such stakeholder mapping exercises always contain a degree of subjectivity, they can help to highlight the potential allies and opponents of the subsidy swap concept and inform strategies. The following sections provide a summary of the main stakeholders.

Table 1: Outline of key stakeholders and approaches to swaps

Stakeholder	Key interests	Engagement
Ministry of Energy	The ministry has been undertaking efforts to meet the country's energy deficit. These efforts have resulted in importing electricity and purchasing power from IPPs at a high cost.	High
The Energy Regulation Board	The ERB supports cost-reflective tariffs and the promotion of renewable energy and so would appear to have interests aligned with the subsidy swap.	High
Zambia Electricity Supply Corporation Limited	ZESCO has conflicting incentives with respect to renewable energy. On the one hand, they have a role to enable the growth of IPPs, including renewable energy generators; on the other, they are concerned with the potential for additional operating costs and the management challenges of adding significant quantities of variable generators.	Medium
International Finance Institutions	The IMF and the World Bank generally recommend the removal of fossil fuel subsidies in particular and subsidies in general (Coady, Parry, Sears, & Shang, 2015; World Bank, 2017). While they may be generally supportive of renewable energy, they may be reluctant to support policies that they view as being detrimental to other economic priorities.	Medium
The Patriotic Front Party	Its manifesto has a section on energy development that states: "*The country is aiming to reach 90 per cent and 51 per cent access by 2030 in urban and rural areas, respectively. In order to exploit the potential and attract IPPs to invest in power generation, the Patriotic Front government has commenced the revision of the electricity tariff with a view of arriving at a cost reflective tariff*" (Patriotic Front, 2016).	Medium
Energy Consumers (Electricity)	Consumers would likely be keen supporters of measures that expand grid access and reliability, but price increases would likely be met with opposition.	Medium
Mining Companies	If renewable energy or energy-efficiency measures lower costs or increase reliability, they would be supported. It is expected that, if renewable self-generation becomes cost effective, they may even make investments in this area. Mining companies are considered to generally support measures that would upgrade the electricity system and increase reliability. However, based on previous experience with the last increase in mining tariffs, they would likely be strongly opposed to price increases in the tariffs they pay.	High
Zambia Development Agency	The ZDA is expected to be an ally in the discussion on the reform of subsidies and the promotion of renewable energy, to the extent that these reforms will promote opportunities for new businesses. On the one hand, the ZDA has an interest in the development of a reliable electricity system that that could be enabled by cost-reflective tariffs. On the other hand, price increases for electricity could undermine some potential businesses.	Medium
Rural Electrification Authority	The REA would likely be keen to collaborate on the development of subsidy swaps to the extent that they would increase electrification in the rural areas, for example through a reallocation of subsidy savings toward grid extension or renewable energy off-grid technologies.	Low

The review assessed the interests of each group and produced an estimate of the support for renewable energy deployment, support for fossil fuel subsidy reform and an indication of their perceived influence on both issues. Figure 10 diagrams the positions of the various stakeholder groups. The position of each organization shows an indication of the perceived support for fossil fuel subsidy reform (x axis), their support for renewable energy deployment (y axis) and their perceived influence (size of bubbles).

Figure 10: Diagram of support for fossil fuel subsidy reform and renewable energy deployment



This exercise highlights a number of findings. First, government agencies tend to be broadly supportive of both fossil fuel subsidy reform and the increased use of renewable energy. After all, it is current government policy. This indicates that the idea of using revenues from fossil fuel subsidy reform to fund a subsidy swap could be well received, in government at least. However, some parts of government are being asked to make trade-offs that may be difficult to reconcile with a subsidy swap. For example, the finance ministry may be broadly in favour of renewable energy, but its main priority is to ensure economic development. Faced with the choice of using savings to reduce government deficits and promoting renewable energy, the finance ministry would need to be convinced that renewable energy expansion would offer concrete economic benefits.

Second, there are several stakeholders who may lose out from subsidy reform and may therefore be opposed to a subsidy swap inasmuch as it increases their overall costs. The main groups in this category are the mining companies and residential consumers, who could all see their tariffs increase if subsidies were removed without any form of mitigation measures in place. These groups might not necessarily be opposed to renewable energy deployment as long as it supports lower tariffs.

4.3 Managing the Impacts of Reform

Two groups would be particularly affected by an increase in electricity tariffs: the mining sector and those benefiting from the lifeline tariff. In addition, high-voltage users as well as schools, hospitals and other social services also pay below-cost-recovery tariffs. All of these groups are likely to face price increases from electricity subsidy reform in the future, as prices rise to cost-recovery levels. Understanding these impacts and determining whether to put in place mitigation policies to limit these impacts should be key considerations for policy-makers contemplating reforms.

To understand what kind of impacts could be expected, we can evaluate previous subsidy reforms. CUTS Lusaka reviewed the impact of the reforms to diesel and gasoline prices in 2013. The reforms took place at a time when the government was spending 3.6% of revenues on fuel subsidies, and reform was considered the only option to reduce fiscal deficits (CUTS, 2013).

The research analyzed the welfare impacts of the price increases on different consumer groups, with a particular focus on the impacts on poverty. The findings of the study were that the rich, who tend to consume more energy, were hardest hit in absolute terms, seeing their spending on energy increase suddenly. However, in relative terms, the poor saw the energy costs increase as a proportion of their income. The price increase led to a reduction in diesel consumption in the manufacturing and agricultural sectors of approximately 40% (CUTS, 2013). This reduction represents a decline in some aspects of economic activity, particularly in the transport of goods. The tariff increases were quite controversial at the time and were put in place without a comprehensive package of measures to limit negative impacts on vulnerable groups. The key finding that can be taken from the experience in 2013 is that more could have been done to predict the impacts on the various beneficiary groups and to mitigate the worst of these impacts.

The impact of power prices on the mining sector is significant. In 2016, with the assumed electricity price of USD cents 9 per kWh, the total electricity bill of the mining industry equals some USD 620 million per year. Indeed, a typical Zambian mine spends several million USD on electricity per month (Mining for Zambia, n.d.). An increase in prices could threaten the viability of some mines. An understanding of the potential impact of energy price increases on viability should inform subsidy reform plans. Conversely, measures that can promote mining sector efficiency can serve to reduce exposure to energy prices.

4.4 Swaps for Sustainable Energy

The feasibility of two swap concepts has been analyzed: 1) swapping electricity subsidies for support to mining sector energy efficiency and 2) replacing subsidized diesel generation with solar PV.

