Frameworks for Attaining Universal Energy Access

by

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DECLARATION

I know the meaning of plagiarism and declare that all the work in the documents, save for which is properly acknowledged is my own.

Abstract

When assessing universal access to clean, modern energy, Sub-Saharan Africa lags behind many other regions. It has an electrification rate of 32% and in rural regions, only 18% of households have access to modern energy. Within Sub-Saharan Africa, there have been two successful cases for expanding access to energy, those of Mauritius and South Africa. Using a case study approach, this dissertation outlines the key components of the necessary enabling environments, including the need for central coordination; effective, independent regulatory regimes; and monitoring and evaluation as a component of good governance, to ensure programmes are adaptable. Using this theoretical framework to analyse the two countries' experiences, the author establishes that even though the Mauritian and South African electrification programmes were implemented in different decades under different sets of socio-economic circumstances, common elements drove the success of both programmes. Both countries placed great political importance on achieving universal energy access. The political will created the sustained momentum needed to implement successful electrification programmes through ensuring sufficient funding, establishing legal environments and policy frameworks within which to operate, and allowing for technical options to be explored where necessary.

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Acronyms

AGECC	UN Secretary-General's Advisory Group on Energy and Climate Change
CPP	Continuous Power Producer
CEB	Central Electricity Board
CEMA	Conference of Energy Ministers in Africa
CEMAC	Economic and Monetary Community of Central Africa
DME	Department of Minerals and Energy
EAC	East African Community
ECOWAS	Economic Community of West African States
FBE	Free Basic Electricity
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
INEP	Integrated National Electrification Programme
IPPs	Independent Power Producers
LPG	Liquid Petroleum Gas
MDGs	Millennium Development Goals
MYPD	Multi-Year Price Determination
NEP	National Electrification Programme
NER	National Electricity Regulator
NERSA	National Energy Regulator of South Africa

OECD	Organisation for Economic Co-operation and Development
PPPs	Public-Private Partnerships
RDP	Reconstruction and Development Programme
RoR	Rate of Return
SADC	Southern African Development Community
SIDS	Small Island Developing State

1. Introduction

Energy is recognised by many governments, policy makers and members of civil society as both a basic human need as well as a catalyst for alleviating poverty. In developing countries, access to clean, modern energy can ensure that basic services such as access to clean water, sanitation and healthcare can be provided. It can also relieve the drudgery of collecting biomass for fuel. Other benefits can include the provision of efficient lighting, improvement in education levels through *inter alia* access to lighting, heat for cooking, telecommunications, and transport. Energy access is also a significant contributor in assisting developing countries towards the attainment of development goals, such as the Millennium Development Goals (MDGs)[1].

In 2011, 81.9% of the world had access to electricity. However, electrification rates vary widely by region, country and within countries. Whilst 99.9% of the Organisation for Economic Co-operation and Development (OECD) countries and economies in transition had access to electricity, developing countries had an electrification rate of only 76.5%. Sub-Saharan Africa had an electrification rate of 32%. Approximately 48% of the total population without access to electricity lives in Africa (International Energy Agency, 2013a). The disparity in access rates among regions and between urban and rural populations is most critical within Sub-Saharan Africa (Legros, *et al.*, 2009), where 55% of the urban population and 18% of the rural population is electrified (IEA, 2013a).

The international community has largely accepted that access to safe, clean, modern energy is imperative in order to achieve sustainable development goals in developing countries, including the MDGs. However, given current access rates, these goals may seem unattainable for many African countries (UN Development Programme, 2013). A lack of access to energy hampers households' development potential, and the World Summit on Sustainable Development (which took place in Johannesburg, South Africa in September 2002) noted that there is an explicit link between access to clean, safe energy services and poverty reduction. This relationship is embodied in the Johannesburg Plan of Implementation, which calls for the international community to work together at all levels to improve access to reliable, affordable, socially acceptable, and environmentally sound energy services (United Nations, 2002; UN-Energy, 2005). The International Energy Conference, held in Vienna, Austria in June 2009, noted that, without further development of the policy agenda, 1.4 billion people will remain without access to clean, modern energy services (UN Industrial Development

[1] The Millennium Development Goals are a series of eight time-bound targets adopted by nations at the UN Millennium Summit in September 2000. They aim to reduce extreme poverty by 2015 (UN Millennium Project, 2006).

Organization, 2009). This access includes diffusion of energy efficient technologies, which with currently available technologies can lead to a saving of 10% of household energy costs. The Sustainable Energy for All Initiative has added greater impetus by establishing the three goals of: achieving universal energy access by 2030; doubling the global rate of energy efficiency; and doubling the share of renewable energy in the global energy mix (Sustainable Energy for All, 2013).

Lower income households are traditionally situated at the bottom of the energy ladder[2], meaning that the primary energy source for these households is biomass, including fuelwood. Households in this category may also use fuels such as paraffin (also known as kerosene) and coal which, along with biomass, have health and safety implications for households. Women and children are generally the most exposed to health problems from this energy use as they are the household members primarily responsible for "household" tasks. Biomass and coal, in particular, create health hazard through the particulate matter that is created when they are used. Due mostly to affordability constraints most biomass and fuelwood has to be collected thus adding a physical burden and a further health burden to households. One of the consequences of this is that women and children may earn less due to their impaired health. An ecological issue also arises in that the use of fuelwood for energy contributes to land use degradation, which then perpetuates a cycle of increased biomass scarcity. The World Health Organization notes that approximately two million deaths occur annually due to exposure from indoor smoke due to burning "dirty" cooking fuels (World Health Organization, 2014).

Households face a number of barriers to accessing clean, modern energy, including financial, social and physical barriers. Governments and intergovernmental agencies have implemented various policies to increase household energy access, particularly for those living below the poverty line. Programmes put into operation have included the free allocation of electricity units for households below a given threshold of electricity consumption or income; grid expansion, particularly in rural areas; the installation of solar home systems and renewable energy technologies; and increased appliance efficiency, in particular for biomass stoves.

Grid expansion, the provision of a free allocation of electricity units, promotional pricing policies and increased appliance efficiency have proven successful at national and regional levels thus far, but are not always suitable for some communities and households. This could be because of the

[2] The energy ladder theory posits that as a household's income increases, fuel consumption changes to use more modern fuel types such as liquid petroleum gas (LPG) and electricity. For instance, this theory suggests that poor households initially consume biomass, coal and paraffin (kerosene) and then switch to modern, cleaner fuels as their incomes increase (Karekezi, et al., 2012).

households' fuel choices, the prevailing environment and other external factors that may exist. Renewable energy technologies, such as solar home systems, are now also playing a greater role in expanding energy access as grid expansion becomes less feasible in rural areas. Further, given current climate constraints, more attention is being paid to the importance of increasing the use of clean energy.

In Sub-Saharan Africa, Mauritius and South Africa have been the most successful in striving to achieve universal access to electricity. Both countries recognised the importance of universal energy access, and undertook large-scale electrification programmes as a result. Mauritius acknowledged this through trying to diversify its economy and ensure equality in its national development plans. South Africa, as part of its Reconstruction and Development Programme (RDP) in a post-Apartheid South Africa, made concerted efforts to decrease the disparities in access to basic services between the different races. Both recognised the opportunities that electricity can provide. As a result, they achieved 99% and 85% electrification rates, respectively, by 2009 (IEA, 2013a). They based their expansion on two different methodologies in two different sets of political and socio-economic circumstances, with both being successful (Mauritius to a larger degree).

Using these two countries' experiences, this dissertation assesses what enabling environments are needed to undertake a successful electrification programme, particularly at the national level. It also investigates if there are other contributing factors to the success of electrification programmes.

In assessing the efficacy of these programmes, and whether the models (or parts thereof) used could be scaled-up or replicated in other countries or regions, this dissertation addresses issues such as political will, community participation and education, and good governance; factors that need to be met for any measure of success to be achieved.

2. Access to Energy

2.1 Defining energy access

In general, energy poverty refers to a lack of modern energy services (IEA, 2013b). Access to energy must be differentiated from access to energy services. Access to energy services typically refers to services such as heat and light while energy access refers to accessing the energy source. This chapter discusses definitions of energy access and the issues surrounding it.

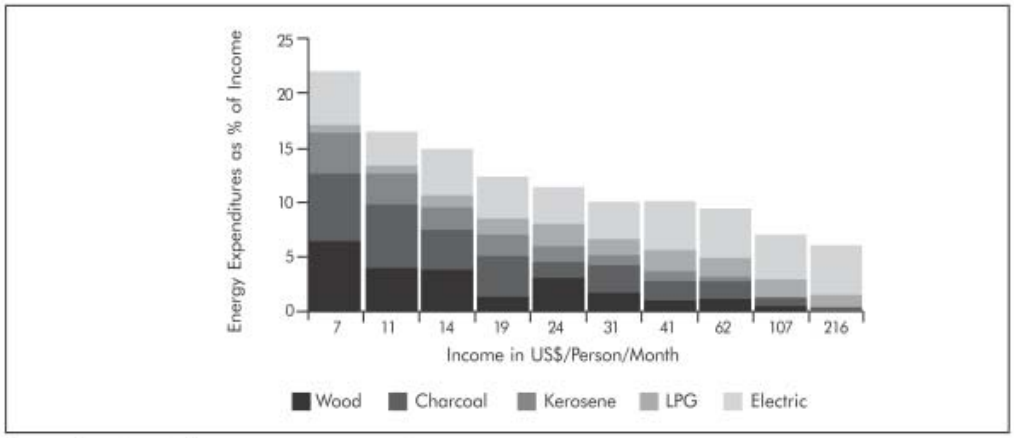
Defining energy access is complex as it includes a number of issues such as affordability, quality, stability, appliance access and other socio-economic factors. It also encompasses different levels of usage, from basic household needs, such as lighting and heat for cooking, to productive uses that can contribute to the larger economy, and to a supply that caters for all types of modern energy services. Pachauri (2011) suggests reflecting upon additional elements when considering how to define energy access, namely what should be included in the "basic needs basket" and how modern energy service costs compare to current household expenditure. Others have also underscored the importance of defining and establishing a minimum level of service, noting that defining a minimum level of service includes both quantitative and qualitative facets (UN Secretary-General's Advisory Group on Energy and Climate Change, 2010; Pachauri, 2011).

