

Addressing the Economic Costs of Sustainable Energy in the Global South

BACKGROUND RESEARCH PAPER

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Executive Summary

This paper contributes to a general understanding of the thematic areas of fossil fuel subsidies and universal energy access and outlines steps toward increasing the adoption of sustainable energy technologies in developing countries by outlining policy options for improving governance frameworks at the multilateral and national levels. It highlights the contemporary debate about the elimination of fossil fuel subsidies and focuses on Sustainable Energy for All (SEFA), since the initiative involves increasing access to and adoption of technologies, aiming to ensure universal access to modern energy services, double the global rate of improvement in energy efficiency, and double the share of renewable energy in the global energy mix.

Eliminating fossil fuel subsidies, which totalled about US\$775 billion in 2012, would contribute half of the emissions reductions needed up to 2020 to reach a trajectory that would limit global warming to 2°C and free up resources that could be used in sustainable energy and climate-related initiatives. The International Energy Agency found that subsidies have nearly tripled since 2009, when Group of Twenty (G20) countries committed to eliminate them, and only between 2 per cent and 11 per cent of consumption subsidies benefit the world's poorest. Lack of transparency and information regarding the amount and type of fossil fuel subsidies is a major problem, especially among developed countries.

The first two SEFA objectives look to reduce poverty and inequality, but may contradict the G20's goal of eliminating inefficient fossil fuel subsidies that encourage wasteful consumption over the medium term. The G20 commitment on targeted support for the poorest,

particularly through consumption subsidies and connection subsidies, suggests that certain subsidies might have to continue to achieve SEFA's first two objectives. Moreover, ensuring universal energy access through SEFA—connecting upwards of 2.6 billion people to electrical grids or providing them with more modern forms of energy—would contribute to global climate change, which the UN is working hard to mitigate. The path forward to achieving broad-based and equitable sustainable development, then, is fraught with challenges and potential contradictions.

With SEFA, financing is the critical issue. Difficulties in financing for developing country governments result primarily from low user fees and poor revenue collection. Regarding Africa, in some cases grid extension is the most economical solution to energy access problems. In general, the best renewable energy alternative in rural areas of developing countries is off-grid solar energy technologies. Decentralized solutions require financial support, but with a small cost change the populations benefitting from decentralized systems would increase significantly. The ability to pay for energy services has to be strengthened by providing initial and continuous support.

Regarding time scales, political costs can be addressed by promoting economic benefits. On costs, developed countries must not refuse to contribute to the Global Climate Fund and developing countries must commit to targets and transparent reporting. In addition to loans and grant funding, international organizations can help governments and especially private sectors by transferring clean technologies and building capacity. Multi-stakeholder public-private partnerships are key for demonstrable results, innovation, sharing of lessons learned, and the determination of best practices. The creation of a global sustainable development council could

directly target the actors that create the problems that regime arrangements set out to address and improve the will among governments for cooperation.

Moving forward, developed countries should, among other things, improve transparency and consistency of reporting on fossil fuel subsidies to facilitate the removal of production and consumption subsidies over the short and medium term, use a process for successful subsidy reform, and develop their own implementation strategies for one- and five-year goals on phasing out fossil fuel subsidies. In addition to development initiatives, developing countries should focus on financing mechanisms for solar energy technologies, improving tax collection systems, and strengthening efforts to crackdown on corruption. Price-based targeting for sustainable energy technologies, especially for off-grid solar energy technologies in Africa, should be implemented. Access to validated information on renewable energy resources and performance of technologies can stimulate deployment of these technologies.

Introduction

The problems of unsustainable resource use, environmental degradation, and global climate change are inherently tied to energy, which therefore must be the key component in any solution. Energy, often created from fossil fuel resources, is a cross-cutting issue in many societies and sectors. People want energy for cooking, lighting, heating, water pumping, transportation, agriculture, and industrial production. Sustainable energy solutions—using hydro, solar, wind, and geothermal resources—are within the reach of developing counties, many of which are experiencing considerable economic growth, rapid population growth, and a scarcity of fossil fuel resources. Some solutions are currently costly, but costs for certain sustainable energy technologies are increasingly becoming competitive with those of fossil fuel technologies. As the depletion of fossil fuel resources becomes an ever more realistic possibility, pragmatic

discussions need to take place to address the economic costs of sustainable energy, facilitate the elimination of fossil fuel subsidies, and implement a global strategy moving forward from 2015.

The objective of this paper is to contribute to a general understanding of the thematic areas of fossil fuel subsidies and universal energy access, assess the economic costs of sustainable energy in the South, and outline steps toward increasing the adoption of sustainable energy technologies in developing countries by providing policy options for improving governance frameworks at the multilateral and national levels. There are many in-depth books that outline the economic costs of sustainable energy in general (see, for instance, Tester et al. 2005), so this paper highlights the contemporary debate about the elimination of fossil fuel subsidies, since it is a relatively new issue on the international agenda, the resolution of which has the potential to increase efficiencies in government spending, reduce global dependence on fossil fuels, reduce greenhouse gas (GHG) emissions, and catalyze new spending on sustainable energy and climate-related initiatives. This paper also focuses on Sustainable Energy for All (SEFA), a relatively new United Nations (UN) initiative, which involves increasing access to energy, energy efficiency, and adoption of technologies, that is virtually unstudied.

This paper focuses on time scales, the increasing cost competitiveness of sustainable energy technologies, and the roles of international organizations, three issues that should help frame the discussion on sustainable energy going forward. Following this introduction, the significance of these three issues will be explained. The paper then turns to the debate on the elimination of fossil fuel subsidies and assesses various commitments made within the Group of Twenty (G20) and under the SEFA initiative. It concludes with policy recommendations.