4.4.1 Swapping Electricity Subsidies to Support Mining Sector Energy Efficiency

Electricity consumption in the mining sector accounts for 55% of all electricity consumed in the country (ERB, 2017). Electricity pricing in the mining sector is therefore essential to bridging the gap between costs and revenues in the electricity sector. Mining tariffs do not currently vary according to time of use or demand on the system. The government has been actively engaging with the mining sector for some time to increase tariffs, as was described in Section 3. Along with increasing tariffs (the "stick"), promoting energy efficiency in the mining sector can be seen as the "carrot" for reducing electricity subsidies.

Promoting energy efficiency in the mines serves two purposes: reducing electricity subsidies and mitigating the impact of price increases on the mines. While increases in tariffs are politically and economically sensitive, with potential repercussions for competitiveness, decreasing consumption may be used to reduce electricity subsidies, since every unit of electricity that is saved through energy efficiency will reduce the effective subsidy to the mining sector. Furthermore, since expensive sources of generation are generally the last to be dispatched, energy efficiency savings at peak times may reduce the cost of operating the electricity systems proportionally more than by average cost of generation. These savings are therefore very valuable for the government and ZESCO.

Energy efficiency is also desirable for mining companies where the costs of investments are lower than the value of the energy savings over a reasonable time horizon, contributing to a lucrative payback period. Before the recent price increases, mining companies had little incentive to make investments in energy efficiency; however, current tariffs shorten the payback of these investments and push mining companies to take energy efficiency more seriously.

One solution therefore is simply to raise mining sector electricity tariffs and allow market forces to drive investments in energy efficiency. However, this approach has a few negative consequences. First, a sudden price shock could drive mining operations to close down due to a sudden change in operating costs. Second, mines may face other barriers to investment such as a lack of affordable credit for energy investments. Finally, this approach creates a political dynamic whereby the mines may use their influence to oppose price increases. Working with the mines to enable energy-efficiency investments offers a more productive way to find a solution that will not be opposed and will therefore be easier to implement.

4.4.2 Options for Energy Efficiency and Renewable Energy in Mining

According to the U.S. Department of Energy (2007), electricity accounted globally for approximately one third of the total energy consumption in the mining industry, with diesel and other fuels also representing one third each. There is limited data available breaking down the mining sector's energy consumption specifically focusing on Zambia. In the international literature, major energy-consuming processes in metal mining are reported to include production machines, including grinding[2] (Holmberg et al., 2017); on-site transportation; and pumping, ventilation and other ancillary processes. Efficient consumption management and monitoring of energy performance through smart metering and other technologies could provide information to highlight opportunities for energy efficiency (Energy Manager Today, 2015).

[2] According to the Australian Government mining handbook (2016), comminution (including grinding and crushing) accounts for at least 40% of a mine's energy consumption. According to Holmberg et al. (2017), approximately 40% of a mine's total energy consumption goes to overcoming friction.

On the production side, prices of renewable energy options, particularly solar and wind, have fallen drastically over the past years and have, in many regions, become less expensive than conventional power sources, raising the possibility that mines could become self-generators (Deloitte, 2017). Faced with load shedding and power outages, mines employ diesel generators to ensure a stable power supply to the mines. Solar generation or possibly even solar-diesel hybrid power plants or micro-grids can provide reliable power and save costs, as well as hedge against tariff increases (Federal Ministry For Economic Affairs and Energy, 2016). This potential could be realized either through installing generation capacity on site or through power purchase agreements (PPAs) with IPPs that produce solar energy close to the mines.

International experience of mining sector energy efficiency

Sources: Australian Government, (2016); U.S. Department of Energy, (2007) & Energy Exchange, (2013), (2018).

A savings potential of up to 20% of the total energy consumption was identified for the U.S. mining industry (U.S. Department of Energy, 2007). Holmberg et al. (2017) calculated more recently that approximately 2 exajoules (EJ) of energy go annually to remanufacturing parts worn out in mining. New technologies to overcome these effects include the potential savings of EUR 31 billion per annum globally.

The *Energy Management in Mining Handbook* by the Australian Government (2016) identifies the following areas for improving energy efficiency in mines:

1. *Operating buildings*, where typical energy savings measures such as solar heaters and efficient lighting solutions may be implemented.
2. *Blasting*, where improved 3D modelling may be used for improving resource characterization as well as for targeted smart blasting and selective blast design. Smart blasting case studies have reported a 30% energy savings (Energy Exchange, 2018).
3. *On-site materials movement*, where factors such as speed, payload, cycle time, vehicle condition, vehicle size, layout of the mine and dump site, idle time, engine parameters and drive patterns may be managed to improve fuel efficiency. For example, performance indicators implemented by Downer EDI Mining made it possible to track the energy intensity of haul trucks over time. In a pilot study, energy intensity improved by 18.2% in an open-cut coal mine. Also, modernization of the fleet plays a key role. For example, Rio Tinto achieved 30% energy savings when upgrading its haul truck fleets to be powered by overhead wires (Energy Exchange, 2018).

4. *Comminution* (grinding, crushing), where factors such as grinding technologies, selection of the grind and particle size, comminution circuits, separation process efficiency and waste removal may be managed to optimize energy consumption. Energy mass-balance models and geometallurgy data on the nature of ore bodies (that depict technical options for comminution) also play a crucial role in optimizing the comminution process as they make it possible to target the blasting to highest ore concentrations and can decrease energy use by 10 to 50% (Energy Exchange, 2013). Furthermore, the energy efficiency of the milling process is typically 30 to 40% when using semi-autonomous grinding, but the efficiency could be doubled using a high-pressure grinding roll, thus halving the required input energy.
5. *Water, ventilation and ancillary equipment*, where relatively low-cost energy savings may be achieved by keeping the systems in good condition (regular maintenance), adjusting ventilation according to demand (the initially optimized level may change over time), using local water and ventilation systems (to avoid unnecessary pumping) and reducing unnecessary ventilation and water flow restrictions to avoid pumping energy losses. For example, several case studies referred to by the Australian Government (2016) have reported payback periods of two years or less, with investments in reducing energy losses in ventilation and water circulation as well as upgrading pump control systems and lighting equipment.

Reliable mapping of the total energy savings potential of Zambian mines through energy-efficiency measures would require a more in-depth analysis of the mines' current situation and energy balance. However, as set out in Box 1, energy savings from 10 to 50% are possible within all energy-intensive phases of mining. Hence, a conservative estimation of at least a 10 to 20% efficiency increase may be given, which is supported by data from Sweden and Australia (Australian Government, 2016 & Department of Energy, 2007). In addition, the replacement of equipment with new technology holds large potential for productivity gains that might benefit the competitiveness of the Zambian mining sector.