In order for a household to be defined as having access to modern energy, it must, at the very least, have access to an energy source. Access alone, however, is of very little use to households if appliances to utilise the energy sources are not available or are unaffordable given that energy's benefit is derived from using it as opposed to owning it. UN-HABITAT highlighted this distinction in their publication on International Guidelines on Decentralisation and Access to Basic Services for All, saying that access should be defined as both the availability of the resource as well as the affordability to use it. Being able to afford to use energy implicitly includes being able to afford appliances (UN-HABITAT, 2009).

Lower-income households generally spend a disproportionately large amount of their budgets on energy. Some studies have shown that low-income households spend, proportionately, at least twice that of higher-income households when purchasing energy (Karekezi & Majoro, 2002 ; Campbell, *et al.*, 2003). Affordable energy services means that more households, particularly lower income households, will be able to realise the benefits derived from accessing and using modern energy services. A number of studies have discussed this matter, saying that modern energy services should cost the end-user no more than their current use of traditional fuels or a reasonable

proportion of their household income, which has been posited as being between 10-30% (AGECC, 2010; Bazilian *et al*, 2010b). Some have noted that the productive use of energy services can generate additional income, which also assists in making energy more affordable.

Figure 1: The Poor Spend More of their Income on Poorer Quality Energy Services



Source: (Rojas & Lallement, 2007)

Affordability of supply can also relate to the quantity of energy used. Consumer preferences for different types of energy can influence the quantity of different energy types used by households. Given that a number of households lacking supply in Sub-Saharan Africa could be considered "traditional" in their fuel use, they may prefer some types of energy over others, including those considered to be "modern" or "aspirational"[3] energy services. Pachauri and Spreng (2004) have noted that household energy use in developing countries eschews the concept of the "energy ladder"; instead, households tend to use multiple energy sources simultaneously[4]. They note, however, that, all things being equal, efficiency in fuels and appliances is generally favoured. Subsidisation programmes may be needed to ensure the uptake of more efficient energy services, either through making the fuel or the appliances affordable.

[3] Aspirational energy services refers to those that are used by wealthier households.
[4] Pachauri and Spreng (2004) note that recent literature on household energy use suggests that households do not switch fuels in a linear fashion, but rather switch from inefficient to more efficient fuels. Households are also known to use many types of energy simultaneously.

Another concern regarding affordability is the illegal supply of electricity. A number of the illegal connections tend to be extension cords between houses and dwellings, which is not only unsafe but is often expensive as the prices charged for "access" are often higher than those from legal connections. This is a further reason to ensure that services are both affordable and "usable" by having sufficient affordable appliances to utilise the supplied energy.

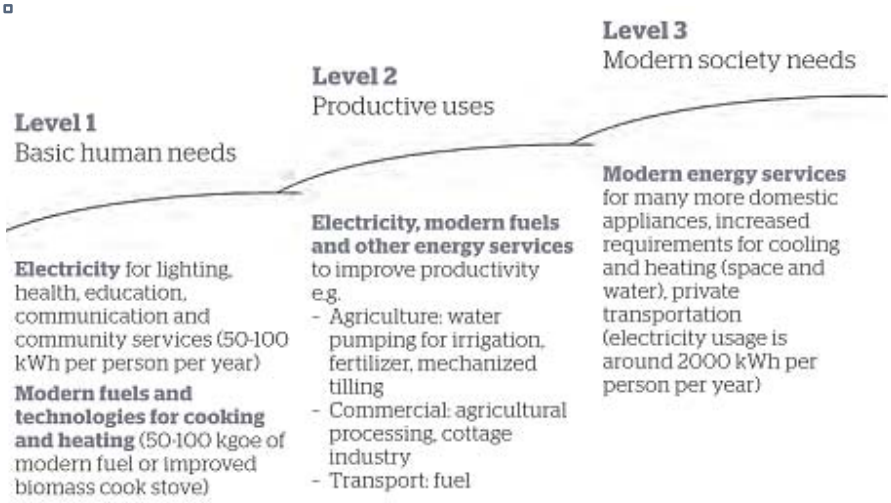
There is also a call from the global energy community for ensuring that energy supply is both reliable and of a predictable and stable quality. The concern is that an unpredictable supply of energy makes the effective use of energy services difficult because households cannot plan usage given this uncertainty of supply. Households need to be able to access the service of their choice at their desired location and time or else the benefits of accessing modern energy services will be negated (Pachauri and Spreng, 2004; Global Energy Assessment, 2012).

Further, where possible, modern energy services should also have low greenhouse gas (GHG) emissions given current concerns regarding climate change. The UN Secretary-General's Advisory Group on Energy and Climate Change (AGECC)'s describes this concern in its 2010 report on energy access. If access to energy expands as planned in the coming years, both the energy intensity[5] (should appliance efficiency remain the same) and the amount of energy consumed will increase dramatically. The increase in energy consumption could have a concomitant negative impact on GHG emissions. This makes low-GHG emitting and energy efficient appliances even more important.

Recognising all off the aspects discussed above, the AGECC (2010) has suggested a three-tier definition of access to energy that considers different levels of access to energy and the benefits that it provides, as illustrated in Figure 2.

[5] Energy intensity refers to the amount of energy used for a given level of output (U.S. Department of Energy, 2012).

Figure 2: Incremental Levels of Access to Energy



Source: (AGECC, 2010)

The AGECC considers levels one and two as a minimum threshold for energy access as these levels encompass both basic human needs and productive uses that can aid in improving livelihoods.

Pachauri (2011) notes that the energy mix used in providing the different service levels will need to be decided locally. She does urge, however, some consensus in defining which services should be included in the "basket of basic needs". The AGECC's three-tier definition addresses this concern, although it can be argued whether the second level of energy services should really be considered as part of a minimum threshold of basic energy services. The argument for including productive uses as part of the minimum threshold of basic energy services is that this creates income-generating opportunities that can improve households' livelihoods.

The AGECC defines energy access as "access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses". It does not recognise the need for appliances to use energy to obtain its benefits.

The International Energy Agency (IEA), as part of its work for the World Energy Outlook, defines energy access as "a household having reliable and affordable access to clean cooking facilities, a first connection to electricity and then an increasing level of electricity consumption over time to reach the regional average" (IEA, 2012). The notion of consumption increasing over time to reach

the regional average implies that the regional average is a sufficient baseline for meeting a household's basic energy needs, which may be an incorrect assumption.

The Global Energy Assessment (2012) says that the simplest definition of universal access to modern energy services is "the physical availability of electricity and modern energy carriers, and improved end-use devices, such as cook stoves, at affordable prices for all".

For the purposes of this paper, no quantitative judgements[6] are made regarding basic levels of service that would meet the basic needs of households. Rather, given the country-driven assessments, this paper uses the definition of having a connection to an energy source while also considering whether there is a basic minimum level of service.

2.2 Measuring energy access and energy poverty

Measuring energy access and energy poverty over time is essential to measure progress in making access to modern energy and electricity available. Due to their similarities, many of the approaches for measuring energy access are the same as those for measuring energy poverty. They range from earlier efforts that tend to be simplistic, but provide a basic measure for whether a household has access to energy, to whether they can be considered as being "energy poor" (Bhatia, 2013).

When measuring energy access rates, the indicators used should cover all dimensions of energy access and use a technology-neutral approach[7] (Bhatia, 2013). Indicators should also be based on the usability of the available energy services. These measures are separate from those measuring the consumption of energy services. Each fuel used by the household should also be considered when measuring progress in energy access. Due to informal and local measures to achieve energy access, these may not be included in official statistics. Bazilian *et al* (2010) argue that metrics should also assess issues of quality and quantity, including aspects such as outages, value of lost output and frequency stability.

A number of approaches have been suggested, as set out in Table 1, including single indicator approaches that establish an energy poverty line or determine the proportion of available connections. More complex approaches suggest using multiple indicators to assess different dimensions of energy access, such as the International Atomic Energy Agency's (IAEA) publication

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[6] The GEA (2012) notes that the difficulty in defining quantitative thresholds is that the basic needs differ between countries and regions due to climate, social, cultural and other reasons.

[7] This was the outcome of discussions held during the 2013 Pilot Countries meeting for the Climate Investment Fund's Scaling Up Renewable Energy Programme.

on Energy Indicators for Sustainable Development (2005). More recently, many studies have suggested using indices to measure energy poverty and access, such as the multi-dimensional energy poverty index (Nussbaumer, *et al.*, 2012). Multi-tier approaches, such as that of the AGECC, have also been proposed as possible approaches for measuring access.

Table 1: Categories and Methodologies for Measuring Energy Access

Category	Example	Objective	Reference
Single Indicators	Energy poverty line	Define a threshold point at which households consume a bare minimum level of energy	(Barnes, *et al.*, 2011)
	Access to energy by fuel type	Identifies if there is household access to an energy source	
	Per capita consumption per fuel type	National consumption per fuel type per citizen	
	Energy Budget Share	Share of budget spent on energy	
"Dashboard" of individual indicators	Energy Indicators for Sustainable Development	Measures the social, economic and environmental impact of energy	(IAEA, 2005)
	Energy access situation in developing countries	Penetration rate of modern energy	(UN Development Programme & World Health Organization, 2009)
Composite indices	Energy Development Index	Penetration rate of modern energy and levels of energy consumption	(IEA, 2011)
	Multi-dimensional Energy Poverty Index	Measure of deprivation of energy services through ownership of appliances	(Nussbaumer, *et al.*, 2012)
	Total Energy Access	Minimum access standards for five energy services	(Practical Action, 2010)

Source: Bhatia, 2013; Nussbaumer, et al., 2012; author

One of the more common approaches to measuring energy poverty has been to establish a poverty line or fuel poverty line. This is a single indicator approach that assesses energy use as a function of the household's income. A fuel poverty line is calculated by ascertaining the average level of energy use corresponding to an amount of income specified by a national income or expenditure poverty line (Pachauri & Spreng, 2004). Pachauri and Spreng also note that this is based on the level of energy that has been defined as the minimum amount needed for basic needs. This approach provides a way to measure energy access that assesses the availability of energy sources above a specifically defined minimum level (Pachauri, 2011).

