Southern Voice

2015 On Post-MDG International Development Goals

Occasional Paper Series

11

Sustainable Access for All

Building Sustainability into Universal Energy Access

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SUSTAINABLE ACCESS FOR ALL

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Preface

The *Southern Voice on Post-MDG International Development Goals* was born in the spirit of collaboration, participation and broad academic inquiry. It is a network of 48 think tanks from Africa, Latin America and South Asia which has identified a unique space to contribute to the post-2015 dialogue. By providing quality data, evidence and analyses derived from research in the countries of the global South, these think tanks seek to inform the discussion on the post-2015 framework, goals and targets, and to help to shape the debate itself.

With these goals in mind, *Southern Voice* launched a call for papers among its members to inform the global debate based on the research they have already carried out, to strengthen national or regional policy discussions. The objective of the call was to maximise the impact of the knowledge that already exists in the global South, but which may have not reached the international arena.

In response to the call, we received numerous proposals which were reviewed by *Southern Voice* members. The research papers were also peer reviewed, and the revised drafts were later validated by the reviewer.

The resulting collection of ten papers highlights some of the most pressing concerns for the countries of the global South. In doing so, they explore a variety of topics including social, governance, economic and environmental concerns. Each paper demonstrates the challenges of building an international agenda which responds to the specificities of each country, while also being internationally relevant. It is by acknowledging and analysing these challenges that the research from the global South supports the objective of a meaningful post-2015 agenda.

In connection with the ongoing debates on post-2015 international development goals, **Sustainable Access for All: Building Sustainability into Universal Energy Access** by *Mr Mohd Sahil Ali* (Research Economist), *Mr Nihit Goyal* (Senior Research Engineer), *Ms Shweta Srinivasan* (Research Analyst) at Center for Study of Science, Technology and Policy (CSTEP), India explore the post-MDGs dialogue on energy access in the context of challenges faced by energy sectors in the Southern countries. It argues that electrical energy systems are open to several disruptions that can affect long-term continuity of access.

I would like to gratefully acknowledge the contributions of *Ms Andrea Ordóñez* (Research Coordinator of the initiative) and *Ms Mahenaw Ummul Wara* (Research Associate, Centre for Policy Dialogue (CPD) and Focal Point at the *Southern Voice* Secretariat) in managing and organising the smooth implementation of the research programme.

I would like to thank *Dr Fahmida Khatun* (Research Director, CPD) for peer reviewing, and *Mr Michael Olender* for copy editing the paper.

I would also like to take this opportunity to recognise the support of Think Tank Initiative (TTI) towards *Southern Voice*, particularly that of *Dr Peter Taylor*, Programme Leader, TTI.

I hope the engaged readership will find the paper stimulating.

Dhaka, Bangladesh
May 2014

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Abstract

This paper investigates whether the goal of universal energy access in the post-MDGs dialogue sufficiently addresses the challenges faced by the Southern countries. Though access to energy is an important pre-condition for development and resilience to socio-economic and climate variability and change, about 1.7 million people lack access to electricity. Hence, the post-MDGs dialogue mandates attention to energy poverty reduction. A critical review of literature on the dialogue was conducted to analyse gaps in the current conceptualisation of the goal. Existing indicators to evaluate access and key discourses on sustainability were also reviewed. The study identifies that at present the dialogue does not take a dynamic view of energy systems given their vulnerabilities. While the notion of energy access in the dialogue may be fairly comprehensive in tracking the current level of access, it does not provide sufficient insight into the ability of the energy system to sustain that level of access. An approach based on literature on risk assessment is proposed to incorporate 'sustainability of access' into the current energy goal.

Contents

Acronyms

HLP	High-Level Panel
ICT	Information and Communication Technology
IEA	International Energy Agency
MDG	Millennium Development Goal
SDG	Sustainable Development Goal
SDSN	Sustainable Development Solutions Network
SE4ALL	Sustainable Energy for All
UN	United Nations

Sustainable Access for All
Building Sustainability into Universal Energy Access

Sahil Ali
Nihit Goyal
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Although the Millennium Development Goals (MDGs) did not include access to energy, subsequent work has emphasised its importance for human development. UN-Energy (2005) highlighted that energy services – lighting, heating, cooking and mechanical power – are essential for alleviating poverty and achieving the MDGs. While the direct impacts of access to modern energy on economic development may be contested, studies suggest that such access plays a critical role in improving quality of life, health, communication, education, access to information, and development outcomes for women (UNDP 2012; Modi *et al*. 2005). Deficient access implies poor resilience to socio-economic and climate variability and change. For example, energy services for use by health centres and communities are essential for disaster management (UNDP 2012; O'Brien and Hope 2010). Energy access is therefore crucial to resilience and adaptive capabilities.

The lack of universal energy access has been a chronic problem in developing countries. Many of the 1.7 billion people without access to electricity and nearly all of the 2.7 billion people without access to modern cooking fuels reside in the developing world (Banerjee *et al*. 2013; Jewell 2011). With this in mind, United Nations (UN) Secretary-General Ban Ki-moon identified "Sustainable Energy for All" (SE4ALL) as a top priority in his five-year action agenda on Sustainable Development Goals (SDGs) that aims to secure "The Future We Want" plan adopted during the 2012 UN Conference on Sustainable Development, widely known as Rio+20 (HLG 2012). The SE4ALL framework proposes a robust structure to address energy poverty reduction and environment sustainability through its three main objectives:

1. Ensure universal access to modern energy services.[1]
2. Double the global rate of improvement of energy efficiency.
3. Double the share of renewable energy in the global energy mix by 2030.

The SE4ALL framework also offers some key insights on how to measure and track multiple dimensions of energy access.

The UN Sustainable Development Solutions Network's (SDSN) action agenda seeks to inform the Open Working Group on SDGs and integrates the objectives of "curbing human-induced climate change" and "clean energy for all" into a single goal. Additionally, it emphasises two challenges that are relevant to an energy goal: a) inequality and social exclusion are widening within many rich and poor countries; and b) the current patterns of energy use and their impacts on the global climate are unsustainable (SDSN 2013).