The key for an energy efficiency scheme is to create a win–win for the mining industry and the government, while also respecting the plans for carbon reductions put forwards in Zambia's NDC (Government of Zambia, 2016). Government support for investments in energy efficiency or renewable energy can accelerate the transition, while leading to electricity savings that can reduce the effective electricity subsidy to the mining companies.

4.4.3 *Replacement of Diesel Generation with Solar PV*

Replacing the highest cost generation, usually from diesel or heavy fuel oil, with lower-cost generation such as solar PV can yield considerable savings, as described in the report *Making the Switch* (Merrill et al., 2017). These generators have previously received PPAs of USD cents 14 to 18 per kWh (Federal Ministry For Economic Affairs and Energy, 2016).

In 2016, total electricity generation from ZESCO's diesel power plants decreased by 14%, to 20.2 GWh in 2016 from the 23.5 GWh recorded a year earlier. The decrease in generation was mainly attributed to the decommissioning of the Mwinilunga diesel power plant in September 2016 following the connection of Mwinilunga District to the national electricity grid (ERB, 2016 & Zambia Daily Mail, 2016).[3]

With regard to the other diesel power plants, Itezhi Tezhi, Mwinilunga, Chavuma, Mufumbwe and Zambezi recorded a reduction in electricity generation of 60%, 48.8%, 41.7%, 8.3% and 3.3%, respectively. However, Luangwa, Shang'ombo and Kabompo recorded increases in electricity generation of 13.8%, 12.5% and 8.6%, respectively (ERB, 2016).

4.4.4 *Options for Replacing Diesel Generation with Solar PV in Zambia*

Solar PV also presents wider opportunities to replace electricity currently generated from expensive diesel or heavy fuel oil generators. Solar energy in Zambia makes up approximately 0.1% of the country's power generation capacity, despite a solar resource described as having "very high potential" (World Bank ESMAP, 2014). The PV

[3] The decommissioning of the Mwinilunga diesel power plant was due to a project that ZESCO is currently undertaking entitled Connection of North-Western Province to National Grid, funded by a loan facility from the Swedish Export Credit Corporation and Standard Bank of South Africa. ZESCO operates five diesel-fired power stations in North-Western Province, located in Mwinilunga, Mufumbwe, Kabompo, Zambezi and Chavuma. The older districts of Mwinilunga, Kabompo and Zambezi have been using diesel power stations for approximately 40 years. Solwezi and Kasempa are the only two districts in the province supplied from the grid through a 66-kV line from Luano near Chingola (ERB, 2016). Mwinilunga was connected to the national grid under the USD 165 million North-Western grid extension electrification project aimed at connecting the district to the national grid. Mufumbwe became the second rural district in North-Western Province to be connected to the national electricity grid. The development is expected to save ZESCO USD 8 million in operational costs and diesel supply annually, once the province is connected to the national grid (Zambia Daily Mail, 2016). The project is also expected to connect Kabompo, Mumbeji, Zambezi, Chavuma and Lukulu to the national grid so that they can be powered by hydroelectricity. The electrification of the seven districts will go a long way to providing a reliable power supply to a province that is characterized by mining activities.

market in Zambia is dominated by donor-funded projects, government, non-governmental organizations and mission institutions for schools, clinics, related staff housing and water supply.

The World Bank is currently the largest single financing agency of PV sales in Zambia. Annual sales are in the range of USD 2 to 3 million, with as much as 70% being through large donor-financed procurements. In 2016, the Zambian government, working with ZESCO, implemented a number of measures in order to mitigate the inadequate power supply. One of the long-term measures included fast-tracking the development of grid-connected solar PV generation (ERB, 2016). Two of the most significant efforts to promote thedeployment of solar PV are described in box XX below.

Solar deployment promotion schemes

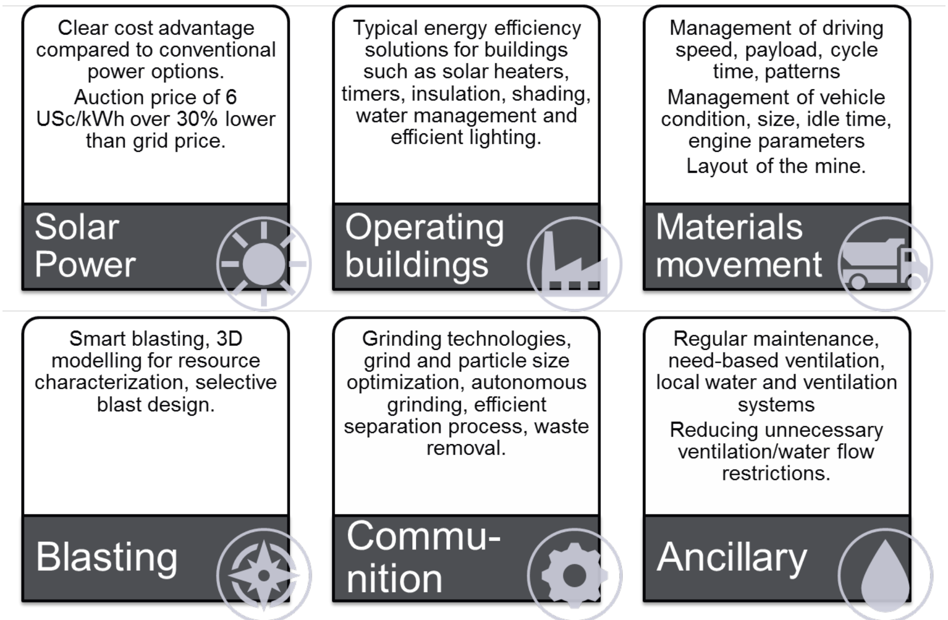
Scaling Solar Initiative
The Scaling Solar project is a World Bank Group program designed to support government procurement of solar power projects. In 2016, the Industrial Development Corporation conducted a competitive tender for the procurement of solar generation power projects of 47.5 MW and 28.2 MW. The winning bidders were Bangweulu Power Company Limited (BPCL) and Ngonye Power Company Limited (NPCL). Both companies entered into a 25-year PPA with ZESCO with tariffs of 6 U.S. cents per kWh for BPCL and 7.8 U.S. cents per kWh for NPC. It is expected that the solar power plants at the Lusaka South Multi-Facility Economic Zone will cost USD 57.329 million and USD 43.194 million respectively (ERB, 2016).