Another single indicator approach is to determine the proportion of households that have an electricity connection, or an access point to other forms of energy. This approach is simplistic and unidimensional in that it does not take into account whether the energy sources are affordable and/or are used by the household. It is, however, commonly used by countries when assessing the success of electrification and other types of energisation programmes. In the absence of any comprehensive data sets for the metrics required for multi-dimensional measures, these single metrics offer at least some sort of indicator and therefore should not be dismissed. Another version is per capita consumption of energy by fuel type. This method can take appliance costs and efficiencies into account, albeit in a rather simplistic manner.

The proportion of the household budget spent on energy as an indicator, as Pachauri (2011) notes, is dependent on the energy used, its price, the costs of appliances and their associated efficiencies. This indicator would not account for traditional fuels such as fuelwood that are commonly collected from surrounding areas and do not necessarily have a market price attached to them. While these sources are considered "free", there is still an opportunity cost associated with fuel collection. Household members that collect fuelwood do this at the cost of using their time for other productive activities, such as earning an income. As this cost can be difficult to quantify, it is not often appropriate to use a derived opportunity cost as an indicator. Single indicators have begun evolving towards a "dashboard" of indicators, such as those proposed by the IAEA in 2005. These are a generally a range of single indicators that can provide metrics across all three spheres of sustainable development – the economic, social and environmental spheres.

Composite indices such as the Energy Development Index, developed by the IEA, or the Multi-Dimensional Energy Poverty Index have been developed to try to offer a more comprehensive approach. Hailu (2012) describes how these indices can more effectively measure progress. These approaches are for the most part highly data intensive, which can be problematic for developing countries where data collection systems may not always have the capacity to collect sufficient and/or accurate enough data for this form of measurement and monitoring to be fully effective.

The Global Energy Assessment (2012) notes that measures of progress, such as the indicators outlined above, depend on definitions adopted by national governments and others. Specific "pitfalls" have included definitions of rural, urban and peri-urban areas as well as definitions such as electrification within a specific programme. In some cases, electrification has referred to electrification reaching a point in a village, which is a loose definition, as opposed to a more

comprehensive definition that looks at the number of household connections that have been made within a village or community (GEA, 2012).

The definition of energy access used and the minimum level of service that has been established guide the decision as to which indicators are used. The considerations of definitions and minimum service levels could include whether a national average of energy consumption should be used as a baseline for a minimum level of service. The definition of energy access could also address affordability of the energy and the quality of energy provided.

The indicators used for monitoring and evaluation are likely to be based on certain factors such as the political acceptability of the assessment tool (Hailu, 2012), data availability, ease of use and "understandability". In order for any measure to gain acceptability and common usage, they need to be easy to understand by their target audience as well as measure and assess the problem being investigated. This requirement will assist in determining if single indicators such as an energy poverty line are more appropriate, or if more complex and comprehensive indicators should be used. Complex indicators could include a collection of single indicators or a composite index, such as the energy development index used by the IEA. Whatever the outcome is, both issues should be determined at the national level based on national circumstances.

3. "Theory" of Energisation and Electrification Programmes

In order to successfully implement and scale-up energisation and electrification programmes, adequate legal, institutional and financial frameworks need to be in place. Coupled with other aspects such as clear policy and strong governance, a suitable enabling environment in which such programmes can have a positive impact can be created. Additional factors for policy makers and implementing agencies to consider include environmental impacts and project sustainability, which, if the programme is to be expanded or scaled up, become more important considerations.

This chapter sets out the measures required for successful implementation of energisation programmes and addresses the possible barriers that can hinder progress.

3.1 The Enabling Environment – Frameworks for success

3.1.1 National policy

It is widely acknowledged that clear, coherent and coordinated policies are imperative to achieve success in a governmental programme (Foley, 1992; Cecelski, *et al.*, 2005; UNDP & WHO, 2009). Policies should, broadly, set standards; provide incentives to enter into energisation programmes, particularly for utilities; monitor performance; and address market failures (AGECC, 2010). Issues that can hinder successful implementation include inadequate strategic planning; lack of consideration of economic, environmental, social and poverty-related impacts; a lack of coherence and coordination with other socio-economic development policies; not allowing for flexibility in technology types; and lack of political will.

A lack of strategic planning and long-term vision can hinder effective implementation. Developing comprehensive energy policies that form a part of all efforts to improve basic services, setting targets and formulating implementation plans are all key actions for progress (GNESD, 2008; Prasad, 2011; AGECC, 2010).

Policies should also be based on assessments of the expected economic, environmental, social and poverty-related impacts (UN-HABITAT, 2009). Brew-Hammond and Kemausuor (2009) urge linking electricity access programmes to productive uses, which aside from improving livelihoods, can assist in ensuring that energy access targets are achieved. Firm political commitment and political will is still needed even if policy and targets are in place (Brew-Hammond & Kemausuor, 2009; Rehman, *et al.*, 2012).

Munasinghe (1987) notes that policy formulation for an electrification/energisation programme should be integrated with overall economic and energy planning. Policies should also meet the development objectives of the state so that the potential results of the programme are not divergent from overall national objectives. Munasinghe also urges that analysis of the macro-economy take place during policy formulation. This further strengthens the policy process through understanding dynamics that could possibly conflict with national objectives.

Effective policy also needs to ensure that the energisation solutions match the region, community and the terrain. For example, some areas, particularly rural locations, may not be suitable for grid extension. Other, cheaper options may be available, such as smaller hydropower installations. For Sub-Saharan Africa, a potentially successful option for rural areas is the installation of solar panels for electricity generation either as an off-grid or mini-grid solution.

Further, the policy process should be participative (Munasinghe, 1987). This helps ensure that the policy framework can cater for a range of potential, socially acceptable solutions. It can also assists in outreach and communication efforts that can encourage a fuller understanding of the range of energy solutions and the benefits that they provide. These outreach programmes could also be used to build trust between the stakeholders. According to Rojas and Lallement (2007) building trust between stakeholders will increase the acceptability of the chosen energy source while at the same time minimising distrust between communities and implementing agencies. This will lead to less disruption of systems or decreased illegal distribution systems.

3.1.2 Legal and regulatory environment

The legal and regulatory environment refers to the laws, legislation and regulations that are in place and govern how programmes and policies should be formulated and implemented. They also provide the rules and standards that need to be complied with during implementation of policy and programmes. The laws and regulations established should provide support for electrification and energisation programmes by providing a clear overview of the roles and responsibilities of local and regional governments and authorities as well as civil society organisations. They should also clarify land tenure issues, should they arise as well as discuss methodologies for "legitimising" consumers and their communities. In other words, address the ways in which an informal settlement can be made "legal" and thus be included in the planning and implementation processes. Collaboration with other social programmes and departments may be necessary for the latter. Laws and regulations can also address incentive and subsidisation regimes if deemed necessary (Rojas & Lallement, 2007).

Codes and standards should also be set for both the energy being provided as well as the appliances that are being used. A credible regulatory regime needs to be established by the government. The institutions operating under the regulatory legal framework should be enabled such that they can operate independently of government and carry out tasks and functions such as tariff setting. Regulators can also periodically assess codes and standards within the industry. These should be monitored against the goals and priorities of the policies introduced by government.

Different types of regulation could be considered when establishing laws and regulations. One example is performance-based regulation, as was adopted in Brazil. This approach focuses on outcomes as opposed to prescriptive processes or procedures and aims to ensure that affordable tariffs are set (Coelho & Goldemberg, 2013). Coelho and Goldemberg (2013) also state that performance-based regulation provides a measure of freedom in implementation methodologies. Other forms of regulation include rate of return or multi-year price determination for tariff regulation.

3.1.3 Institutional arrangements

The importance of robust, capable, and flexible institutions cannot be underestimated. Munasinghe (1987) states that the institutional environment should have three well-defined and balanced elements: policy making; implementation; and research and development. The AGECC (2010) notes that there is no single institutional model that is always successful; both large-scale utilities and smaller businesses and service providers are able to make positive contributions, depending on the circumstances.

The state, usually through a designated department or ministry, can be assumed to take the lead on policy making. It also plays an important role in coordinating the programme. Even if energisation and electrification programmes are carried out by private entities, the state's role in establishing institutions to provide programme support, enforce legal requirements and ensure standards is key (AGECC, 2010; GEA, 2012).

UN-HABITAT (2009) notes that the state (including local authorities) should provide basic services to its people. Engagement of the state with civil society organisations, the private sector and local communities may also be necessary for effective implementation in some situations; it has been shown that it is beneficial for consultations among all parties to take place (Energy Sector Management Assistance Program, 2011; UN-HABITAT, 2009; Khennas, 2012). The state may also be expected to carry out capacity building where needed. Lemaire (2011) suggests establishing

institutional frameworks, together with capacity building, to ensure success in rural areas with renewable energy, primarily photovoltaics.

Electricity utilities, where a monopoly exists, or electricity distributors and other designated agents are generally responsible for implementation. Munasinghe (1987) suggests that this arrangement is often successful as utilities are well placed to attend to the day-to-day needs of electrification. Depending on the structure of the market, they can be solely or separately responsible for the operation and maintenance of electricity supply systems or other day-to-day operations required to provide energy.