The UN High-Level Panel (HLP) of Eminent Persons on the Post-2015 Development Agenda identified energy as one of 12 goals in the ongoing post-MDGs dialogue (HLP 2013). Its suggestion

[1]The goal for universal energy access is that every person has access to modern energy services provided through electricity, clean cooking fuels, clean heating fuels, and energy for productive use and community services (Banerjee *et al*. 2013).

for a goal to secure sustainable energy in the post-2015 period resonates with the idea of SE4ALL. In fact, the HLP relies on the Global Tracking Framework in SE4ALL for the overlapping objectives – universal access, energy efficiency and renewable energy – between the two.

Given the importance of energy access for development and climate adaptation and mitigation strategies, this paper reviews the post-MDGs dialogue on energy access in the context of challenges faced by energy sectors in Southern countries. It argues that the electrical energy system is susceptible to several disruptions that can affect long-term continuity of access. At present, the dialogue does not take a dynamic view of these systems, and consequently, of access.

By operationalising the definition of sustainability[2] proposed by Ian Scoones *et al*. (2007), this paper posits that the post-MDGs dialogue could be broadened to capture the *sustainability* of energy access. An approach to assess and track sustainability of access as part of the objective to ensure universal access to modern energy services is also proposed. This approach may be particularly important given that energy systems involve long lock-in periods and infrastructure built over the post-MDGs timeframe is likely to determine energy pathways beyond 2050.

The paper is organised as follows. It begins with a review and analysis of the SE4ALL framework from the perspective of Southern countries. In particular, the Global Tracking Framework for universal access is reviewed.[3] The challenges faced by electrical energy systems and their implications for these systems' sustainability are then highlighted using the "dynamic sustainabilities" framework (Scoones *et al*. 2007). The following section discusses the significance of sustainable energy access for the global South. An approach to incorporate and track sustainability of access within the objective of universal energy access is then proposed. The final section summarises key arguments and discusses the benefits that may accrue from operationalising the proposed framework in the post-MDGs dialogue.

Universal Energy Access in the SE4ALL Framework

The overarching goal of sustainable energy is part of each of the three main objectives in the SE4ALL framework. The first objective deals specifically with universal access to modern energy. The second and third objectives – doubling the global rate of improvement of energy efficiency and doubling the share of renewable energy in the global energy mix by 2030 – are aimed at shaping global energy trajectories with due consideration for climate change mitigation[4] (Nakićenović *et al*. 2012). These objectives are tracked separately by the SE4ALL Global Tracking Framework. SE4ALL acknowledges that Southern countries' focus is likely to be on universal access rather than improving energy efficiency and decarbonising energy systems. Country-level tracking offers countries flexibility to set their own targets for all three objectives.

In most Southern countries, existing indicators on electricity access have been defined and measured in terms of grid connection alone. Bazilian *et al*. (2010) aptly point to this being a binary measure for evaluating energy access. The problems of access, however, go beyond this simple categorisation in most Southern countries. Poor electrification rates, poorly energised grids, irregular supply of electricity, frequent breakdowns, problems of quality (such as low or fluctuating voltage), and high

[2] Defined as "long-term maintenance of system functions with respect to equity, well-being and environmental quality" (Scoones *et al*. 2007: 40).

[3] Though the need to evaluate the sustainability of access is equally relevant for both electricity and cooking fuels, this paper focuses on the provision of electricity services, which faces more perceivable challenges and inherent complexities.

[4] For instance, the International Energy Agency's (IEA) New Policies Scenario took into account the relevant policy commitments and plans announced or adopted by governments to model global energy trajectories. It found that even with those efforts, total energy consumption would rise by 29 per cent and fossil fuels will remain the dominant source of energy. Renewable electricity generation would rise from 20 per cent to 29 per cent. In this scenario, however, the world is not on track to achieve the agreed objective of maintaining a global temperature increase under 2°C. The International Energy Agency estimated that meeting this objective would require renewables to make up 50 per cent of electricity generation by 2030 (Jewell 2011).

losses due to theft are common. Electricity planning is also characterised by supply-based approaches rather than emphasis on services (Practical Action 2013).

Power in rural areas is often supplied at odd hours (such as midnight or midday), which restricts its usefulness and does not cater to the needs of vulnerable people (Practical Action 2013). At the household level, connection costs and electricity charges are considerable, and hence not affordable for poorer households. Many are served by illegal and secondary connections (Udupa 2011), which not only result in losses for utilities but also pose a safety hazard. Further, the way that energy is produced, distributed and consumed affects the local, regional and global environment through land degradation, local air pollution and greenhouse gas emissions (HLG 2012).

In addressing several of these challenges to energy access, the Global Tracking Framework moves beyond binary measures to a multi-tier approach that captures the quantity and quality of electricity supply and services more comprehensively (Banerjee *et al*. 2013). The framework defines access to electricity supply on the basis of attributes of electricity supply such as peak available capacity, duration, evening hours, affordability, legality and quality, as well as access to electricity services on the basis of appliance ownership categorised by tiers. The framework is outlined in Figure 1.

Figure 1: SE4ALL Global Tracking Framework

Access to Electricity Supply

Attributes	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Peak available Capacity (W)	-	>1	>200	>500	>2000	>2000
Duration (hours)	-	≥4	≥4	≥8	≥16	≥22
Evening supply (hours)	-	≥2	≥2	≥2	≥4	≥4
Affordability	-	-	√	√	√	√
Legality	-	-	-	√	√	√
Quality (voltage)	-	-	-	√	√	√

Based on six attributes of electricity supply, the index of access to electricity supply = $\sum (P_T \text{ X } T)$
Where, P_T = Proportion of households at tier T
T = tier number (0,1,2,3,4,5)

Use of Electricity Services

Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
-	Task lighting and phone charging (or radio)	General lighting, television and fan (if needed)	Tier 2 and any low-power appliances	Tier 3 and any medium-power appliances	Tier 4 and any high-power appliances

Source: Banerjee *et al.* (2013).