Focus Issues

The long-term time scale for change in international energy- and climate-related discussions, with objectives having to be accomplished within a generation, defined here as 20 years, tends to allow policy-makers to make domestic and international commitments but delay action. The costs considered are too often political, rather than economic or social. Electoral cycles that complicate contemporaneous trade-offs in spending scarce political and monetary resources, domestic political manoeuvring related to the expectations of core constituencies, and the requirement of international consensus make designing international environmental agreements difficult (Hovi, Sprinz, and Underdal 2009). The short term and medium term, defined here as one year and between five and 10 years respectively, therefore deserve renewed consideration.

Importantly, sustainable energy technologies are becoming increasingly cost-competitive, especially where resources are available and in certain geographic locations, with investments in electricity from wind, solar power, ocean waves, and biomass growing faster than oil, natural gas, and coal in 2012 (SEFA 2013b). Enabling public policies and private sector investment could give a further boost to these technologies, especially when short- and medium-term economic benefits of sustainable energy are considered.

In addition to national governments taking action, international organizations can lead in policy development in the short and medium term to address the trade-offs involved. The G20 and UN can help forge consensus and generate commitments, the World Bank through the International Finance Corporation (IFC) can offer loans, the Global Environment Facility (GEF)—the largest public sector renewable energy technology transfer mechanism—can offer grants, and the Global Climate Fund (GCF), which will become operational in 2013, can support large-scale projects over time. These organizations can also encourage or be part of partnerships.

Fossil Fuel Subsidies and the G20

Fossil fuel subsidies are increasingly prominent on the international agenda because their scale is staggering and they grow with increases in the price of oil. There are two main types of subsidies: consumption subsidies and production subsidies. Consumption subsidies involve government spending to lower or cap consumer fuel prices in order to make energy more affordable, while production subsidies involve tax credits and tax breaks for producers of petroleum products, natural gas, and coal. For governments, two of the biggest issues at hand are price stability and energy security, with environmental and health challenges a distant concern. The macroeconomic, environmental, and social implications of pervasive subsidies are both largely negative and substantial, however. In addition to causing fiscal imbalances and in many cases increased public debt, subsidies can depress growth by discouraging investment in the energy sector, crowding out growth-enhancing public spending, diminishing the competitiveness of the private sector, and creating incentives for smuggling. For net petroleum importers, their balance of payments can be adversely affected by international price increases if prices are not passed on to consumers, and the volatility of subsidies complicates budget management. For petroleum exporters, subsidies exacerbate macroeconomic volatility by increasing subsidies when international prices increase. Notably, subsidies cause overconsumption of petroleum products, natural gas, and coal, which reduces incentives for investment in improving energy efficiency and increasing the use of renewable energy, worsens local pollution and aggravates health problems such as respiratory illnesses, and exacerbates global warming and climate change (IMF 2013, 15–19).

Data are not sufficiently transparent, but a number of different estimates of subsidies currently in place exist. Conservative estimates using Organisation for Economic Co-operation

and Development (OECD) subsidy data suggest that in 2012 there were US\$775 billion in fossil fuel subsidies, with US\$630 in consumption subsidies for developing countries, approximately US\$45 billion in consumption studies for developed countries, and more than US\$100 in production subsidies globally (NRDC and OCI 2012, 2). Using the price gap approach and different calculations based on available data, where the prices that firms and households pay are below a benchmark price based on the international price of an energy product and the prices that producers pay are above the benchmark, the International Monetary Fund (IMF) estimates that on a pre-tax basis in 2011, global subsidies for gasoline, diesel, and kerosene amounted to US\$212 billion, subsidies for natural gas US\$112 billion, and subsidies for coal US\$6 billion. On post-tax basis, which adjusts the benchmark price for corrective taxes and revenue considerations linked to negative externalities of energy consumption such as global warming and local pollution, that same year global subsidies for petroleum products amounted to US\$879 billion, subsidies for coal US\$539 billion, and subsidies for natural gas US\$299 billion. The IMF indicates that these estimates likely underestimate subsidies currently in place. In terms of total subsidies, the IMF names the top three subsidizers to be the United States, China, and Russia, while petroleum-exporting countries across the world account for the largest subsidies (IMF 2013, 1–14).

Eliminating subsidies would have the biggest impacts on the environment and equity. Fatih Birol, chief economist at the International Energy Agency (IEA), argues that eliminating subsidies for oil, gas, and coal could avoid up to 2.6 gigatonnes of GHG emissions per year by 2035 and provide half of the carbon savings needed to stop dangerous levels of climate change. Complete elimination would amount to half of the emissions reductions needed up to 2020 to reach a trajectory that would limit global warming to 2°C, an internationally negotiated target. The World Bank and environmental non-governmental organizations have also called for the

elimination of subsidies. Notably, only 7–8 per cent of subsidies reached the poorest 20 per cent of populations in 2010 and the richest 20 per cent of households in developing countries capture on average about six times more, or 43 per cent, in total subsidies. Subsidies primarily benefit upper-income groups, but the distributional effects vary by product, with gasoline being the most regressive and kerosene being progressive. Overall, other forms of welfare support would cost less and the money involved could improve access to schools, hospitals, and social protection, especially for the poorest (Clark 2012; IMF 2013, 19). Eliminating subsidies would save governments hundreds of billions of dollars that could be used in other ways, notably on sustainable energy- and climate-related initiatives, reduce annual global primary energy demand by nearly 5 per cent and global GHG emissions by around 6 per cent if done by 2020, and increase global gross domestic product by 0.7 per cent by 2050 (NRDC and Oil Change International 2012, 1). Reductions would be much larger if prices were raised to levels that eliminated subsidies on a post-tax basis, which would stop the overconsumption of fossil fuels, reduce international energy prices, and extend the availability of scarce natural resources (IMF 2013, 19).