Global Energy Transfer Feed-In Tariff
The Global Energy Transfer Feed-In Tariff (GET FiT) program is designed to leverage private sector investment into renewable energy generation projects. In 2016, the ERB worked closely with the Government of Zambia and the German Development Bank (KfW) to jointly develop the GET FiT Zambia program. The program intends to fast-track a portfolio of up to a maximum of 20 MW (each) small-scale renewable energy generation projects promoted by private developers. Preparations advanced well in 2016 and the German government committed full funding for Phase I of the program in December 2016. The program was launched in early 2018 with a solar PV auction for a total capacity of 50 MW (ERB, 2016).

4.5 Business model specific and energy efficiency payback periods

Recent experiences of the Scaling Solar and GETFiT programs have contributed to building a strong business case for on-site solar generation in the Zambian mining industry. At the same time, lessons learned globally indicate major savings potential from improving energy efficiency in mines, in which taking a long-term perspective in mine management and maintenance plays a key role. Figure 4 represents some of the main energy efficiency or self generation improvement categories in mining together with selected efficiency measures.

Figure 11: Main categories for energy efficiency improvement and self generation options in mining



Successful energy efficiency schemes create a win-win for the mining industry and the government, especially when the savings from these will also reduce the effective electricity subsidy to the mining companies by displacing subsidized electricity. Table 2 presents three different options for building a support model for energy efficiency, some based on examples from Nordics directly.

Table 2: Example energy efficiency schemes

	Voluntary (Finnish) model	Mandatory (Swedish) model	Revolving energy efficiency fund
Process	Companies and the government agree on voluntary energy efficiency targets through consultation.	Putting energy management in the heart of the operation whilst systematically improving energy efficiency.	A surcharge on electricity pricing is allocated to an energy efficiency fund.
Requirements	A company joining the agreement commits to an energy efficiency target.	A company must conduct energy audits and implement proposed efficiency measures with less than three-year payback.	Regular calls for proposals for mining companies with eligible projects.
Support	Companies receive financial support (e.g. grants and tax credits) for energy audits and energy management systems →targeted support.	Full exemption from electricity tax (0.6$/MWh).	Mining companies can apply for low-cost loans to fund energy efficiency projects. Loan repayments return to the fund.
Results	371 TWh of consumption covered (65% of Finnish total). 16 TWh / 4.7MtCO_2 saved annually.	3TWh annual energy savings within the applicable 16 TWh consumption.	

Source: Compiled from: Motiva (2016) and (2018), Energimyndigheten (2016) and International Energy Agency (2016c).

To facilitate the economic analysis of different energy efficiency technologies and solar power options, an investment analysis tool was created as part of this work with the aim of supporting the further advancement of a potential swap in the Zambian mining sector. Table 3 provides a summary of the results of a modelling exercise based on this tool, evaluating the likely impact of a range of energy efficiency and renewable energy projects.

Based on the estimated investment and operations and management costsand the foreseen effect of efficiency measures on electricity consumption, the tool gives an indication of basic economic investment indicators such as internal rate of return (IRR) and payback period. For solar power, the tool uses the estimated investment price per kW and rough information on the mine's load pattern. Emission savings in the model are calculated by assuming that grid average electricity is displaced. Due to the high penetration of hydropower in the grid the avoided emissions are low. If efficiency measures can be designed to offset coal or diesel the emissions savings could be greater.

Table 3: Energy efficiency modelling results

Type of investment	Solar power	Energy efficiency category 1	Energy efficiency category 2	Energy efficiency category 3
Description	Instalment of 20 MW solar PV panels to reduce grid intake	E.g. Energy efficiency for buildings (lighting, insulation, water management, shading, solar heating)	E.g. Reducing unnecessary ventilation and pumping water flow restrictions, smart blasting, resource characterization	E.g. communition improvement by new grinding technologies, grind and particle size optimization
Assumed effect on total electricity saving in Zambian mining	-0.6 %	-0.5 %	-1.5 %	-3.0 %
Costs				
Capital expenditure	USD 18,000,000	USD 5,000,000	USD 20,000,000	USD 50,000,000
Yearly O&M expenditure	USD 900,000	USD 250,000	USD 1,000,000	USD 2,500,000
Benefits				
Yearly savings in energy cost	USD 3,060,000	USD 2,700,000	USD 8,100,000	USD 16,200,000
IRR of the investment (%)	12%	49%	35%	27%
Payback period of the investment (a)	12	3	4	5
Emissions avoided per ton CO_2	109	96	288	576

4.6 Summary of Zambia swap business model

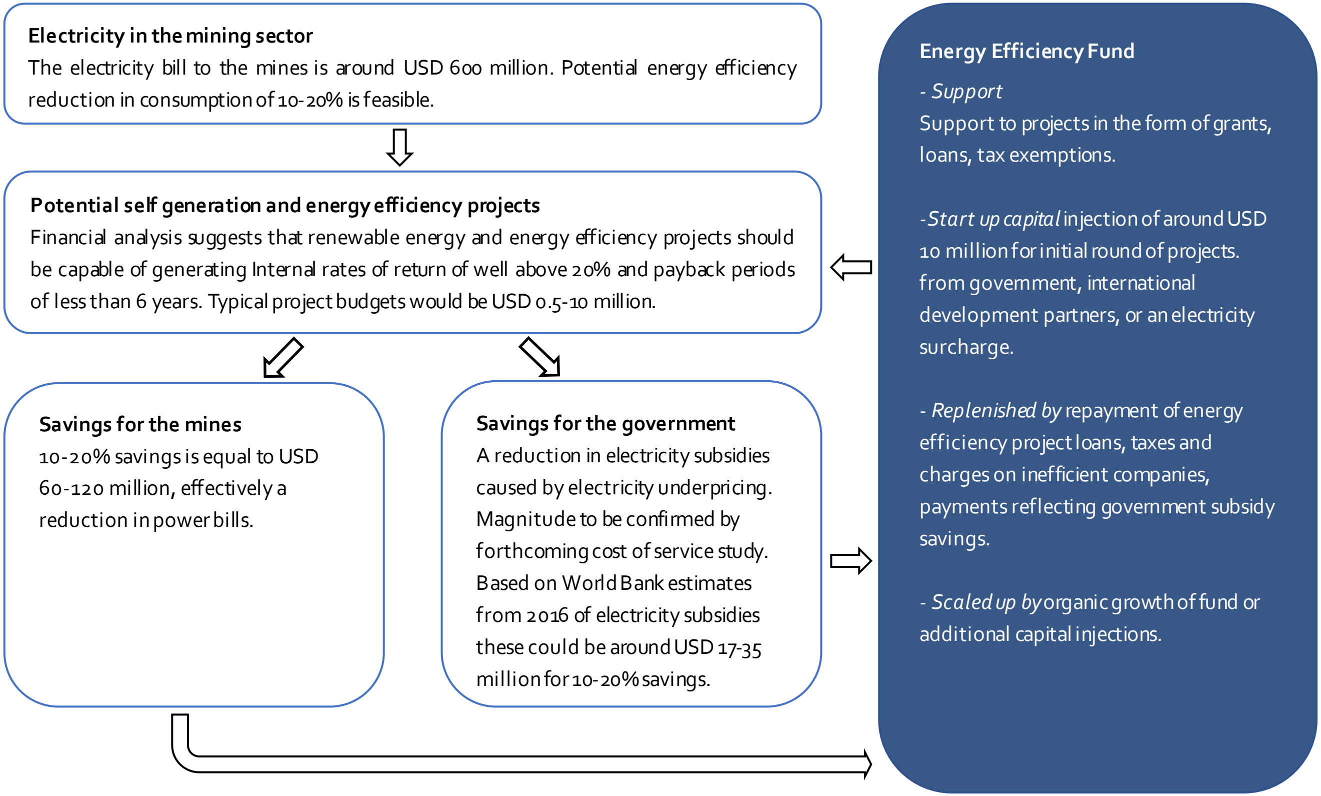
The previous sections outline some of the options for developing an energy efficiency scheme and self generation in Zambia. Figure 12 below summarizes the potential business model for a mining energy efficiency and self-generation swap. Research has shown that it would be possible to save at least 10 to 20% of mining electricity consumption through proven cost-effective energy efficiency schemes. This could save between USD 60 and 120 million for the mining companies and USD 17 to 35 million for the government in displaced subsidies.