To determine the extent of access, the Global Tracking Framework suggests the use of household-level data[5] to apportion the number of households into each of the six tiers. This takes care of tracking distributional aspects and inequity across households. As commonly used indicators of consumption fail to capture access to energy services, the framework proposes to track the use of electricity services as well (Banerjee *et al*. 2013). Thus, the tracking framework is cognisant of measuring both the supply and demand perspectives of access.

Scholars have argued that in opting to use household surveys to enable tracking, SE4ALL would not address sub-national, urban-rural, and gendered disparities in access that are masked in such data. The need to track these disparities using indicative frameworks has been identified by several

[5]These data will be obtained through detailed surveys that will be piloted in the medium-term.

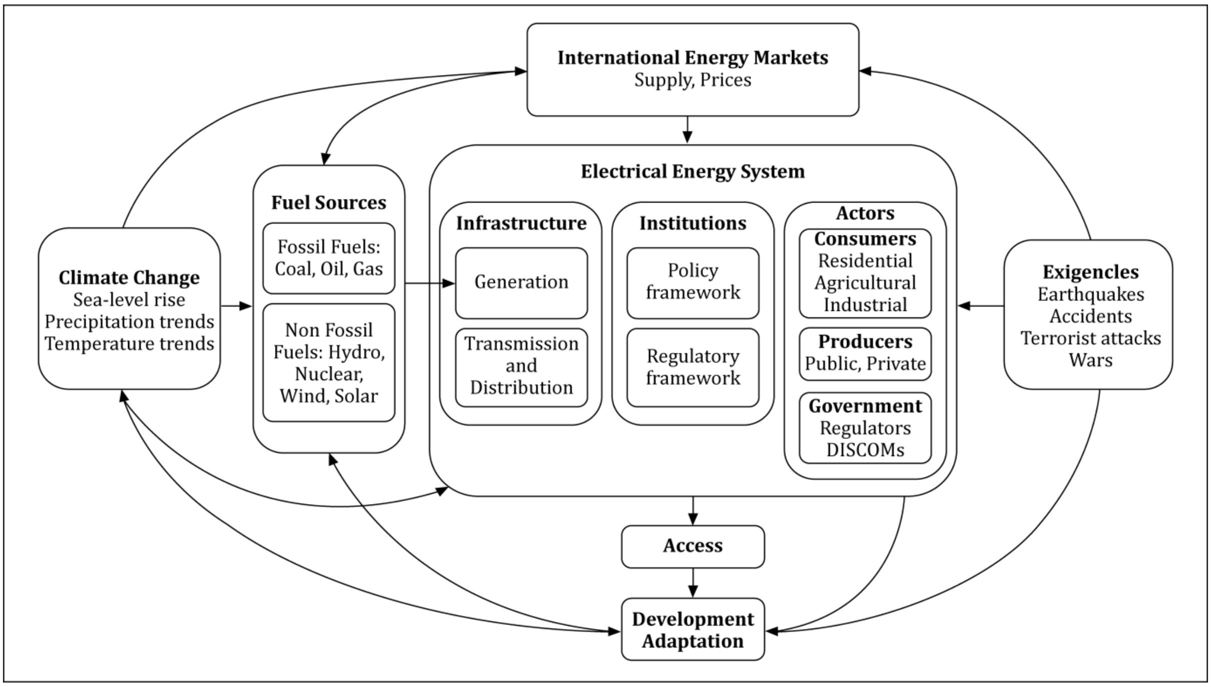
researchers (Khandker *et al*. 2010; Bazilian *et al*. 2010; Barnes and Foley 2004; Nussbaumer *et al*. 2011). Observers, however, have not yet elaborated on the limited conceptualisation of sustainability in SE4ALL.

SE4ALL seems to associate sustainability primarily with environmental sustainability and does not discuss the sustainability of energy access. While the dimensions of energy access considered within the Global Tracking Framework, such as duration, affordability and quality of supply, help in determining past and current levels of access, they may not provide insight into future levels of access. Hence, the framework offers a static conceptualisation of access. In other words, the framework implicitly considers energy access as a variable that can be maintained at its current level over time. In reality, access is a dynamic variable that depends on several factors, and could follow one of several probable trajectories.

Sustainability of an Electrical Energy System

The electrical energy system of a country, illustrated in Figure 2, involves the provision of electricity using various fossil and non-fossil sources and infrastructure for electricity generation, transmission and distribution. It is comprised of interactions among many actors, such as electricity producers and consumers, tempered by policies and regulations. Different aspects of this system are affected by climate change, international energy markets, economic development, and natural exigencies such as hydrometeorological and geophysical events. In turn, the system affects other systems such as water, transportation, and climate systems, as well as energy markets.

Figure 2: Electrical Energy System in a Complex, Dynamic Environment



The electrical energy system is evidently complex and dynamic, with non-linear relationships and outcomes and strong path dependencies. These complexities arise from design, co-dependencies, and unpredictable interactions (Lovins and Lovins 2001). The system interacts with wider socio-political and ecological environments, directly influencing and being influenced by them. Moreover, outcomes of planning and operations in the system may impact other systems with an indeterminate time lag. These systems then attempt to adjust to new conditions. Lovins and Lovins (2001, 19) summarise this nature of the system: "Considering the energy system as a mere collection of components . . . ignores the crux of the problem: interactions, combinations, feedback loops, higher-order consequences, and links across the system boundary."