Currently there are two key frameworks in place to address sustainable energy and green growth—the G20 and SEFA. The G20 is specifically focused on eliminating certain fossil fuel subsidies, providing targeted support for the poorest, and increasing the use of clean energy technologies and renewable energy. SEFA is concerned with increasing access to energy, boosting energy efficiency, and increasing the use of renewable energy. The Group of Eight and the United Nations Conference on Sustainable Development (UNCSD), which SEFA complements, are fora where debates on sustainable development are also happening, but concrete initiatives explicitly affecting the policies of a large number of key countries are being

decided within the G20 and under SEFA. The consensuses within the G20 and under SEFA cover all G20 members and a large proportion of developing countries, respectively, but a close look at the details demonstrates low compliance in the elimination of certain fossil fuel subsides and potential contradictions between the G20 and SEFA.

At their 2011 summit in Cannes and their 2012 summit in Los Cabos, G20 countries reaffirmed their commitment to “rationalise and phase-out over the medium term inefficient fossil fuel subsidies that encourage wasteful consumption while providing targeted support for the poorest” (G20 Research Group 2012, 362; G20 2012). There has been little compliance with the commitment to rationalize and phase out inefficient fossil fuel subsidies before 2020 since it was first introduced at the 2009 Pittsburgh summit (G20 Research Group 2012; Koplow 2010). Notably, G20 countries have not yet established a common definition of “inefficient fossil fuel subsidies that encourage wasteful consumption” (IEA, OPEC, OECD, and World Bank 2011). At the 2010 Toronto summit, Australia, Brazil, France, Japan, Saudi Arabia, South Africa, and the United Kingdom stated that they do not have inefficient fossil fuel subsidies—despite IEA and OECD reports indicating that all G20 countries save for Brazil, for which there is no information, have fossil fuel subsidies—and therefore would not formulate implementation strategies (G20 Research Group 2012, 364). Direct targeting, through the use of targeted cash transfers and other mechanisms, is used to provide those in need with essential energy services. Price-based targeting, which can influence the adoption of a certain type of energy source, is popular among governments to set the end price below the cost of supply. Most G20 countries have taken certain actions to help the poorest to cope when costs increase (G20 Research Group 2012, 362).

Lack of transparency and information regarding the amount and type of fossil fuel subsidies is a major problem, especially among developed countries (OECD 2012, 2), and

subsidies appear to be increasing as international energy prices rise and remain high. The G20 has no official monitoring mechanism, but G20 countries in Los Cabos acknowledged “the relevance of accountability and transparency” and asked finance ministers “to explore options for a voluntary peer review process for G20 members by their next meeting” in September 2013 (G20 2012a). The IEA has found that subsidies have nearly tripled since 2009, when G20 countries committed to eliminate them, and only between 2 per cent and 11 per cent of consumption subsidies benefit the world’s poorest (Swift 2012). International energy prices have started to escalate substantially since 2009, which partly explains the increase in subsidies (IMF 2013, 9). Governments’ policies largely explain the rest of the rise. The OECD’s *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels 2013*, published in January 2013, improved transparency for OECD countries and facilitated analysis on the efficiency and wastefulness of subsidies, but non-OECD countries need to be systematically assessed over time as well.

Caution is necessary so that reduction or elimination of subsidies does not disproportionately harm the poorest segments of populations. For instance, a US\$0.25 per litre increase in energy prices can reduce real consumption for the poorest 20 per cent of households in developing country by about 5.5 per cent, meaning that subsidy reform can result in increased poverty if effective safety nets and other mitigating measures are not put in place. In particular, higher energy prices restrict cooking, heating, lighting, and transportation (IMF 2013, 19). In most developing countries, fossil fuels are a particular concern in the transportation sector, since this is the sector in which renewable energy technologies are least developed. Reducing or eliminating subsidies would result in higher transportation costs that would negatively affect the poorest members of populations by increasing the price of transportation and food, increasing

unemployment and threatening livelihoods, and decreasing nutrition (Monkelbaan 2011). If the aim is to reduce the use of fossil fuels in a way that would not disproportionately disadvantage the poor, then measures such as improving energy efficiency and ensuring cleaner methods of energy use would be more appropriate.

The IMF explains that subsidies have been difficult to reform due to the absence of public support and governments' concerns about price volatility, inflation, and competitiveness. The readjustment of prices has led to public protests by politically active groups who benefit from subsidies and organized efforts to block reforms, leading to a complete or partial reversal of price increases. The lack of public support for subsidy reform is partly due to lack of government credibility and administrative capacity as well as a lack of confidence in governments' abilities to allocate saved resources to benefit broader populations, especially the poorest segments. In petroleum-exporting countries, where subsidies are often used as a policy instrument for sharing wealth among citizens, subsidies are not an effective instrument for redistributing wealth because benefits primarily accrue to upper-income groups. Moreover, populations often cannot make judgments because of a lack of information about domestic energy prices in relation to international market prices as well as the shortcomings of subsidies in terms of spending and economic inefficiencies. Public resistance is relatively lower in cases where economic growth is high and inflation is low. Governments are primarily concerned with the volatility of domestic energy prices, the inflationary effects of higher energy prices, and the negative impacts of higher prices on the international competitiveness of domestic producers (IMF 2013, 5, 19, 23–25).

Elimination of subsidies is certainly possible, but reduction indeed needs to be gradual. Ideally, like the G20 suggests, countries would implement fossil fuel reform gradually while protecting the poor and most vulnerable with targeted assistance—the intention is right. Certain

subsidies will likely need to be kept in place for the optimal functioning of economies, so a process for successful subsidy reform should be introduced. Tara Laan, Christopher Beaton, and Bertille Presta (2010, 22) outline one such process:

- Research: assess the nature of each subsidy, its original objectives, and current role in the economy; assess how the subsidies have arisen or have been exacerbated; analyze the economic, political, social, and environmental context of reform; identify the political-economy issues, such as subsidy recipients, non-recipients, and other stakeholders; and make results of research public to improve understanding of the rationale for reform.
- Objectives and parameters of reform: articulate the objectives of reform; assess the potential economic, social, and environmental impacts of reform; consider the limits on reform, including funding available for policies to ease the transition to de-subsidization; and assess external constraints, such as donor requirements or international obligations.
- Building a coherent reform policy: determine the time period over which reform is to take place, based on available resources and likely stakeholder response; design transitional measures to reduce impacts on affected industries and consumers, and exit strategies for these measures; develop a communications strategy; and ensure transparency regarding subsidy levels and strategies for de-subsidization.
- Implementation: ensure that those charged with implementing the reform strategy are determined to carry it through, even if it takes many years; and communicate to affected groups and the general public the necessity of reform, the strategy, and the expected benefits.