Regulators are generally established to regulate the industry with the responsibilities of tariff setting while at the same time ensuring that legislation, standards and norms are adhered to. Through these functions, regulators can assist in ensuring that there is transparency both within the energy sector as well as electrification programmes. The regulators can also ensure that any authorised investments or tariffs in the industry comply with national development and macro-economic policy (Lamech & O'Sullivan, 2002).

Using cooperatives to expand access to energy, particularly in rural areas, has also been successful in some programmes. Cooperatives are businesses that are self-governing entities, jointly owned and run by its members in a democratic manner (Viardot, 2013). Cooperatives buy in energy from distributors in bulk, which can help keep costs low, and distribute locally. Viardot (2013) also states that cooperatives have been successful in decreasing barriers to adoption of renewable energy technology; by extension, cooperatives could also be successful in increasing the willingness to adopt more conventional energy sources such as electricity. Barnes (2011) notes that in Bangladesh, the Rural Electrification Board supported the rural electric cooperatives by providing general monitoring and oversight functions to ensure that sound decisions were made.

Regional institutions such as power pools have an equally important role in progressing universal energy access. They allow countries' and regions' electricity networks to be connected and allow energy trade within the power pool. The main advantages to establishing power pools is that the available amount of electricity can increase as well as creating a potential decrease in the average price of electricity. They can also reduce capital investment and operating costs through improved coordination among power utilities (Khennas, 2012). Successful examples of power pools include the West African Power Pool or the Southern African Power Pool. The West African Power Pool has also gone so far as to establish a regional regulator for cross-border trade, which further

strengthens the institutional arrangements (ECOWAS Regional Electricity Regulatory Authority, 2014).

3.1.4 Technical

The technical sphere of the enabling environment deals with stakeholders' capacity, available technologies and their suitability. It also addresses the tools required to implement and progress policies and programmes, within the policy, legal, regulatory and insitutional frameworks.

The choice of fuel is an important consideration. As previously mentioned, traditional fuels tend to be burdensome with regards to health and time. Clean fuels may also be inaccessible to some communities (GNESD, 2008); for instance, informal settlements, which may not be classified as legal, may have a harder time accessing such fuels. If government departments have the capacity and ability to map informal settlements, the settlements can be integrated into the electrification programme so that some form of energy access is available to these communities. Baselines and standards for different levels of service provision, if there are any, should be set before implementing any programmes, so that the appropriate services are provided (UN-HABITAT, 2009b).

There may also be a lack of desire by some communities to change to more modern fuels. Often this can be because there is a perception that food may cook or taste better using traditional stoves. In these cases, aside from exploring off-grid and mini-grid solutions, appliances that can increase the efficiency of traditional fuels should also be considered. For example, the ceramic Jiko stove or *kuni mbili,* which were developed in Kenya. These stoves can improve efficiency by 70% (Global Alliance for Clean Cookstoves, 2013; Household Energy Network, 2010).

Figure 3: Ceramic Jiko Stoves

Source: (Appropriate Infrastructure Development Group, 2007)

Some technologies, such as solar home systems[8], may not provide sufficient power, either in the views of the households or to engage in productive purposes. As such, different technological solutions should be explored – either providing a mix of technologies or focusing on a single solution. Brew-Hammond (2009) calls for new models of technology transfer to encourage greater diffusion of more efficient, cleaner technologies through to least developed and landlocked developing countries that would benefit from them. Cost-benefit analyses could also be carried out to determine which form of electrification is the most cost-effective (i.e. grid expansion, mini-grid or off-grid solutions). Palit and Chaurey (2011) caution that technology should be assessed prior to installation to ensure long-run sustainability. In almost all cases, densely populated areas will be the most effective areas to expand electricity coverage (Prasad, 2011).

Capacity building and training programmes to increase the abilities of local institutions, as well as increase awareness and the abilities of the end users and other stakeholders involved is critical. These forms of outreach and awareness have been cited as key to ensure increased uptake of clean fuels and/or efficient appliances. Capacity building also aids in engendering trust between the communities and service providers (GNESD, 2008; ESMAP, 2011). Workshops and training

[8] Solar home systems, typically, are one-panel systems (including inverters and batteries) that are off-grid electrification solutions. They generally provide enough power to be able to operate lights, radio, and black and white televisions (Prasad, 2007).

programmes can also facilitate building institutional understanding of the real costs and benefits of rural energy development.

3.1.5 Financial arrangements and incentives

Even though universal energy access may be government sponsored, the energisation programmes should still strive to be fiscally sound. Costs can be prohibitively high, particularly if the main grid is being extended to rural areas. Less expensive options that have been proposed as solutions for energy provision in rural areas should be considered, such as solar home systems. These systems may also be more appropriate for expanding access to clean energy.

The cost of fuels and appliances can also mean that modern energy use is either not taken up or is taken up at a slow rate. Sustainable and innovative, pro-poor financing[9] options are an opportunity that could be considered both for the implementation and rehabilitation of infrastructure, as well as for ensuring that the targeted communities are able to use the available energy services. Incentives to encourage consumer and private sector involvement in the energy sector are another set of mechanisms to be considered. Both financing options and incentives can be used to make electrification and energisation programmes financially attractive. This is often particularly important to encourage involvement from the private sector or for the establishment of public-private partnerships (PPPs). Incentives can also encourage households to use more of the (newly) available clean fuels through being able to afford fuel and appliances. These different options are discussed below.

Subsidisation programmes have been one of the more traditionally favoured options for incentivising an increased uptake of (newly available) clean, modern energy services. Types of subsidies that have been offered in the past include flat rate subsidies for fuels, subsidised connection fees or free electricity allocations for households below a certain income threshold. To make such schemes affordable, cross-subsidisation is often used to fund such subsidisation schemes, whereby customers who consume more pay a higher tariff that would offset the loss made on subsidising customers at lower tariffs.

Subsidies often have unintended consequences. One commonly cited problem is subsidy leakages, where recipients of the subsidies are not the intended targets. In some instances, subsidies have also been prone to misuse (Rehman, *et al.*, 2012). It has been suggested that for subsidy

[9] UN-HABITAT (2009a) suggests that policies, including financial policies, be pro-poor so that strategies and programmes remain financially viable and accessible to all sectors of the population.

programmes to be successful, they should be considered temporary programmes and exit strategies should be devised ahead of implementation. Senegal, during its programme to increase access and affordability of clean fuels, provided a subsidy for gas cooking. The subsidy was designed with an exit strategy, which even though demand dropped once the subsidy ceased, was successful. 85% of Senegalese households now use gas as their primary cooking fuel (Cook, 2011).

One concern is that subsidies such as those mentioned above can also place a burden on other private companies that are in the market and lead to under recovery on their part as they either charge a tariff higher than the subsidised price, or below the true market rate (Rehman, *et al.*, 2012). Another cautionary is that should the full energy service be unavailable, or the energy service is not fully understood, the subsidy cannot be fully utilised.

Alternate financing options should be explored, including investigating consumer-friendly ways of spreading connection costs. South Africa managed this by subsidising the initial connection fee for the minimum service level, if customers were unable to pay for it. Some suggest, however, that it is better for consumers to pay for a part of the connection fee in order for them to "value" the service (GNESD, 2008; Rojas & Lallement, 2007). There have been anecdotal reports of vandalism where customers may not have fully understood or accepted the service provided. Bolivian utilities, through financing connection, doubled their customer base[10] (Lamech & O'Sullivan, 2002). If tariffs are to be subsidised, then extending the subsidies to cover appliances could also be considered.

Encouraging private sector involvement has also been suggested as part of the financial arrangements for expanding energy access. Aside from the incentives stated above, PPPs or a solely private sector-led campaign could be pursued. Experience from Asia has shown that these models can improve the financial sustainability of the sector as well as improve governance and transparency. The models have also been shown to increase efficiency and reduce prices. Rehman, *et al.* (2012) also suggest that governments facilitate PPPs or private sector involvement by providing risk sharing measures as well as hedging investments made by private parties. The debate as to whether government-, private sector- or PPP-led programmes is the best option is still ongoing.

Another means of financing energy access is through being able to access microfinance. These programmes can assist by providing relatively small loans either to households or to local entrepreneurs. Coelho and Goldemberg (2013) recommend this approach to provide financial support in rural areas, particularly as a means to support energy entrepreneurs. As microfinance

[10] A Bolivian public utility offered to finance connection charges over a five-year period (Lamech & O'Sullivan, 2002).

institutions are not traditional lending institutions, they can be more flexible in granting credit. They can also lend smaller amounts that traditional lending institutions may not be able to grant.

Concessional loans from development banks may also be an option to fund initial steps in energy access programmes. Grants from aid and other organizations could also be explored (AGECC, 2010). The GEA (2012) suggests that a mixture of domestic and external funding is the optimal way to fund energisation programmes.

3.1.6 Governance and sustainability

Mistrust between communities and service providers has affected a number of energy access programmes (GNESD, 2008; Rehman, *et al.*, 2012; ESMAP, 2011). Lack of formal monitoring and evaluation programmes have also meant that barriers to progress have not been identified timeously, along with other hurdles and any mismanagement that may exist, particularly those that may adversely affect the poor. Monitoring and evaluation can also provide feedback on areas that need to be modified.

On monitoring and evaluation, UN-HABITAT (2009a) recommends that indicators be established both at the national and regional levels. They also suggest creating a framework that encompasses effective regulatory practices as well as penalties for non-compliance. GNESD (2008) has suggested that a potential monitoring and evaluation activity to carry out is audits on fuel subsidies.

Ensuring that the community is involved in the implementation and management of the energisation programme has been suggested as a way to avoid mistrust between the communities and other stakeholders. Community participation is also key for ensuring the sustainability of the project; there must, however, be a willingness on the part of stakeholders to continue the project (ESMAP, 2011).

Continued efforts to maintain stability and improve the policy environment, financial mechanisms and institutional arrangements are also needed for the sustainability of such projects.