A simple illustration of the complexities follows. Coal has been a cheap and trusted source of electric power since the Industrial Revolution. Decades later, implications of open fossil-fuel combustion for climate change came into scrutiny. These are manifested not only through temperature rises, but also with an increase in the frequency and intensity of extreme events and shifts in precipitation patterns that may be temporary or lasting. These implications can:

a) Increase demand for agricultural water pumping, while simultaneously increasing demand for air-conditioning in residential and commercial buildings;
b) Reduce availability of hydroelectric power due to adverse impacts on hydrological flows and threaten coal-based electricity generation (especially in rural areas) due to water constraints (FICCI and HSBC 2013).

Together, these consequences imply that energy access can be compromised despite no fundamental changes occurring within the energy system. From a long-term perspective, assessing the predictability of demand during energy planning becomes difficult and energy infrastructure, especially along coastal lines, could be adversely impacted.

Hence, the Brundtland Commission's definition of sustainability[6], commonly understood as the ability of a system to maintain a certain level of functioning, is limiting in the context of such a system (Scoones *et al*. 2007; Cary 1998). Cary (1998: 12) highlighted the reflexive and adaptive properties of a complex system in arguing that sustainability is "not a fixed ideal, but an evolutionary process of improving the management of systems, through improved understanding and knowledge." Scoones *et al*. (2007, 40) posited that a system should be able to withstand shocks and stresses for it to be considered sustainable. Sustainability may then be defined as "long-term maintenance of system functions with respect to equity, well-being and environmental quality."

The "dynamic sustainabilities" framework helps in identifying disruptions that an energy system is likely to face and resolves ambiguities through precise characterisation (Scoones *et al*. 2007). The temporality of change determines whether a disruption is a shock (short-term) or stress (long-term). Further, shocks and stresses may originate and persist within the boundaries of an energy system or outside of it.

History is replete with events that caused disruptions due to such complexities. For instance, as shown in Table 1, the 1986 Chernobyl nuclear disaster could be categorised as an internal shock in the former Union of Soviet Socialist Republics, where a power spike led to explosions in the core of a nuclear reactor, dispersing large particles of radioactive fuel and core materials into the atmosphere. An example of internal stress is the lack of skilled personnel and physical infrastructure to help undertake expansion and diversification in a climate-vulnerable, energy-constrained (less than 20 per cent of people have access to electricity) and energy-dependent, and natural resource-rich Sub-Saharan Africa (Williamson *et al*. 2009). The oil shock in the wake of the 1979 Iranian Revolution and Iran-Iraq War that began the following year originated outside the energy systems of the United States, Italy, France, Brazil and India, which were particularly affected and had their energy vulnerabilities pronounced. Also in the 1970s, the US state of California received 60 per cent less rainfall for three consecutive years, reducing hydroelectric output by 40 per cent, and causing a 30 per cent increase in the operating costs of Pacific Gas and Electric Company since 50 million extra barrels of oil had to be burned, which resulted in much stress on the people of the state (Lovins and Lovins 2001).

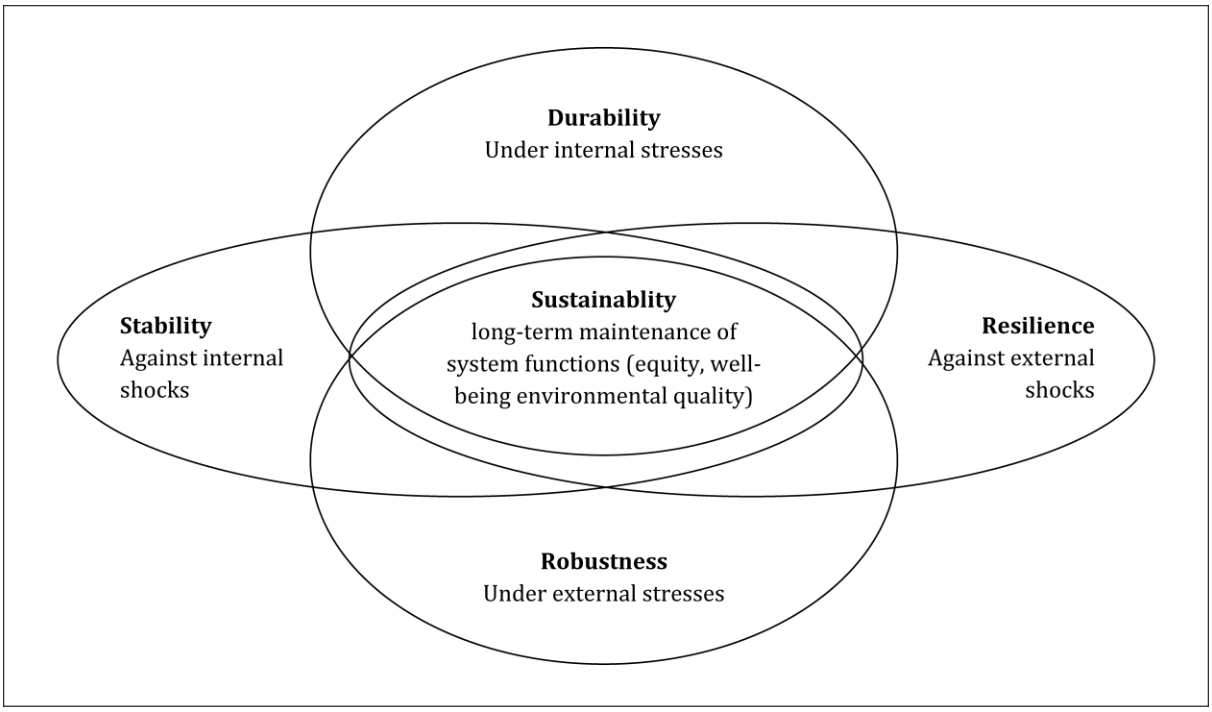
Table 1: Examples of Disruptions to Energy Systems

Temporality	Internal	External
Shock	1986 Chernobyl disaster	1979 oil shock
Stress	Lack of infrastructure in Sub-Saharan Africa	Three-year drought spell in California

[6]The Brundtland Commission defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland 1987).