- Monitoring and evaluation of reform: monitor the impacts of reform, checking against the initial objectives and for unintended negative consequences; and adjust the policies as necessary, based on observed impacts.
- Going forward: establish independent institutions and automated price-setting mechanisms to distance the government from the supply and pricing of energy; ensure that the government's involvement in the energy sector is transparent and accountable; and promote greater contestability of energy-related decisions, such as access to resources.

Such a subsidy reform process could be used as a starting point for governments and international organizations to develop national sustainable energy plans and international standards. Any national subsidy reform process or multilateral discussion about international standards should keep in mind the IMF's six key elements for subsidy reform, which are based on comprehensive country-specific case studies: (1) an energy sector reform plan with clear long-term objectives, analysis of the impact of reforms, and stakeholder consultation; (2) a communication strategy alongside improvements in transparency, specifically the dissemination of the scale of subsidies and recording of subsidies in the budget; (3) carefully phased price increases sequenced differently across relevant energy sources; (4) improved efficiency of state-owned enterprises to reduce production subsidies; (5) targeted measures to protect the poorest segments of the population; and (6) institutional reforms that depoliticize energy pricing, particularly the introduction of automatic pricing mechanisms (IMF 2013, 1, 25–34).

Energy Poverty and the Sustainable Energy for All Initiative

Launched in September 2011, SEFA has the aim of mobilizing global action to achieve three objectives by 2030: ensure universal access to modern energy services, double the global

rate of improvement in energy efficiency, and double the share of renewable energy in the global energy mix from 15 per cent to 30 per cent (SEFA 2013a). To date, more than 50 governments—the majority from developing countries—are developing energy plans and programs, businesses and investors have committed over US\$50 billion to achieve the initiative’s three objectives, stakeholders such as multilateral development banks and civil society organizations have committed tens of billions of dollars, and hundreds of public and private actions and commitments are underway, all which will benefit more than one billion people (SEFA 2013c). A baseline report, which was completed through a partnership between the World Bank, IEA, and others and provides an overview of progress, builds consensus on tracking progress through 2030, and serves as a basis to produce periodic tracking reports, was published in January 2013.

The first two of SEFA’s objectives relate to the fact that 1.3 billion people are still without electricity, while another 2.6 billion rely on wood, coal, charcoal, and animal waste for cooking and heating (SEFA 2013a). These objectives aim to reduce poverty and inequality, but may contradict the G20’s goal of eliminating inefficient fossil fuel subsidies over the medium term, given the scale of consumption subsidies in developing countries, the inclusion of developing countries in the G20, and the lack of a common definition of “inefficient fossil fuel subsidies that encourage wasteful consumption” among G20 countries. The G20 commitment to targeted support for the poorest, particularly through consumption subsidies and connection subsidies (designed to reach a majority of the unserved population living in areas connected to a grid), suggests that certain subsidies might have to continue to achieve SEFA’s first two objectives. Without a common definition of “inefficient fossil fuel subsidies that encourage wasteful consumption,” some of those subsidies may in fact have negative impacts over the medium and long term.

Moreover, ensuring universal energy access through SEFA—connecting upwards of 2.6 billion people to electrical grids or providing them with more modern forms of energy, not to mention that at least 3 billion will enter the global middle class by 2030 and likely demand more resource-intensive foods such as meats—would increase emissions levels and significantly contribute to global climate change, which the UN is working hard to mitigate (Kharas 2010; GO-Science 2011). The third objective, however, complements G20 commitments to eliminating inefficient fossil fuel subsidies and transferring clean energy technologies. The path forward to achieving broad-based and equitable sustainable development, then, is fraught with challenges and potential contradictions, especially with regard to subsidies.

First of all, there are difficulties on the sides of supply and demand in developing countries. Supply-side shortages are due to: poor generation and distribution equipment; high levels of technical loss; low numbers of generation processes, programs, strategies, and mechanisms; technical constraints related to low levels of education and research and development; organizational issues; under-financed power companies; restricted or non-existent domestic financing; and consumer prices that are too low (Urban, Benders, and Moll 2007). Each of these issues needs to be addressed if large-scale investment and development of sustainable energy projects is to be achieved. On the demand side, in urban areas demand often outpaces supply, but in many rural areas there is a lack of consumption due to biomass fuel predominance (Urban, Benders, and Moll 2007). This situation may make new forms of investment into sustainable energy solutions unattractive. There are many potential steps forward, however.

With SEFA, financing is the critical issue. The availability of finances for sustainable energy solutions is largely related to available domestic resources. In 2011, it was estimated that developing countries were spending between US\$40 billion–60 billion annually on electricity

grids. Unfortunately, despite domestic financing, nearly 40 per cent of the populations in these countries remain without access to electricity, indicating that the aggregated number of those without reliable energy access has hardly changed since 1970 (Ahuja 2012). Difficulties in financing for developing country governments result primarily from low user fees and poor revenue collection. Energy sectors cannot hope to be properly financed domestically if consumer fees fall well below producers' basic operating costs. Moreover, substantial revenue, which could be used to expand access, is not collected by energy companies due to evasion by consumers or protection from tariffs by governments (Urban, Benders, and Moll 2007). If subsidies were significantly reduced or eliminated, fossil fuel use would decline and monetary resources could be redirected toward funding and continually supporting sustainable energy technologies. Corruption among government officials, a widespread problem that also reduces funding available for sustainable energy solutions, also needs to be strongly addressed.