A key challenge is how the government can help to identify which projects could be cost-effectively deployed with relatively limited government support. It is proposed that an energy efficiency fund could accept applications for project involvement in the form of debt, equity grants or technical assistance on a periodic basis and an evaluation process should be developed to take account of costs and potential benefits. See Table 2 Example Energy Efficiency Schemes for a summary of international examples.

A further challenge is how to provide the initial funds to the scheme. There are several options for this. Funds could either be collected through the imposition of a surcharge on electricity sold to the mines, possibly a peak time surplus, creating an incentive for load shifting, a charge made to mines that are deemed not to have invested in energy efficiency, government funds, donor funds or a combination of one or more of these. The next step here is to evaluate the feasibility of each of these options.

Following the initial set up, measures need to be put in place to recover a share of the savings created by the scheme. Some savings will be recouped by the government in the form of a net reduction in electricity subsidies equal to the under-pricing of electricity sold to the mines. A second source of revenues could be from repayment of loans made to energy efficiency projects. A third source could be from the ongoing collection of a surcharge as discussed above.

Figure 12: Energy efficiency and self-generation swap summary concept diagram



Initial economic modelling and international experience indicates that such a scheme can help to identify and develop projects that have short payback periods and high rates of return. Initial discussions with mining sector representatives indicate that many potential projects have received some level of feasibility analysis and could be further developed if support were available. These conversations also indicate that access to capital is a key constraint to carrying out these projects.

Further work in Zambia will focus on the feasibility of energy efficiency schemes design. A further report is scheduled to be published in 2019

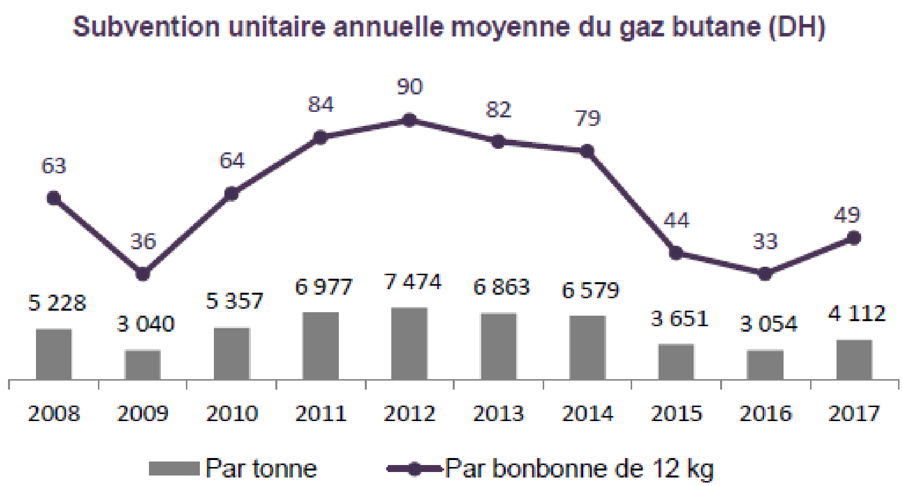
A potential avenue for Nordic cooperation will be to build links between the policy specialists and practitioners who are currently administering the energy efficiency schemes in Finland and Sweden to share experiences with Zambian policy makers.

5. Morocco Swap

5.1 From butane subsidies to heating and pumping with solar energy

Butane subsidies are the only fossil fuel subsidies remaining in Morocco after the comprehensive reforms in 2014. Butane gas is sold at a fixed price, with public subsidies paid by the Caisse de Compensation making up the difference in cost. As the price of butane is fixed, but world market prices for butane vary, the total amount of subsidies changes widely (see Figure 13). Currently 55% of the cost of butane is subsidized. In 2012, during a period of high oil prices, up to 69% of the cost was subsidised. Butane subsidies place a heavy burden on the Moroccan economy. In 2017, butane subsidies stood at almost MAD 9.9 billion (USD 967 million). This is 48% higher than the year before (Caisse de compensation, 2018).

Figure 13: Annual subsidies for butane gas between 2008 and 2017, per ton and per 12-kilogram bottle



Source: Royaume du Maroc (2018a).

Table 4: Subsidy rate for the price of butane gas

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cost of supply of butane gas in DH per barrel	103	76	104	124	130	122	119	84	73	89
Proportion of subsidy (%)	61%	48%	62%	68%	59%	67%	66%	52%	45%	55%
Proportion of sale price (%)	39%	52%	38%	32%	31%	33%	34%	48%	55%	45%

Note: *until the end of September for the year 2017.

Source: Royaume du Maroc (2018a).