This characterisation of disruptions helps in identifying appropriate coping strategies. Shocks may involve engineered approaches to overcome temporary barriers, while stresses may call for long-term overhauls and realignments of strategies.[7] The properties that sustainable energy systems must demonstrate in the wake of such disruptions are illustrated in Figure 3.

Figure 3: Sustainability and its Properties



Source: Scoones *et al.* (2007).

Table 2 presents the conditions under which these properties ensure sustainability. Stability is required when an electrical energy system is exposed to temporary internal disruptions, such as miscalculations of peak power requirements in the short-term, to which having adequate peaking reserves is a solution. Durability is required to successfully meet stresses originating within the system, such as chronic technical and commercial losses that affect most Southern countries' grids. Technological innovations like smart grids and feeder separation for different consumer categories help in this respect. But in cases of events occurring outside the energy system, such as extreme climatic events like floods or sustained sea-level rise, the system will nevertheless need to adjust either by withstanding shocks – resilience – or transforming itself through robust interventions. In case of the former, having an adequate number of skilled personnel on the ground to quickly restore energy services could improve the resilience of the system. On the other hand, locating key power projects so that they are not affected by sea-level rise could make the system more robust.

Table 2: Dynamic Properties of a Complex System

Temporality	Internal	External
Shock	Stability	Resilience
Stress	Durability	Robustness

Sustainable Access for the Global South

A majority of the world's vulnerable population resides in the global South. Even in Northern countries, low-income groups are threatened by the impacts of climate change. The UN

[7] Shocks and stresses denote the temporality of the disruption and are not considered to have a negative connotation.

Intergovernmental Panel on Climate Change noted that among the regions and people especially at risk of climate change impacts, Africa (particularly Sub-Saharan Africa), small islands, Asian mega-deltas, and the poor in Northern countries will be particularly vulnerable due to low adaptive capacities and high exposure of populations and infrastructure (Parry *et al*. 2007). As mentioned above, access to energy is crucial for alleviating poverty and building adaptive capacities. Thus, vulnerable populations could be affected by the lack of sustainable access when they need it most.

Several Southern countries are in high-risk regions and their energy systems may be compromised by natural disasters if not properly safeguarded. In the event of natural disasters, the resilience of these populations, among other things, will be determined by the efficacy with which health, communication, and other crucial services are provided for relief and rehabilitation; all of these services require energy (Banerjee *et al*. 2013; Jewell 2011).

Even in the absence of natural disasters, the health and livelihoods of vulnerable populations are affected by energy insecurity. Bhowmick (2012) noted how the blackout experienced in North India in 2012 asymmetrically impacted vulnerable groups that received electricity subsidies. Others have also argued that internal system failures invariably produce more unfavourable outcomes for the vulnerable by disrupting their livelihoods (Williamson *et al*. 2009). For example, the majority of the rural population in the developing world still relies on electricity subsidies for irrigation pumping and any decline in energy availability in a system impacts subsidised sectors first.[8] Notably, in regions where water availability is already low, the uncertainty of electricity supply pronounces the income vulnerability of farmers.

Energy systems that already lack capacities, such as financial or institutional capacities, seem to take longer to respond to shocks. Illustratively, Udupa (2011) noted that the supply-deficient Indian states of Uttar Pradesh and Bihar recorded higher repair times and greater irregularity of supply compared to Andhra Pradesh, a more developed state where the supply deficit was much less and grievance redressal mechanisms were much better organised. Thus, energy systems in Southern countries with low capacities are at greater risk of being unsustainable.

Energy investments are characterised by large gestation lags and lock-in periods that limit long-term energy pathways. Southern countries' energy demand is rapidly growing and so they are in the process of building large-scale energy infrastructure and networks. This provides opportunities to account for systems' vulnerabilities based on geopolitical, environmental and other factors, and to develop specific approaches to mitigate or overcome the most pressing challenges. To build sustainability into the energy system now could be cheaper than to constantly redesign or repair it in response to failures. This may be especially true when one considers the costs of resulting failures in other systems (such as water, transport, and information and communication technologies (ICTs)) that depend on energy (ADB 2012).

Incorporating Sustainability into Universal Energy Access

The post-MDGs dialogue provides an appropriate opportunity to highlight the importance of sustainable access and expand the discourse on the sustainability of energy systems. As an international and consensus-driven process, it enjoys the support of many developing and developed country governments. It also includes actors from the private, non-profit and philanthropic sectors. Consequently, the financing likely to be channelled through the post-MDGs framework is expected to be over USD 600 billion annually (Banerjee *et al*. 2013). In addition, the post-MDGs dialogue presents an opportunity to emphasise important issues for dealing with uncertainties such as capacity building in climate science and disaster management, technology transfer and financing. The learning from this dialogue can feed into the final discussions on the post-MDGs framework.

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[8] In the event of supply shortfall in developing countries such as India, higher-paying customers such as firms and industries are served first, while poorer rural and agricultural customers are served last.

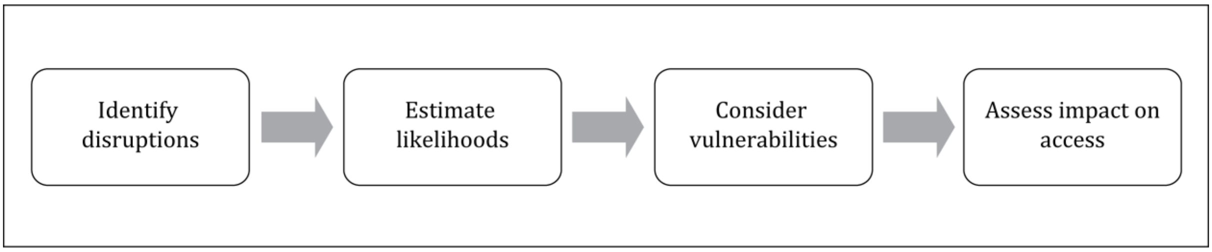
It may be more desirable to embed the notion of sustainable access into the goal of universal access rather than incorporating the idea into a separate goal, such as one on improving disaster management and resilience. There are two reasons for this:

- As this paper attempts to demonstrate, the concept of sustainability goes beyond disaster management or climate adaptation and requires a wider perspective of not only energy systems but also relevant properties and conditions necessary for sustainability.
- Treatment of sustainability outside the goal of energy access may reduce the problems with energy systems to infrastructure, ignoring complex dynamics.