A priority region should be Africa, given recent rapid economic growth tied to natural resource extraction. There is huge potential for the reinvestment of windfalls into sustainable energy development, which could lead to broad-based sustainable economic growth, poverty reduction, and an overall reduction in GHG emissions. With almost 60 per cent of Africa's approximately one billion people living in non-urban areas, and with more than 60 per cent of the population of sub-Saharan Africa, primarily in rural areas, unconnected to the grid, providing electricity access should be a primary task (Szabó et al. 2011). Because of low capital costs and large networks of suppliers, diesel generators are often the technology of choice in these rural areas, but the volatility of fuel prices often results in high generation costs (Casillas 2010). Connecting people to a centralized electricity grid is generally preferred, with locally applicable solutions, which are independent of national energy networks, providing flexible power supplies

(Dincer 2000). In some cases, grid extension is the most economical solution, but mini-grids based on local renewable resources are more affordable in rural areas where expected electricity load is relatively low. Diesel stand-alone systems and grid extension can be replaced with solar, wind, hydro, and hybrid systems that can help establish long-term electricity supplies. In general, the best renewable energy alternative in rural areas of developing countries is off-grid solar energy technologies, especially household-level devices and system such as the solar lanterns—which can be made locally in developing countries—that are promoted by SEFA, rooftop solar home systems, and portable solar kits that include multiple lights and charge small devices. Decentralized solutions require financial support, but with a small cost change the populations benefitting from decentralized systems would increase significantly. Over large rural regions, biomass, hydro, wind, and efficient fuel use options may be more viable context-specific solutions (Szabó et al. 2011).

One key way of addressing the economic costs of sustainable energy in the South, which SEFA strongly encourages, is increasing the involvement of private sector actors in improving energy access. Small and medium-sized enterprises, domestic conglomerates, and multinational corporations can play significant roles if they have the right business models and enabling conditions, such as legal provisions and regulatory frameworks. Some have already established large customer bases, often with small capital subsidies or no subsidies at all, and have profit margins of 10–30 per cent. Businesses are focusing on household-level devices and systems, community-level mini-grids, and grid extension. Household-level devices and systems, especially solar lanterns, have attracted the greatest private sector investment in Africa, Asia, and Latin America since barriers to entry are low and such lanterns are increasingly popular and affordable. Affordability is a paramount issue, so when technology costs are still high, like for rooftop

systems and solar kits, governments should increase the availability of large amounts of concessional financing in partnership with microfinance institutions. Strong distribution networks, supply chain financing, low-cost marketing, product standards, non-discriminating tax and duty regimes, and training and support of entrepreneurs should also be a priority. In cases with adequate demand for power from households and businesses, profitable mini-grids—which can support local economic development by providing sufficient power for water pumping and forms of processing—require a reliable, low-cost fuel source, formal billing systems, training in formal business skills for entrepreneurs, regulatory regimes with cost-reflective tariffs, and some cases capital subsidies. Grid extension remains costly, but policies that support private participation, such as removing limits on service areas, relaxing restrictions on serving informal settlements, allowing flexibility in tariff regulations, and financing connections of end customers, as well as significant public funding, especially in the form of concession contracts for companies to serve unserved areas, can improve access to grids (IFC 2012, 12–19).

Critics argue that SEFA is focusing too much on large-scale infrastructure investment, missing opportunities to boost enterprise locally for the benefit of the poorest, and failing to engage all levels of the private sector effectively. To succeed in delivering universal energy access, SEFA must address the lack of finance for businesses and end users, infrastructure and support services for new businesses, local skills, capacity, and information about workable models, and favourable policy frameworks. In particular, SEFA needs to incentivise financially viable but less-profitable models, such as social enterprises, co-operatives, corporate social investment programs, and private-sector partnerships with governments and non-governmental organizations. SEFA should also stimulate policy reform, support business innovation, and build confidence in novel solutions by substantiating successful models and supporting validation

processes. In order to reach out beyond industry associations and international development networks, SEFA could actively engage with groups and small and medium-sized enterprises through professional and social networks such as LinkedIn and Twitter. To reach the poorest, SEFA can promote private-sector partnerships with governments and non-governmental organizations, encourage corporate responsibility initiatives, and support social entrepreneurs (Bellanca and Wilson 2012). In order to be a broad, viable strategy moving forward, SEFA must continually address criticisms, adjust its country actions according to lessons learned, and attempt to incorporate its commitments and actions into national frameworks for alleviating poverty.

When it comes to reaching the poorest, traditional biomass—which includes firewood, charcoal, manure, and crop residues—deserves special attention. About 2.6 billion people, or 40 per cent of the world's population, rely on traditional biomass to meet all their energy needs, owing to a lack of access to clean renewable energy sources, which can have harmful consequences for health, the environment, and economic and social development (Birol 2007). Traditional biomass is the largest energy supply for members of many dispersed and poor rural populations, who often use it inefficiently in simple cook stoves or open hearths in poorly ventilated areas to cook food. Indoor air pollution, responsible for 2.7 per cent of the total burden of disease and approximately two million deaths per year, has implications for women, children, and the elderly, who endure poisoning, chronic pulmonary disease, pneumonia, and lung cancer due to long hours spent around biomass fuel-based fires. Cooking represents 5 per cent of total global warming, while use of biomass—charcoal in particular—is linked to degradation of forests and woodland resources and soil erosion (UNEP 2013).

Use of biomass correlates with people's income levels, living habits, village structures, and gender roles. Alternative biomass-related solutions include using biomass cook stoves that

offer improved fuel consumption of up to 50 per cent, switching to cleaner fuels, and using electricity-powered appliances. Encouragement and financial support for new businesses that sell more efficient stoves or facilitate shifts to cleaner energy have helped to improve people's situations (UNEP 2013). In some cases, carbon credits can help bring down costs of stoves, which can allow new businesses to become established and grow quickly (IFC 2012, 14). Development initiatives that improve incomes, such as improvements in education, could lead households to use wood, the best form of biomass to create energy, or cleaner fuels and appliances. The benefits of moving away from a significant reliance on biomass fuel sources toward sustainable energy resources include a decrease in time and effort to procure fuel sources and the reduction of severe and widespread health impacts associated with indoor air pollution (Sagar 2005).