Butane subsidies place a heavy burden on the government budget. In 2016, the total value of subsidies was the equivalent of 1.4% of the Moroccan gross domestic product. In 2017, butane subsidies made up 3.9% of the general budget, while the expenditure for health and education stood at 5.7 and 21.6% respectively (Royaume du Maroc, 2018b). The expenditure for subsidies can be expected to grow further if there is no change in policy, as the demand for butane gas doubled between 2002 and 2016, with an average increase of 5.2% per year (MEMDD, 2018).

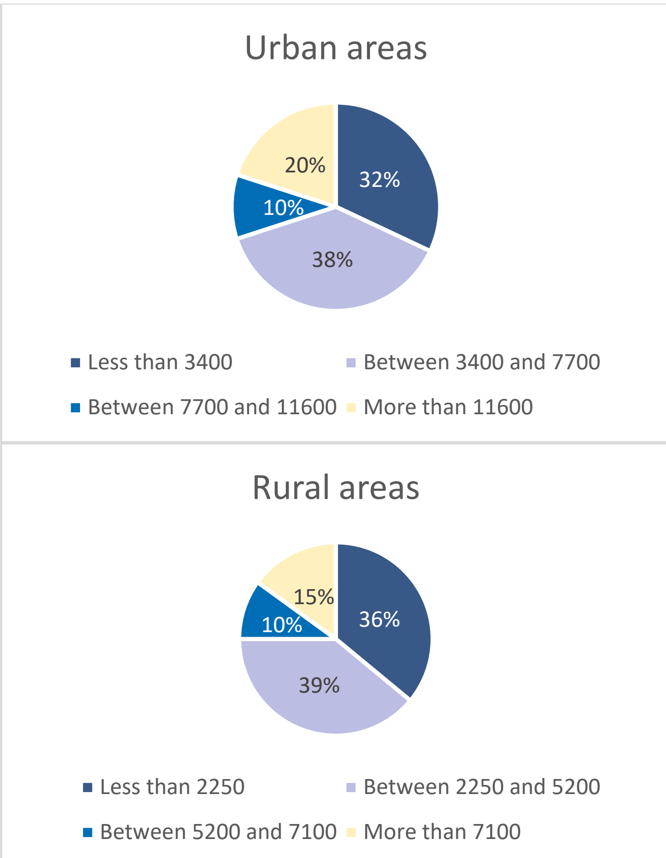
In its NDC, Morocco has committed to "substantially reducing public fossil fuel subsidies, building on reforms already undertaken in recent years." The Moroccan government had already successfully reformed subsidies for transport fuels in 2014–15. The butane gas subsidies are the only subsidies left. The previous and current governments have made several announcements about plans to reform butane subsidies.

Nevertheless, reforming butane subsidies is a difficult undertaking, as this fuel is used by most households for cooking and water heating. Meanwhile, a substantial portion of the butane is being diverted to the agricultural sector, especially for water pumping. Due to the importance of butane for households, announcements to reform subsidies were met with considerable public protest. Prices of consumer goods are a sensitive subject in Morocco. In this situation, subsidy swaps that reduce the consumption of butane gas can contribute to alleviating the impact of higher prices and building support for reforms.

5.2 Managing the impacts of reform

Removing butane subsidies is a challenge, given the long history of subsidization and butane's importance for households, especially for lower-income households. More than two thirds of the energy used by households comes from butane (International Energy Agency, 2016). Households use most of the butane for cooking (81% of total use) and the rest for water heating (18%) (MEMDD (2018)). A large amount of the subsidized butane is used by lower-income households, given their larger share of the population (Figure 14).

Figure 14: Butane gas consumption per income bracket in dirhams (DH)



Source: MEMDD (2018).

Nevertheless, higher-income households receive more subsidies per household, given their higher consumption levels. Households in the highest income category received 60% more subsidies than the poorest households. This unequal distribution is likely even higher when calculated as subsidies per person, as lower-income households and households in rural areas are generally larger.

In the agricultural sector, modified diesel engines are being used for water pumping with butane, particularly by small farmers. Small farms often have low productivity but high relevance for employment. Fuel cost can represent up to 40% of their operational cost (Global Environment Facility, 2016). The exact figures for butane used in agriculture are not currently available. A study on the use of energy in the agricultural sector is currently ongoing under the Ministry of Agriculture and will shed more light on this issue. In the absence of a decisive study, Doukkali and Lejar (2015) estimate that in 2011, butane gas made up 46% of the energy used in the agriculture sector, followed by diesel (45.5%) and electricity (7.9%). A study on onion farming in El Hajeb province found that butane made up 80% of total direct energy consumption (Allali, Dhehibi, Kassam, & Aw-Hassan, 2017). An increase in butane prices without mitigation measures would therefore impact these farmers.

The reform plans that were tentatively announced proposed an increase in prices from currently 42 DH to 120 DH, that is, three times the current price. Such an increase in prices would have a large impact on households, as well as on small-scale farmers. A butane gas reform without compensation would likely lead to an increase in poverty, as well as an increase in deforestation, if poor rural households resort to cooking on biomass. Social protection and mitigation measures are therefore essential. Possible strategies would be targeting by only providing subsidies on butane gas sold in the smallest bottles; limiting the amount of subsidized butane that can be purchased per household; limiting access to subsidized butane to low-income households (smart cards); and reimbursing costs for low-income households (for a full analysis see Adeoti, Chete, Beaton, & Clarke, 2016).