To incorporate sustainability of access into the post-MDGs/SDGs, a framework to assess it would be required. Loucks (1999) argued that the sustainability of water systems can be measured as a combination of reliability, resilience and vulnerability. Various studies have defined indicators involving aspects of reliability, resilience and vulnerability in the context of energy (Hirschberg *et al*. 2008; Williamson *et al*. 2009; Ebinger and Vergara 2011). The literature on energy security also deals with the question of ensuring the availability of energy at an affordable price (Jewell 2011). A sustainability indicator for energy systems or access could build on the indicators and approaches proposed by these studies.

However, anticipation of what may go wrong in the future is complicated by a wide range of uncertainties. In the context of national energy security, Lovins and Lovins (2001, 177) contended that "for the most serious and unacceptable types of failure, the probability cannot be calculated." To some extent, this argument holds for complex events such as natural disasters, as seen in the case of the recent Fukushima nuclear disaster in Japan. Further, Scoones *et al*. (2007) suggested that the tendency to focus on disruptions for which knowledge is complete – in other words, likelihoods and outcomes that can be easily estimated – may result in "closing down" the system to alternate pathways. This could lead to an overemphasis on stability at the cost of durability, resilience and robustness. Thus, this paper proposes a sustainability assessment framework that allows for the flexibility to capture disruptions about which knowledge may be limited. An overview of the concept is presented in Figure 4, but the specifics of such a framework would require further research.

Figure 4: Proposed Framework for Assessment of Sustainability of Access



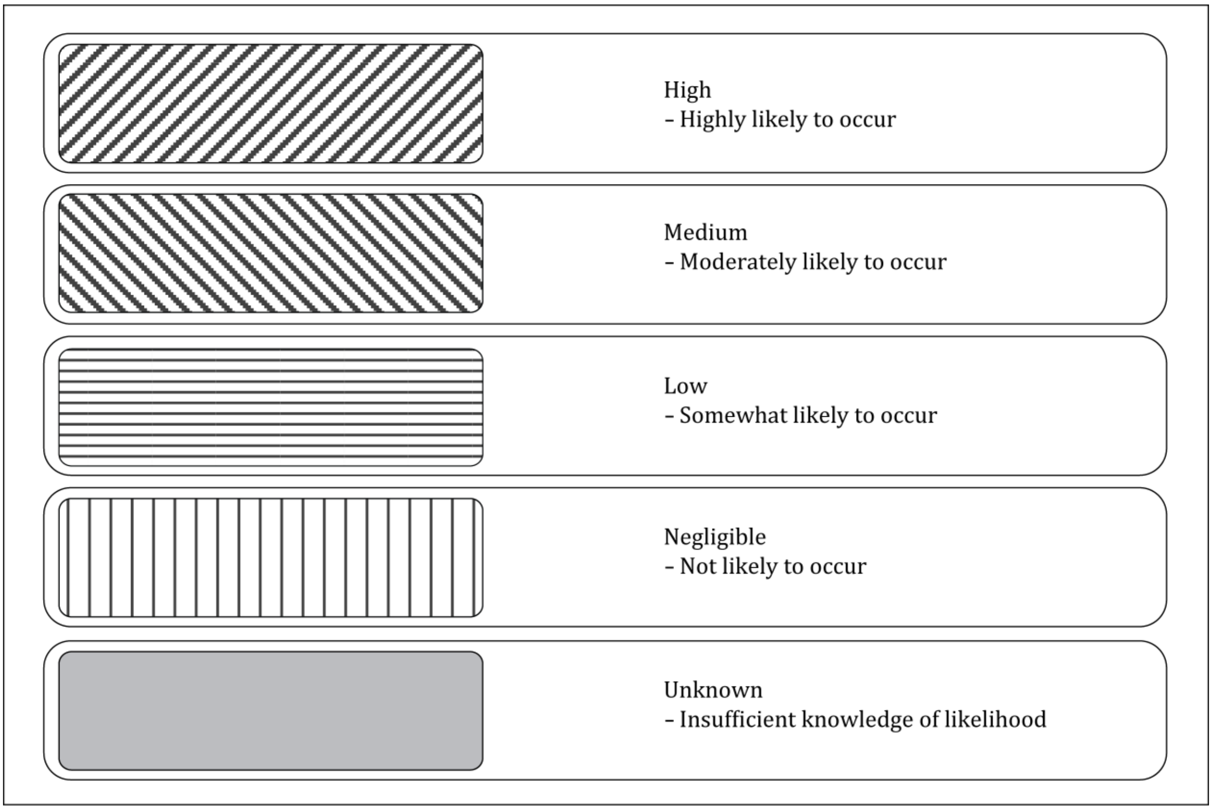
Adapted from the literature on risk assessment (ISO/IEC 2009), the framework enables systematic analysis of disruptions that may affect an energy system and their likely impact on access. The first step involves identifying disruptions that may affect the system. The assessor should list short and long-term disruptions during this step. Also, a broad categorisation of events could be used so that factors both within and outside the energy system are considered. One possible categorisation is shown in Table 3.

Once disruptions are identified, the likelihood of occurrence for each should be estimated, either quantitatively or qualitatively. The probability of an event could be estimated by way of quantitative evaluation. If qualitative assessment is used, the likelihood could be rated as high, medium, low or negligible, as shown in Figure 5. When an event has a significant impact on access and the knowledge of likelihood is highly problematic, then the rating "unknown" could be used. This would allow the assessor to capture the current state of knowledge more accurately and keep alternate pathways open.