Notably, the value and importance of liquefied petroleum gas (LPG) has been overstated in the past. LPG is a common cooking fuel in many developing countries, especially Brazil and India. To move their populations away from charcoal use, many governments subsidize LPG through measures such as exemptions of customs duties on equipment designed to operate on LPG. However, the problem is that LPG is derived from natural gas, results in fossil fuel depletion, and emits carbon dioxide emissions (though less than coal and oil). In the case of Africa, where use of biomass predominates, a shift toward the use of LPG by using targeted subsidies would improve health but not result in the adoption of renewable energy technologies. Alternative biomass-related solutions or clean energy technologies are preferred.

Regarding gender, the adoption of sustainable energy solutions may help reduce the number of women, who typically bear the brunt of household chores including the collection of biomass fuel sources, forfeiting education opportunities and higher wages. Better education and higher

household incomes among women are powerful factors in stabilizing the number of children born into extreme poverty. Regarding the environment, reducing firewood collection would reduce instances of desertification, which contributes to poverty exacerbation (Holm 2005). Therefore, not only would sustainable energy programs in developing countries improve the health of rural populations who rely extensively on biomass, but could equally have trickle down effects that improve social and environmental outcomes.

Renewable energy sources are often misunderstood and consequently evaluated as a less cost-effective means of reducing energy poverty and alleviating climate change. Renewable energy sources offer benefits such as flexibility and modularity and generally have low operation costs, a situation which is considerably different from fossil fuels, which require large-scale capital investment and have long-term implementation and operating cost uncertainties (Dincer 2000). Initial costs for sustainable energy technologies tend to be high, but lifetime costs are predicted to be low. High initial costs do not mean that sustainable energy technologies are unaffordable in developing countries, especially to their rural inhabitants. Costs are dependent on type of energy, for which different systems have different lifetimes. In some developing countries, the lifetime operation and maintenance costs of solar energy technologies, which are twice as productive in Africa than in Central Europe on average, are lower than those of major rival technologies. In the case of sub-Saharan Africa, renewable energy sources—hydro, solar, biomass, and wind in particular—can meet Africa’s energy demands “many times over,” so the ability to pay for energy services has to be strengthened by providing initial and continuous support. Importantly, sustainable energy technologies should be seen as complementary options in situations where conventional energy is unavailable or the grid cannot be economically extended (Szabó et al. 2011). It should be noted that all renewable energy sources are location-

specific. Wind power, for instance, is promising but adoption is unrealistic in many developing countries since wind speeds are low near the equator and the costs of technologies that generate electricity at low wind speeds are often prohibitive. Off-shore wind farms are an option, but they are also expensive. Greater context-specific research and development is required to identify cost-effective solutions for each developing country and to make sustainable energy options more efficient and more affordable.

In the transportation sector, biofuels can replace fossil fuels if vehicles are modified, but biofuels such as bioethanol can only be blended into gasoline at up to 10 percent without vehicle modification, the costs of which are prohibitive for many developing countries. In its 2009 report titled *Future Bioenergy and Sustainable Land Use*, the German Advisory Council on Global Change (WBGU) concluded that the global sustainability potential of energy generation from biomass, which can be converted into biofuels, is significant and should be tapped. In the medium term, around 10 percent of the world's energy needs could be met with sustainable bioenergy from biogenic residues and energy crops. About one quarter of the potential arising from energy crops is located in Central and South America. Sub-Saharan Africa, Europe, North America and China each account for around 15 percent, while India accounts for 6 percent. However, this potential should only be pursued if risks to food security and nature conservation are minimal and climate change mitigation targets could allow increased production or do not exist (Schubert et al. 2009).

On the issue of climate change, production of first-generation liquid biofuels such as bioethanol from maize or biodiesel from rape can increase food insecurity and generally does not help to mitigate climate change. If the cultivation of energy crops on agricultural land displaces food production and land elsewhere has to be cleared as a result, more GHG

emissions may be released than would have been the case if fossil fuels had been used. Second-generation liquid biofuels, in which the whole above-ground part of the plant is used, perform no better in this regard. By contrast, biofuel production using perennial tropical plants such as sugar cane, oil palm, and jatropha can substantially mitigate climate change when these plants are grown on degraded land. However, considerable damage to the atmosphere can be done if tropical forests are cleared in order to grow these crops (Cotula, Dyer, and Vermeulen 2008). Again, context-specific research is needed.

Time Scales, Cost Competitiveness, and International Organizations

Time scales related to political costs might be the most important, though largely undiscussed, factor in discussions within the G20 and under SEFA. According to joint declarations, G20 countries speak with a single voice and primarily work according to medium- and long-term time scales. SEFA works on a long-term time scale, aiming to achieve its objectives by 2030. While it is understandable that certain objectives can only be achieved in the long term, long-term time scales without short- and medium-term goals complicate efforts to design effective international solutions. Recent political trends in developed countries, mainly concerned with boosting growth during the so-called “global slowdown,” and resistance to the SEFA debate by oil exporters, particularly Russia, Venezuela, and some Gulf states, are obstructing the implementation of sustainable energy strategies.

Political costs can be addressed by promoting economic benefits. Short- and medium-term economic costs are increasingly significant and well-understood, as each sub-sector of the renewable energy sector, which grew nearly 18 per cent between 2005 and 2009, has been growing strongly, with hydro power being the most important source, generating 16 per cent of total power generation in 2009 (Gloystein 2011). One academic study found that there is an

“interdependency” between renewable energy and economic growth in the short term, which “suggests that energy policies aimed at increasing the production and consumption of renewable energy will have a positive impact on economic growth” (Apergis et al. 2010, 2258). Many developed countries have large-scale subsidies in place to develop clean and renewable energy supply systems, but according to the IEA, investment opportunities in hydro, geothermal, and biomass power exist without the need for subsidies, while cost reductions for wind and solar power are set to continue along with research and development (Gloystein 2011). Competitiveness is an issue, since in many cases sustainable energy technologies remain more expensive than equipment that uses fossil fuels. Renewable energy sources are able to provide energy security while reducing GHG emissions, and are creating new jobs, though faults exist, such as approved fraudulent grant applications, low competitiveness, and unintended environmental consequences for economic outcomes.