5.3 Building Support for reforms

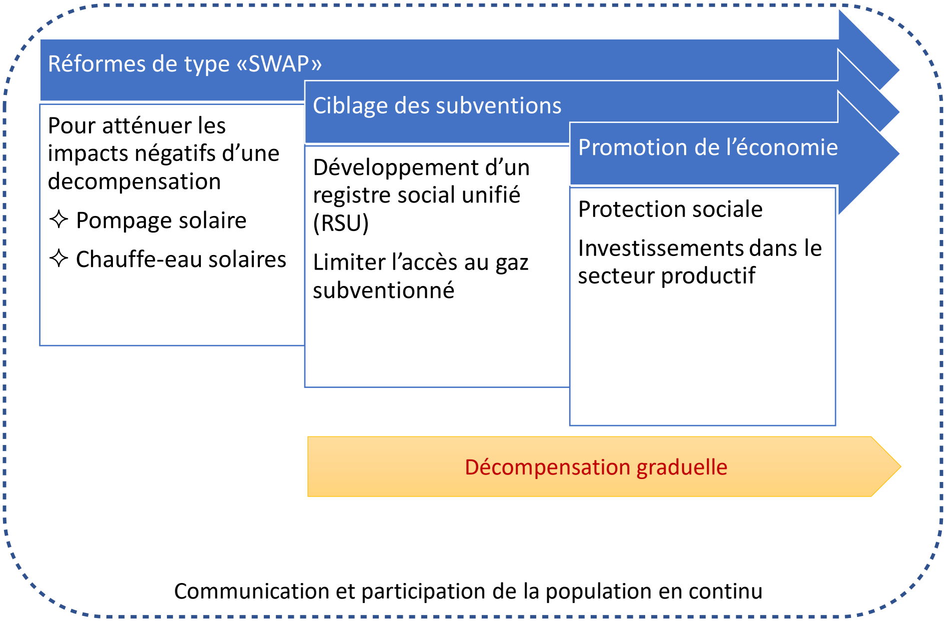
Any reform plans therefore need to be implemented carefully in a way that protects lower-income households, but also take into consideration current stakeholder positions. A stakeholder analysis in Morocco showed that most government agencies are in favour of subsidy reform. Nevertheless, they see difficulties in implementing reforms given the outspoken opposition. Public opinion is mostly opposed to reforms. The previous lifting of subsidies on petroleum products (2012–16) was criticized as being against the public interest (Telquel, 2017). While research was being conducted for this report, a boycott campaign against high consumer prices was actively promoted in social networks (Jeune Afrique, 2018a).

Any reform would therefore need to clearly demonstrate that the funds allocated to butane subsidies will be reinvested into social programs and targeted support to the most vulnerable. A subsidy swap can support this by reducing butane consumption through strategic investments in sustainable energy and presenting tangible outcomes to the population.

5.4 Swaps

A subsidy swap, i.e. reducing fossil fuel subsidies and reallocating a portion of the savings to promote clean energy, can support reform efforts for butane. This approach could reduce the cost of subsidies for the budget, and at the same time make an increase in butane prices easier for households and farmers that have already adopted these technologies (cf. Figure 14 below for the timing). It is estimated that a phase-out of butane gas subsidies by 2020 instead of 2030 could reduce greenhouse gas emissions by 0.2% of total emissions. Annual savings would be 108,000 tons of CO_2-equivalent, or 1.62 million tons in total (Gagnon-Lebrun & Bassi, 2015).

Figure 15: Linkages between subsidy swaps, targeting of subsidies and promotion of economic development



In the Moroccan context, two technologies are particularly relevant for a subsidy swap: solar water pumps to reduce the use of butane in agriculture, and solar water heaters to reduce butane gas consumption in households. Solar pumping can replace the use of butane in agriculture. This technology can already now be cost-competitive (Merrill, et al., 2017); nevertheless, its uptake is hindered by high upfront cost. A reform of butane subsidies could give a boost to solar pumping. A national program for solar pumping was established in 2013 that provides grant financing for up to 50% of installation cost, but its implementation has been stalled. In addition, smallholder farmers require a different kind of support, as they are often not eligible for credit. Different business models to address this segment of the agricultural sector are described in more detail in Zinecker et al. (forthcoming).

Solar water heaters in residential buildings and villas can gradually reduce the use of butane for hot water use. So far, 600,000 m² have been installed,[4] which is far from the potential uptake in Morocco. Similarly to solar pumping, the uptake of solar water heaters is hindered by high upfront costs, which constitute an important barrier particularly for poor households. The government program Shemsi, implemented by the Moroccan Agency for Energy Efficiency, aims to promote the uptake of solar water heaters, with the aim of reaching 1.35 million m² (AMEE, N.D.) of solar water heater installations by 2020.

[4] Source: Personal communication with AMEE.

6. Nordic Engagement

This project, supported by the Nordic Council of Ministers and led by the Nordic Working Group for Global Climate Negotiations (NOAK), focuses on the implementation of FFSR and, in addition, a proposed swap toward sustainable energy with the savings from reform. Denmark, Finland, Sweden and Norway are also members of a group of countries, the Friends of Fossil Fuel Subsidy Reform, that have also boosted the issue higher on the international agenda (FFSR, 2018).

> "The Nordic countries will work to phase out subsidies to fossil fuels and introduce taxes that reflect environmental impact. This will provide the right incentives to reduce emissions from energy and transport, including international shipping and aviation." (Nordic Environmental Action Plan 2013–2018, 2012)

Early phases of the program emphasized research and awareness-raising in the lead-up to the Paris Agreement, with many countries and stakeholders. For example, in 2015 a model was developed to demonstrate potential national emissions reductions to 20 countries. The message before Paris was clear: fossil fuel subsidy reform can be considered and potentially included as a co-benefit as part of countries' Nationally Determined Contributions (NDCs). Nine% of NDCs ended up reflecting this specific policy tool (fossil fuel subsidy reform) within their submissions (see Table 5).

Table 5: Countries including mention of fossil fuel subsidy reform or energy pricing and reform in 2015 Nationally Determined Contributions

Countries	
Burkina Faso	China (energy pricing)
Ethiopia	Egypt
Ghana	India
Mexico (energy reforms)	Morocco
Nigeria	Saudi Arabia
Sierra Leone	Singapore
United Arab Emirates	Viet Nam

Source: Terton et al., (2015) with additions.

The project has focused on various options, such as describing the links between fossil fuel subsidies and many other issues including the economy, social protection and safety nets, sustainable development goals, gender, air pollution and links to climate change (Making the Switch, 2017). The research has also highlighted leadership on the issue from countries such Morocco, Peru, the Philippines and Ethiopia (Learning from Leaders, 2016) as well as development of scoping and mapping exercises and outreach with partner countries for the implementation of swaps, such as for Bangladesh, India, Indonesia, Morocco and Zambia (Merrill et al., 2017). Current efforts have led to deeper in-country research with Morocco and Zambia alongside the government and in-country partners, and focused on implementation with an emphasis on a final roadmap and swap with Zambia. Separate roadmaps and swaps for implementation in both countries are forthcoming, and described in this report in more detail in Chapter 4 (Zambia) and Chapter 5 (Morocco). The work has been presented at forums such as the UNFCCC (via side events, technical expert meetings and the Talanoa Dialogue), SDGs, Nordic Clean Energy Week, and via webinars (FFFSR, 2018) and videos.