4. Energy Access in Sub-Saharan Africa

4.1 General overview

Despite considerable efforts in recent years, achieving universal access to modern energy still remains a goal that will take considerable effort to reach the 1.3 billion people that have no access to electricity and the 2.6 billion people who use biomass for cooking (IEA, 2013a).

Africa, which accounts for approximately 15% of the global population, has the lowest level of electrification at approximately 43%. Across Africa there is a dissonance in access with Sub-Saharan Africa having the lowest electrification rate of 32% as opposed to North Africa, which has a 99% rate of electrification. When assessing rural versus urban electrification rates, Sub-Saharan Africa again falls short, with an electrification rates of 18% for rural areas and and 55% for urban areas. 79% of sub-Saharan Africa relies on biomass as its energy source. (IEA, 2013a).

Region	*Population without electricity* *(millions)*	*Electrification rate* *(%)*	*Urban electrification rate* *(%)*	*Rural electrification rate* *(%)*	*Population relying traditional use of biomass* *(millions)*	*% relying on traditional use of biomass*
Africa	599	31.8	55.2	18.3	696	67
North Africa	*1*	*99.4*	*100*	*98.7*	1	1
Sub-Saharan Africa	*599*	*32*	*55*	*18.3*	*695*	*79*
South Africa	8	85	96	67	6	13
Mauritius	0	99	100	99	-	-
World	1 258	81.9	93.7	69.0	2 642	38.1

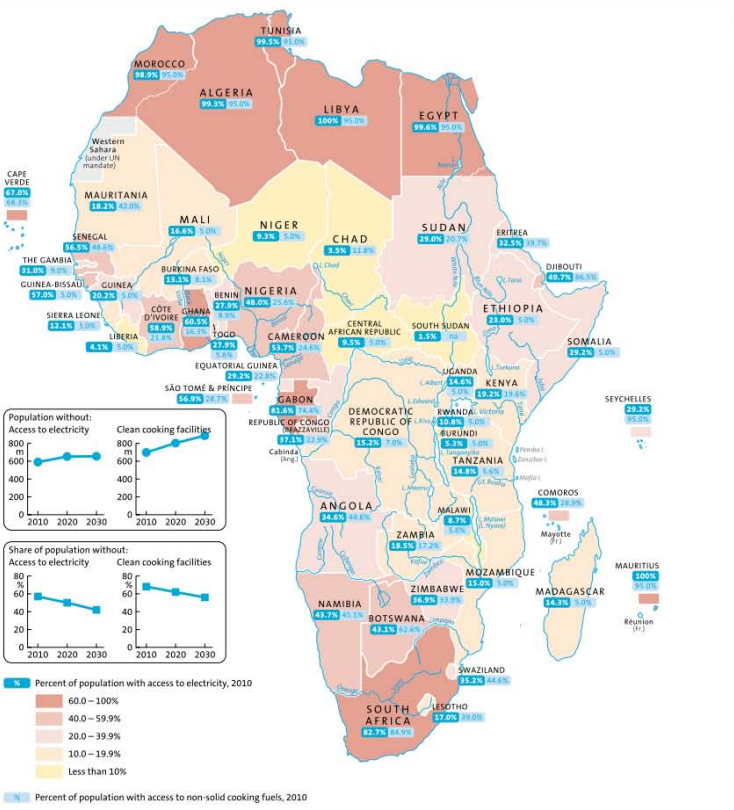
Table 2: Energy Access in Africa

Source: IEA, 2013

Biomass usage remains a challenge in Africa. 80% of households in Sub-Saharan Africa still use biomass. The numbers of people relying on traditional biomass for cooking in these regions is projected to increase consistently over the next 20 years (IEA, 2013a). Bearing in mind the negative effects of the use of biomass and therefore the implications of these projections, several countries

have made efforts to encourage households to use alternate energy sources. Gabon, Cape Verde and Ghana have the highest electricity access rates in West Africa (Bouille, *et al.*, 2012). Senegal has succeeded in implementing programmes to get the majority of households to use LPG for cooking. Nigeria, Uganda, Kenya and Tanzania are experiencing a worsening trend, where the proportion of the population relying on traditional biomass for cooking is increasing (IEA, 2013a).

Figure 4: Access to Electricity and non-Solid Fuels in Africa



Source: (AEEP, 2014)

Even in urban areas, where electrification has taken place, power supply may be intermittant with potentially fluctuating voltages. Infrastructure has remained a problem in both urban and rural areas; it is either aging or not available due to the cost of expansion. Aging infrastructure also leads to inefficiencies within the system .

4.2 Regional Economic Communities and Energy Access

There have been a number initiatives to advance energy access and access to electricity both through the regional economic communities and nationally within Sub-Saharan Africa.

Access to modern energy has been highlighted as a priority for the African Regional Economic Communities (RECs). The Conference of Energy Ministers of Africa (CEMA), established and overseen by the African Union (AU), provides a political platform for the RECs to meet and discuss issues that are deemed of continental importance. The Forum of Energy Ministers in Africa preceded CEMA, which was a less formal arrangement (EU Energy Initiative Partnership Dialogue Facility , 2014).

Table 3: Regional Energy Access Goals in Sub-Saharan Africa

Regional Economic Community	*Strategic Goals*	*Operational Goals*
Economic Community of West African States (ECOWAS)	At least 50% of the urban and peri-urban ECOWAS population has access to modern energy services by 2015	100% access to improved energy services for domestic cooking by 2015
		60% of rural population to have access to productive energy services in villages by 2015
		By 2015, 66% of the population have access to an individual electricity supply *or* By 2015: • individual electricity supply to 100% urban and periurban areas; • 36% of rural population; • 60% of rural population with modernised basic social services, access to lighting and other services and coverage of isolated populations with decentralised approaches
East African Community (EAC)	Use of modern cooking practices by 50% of the population currently using biomass	
	Access to reliable electricity for all urban and peri-urban poor	
	Provide modern energy services and water treatment and supply for all schools, clinics, hospitals and community centres	
	Access to mechanical power within all communities for productive uses	
Economic and Monetary Community of Central Africa (CEMAC)	At least 50% of the CEMAC population has access to modern energy services by 2015	Supplying 50% of the peri-urban population via grid extension
		Providing individual power supplies to 35% of rural households via grid or solar home systems
		Installing corresponding infrastructure in non-electrified villages so 56% of rural population has access to power supplies
Southern African Development Community (SADC)	Member states are to harness regional energy resources to ensure that all the SADC region have access to adequate, reliable, least cost, environmentally sustainable energy services.	Halve the proportion of people without access by 2020; halve again in successive 5-year periods until universal access is achieved.

Source: SADC, 2010; CEMAC, 2006; EAC, 2006a; ECOWAS, 2006

The Southern African Development Community (SADC) have defined energy access as being the actual use of energy, stating that access encompasses the following factors: availability, affordability and accessibility (Southern African Development Community, 2010).

SADC recognizes the importance of facilitating energy transitions to cleaner forms of energy and encourages energy use for productive purposes. It also notes that its role in advancing energy access is to support national efforts, as responsibility for improving energy access lies at the national level rather than the regional level. SADC recognizes that the ability of countries to enable universal energy access is not equal, and thus the operational goal of halving the proportion of people without access within 10 years and then again within successive five-year periods is a reference point as opposed to a hard goal. It has also established a strategic goal to harness the natural resources of the region to enable universal energy access (SADC, 2010).

The Economic and Monetary Community of Central Africa (CEMAC) Energy Plan was drafted in 2006 to initiate a CEMAC-wide drive to meet the objective of reducing poverty by 2015 (Economic and Monetary Community of Central Africa, 2006). The strategic goal of 50% of rural and peri-urban populations having access to modern energy by 2015, in order to attain poverty reduction. CEMAC places the responsibility of widening access on its members. The energy access plan has been devised to provide a platform for elaborating on and assessing energy objectives. The access plan was expected to give member states the opportunity to assess overall energy-specific objectives for inclusion in national frameworks. CEMAC decided on this as the Poverty Reduction Strategy Papers were wound up in 2006 and there was a need to fill this "gap" (Economic and Monetary Community of Central Africa, 2006).

The East African Community (EAC) formulated its energy access strategy to address two overarching issues: increase the supply of modern energy for economic development; and increase pro-poor access to modern energy services to meet the MDGs. It sets four strategic targets to address energy access for achieving the MDGs. These targets include use of modern cooking practices by 50% of those who currently use biomass; access to reliable electricity for all urban and peri-urban poor; provision of modern energy services, and water supply and treatment for all schools, clinics, hospitals and community centres; and access to mechanical power for productive uses. The EAC does not stipulate an end date for its strategic goals, but as the energy access strategy was drafted with the target of attaining the MDGs, 2015 can be assumed as the target year for its goals. In trying to achieve these goals, the EAC recognises the need to increase private sector investment and financing household energy use through end-user payments (East African Community, 2006a, 2006b).

In 2006, the Economic Community of West African States (ECOWAS) published a White Paper for a regional policy geared towards increasing access to energy services for rural and peri-urban populations in order to achieve the MDGs. Again, ECOWAS recognises the sovereignty of its members and that electrification and increased energy access is their responsibility. ECOWAS, in the White Paper, also notes the following guiding principles for increasing access: using participatory approaches; cohesion, consultation and cooperation are necessary; using multisectoral approaches;

using technology neutral approaches[11] to increase access; promotion of PPPs; and keeping sustainable development in mind at all times (Economic Community of West African States, 2006).

The policy positions taken by the RECs are ambitious, and unlikely to be achieved before 2015. The strategies and goals that were set do, however, provide a sound policy framework, which can assist in guiding countries efforts to increase energy access. The policies go beyond target setting, and discuss possible aspects to consider when formulating national policy. Some policies, as is the case with the SADC energy access policy, define energy access. Other policies, like those of ECOWAS and the EAC, also detail possible institutional arrangements and financial strategies. Munasinghe (1987) suggests that formulating policy for increasing electricity access should be strengthened, and the RECs' policies and strategies are also positive steps for strengthening policy making.