Moving toward sustainable energy solutions, each developing country has its own financing needs. Country case studies are needed, since there is no one-size-fits-all solution for meeting the daily energy requirements of diverse populations. Some finances should come from developed countries. A key development in recent years is the GCF, which is expected to play a key role in new adaptation and mitigation strategies by channelling \$100 billion annually to developing countries by 2020. Developed countries must not refuse to contribute to the fund and developing countries must commit to targets, transparent reporting, and other accountability arrangements. Finances should also come from citizens of developing countries, so in addition to development initiatives in developing countries, fossil fuel subsidies should be reduced gradually, tax collection systems should be improved, and efforts to crackdown on official corruption need to be strengthened. Developing country governments can adopt well-designed financial

mechanisms that support renewable energy technologies, such as mechanisms that provide a subsidy only if a system delivers energy, to smooth out the lifetime cost burden and so can help expand renewable energy technology to rural areas (Szabó et al. 2011).

International organizations can help smooth out cost/quality trade-offs in financing, investments on returns, growth trajectories, and competitiveness. Financing mechanisms that transfer resources from developed to developing countries, which reduce market barriers, are crucial. Large loans through the IFC and grants through the GEF have been made available for developing countries, which can offset initial costs, reduce risk, and make sustainable energy technologies affordable across time scales. The Kyoto Protocol's Clean Development Mechanism remains important. The GFC will be a game-changer if most, if not all, developed countries contribute. SEFA's strategy includes fostering public-private partnerships and innovative investment models (Nakićenović, Kammen, and Jewell 2012, 14) and organizations can encourage or be part of such partnerships. IFC loans and GEF grants often include public-private partnerships. Organizations can also help governments and especially private sectors by transferring sustainable energy technologies and building capacity, which remain the most important ways to increase uptake of these technologies in developing countries. Private sector actors have long indicated that they require additional forms of support, including assistance with business plans, financing pre-feasibility studies, reducing commercial risks, supporting joint ventures, building market volume and stability, and piloting and testing innovative business models (Martinot 2001).

When it comes to capacity building, multi-stakeholder public-private partnerships on sustainable development have been shown to pool together diverse expertise and resources from governments, businesses, and civil society, and decentralization, flexibility, and informality can

link local practices with global environmental and development norms (Bäckstrand 2006, 303). Encouragement of such partnerships through the G20, UN, and World Bank could lead to demonstrable results, innovation, sharing of lessons learned, and the determination of best practices. Collaboration on sustainable development could be improved through “clearer linkage to existing institutions and multilateral agreements, measurable targets and timetables, more effective leadership, improved accountability mechanisms, more systematic review, reporting and monitoring” (Bäckstrand 2006, 303). Moreover, the encouragement of urbanization, like through the World Bank’s current infrastructure strategy in Africa, could lead to improvements in the energy situations of developing countries.

To address the challenges and potential contradictions facing the G20 and SEFA and to improve coordination among organizations, both institutional and organizational reform is necessary. The UN High Level Panel on Global Sustainability recommended the creation of a global sustainable development council, a subsidiary organ of the UN General Assembly which could develop a peer review mechanism for states and engage international organizations, particularly UN agencies and the World Bank (GSP 2012, 77–78). This council could also facilitate reporting on fossil fuel subsidies by phasing in reporting by subsidy categories, offering technical guidance, establishing a standardized submittal process for subsidy information, requiring third-party certification of data, and establishing an external committee to address recurring subsidy definition, valuation, and impact issues (Koplow 2010, 14–16). Alongside continuing with the momentum after the last UNCSD, widely known as Rio+20, where the development of Sustainable Development Goals was discussed, such institutional reform could address real problems in global environmental governance, namely directly targeting the actors that create the problems that regime arrangements set out to address and improving the will

among governments for global environmental cooperation (Najam 2003, 368–71). Engagement with global public policy networks and civil society through the UNCSD could allow the council to gain broad-based legitimacy.

Conclusions and Policy Recommendations

The intergovernmental debate on the post-2015 development agenda can consider many paths to elaborate upon or succeed Millennium Development Goal 7. Poverty alleviation will undoubtedly be a major topic of discussion. It should be noted that poverty alleviation is hindered primarily by two inter-linked phenomenon: lack of access to energy services and worsening of climate change effects. The former results in unmet basic needs and depressed economic and educational opportunities, particularly among the most vulnerable members of the world's poorest populations. Clean, reliable energy improves access to services, catalyzes economic activity, and helps alleviate extreme poverty (Casillas 2010). Renewable energy sources have been proven to deliver clean, sustainable, and cost-effective energy services, providing a necessary base for poverty reduction and development. A rapid and sustained transformation to the use of renewable energy sources and energy efficient equipment is an essential supportive step toward the achievement of Millennium Development Goal 1 (Holm 2005). One of the most important solutions to reducing the effects of climate change, and in particular the rapid growth of GHG emissions, is the introduction of robust and universal sustainable energy technologies (Dincer 2000).

Developed and developing countries must do their respective parts moving forward. Uptake of sustainable energy solutions has been highest among OECD members and emerging market countries such as China, India, and Brazil (Gloystein 2011). A realistic yet aggressive strategy to implement sustainable energy solutions worldwide would include a focus on

significantly scaling down fossil fuel subsidies and engaging the private sector to use and further improve sustainable energy technologies. The strategies outlined in IEA, OPEC, OECD, and World Bank (2011) and SEFA's "Global Action Agenda" (see SEFA 2012) are well-articulated and sufficiently aggressive. One major challenge for the SEFA initiative is to get more countries to sign on, especially developed countries. While it is true that developing countries are in the early stages of modern energy development and could advance considerably quite quickly with the proper international support, the situation of global climate change in particular will not change much if developed countries continue using fossil fuels at current levels of intensity. Developed countries should do much more to adopt sustainable energy technologies if GHG emissions levels are to be reduced significantly (see OECD 2012b).