Table 3: Possible Categorisation of Disruptions

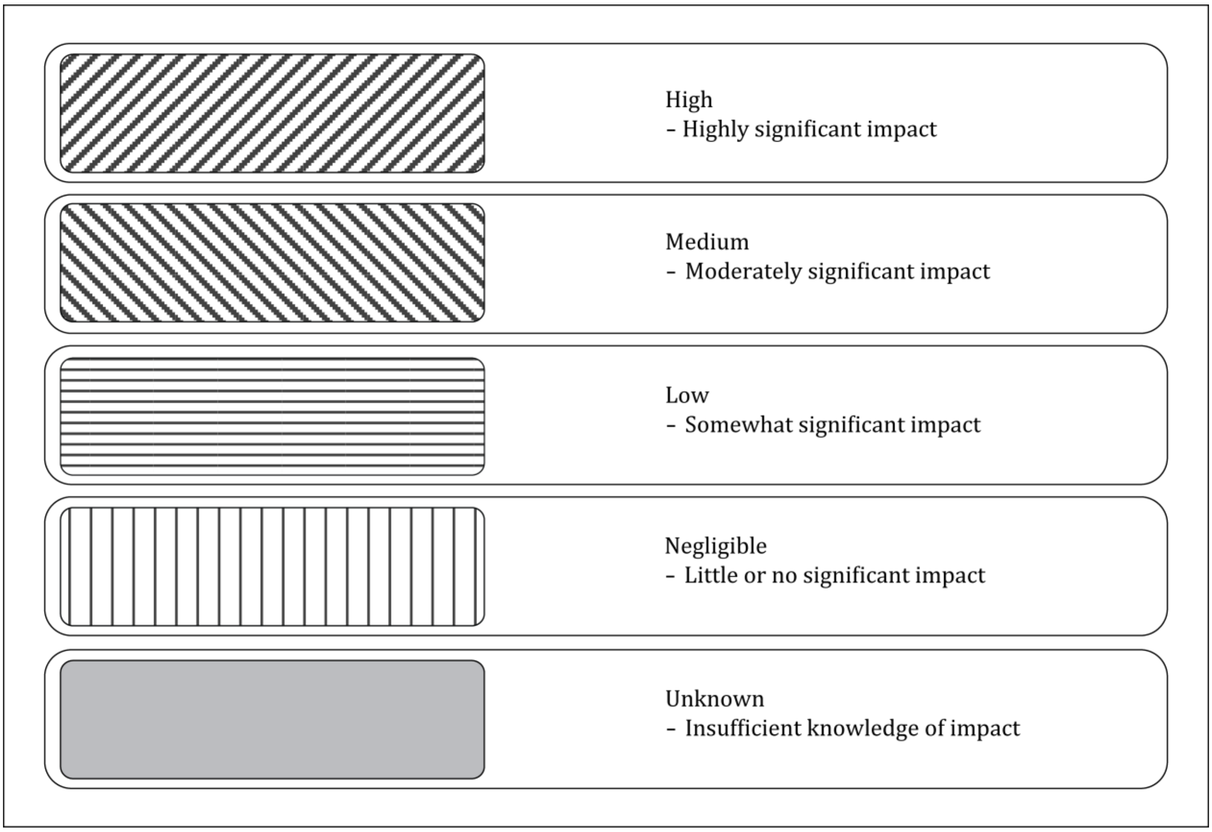
Nature of Disruption	Temporality	Example
Environmental	Shock	Disruptions by earthquakes
	Stress	Sustained sea-level rise
Economic	Shock	Costly short-term purchases in times of peaking deficit
	Stress	Chronic commercial losses due to theft, non-payment
Organisational	Shock	Corruption in implementation of a major scheme
	Stress	Lack of technical and administrative capacities
Security	Shock	Terrorist attacks on strategic facilities
	Stress	Protracted wars in fuel-exporting regions
Fuel supply	Shock	Short-term drop in oil supply in the global oil market
	Stress	Discovery of large shale reserves
Socio-political	Shock	Political opposition to nuclear power
	Stress	Chronic end-use inefficiency of subsidised sectors
Technical	Shock	Grid failure caused by overdrawal of electricity
	Stress	Chronically high transmission and distribution losses

Figure 5: Qualitative Classification of the Likelihood of Occurrence of a Disruption



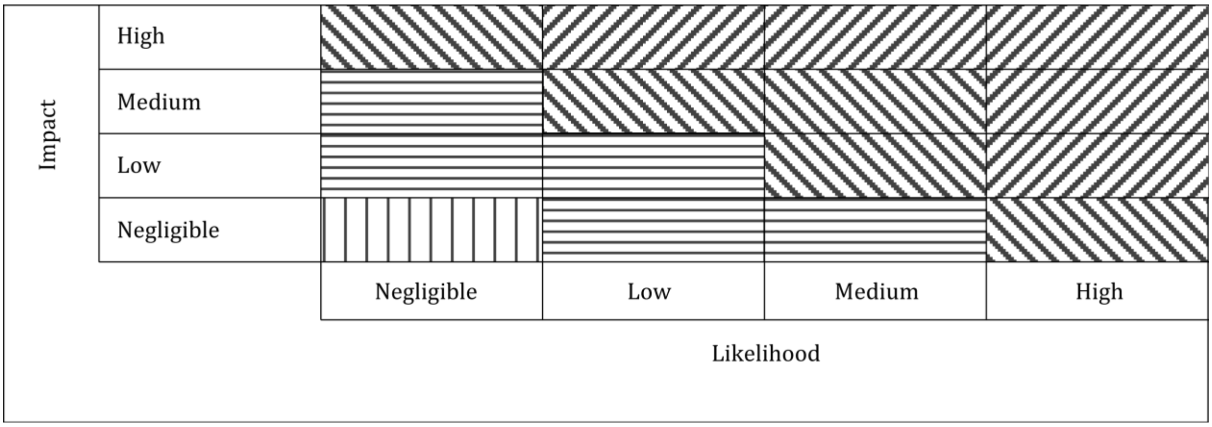
Next, the vulnerability of the energy system to each disruption should be considered. This involves examining factors such as the sub-sector(s) exposed (supply, transmission and distribution, demand), the region disrupted, and the communities affected. The impact of the disruption on access can then be assessed in terms of its magnitude (how many people affected), extent (geographical area affected), and temporality (for how long effects are felt). This assessment should go beyond just electrification and duration of supply to analyse all dimensions of access included in SE4ALL to the extent possible. The assessor could choose to quantify the impact on access into a metric or evaluate it qualitatively as high, medium, low or negligible, as shown in Figure 6. As in the case of estimation of likelihood, the rating "unknown" could be used to indicate insufficient knowledge of the impact.