Over the last ten years, the AU and the RECs have taken steps to redress the lack of energy access in Africa. While the targets are ambitious, the strategies themselves address a number of facets to consider when setting policy and establishing an energisation programme. This is a good step for many countries, specifically as the strategies do not interfere with national policy making but rather support national actions from a regional stand point.

[11] ECOWAS suggest that using a technology neutral approach will allow for the best technology to be used given the circumstances.

5. Country Level Experiences: South Africa

5.1 Background

South Africa is situated at the southernmost end of the African continent. It is bounded by both the Indian and Atlantic Oceans to the East and the West respectively. To the north, it is bordered by Namibia, Botswana, Zimbabwe, Mozambique and Swaziland.

Situated below the equator, with the Tropic of Capricorn slicing through the North-East, South Africa enjoys a subtropical climate, with warm and temperate conditions. The interior of the country has generally cold winter temperatures, with some evenings dropping below freezing. It is also a water-scarce country (Government of South Africa, 2012b).

A population of 51.7 million people live on approximately 1.2 million km^2 according to the latest census. 84% have access to electricity (Government of South Africa, 2012a). South Africa's current GDP growth is 0.7%. At the start of the electrification programme, in 1994, South Africa's GDP growth was 1.9% (Statistics South Africa, 2013).

Coal-fired power plants have largely dominated the South African energy industry. Given its abundant coal resources, this source has been, traditionally, a "cheap" option. Increasingly, however, the South African Government is urging that the electricity supply industry change its focus and increase renewable energy capacity, given the wind and solar resources available in South Africa. As South Africa is moving away from "cheap, dirty" energy, it is also increasing efforts to improve energy efficiency nationally.

5.2 South African National Electrification Programme

Prior to 1994, when South Africa held its first democratic elections, 36% of households had been electrified - 50% of the urban population and 12% of the rural population. Eskom, taking cognisance of the change in political climate, embarked on its "electricity for all" programme in the early 1991. The "electricity for all" programme expanded electricity access to households in areas that Eskom serviced. Sanctioned by the new government, this became the National Electrification Programme (NEP) in 1994 (Marquard, *et al.*, 2007).

The first phase took place from 1994-1999. The second phase, the Integrated National Electrification Programme (INEP) began in 2000. Over 4 million connections have been made to date, although the deadline for universal electrification have been amended to become more realistic targets.

Table 4: Snapshot of the South African National Electrification Programme

Phase	*Years*	*Targets*	*Cost*	*Implementing institutions*	*Funding*	*Target Achieved*	*Total Electrified*
NEP (Phase One)	1994-1999	450 000 connections/ year OR 2.5 million households over the five years	+/- R7 billion	Eskom, Municipalities	Debt financing & tariff mark-up	Yes	66% of all households
		Connect all schools and clinics					
INEP (Phase Two)	2000 - present	Universal electrification by 2012 subsequently extended to 2014 and then 2025		Eskom, Municipalities		Initial targets were not achieved. Current target is 2025.	To date: 5.7 million households

Source: Compiled by Author

5.2.1 Policy

The South African Government published its White Paper on Energy Policy and its White Paper on Renewable Energy Policy in 1998 and 2003 respectively. These are the two overarching policy documents that guide the actions undertaken in the industry. Prior to this, the RDP[12] guided policy decisions with regard to electrification in South Africa.

Phase One had the following goals, which had emerged from the RDP: 450 000 connections per year, with 300 000 Eskom connections and 150 000 municipal connections; and connecting all clinics and schools (Marquard, *et al.*, 2007). At the conclusion of Phase One (NEP), 1.75 million connections had been made on the part of Eskom at a cost of approximately R5 billion, primarily in rural areas. 750 000 municipal connections had been made, primarily in urban areas, at a cost of approximately R2 billion.

Phase Two (INEP) commenced in 2000, when the electrification programme was institutionalised and operated by the then-Department of Minerals and Energy (DME), now the Department of Energy (DoE). This second phase was supported by the White Paper on Energy

[12] The RDP was the policy framework implemented by the post-Apartheid government in South Africa. It addressed five key areas, including meeting basic needs, developing human resources, building the economy, democratising the state and society, and implementing the RDP (African National Congress, 2011).

Policy, which explicitly stated the DME's role in coordinating the electrification programmes in the country. The goal of achieving universal access was announced in 2004 by the then-President Mbeki. Phase Two also started paying more attention to the backlog in rural areas. The White Paper on Energy Policy also called for areas that are too remote for grid electricity to have photovoltaics installed and urged investigating and establishing integrated solutions (Marquard, *et al.*, 2007). In its latest strategic plan, the DoE committed to making 150 000 grid connections and 10 000 off-grid connections on an annual basis (Department of Energy, 2011).

In 2013, a revised strategy was introduced and adopted by Parliament. The strategy set out a roadmap to achieve universal access by 2025. It stated that 90% of households would be connected to grid electricity while the remaining 10% would be electrified through solar home systems.

In all of the above cases, energy access was defined as having a connection to the grid. The connection itself was set at a minimum standard of 20 Amperes, which was considered a basic supply. This supply is expected to be able to power radio, lights, television, fridge and one other heating appliance such as a geyser, kettle and heater or iron and hotplate (DoE, 2012).

5.2.2 Legal and regulatory

Numerous pieces of legislation have been promulgated since 1994 to address the imbalances in electrification that resulted from apartheid policies. They also aim to broaden the energy mix, which is advantageous both environmentally and from an energy security point of view. The main laws governing the sector include the amended Electricity Act (1987), the Electricity Amendment Act (1995), the National Energy Regulator Act (2004) and, more recently, the National Energy Act (2008)[13].

The Electricity Act (1987), and subsequently the National Energy Act (2008), sets out the roles and responsibilities within the electricity industry; this includes the jurisdictions, land expropriation procedures, requirements for plant and other infrastructure etc. It also sets out offences and penalties, liabilities and ownership of meters and so forth (Government of South Africa, 1987; Government of South Africa, 2008).

The National Electricity Regulator was established in 1995 as a result of the Electricity Amendment Act, 1995. It was to provide regulation over the electricity industry, much like its predecessor, the Electricity Control Board. The National Energy Regulator Act, 2004, established

[13] Copies of the relevant acts and policies can be accessed at http://www.energy.gov.za/files/policies_frame.html

the National Energy Regulator of South Africa (NERSA) as the sole regulator of the energy industry. It incorporates the National Electricity Regulator (NER). Its role is to take all the necessary regulatory actions given the circumstances being experienced in the energy industry (National Energy Regulator of South Africa, 2009).

With regards to electricity, the NER, subsequently NERSA used a rate of return[14] (RoR) methodology for setting electricity prices. By doing this, NERSA used international best practices and benchmarked prices both locally and internationally. The reasoning behind this initial methodology was that it would allow a reasonable recovery of operating costs as well as a return on assets for the distributors. The regulatory methodology adopted from 2006, once the NER had been incorporated into NERSA, is Multi-Year Price Determination (MYPD)[15], which incorporates elements of RoR as well as incentive regulation. The reasoning behind this is, *inter alia*, to ensure price stability, sustainability and provide efficiency incentives (NERSA, 2012b).

The National Energy Act, adopted by the South African Parliament in 2008, sets out in Article 5 that the Minister must adopt measures that provide for universal access to appropriate forms of energy or energy services for all the people of the Republic at affordable prices (Government of South Africa, 2008).

5.2.3 Institutional arrangements

The DoE, initially the DME, was the key government institution for electrification. As it was formed in 1994, and included mineral affairs in its portfolio at the time, it did not initially play a large role in the electrification programme. The DME did not assume the role of coordinator and administrator of the programme until 2000, when the INEP came into being. A unit was established within the department to the programme. A three-to-four year delay occurred in the effective running of the programme while the DME took control of the electrification programme (Marquard, *et al.*, 2007).

Eskom is the largest generator of electricity in South Africa, generating about 95% of the electricity in South Africa. Along with municipalities and other local authorities, it is also responsible for electricity distribution in the country (Eskom, 2014). Its initial role was as planner, administrator and implementer of the bulk of the NEP (Marquard, *et al.*, 2007). It is now the implementing agent

[14] RoR regulation adjusts price levels according to operating costs and cost of capital (Jamison, 2007).
[15] Multi-year price determination sets tariffs in cycles.

for the DoE in the areas where it is the electricity distributor. Municipalities and other local authorities are the implementing agents in the areas where they have been appointed as distributors.

The NER, as mentioned above, was also established in 1994. It administered the NER electrification fund, which contained annual grants from Eskom to subsidise municipalities' efforts in electrification. The NER also had an oversight role and monitored the NEP by virtue of its functioning. This was achieved by having to license distributors, collect statistics and audit municipalities' activities (Marquard*, et al.*, 2007). The NER was incorporated into NERSA in 2005, when NERSA was established. NERSA's role consolidated regulation of the energy industry, including liquid and other fuels.

5.2.4 Technical

The *ex-post* evaluation of NEP recognised that off-grid and mini-grid solutions may be needed to electrify rural areas. Anecdotal evidence has suggested that Eskom's efforts to install solar photovoltaic were not successful for three reasons. Firstly, there was a lack of sufficient consultation with the community before implementation. Secondly, there was a lack of awareness and understanding on the part of the community- this could have been avoided with adequate consultation initially. Thirdly, due to the history of South Africa, some communities prefer to be connected to the main grid to "show that the government is looking out for them".

At the time of the NEP, grid connections were the preferred method of electrification. During the same phase, alternate methods were explored to make connection fees affordable to low-income households. As a solution, households that were not able to afford electrification costs were provided with at least a 20-ampere connection[16] depending on what the household could afford. Providing a connection in this manner meant that all dwellings could be electrified simultaneously and that utilities would not, in theory, have to return to the area at some future point to complete electrifying the community and/ or area. In this manner, costs could be kept to a minimum.