In order to achieve goals and capitalize on opportunities, several key measures must be adhered to. Since many sustainable energy strategies target developing countries, developing country governments must create the conditions that enable growth by establishing a clear vision, national targets using internationally agreed upon standards, policies, regulations, and incentives, and strengthened national utilities sectors (SEFA 2012). While the preference is for a global shift toward the usage of renewable energy, reliance on fossil fuels and biomass in developing countries will likely continue for many years to come, so these energy sources cannot be left out of national energy strategies. The focus should be on how to encourage their sustainable management, more efficient use, and cleaner methods for use. While great progress has been made in recent years in developing sustainable energy technologies, they cannot replace all other sources of energy in the medium term. In the search for sustainable energy solutions, a wide range of options should therefore be considered, including combining the use of fossil fuels with renewable energy sources alongside more efficient, cleaner technologies. Such a dynamic agenda

will require collaboration, which will take different forms, among all stakeholders, which cut across all sectors (SEFA 2012). Support for sustainable energy programs in developing countries can lead to increased access to energy services, an overall increase in development, and significant alleviation of poverty.

The likelihood of this strategy being implemented given current technology is high if global economic conditions improve. In the context of many economies being depressed and increasing economic nationalism, prospects for focusing on sustainable energy solutions seem low, so efforts to rebalance the global economy and solve the euro crisis must be strengthened if countries are going to cooperate on sustainable energy initiatives. An about-face toward positive progress is unlikely, but numerous small steps on a path to renewable energy usage are possible and could create self-reinforcing synergies among governments, organizations, and private actors. The policy recommendations for governments that follow should help frame the discussion about designing a path forward from 2015.

- Improve transparency and consistency of reporting on fossil fuel subsidies to facilitate the removal of production and consumption subsidies over the short and medium term.
- Further implement direct targeting, given that the poorest segments of populations remain neglected since richer segments receive a disproportionate amount of subsidies.
- For the G20, agree on a common definition of “inefficient fossil fuel subsidies that encourage wasteful consumption.”
- Introduce a voluntary peer review process within the G20 to monitor progress on the elimination of inefficient fossil fuel subsidies.
- Considering the medium term, follow the recommendations of the IEA, OPEC, OECD, and World Bank (2011, 13) on developing implementation strategies for improving social

safety nets (making sure that they are gender-sensitive) and improving targeting mechanisms for subsidies (connection subsidies are progressive, consumption subsidies are regressive), informing the public and announcing one-off compensatory measures, and reforming energy sectors.

- Use the process for successful subsidy reform outlined by Laan, Beaton, and Presta (2010) as a starting point for governments and international organizations to develop national sustainable energy plans and binding international standards, keeping in mind the six key elements for subsidy reform outlined by the IMF (2013).
- Alongside long-term objectives agreed within international fora, have countries develop their own implementation strategies for one- and five-year goals on phasing out inefficient fossil fuel subsidies and, where appropriate, improving access to modern energy, improving energy efficiency, and increasing the use of renewable energy sources according to national contexts.
- To improve energy access alongside private sector actors, encourage and leverage businesses to address large portions of energy access gaps, resist giveaway programs and unrealistic programs where markets exist, remove discriminatory import tariffs across energy access products, rethink service areas, institute lighter regulations, establish revenue frameworks, foster public-private partnerships with incentives to connect end users, provide market intelligence and information on the availability of resources, help build consumer trust and awareness, and establish bodies tasked with managing the rollout of target energy access efforts, local standards agencies for device manufacturers, and regulatory bodies to manage mini-grid power purchase agreements and large electrification concessions (IFC 2012, 17–19).

- To address the energy needs of the poorest, incorporate SEFA commitments and actions into national frameworks to alleviate poverty, focusing on financially viable but less-profitable models, private-sector partnerships, corporate responsibility initiatives, and support for social entrepreneurs.
- Provide financial support for new businesses that sell efficient stoves which use biomass or that facilitate shifts to cleaner energy, especially with the use of carbon credits.
- Since it can influence the adoption of certain types of energy sources, implement price-based targeting for renewable energy sources, especially in cases where introducing off-grid solar energy technologies in Africa would benefit large populations.
- Developed countries should contribute to the GCF if developing countries commit to targets, transparent reporting, and other accountability arrangements.
- In addition to development initiatives in developing countries, reduce fossil fuel subsidies gradually, improve tax collection systems, and strengthen efforts to crackdown on corruption.
- Encourage public-private partnerships, especially between businesses from developed and developing countries, to build capacity and catalyze innovation.
- Follow through on the recommendation of the UN High Level Panel on Global Sustainability to create a global sustainable development council, which could develop a peer review mechanism for governments (particularly concerned with short- and medium-term strategies and results) and engage international organizations.
- Since many sustainable energy projects supported by initial investment subsidies have failed shortly after their start due to negligence, poor operation, or misuse, prioritize

support to the continuous operation of electricity generation systems that use renewable energy sources in national sustainable energy plans (Szabó et al. 2011).

- Conduct greater context-specific research and development to identify cost-effective solutions for each developing country and to make renewable energy options more efficient and more affordable.
- Support innovation in decentralized and user-owned electricity generation systems, such as photovoltaic paint, blinds, and glass (see Vince 2013).
- Develop communication and stakeholder strategies and increase transparency to make sure that subsidy reform strategies are successful (Laan, Beaton, and Presta 2010), and increase access to validated information on renewable energy resources and technologies' performance to increase demand for renewable energy and make sustainable energy technologies an attractive endeavour for private sector actors (Szabó et al. 2011).

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