Figure 6: Qualitative Classification of the Impact of a Disruption on Access



The likelihoods of disruptions in combination with the impacts on access give an indication of the sustainability of access or lack thereof. Quantitatively, the overall threat to sustainability could be gauged by aggregating the likelihoods of disruptions and their impacts on access. A smaller result would indicate a more sustainable system while a larger result would indicate a relatively unsustainable system. In qualitative assessment, sustainability of access can be gauged using the matrix in Figure 7. As sustainability increases, the overall threat to the energy system would be reduced and disruptions would move toward the bottom left of the matrix. Thus, sustainability can be improved by lowering the likelihoods of disruptions, where possible, and by reducing their impacts on access.

Figure 7: Matrix to Assess Threats to Sustainability of Access



An illustration of this framework is shown in Table 4.

Table 4: An Illustrative Snippet of a Sustainability Assessment Exercise

Disruption	Likelihood	Vulnerability	Impact on Access
Sustained sea-level rise	Medium	Electricity supply as well as transmission and distribution network are both vulnerable; coastal regions would be affected	Medium
Costly short-term purchases in times of peaking deficit	High	Price of electricity would increase; affordability may be impacted	Low
Terrorist attacks on strategic facilities	Unknown	Electricity supply would be affected for the entire grid; surrounding areas may require evacuation	High
Discovery of large shale reserves	Low	Electricity supply sector may be affected; impact on affordability would depend on cost of extraction	Unknown

The adoption of such a sustainability assessment framework alongside the goal of universal access would complement the Global Tracking Framework by adding the dimension of sustainability of access and also raise the objective so far discussed during the post-MDGs dialogue to sustainable access for all.

Conclusion

Access to energy has been recognised as a pre-condition for facilitating human development and building the adaptive capacities of vulnerable populations. At the same time, the production and consumption of energy need to be consistent with the global goal of climate change mitigation.

The post-MDGs dialogue on energy strives for a balance between these objectives. The HLP proposed the following goals: achieving universal access to modern energy services; increasing the share of clean energy; improving energy efficiency; and phasing out subsidies for fossil fuels. This is broadly in line with the objectives proposed under the SE4ALL initiative. Notably, the HLP recommends using the Global Tracking Framework in SE4ALL for monitoring progress on the goal of achieving universal access.

While the dialogue considers access in a static context, energy systems operate in a complex, dynamic environment. The sustainability of such a system is best defined as its ability to maintain long-term functionality – to withstand and recover from shocks and stresses – without compromising well-being, equity or the environment. The energy system, thus, needs to possess stability, resilience, durability and robustness to be sustainable. The failure to exhibit these properties could compromise the goal of energy access. The costs of ensuring sustainability when energy infrastructure is being built may be much lower than the costs of incorporating these properties in the system at a later date.

The post-MDGs dialogue on energy should, therefore, include the dimension of sustainability within its goal on universal access. Though it may be possible to define a metric to track sustainability of access, such an approach may overemphasise the easily quantifiable – stability or reliability. Consequently, resilience, durability and robustness of the system may not receive sufficient consideration. This paper proposes the adoption of a flexible sustainability assessment framework to complement the Global Tracking Framework for energy access.

The sustainability assessment framework permits assessment of threats to sustainability through a quantitative or qualitative evaluation of likelihoods of disruptions and their impacts on access. A systematic assessment of sustainability of access could encourage planning and designing for sustainability and reduce the vulnerabilities of energy systems over time. Low-hanging fruits – actions that have significant benefits for relatively small costs – for sustainable access may also be identified through such assessments. Assessments could also detect significant gaps in current knowledge and highlight areas for further research.

However, the choice of sustainability may involve trade-offs with efficiency and the pace of universalisation of access. Further, not all countries may possess the capabilities to translate the findings of an assessment into sustainable access. Some may need support in areas such as climate science, capacity building, financing and access to technology. By creating the space to bring these challenges to the fore, the post-MDGs dialogue could facilitate international learning and make "the future we want" more *sustainable*.

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Southern Voice on Post-MDG International Development Goals (*Southern Voice*) is a network of 48 think tanks from Africa, Latin America and South Asia, that has identified a unique space and scope for itself to contribute to the post-MDG dialogue. By providing quality data, evidence and analyses that derive from research in the countries of the South, these institutions seek to inform the discussion on the post-2015 framework, goals and targets, and to help give shape to the debate itself. In the process, *Southern Voice* aims to enhance the quality of international development policy analysis, strengthen the global outreach capacity of Southern think tanks, and facilitate professional linkages between these institutions and their respective governments. *Southern Voice* operates as an open platform where concerned institutions and individuals from both South and North interact with the network members. *Southern Voice Occasional Papers* are based on research undertaken by the members of the network as well as inputs received at various platforms of the initiative. *Centre for Policy Dialogue (CPD)*, Dhaka works as the Secretariat of the *Southern Voice*.

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