A hindrance in a few areas is the lack of bulk infrastructure. Thus, distribution lines need to be extended. The funding for this is part of the overall electrification funding. Given that even with extending the grid it will still be impossible for some areas to be electrified, the DoE has committed to connecting 10 000 households using off-grid technology every year. This includes solar home systems (DoE, 2011).

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[16] A 20-ampere connection is the lowest capacity and is considered a basic supply, which is supplied at no cost to the consumer. Increased capacities are available at stepped rates.

5.2.5 Financial arrangements and incentives

Eskom and local municipalities funded the NEP (Visagie, 2008). The cost was financed through debt financing and a mark-up on Eskom's electricity tariff. R300 million was provided on an annual basis by Eskom to the NER for the implementing arms of local authorities, i.e. municipalities.

During the NEP, the uptake in electricity usage was lower than expected due to many households not being able to afford to use electricity once they were connected. Countering this, free basic electricity (FBE) was introduced in 2003 (Marquard, *et al.*, 2007; Global Energy Assessment, 2012). It is set at 50 kW/h per month with stepped tariffs that increase as consumption increases.

From 2000, the DME has provided space in the budget for funding the INEP. It currently earmarks R1.7 billion per annum for the programme. The Treasury provides these funds. The municipality-run electrification efforts are only partially subsidised through the DoE, although these subsidies have increased over the intervening years to match rising capital costs (DoE, 2012). According to Eskom, however, this level of funding is not sufficient to attain universal access in 2014 or the revised target of 2025. Universal access will only be achieved in 2033 (Eskom, 2012).

5.2.6 Governance and sustainability

As the NEP was self-funded by the industry, the funding regime used was not as transparent as it could be (Department of Mineral and Energy, 2002). The lack of transparency in the NEP was recognised by the DME in its review of the initial phase of the electrification programme.

Initial evaluations of the NEP also noted that operational costs were not covered by additional revenue. Not being able to cover operational costs would limit the sustainability of the project, particularly if it is to be self-financed or financed through debt financing (Department of Minerals and Energy, 2001). Initial consumption levels were also not as high as anticipated, which makes cost recovery even more difficult to achieve (DME, 2001). Recognising the lack of electricity uptake, the South African Government has had to subsidise electricity for low-income households. The Government has adopted a policy that states that NEP was not commercially viable and that electrification is a social investment as opposed to being a true commercial venture (DME, 2002).

No specific monitoring and evaluation has been set out in the policy documents. Monitoring and evaluation has been cited as key to ensuring that no misuse or misappropriation of resources takes place. It is also important, in as much as such a programme should be an iterative

and flexible process whereby feedback from monitoring and evaluation would allow modifications that can overcome hurdles, address barriers and increase efficiencies.

5.3 Discussion

5.3.1 Policy

Although there is no explicit reference to an energy access definition in available policy documents, it is implicit from the INEP and FBE policies that access has been defined as having a connection to an energy source. In this case, electricity. The lack of an energy access definition in policy papers leads to the terms electricity and energy being used interchangeably, which may lead to some confusion. This implicit definition of energy access being electricity access is further confirmed by the initial industry-led phase of electrification, which based its actions on the RDP. The South African Government does recognise that multiple fuel use takes place, particularly in low-income households and must therefore act across the spectrum of sources. Taxes on paraffin (also known as kerosene) have been zero-rated, as it is one of the more commonly used fuels in low-income households (SADC, 2012).

The government has defined a minimum basic level of electricity that each household should receive at no cost. The AGECC's minimum basic level includes energy for productive uses. The minimum level provided by the South African Government (the FBE allocation) meet the AGECC's guidelines for meeting basic human needs, which is in-line with the intention of the South African Government.

The electrification policy in South Africa has gone through three clear stages – the first being industry-driven, the second being run by the DME with a target for universal access of 2012 and the third, while still being run by the DME, has been reassessed to have a target for achieving universal access by 2025 (DoE, 2013).

The post-Apartheid South African Government placed a strong emphasis on expanding access to basic services such as water, sanitation and clean energy, in order to redress the imbalance that had occurred as a result of the previous regime. This has been re-endorsed over the intervening years, particularly through the DME assuming control of the programme and making provision in the departmental budget for electrification. The statement by the Mbeki Presidency providing a target for universal electricity access also demonstrated the importance of the programme to the Government. The reassessment of the INEP in 2013 has reiterated the desire on the part of the Government to complete the programme, but they have now assumed a more (probably) realistic

view of when universal access can be achieved. If achieved, the INEP will be completed five years ahead of the Sustainable Energy for All target. The political will demonstrated throughout the three stages is one of the primary reasons that the electrification programme in South Africa has been such a success.

As the NEP came into being around 1994, a result of Eskom's efforts to electrify households that had previously been excluded, certain elements of good practice were missing from the first phase of electrification. These include transparency in financing and funding, as well as formally monitoring the electrification programme. The need for a review of the process was recognised though, and an evaluation was carried out by independent experts upon completion of the NEP's first phase (DME, 2001).

During the first phase, the South African Government did not assume a central coordination role. A single, central coordinator, usually government agencies, have been demonstrated as necessary for success. Despite this, the first phase of electrification was successful. The institutionalisation of the electrification programme within the DME should have continued this success. However , this institutionalisation, coupled with the remaining areas to be electrified being more remote, seems to have led to a delay in the programme. Progress has been steady since; this again demonstrates the political will and policy impetus to ensure universal electrification, even in the face of delays and slow progress.

As the electrification programme progresses, the Department of Energy (2012) has suggested that a common policy should be developed to address the implementation and increased utilisation of different technologies. This would also facilitate speedier access in some areas.

Given the number of stakeholders in the electricity distribution industry, particularly the number of implementing agencies[17] (Eskom and local authorities), coordination will remain imperative. There have been some concerns that this effective coordination may still be too big a task to achieve.

5.3.2 Legal and regulatory

The legal and regulatory regime has long been established in South Africa. Although amendments were made to ensure that policies were consistent and coherent with each other, which was necessary given the changeover to a democratic regime, the industry was largely established.

[17] As of 2012, NERSA had granted 189 electricity distribution licences in South Africa (NERSA, 2012a).

This meant that the roles, rules and regulations were clear prior to start of the electrification programme.

This has been an issue in some electrification programmes, particularly in countries where the electricity supply industry is not fully developed. Having these already established has meant that the programme was able to avoid this step in planning and implementation, which ultimately speeds up the process of achieving universal access.

5.3.3 Institutional arrangements

The policy papers list the institutions which are involved in implementing the electrification programme in South Africa. This allows for distinct actions and responsibilities to be designated to each stakeholder. A problem arises in that there are often a large number of stakeholders of varying sizes and capacity involved and this can mean that inefficiences can arise. These should be addressed going forward.

5.3.4 Technical

Initial efforts under the electrification programme did not commit to using solar home systems or other renewable technologies for off-grid and mini-grid solutions should grid electrification prove unsuitable. Solar-home systems are an easy to implement and a low-maintenance solution to electrifying rural areas. In order for them to be "approved" of or "owned" by the community, greater community engagement will be needed. Some communities and households are suspicious of solar solutions and view them as "second-class" as they are not the same energy source as that which is used for urban residents. Greater communication with local communities should have been ongoing throughout all stages and needs to be addressed if alternate energy sources are to become acceptable to all South Africans.

Since the start of the electrification programme, the connection fee has been subsidised for a defined minimum level of electricity service. This policy has meant that electrification of communities and areas can be carried out efficiently and connect all households irrespective of if they have paid for a connection or not. Not having to return to a settlement to continuously connect households when they can afford the connection fee can increase efficiency and keep implementation costs at a minimum.

5.3.5 Financial arrangements and incentives

The funding of first phase of the electrification programme by the industry, which, if it had continued, would have placed a burden on the industry that was unsustainable. With the DME assuming the role of central coordinator for the second phase, the electrification was formally budgeted for, which, to an extent released the burden on utilities and local authorities. It can however be argued that since Eskom is a wholly owned government entity the burden has simply been shifted from one department of government to another.

During a 2012 review of the INEP, the DoE acknowledged that additional funding would be needed due to increasing capital costs. According to an Eskom estimate, if more funding is not obtained, the Programme will once again miss its target for achieving universal access to electricity. Eskom predicts that at current funding levels, universal access can only be achieved by 2034 at the earliest (Eskom, 2012). Funding will remain a concern going forward. New funding sources should be explored, including concessional loans and grants. Coordination and collaboration may also be used to identify other sources of funding. This will be imperative if universal access is to be achieved sooner than 2030.

5.3.6 Governance

There was no specific monitoring and evaluation role during the first phase of the electrification programme. Oversight during the latter phases was through the DoE's reporting to Parliament on progress. While this has provided some transparency, figures regarding progress can be difficult to obtain at times. It is also unclear how communities and other civil society stakeholders are engaged in the process. However, a review of the programme has taken place twice – once at the end of the first phase and a second in 2012. Both of these reviews have allowed modification of processses and targets to achieve a more realistic and potentially more successful programme.

Sucessful programmes have a monitoring and evalution programmes set up as part of the implementation of the process. This becomes an ongoing part of the programme and is used to modify process and improve results as the programme progresses. In South Africa this iterative process needs to be set up and carried out on a more regular basis in order to more effectively drive results.

5.4 Conclusion

South Africa's electrification programme has been ongoing since 1994. It has made steady progress over the intervening years, largely due to the frameworks and policies that have enabled its functioning. This improvement has been driven by political will that has placed universal energy access high on the South African Government's social agenda. Government funding for the programme has therefore been available.