Many countries have fossil fuels, including Nordic countries. The issue of fossil fuel subsidy reform is included within the Sustainable Development Goals (SDGs), particularly 12.c.1. on sustainable production and consumption. Many countries have started to report against the SDGs, and many more will do so before 2030. Guidance on the reporting on and measurement of the indicator that covers both production and consumption fossil fuel subsidies will be released in the near future from United Nations Environment (UNE). Furthermore, countries must resubmit NDCs with increased ambition by 2020. A recent report, also from the Nordic Council of Ministers, identified some Nordic countries that could do much more to develop methods and reform subsidies for fossil fuels (Bauer, Watson, Gylling, 2018). The report recognizes that Nordic tax expenditures are some of the highest in OECD countries but ranks the region as a whole badly, on this particular indicator of fossil fuel subsidy reform, within SDG 12. Global methods for measuring fossil fuel subsidies are available as part of SDG 12. The first step towards reform is the process of understanding national subsidies via a process of self- or peer review, as outlined in a Guidebook to Self and Peer Reviews of Fossil Fuel Subsidies (Gerasimchuk et al., 2017b). Some countries within the G20 and APEC have undergone a peer review of fossil fuel subsidies linked to commitments made in 2010 to phase out inefficient fossil fuel subsidies. Nordics such as Finland and Sweden have also undergone extensive self-reviews of subsidies, as part of commitments within the EU to reform environmentally harmful subsidies (EHS) including those linked to fossil fuels. Case studies from the approach taken within Finland and Sweden can be found in a guidebook published to support other countries, including within the Nordic region itself, in undertaking peer or self-review (Gerasimchuk et. al., 2017b).

Overall this report and work, alongside the governments of Zambia, Morocco and the Nordic Council of Ministers, has developed opportunities within sectors for support toward energy efficiency and renewable technology measures to replace fossil fuel generation and fuels, combined with reforms that imply increasing prices in electricity and gas. Nordic and international finance institutions could support projects, such as the reform and energy efficiency feasibility plan in Zambia, that help countries to put in place new low-carbon infrastructure in the context of energy sector reforms that have led to increased prices in fossil fuels and associated electricity prices, often generated by such fuels. Many researchers have made the case for reforms. Now is the time to invest in support of governments to help them shift policies away from subsidizing fossil fuels, and to encourage economies to take the opportunity, when reforming the energy sector, to move toward creating an enabling environment for investment in sustainable energy going forward.

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Sammanfattning

Alltför många regeringar prissätter fortfarande fossila bränslen för lågt - antingen genom att subventionera fossila bränslen eller genom otillräcklig beskattning. Vissa andra regeringar har genomfört subventionsreformer och börjat införa en bättre beskattning av fossila bränslen. Dels görs detta för att spara pengar eller för att samla in mer pengar, dels för att man istället ska kunna återinvestera pengarna bland annat till att utveckla hållbar energi eller sociala säkerhetsnät.

Alla regeringar borde överväga att i sina årliga budgeter slopa subventioner till fossila bränslen. Detta kunde göras genom direkta överföringar eller genom skattelättnader och incentiv för lösningar som uppmuntrar övergången till en hållbar och koldioxidsnål energiframtid. År 2017 uppgick fossila bränslesubventioner till cirka 400 miljarder dollar. Detta innebar stöd till både konsumenter och producenter. Subventionerna verkar i dag föråldrade och ineffektiva och är ekonomiskt kontraproduktiva. De är farliga eftersom de driver konsumenter mot en koldioxidintensiv konsumtion i en värld där vi raskt borde minska koldioxidutsläppen. En "swap" behövs för att byta subventioner till fossila bränslen till något som är till gagn för människor, förnybar energi och hållbar ekonomisk utveckling.

Teknologin för en samhällelig transformation existerar, vilket innebär att en koldioxidsnål framtid redan är möjlig. Det handlar nu främst om timing. FNs klimatpanel IPCC pekar i sin specialrapport om 1,5 graders global uppvärmning på ett starkt behov av omedelbara åtgärder för att man ska kunna halvera utsläppen före år 2030 samt för att man ska kunna uppnå koldioxidneutralitet år 2050. Det kommer inte att vara möjligt utan snabba och ambitiösa åtgärder som har som mål att fasa ut fossila bränslen. Detta betyder att regeringarnas stöd för fortsatt utvinning och användning av fossila bränslen måste avslutas. Tidpunkten är också av vikt med beaktande av de politiska processerna på nationell nivå. Globalt gäller det att fasa in långsiktiga reformer när oljepriserna är låga, för att man ska kunna förbereda sig för framtida prishöjningar.

För vissa länder gäller det också att kunna lösa finansieringsfrågan. Bland annat bilaterala och multilaterala biståndsorganisationer kan hjälpa till vid planering av ett skifte och åtföljande åtgärder som skyddar speciellt de fattiga. Biståndsaktörer kan även hjälpa med att dela på erfarenheter från andra länder, samt ta fram fördelar från en välplanerad ”swap” med hållbara investeringar bland annat i förnybar energi eller energieffektivitet.

I rapporten beskrivs Nordiska ministerrådets arbete inom detta område och det övergripande begreppet ”swap” som ett konkret instrument för reformen (kapitel 3). Rapporten fokuserar därefter på ett potentiellt ”swap” i Zambia inom ramen för de pågående reformerna inom energisektorn (kapitel 4). Särskild fokus läggs på energieffektivisering inom gruvdrift, med potentiella lärdomar även för andra utvecklingsländer. Gruvverksamheten är en betydande användare av energi och tvungen att reagera på stigande priser, bland annat via aktiva energieffektiviseringsåtgärder.

Även andra ”swap” möjligheter diskuteras i rapporten, till exempel möjligheten att byta kerosin mot solpaneler för belysning i Indien eller butan mot solpaneler för bevattning i jordbrukssektorn i Marocko (kapitel 5). Det är viktigt att lära från andras erfarenheter, men man bör samtidigt förstå att det inte finns några "one-size-fits-all" lösningar för dessa reformer.

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Swapping Fossil Fuel Subsidies for Sustainable Energy

Underpricing of fossil fuels, caused by subsidies, drives carbon intensive consumption. Reforming fossil fuel subsidies and allocating some of the savings to sustainable energy could accelerate a transition to fairer, safer, cleaner and more sustainable energy systems. This report outlines the Nordic Council of Ministers' work to promote these swaps through the development of a business model and description of the link between fossil fuel subsidies, reforms and carbon emissions. The report evaluates potential swaps to increase industrial energy efficiency in the mining sector, in the context of energy sector reforms in Zambia; and the replacement of butane subsidies with solar investments in Morocco. The report also presents an outline of how Nordic countries are supporting reforms and driving the swaps agenda as part of the Nordic Solutions to Global Challenges projects.

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