The frameworks and policies were largely in place prior to the start of the electrification programme, which has also meant that initial successes were achieved sooner. The fact that Eskom was already estabished as the national electricity provider eased the process and shortened timelines for implementation. The changing of central coordinator midway through the programme did cause some delays. Subsidisation of connections as well as free basic electricity allocations have provided some incentive for consumers to increase their consumption of clean energy, although even with this, electricity consumption increases have not been as high as expected.

Reviews have been conducted at two stages during the programme and allowed a revision of policy, including greater importance placed on alternative energy access solutions for rural areas. It is widely acknowledged that such programmes are generally not viable or sustainable, but the South African Government have acknowledged that the investment in electrification has greater benefits for the economy overall, than if households remained unelectrified.

These key attributes of the electrification programme are universal in their ability to ensure success. Such lessons should be taken and incorporated into other national and regional programmes, which could lead to a greater success.

6. Country Level Experiences: Mauritius

6.1 Background

Mauritius is a small island developing state (SIDS), situated in the Indian Ocean off the coast of Africa. Its main island is 1870 km^2 and, surrounded by several outer islands, its total size is 2040km^2. It is a sub-tropical climate with two seasons – winter and summer. It experiences generally mild termperatures throughout the year (Government of Mauritius, 2009).

Since 1598 Mauritius has been a colony of the Netherlands, France and Great Britain. It gained its independence from Great Britain on 12 March 1968. As of July 2012, Mauritius had a population of 1.29 million people. The island has a low population growth rate, which is approximately 0.4%. Its GDP growth rate is 3.2% (Statistics Mauritius, 2013). 90% of Mauritius' arable land is used for sugar cane.

The island itself has no fossil fuel reserves. It also cannot benefit from interconnection facilities such as the Southern African Power Pool, like other SADC members are able to (excluding Madagascar and the Seychelles). It thus relies on oil and coal imports to meet the majority of its energy demand. Electricity generated from bagasse, a by-product of the sugarcane industry, has become an increasingly important part of the energy mix, with 60% of the electricity being generated from bagasse. Electricity on the island is generated from a mixture of state-owned and independent power producers.

6.2 Mauritian electrification programme

The Mauritian electrification programme, although underway before independence, gathered momentum after independence in 1968. It primarily focused on rural areas through extending the grid. Household electrification was largely completed by 1981, with all rural communities electrified. Government focus turned to industrial and commercial development thereafter (Karakezi, *et al.*, 2005).

Table 5: Electrification progress in Mauritius: 1953-2004

	1953	*1968*	*1981*	*2004*
Number of households	119 000	148 000	198 080	307 945
Number of residential electricity consumers	31 050	80 456	144 995	309 496
Electrification rate (%)	26.1	54.4	73.2	100.5

Source: (Hurdowar, 2005)

6.2.1 Policy

Following independence, the Mauritian Government prioritized implementation of development projects, specifically those that assisted the poor and closed the gap between rich and poor. Goals within the development plans included ensuring real growth rates exceeding 6% with concomitant job creation, with the ultimate goal of reaching full employment. The focus has been on implementing projects that further the government's overall socio-economic objectives. This includes the drive from Government and the Central Electricity Board (CEB), the Mauritian electricity utility, to electrify residential areas, particularly in rural locales (World Bank, 1978).

6.2.2 Legal and regulatory

The legal and regulatory regime for the Mauritian energy sector has been somewhat fragmented. The Electricity Act (1939), also known as the Electricity Regulations 1939 has been in place since 1939 and amended during the intervening years to ensure that it is kept up-to-date. It largely deals with technical issues such as the requirements and standards for transmission and distribution infrastructure. It also addresses remedies for billing and other financial considerations and metering disputes (Government of Mauritius, 1939).

The Central Electricity Board Act of 1963 strengthens the functioning of the CEB by setting out its duties and functions, which includes preparing and carrying out development schemes to promote, coordinate and improve the generation, transmission, distribution and sale of electricity. It also sets out the CEB's limits of authority, which includes allowing the CEB to secure loans if necessary (Government of Mauritius, 1963).

These two acts were the primary acts within the energy sector until the early 1990s when additional acts were introduced to develop further the energy industry in Mauritius.

6.2.3 Institutional arrangements

The two primary institutions addressing energy planning and electrification were the Ministry of Energy, in its different forms, and the CEB.

Currently the Ministry of Energy and Public Utilities is responsible for energy policy. Its portfolio includes energy, water and wastewater (Government of Mauritius, 2009). Prior to this, the Ministry of Fuel, Power and Energy as well as the Ministry of Energy and Internal Communications existed. The ministries largely played an administrative role over the years and did not involve themselves in policy matters such as electrification programmes. A small energy planning unit was

established in 1981 within the Ministry of Economic Planning and Development. During an institutional strengthening exercise, this was moved into the-then Ministry of Energy and Internal Communications. This new ministry became the central coordinator for the energy sector (World Bank, 1983).

The CEB is a parastatal, wholly owned by the Government of Mauritius, and is the utility responsible for generating electricity on the island. It was established in 1952 and is responsible for the electricity network. In 2010, the CEB was responsible for producing approximately 42% of the island's electricity (derived mainly from oil and coal). The rest of the production is met from electricity generated by Independent Power Producers (IPPs) or Continuous Power Producers (CPPs) generating electricity from bagasse[18] or coal (Central Electricity Board, 2010). The CEB also currently acts as the electricity regulator (Ministry of Public Utilities, 2013). The energy industry has had no other regulation to date.

The IPPs in Mauritius are largely private generators from the sugar industry – these producers meet only base load requirements. The current energy policy aims to increase the contribution of bagasse to the energy mix, as well as increasing the efficiency of bagasse-coal co-fired power stations to lessen costs (Government of Mauritius, 2009).

6.2.4 Technical – mention bagasse

Given the size of the island, alternate electrification solutions were not an imperative initially. The programme thus relied on extending the main grid. Given that this led to an increase in demand[19], the CEB attempted to ensure that demand was matched by supply. The lack of oil, gas or fossil fuels reserves and the oil price shock that took place during the 1970s, an initiative to diversify the energy supply through increasing the contribution of electricity generation from bagasse from sugar mills was undertaken.

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[18] Bagasse is a renewable energy source obtained from sugar cane after it has been crushed to extract the juice. It is composed of 50% fibre, 48% moisture and 2% sugars, which is then burnt to generate heat and electricity (Deenapanray, 2009).

[19] The World Bank notes that at the time, domestic consumption accounted for 40% of total consumption, which was approximately equal to commercial and industrial consumption together. Consumption was also increasing at a rapid rate as electricity sales more than doubled between 1965 and 1975 (World Bank, 1978).

6.2.5 Financial arrangements and incentives

The electrification programme was intended to be self-funded. However, due to promotional tariffs to incentivise uptake this was not always possible. The CEB thus relied on loans from both the World Bank as well as the Mauritian Government. From 1970 - 1978 the government provided grants for the programme. These grants were the primary driver in ensuring the sustainability and success of the programme. Where sufficient funds were not available, as occurred during the mid-1970s, fewer households were connected (Karakezi, *et al.*, 2005). The loans provided were expected to be repaid over 18 years (World Bank, 1978).

The domestic tariffs during the electrification programme were designed as a declining block charge (i.e. the greater the consumption, the cheaper the price per unit of electricity). This was to encourage greater consumption from newly connected households. The World Bank (1978) noted that there was "a sharp reduction in the charge per unit, as consumption rises, and thus the tariff is highly promotional". At the time, the CEB's promotional policy also increased appliance sales on the island as a result of low electricity tariffs and thus having more disposable income (World Bank, 1978).

6.2.6 Governance and sustainability

As has been mentioned previously, there was and is no independent regulator in the energy industry in Mauritius. There was also no formal monitoring and evaluation system in place. The revenues from electricity sales were expected to cover infrastructure expansion but as the domestic tariffs were promotional, this was not always the case.

6.3 Discussion

6.3.1 Policy

There was no formal electrification or energisation policy that drove the electrification programme. Rather, it was a component of a series of socio-economic development programmes that the Mauritian Government had in place. Due to this, there is (and was) no definition of energy access. It is implicit, though, that access to clean, modern energy was largely viewed as access to electricity. Although there was no targeted policy dealing with electrification, the levels of commitment from the Government and the CEB were remarkably high. This has been noted by a number of sources as the primary reason for the success of Mauritius achieving 100% electrification (Karakezi, *et al.*, 2005; World Bank, 1978).

Since 2005, various energy sector plans and strategies have been formulated. This has helped establish a policy environment to support future growth in the energy industry as well as assist in attaining sustainable development and transitioning to a green economy[20]. Undertakings include formulating long-term strategies that explore options for renewable energy, given Mauritius' lack of fossil fuel reserves

6.3.2 Legal and regulatory

The legal framework, although not as comprehensive as other countries, for example South Africa, does establish the roles and functions of the government and the CEB. Given the size of the island, this may be all that was necessary at the time. More recently, the government has recognised that as the electricity supply industry becomes more complex due to the diversification of energy sources[21], a more robust legal environment needs to be established. Legislation for energy regulators, IPPs and contributions from the sugar industry have since come into effect.

The legislation that has been in place, since before independence, has addressed considerations of stable, quality delivery. Many have noted that this contributes to supply being predictable and of a minimum quality. It also means that damage to appliances is less likely to occur.

6.3.3 Institutional arrangements

The World Bank (1983), in its assessment of the energy sector in Mauritius in the early 1980s, suggested that the institutional arrangements were weak and fragmented. Given that the island is small, and that, at that stage, electricity generation, transmission and distributiuon fell solely to the CEB, it is questionable wether involvement from more organisations was necessary.

The CEB was the sole institution, and therefore implementing agency, that was progressing electrification on the island. It did maintain a coordinating role across stakeholders, and deal with addressing issues with these stakeholders. They were central to the coordination of the electrification efforts that were underway at the time (World Bank, 1983). The ministries that dealt with energy at

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[20] As Mauritius is a SID, it recognises the precarious position it is in due to its vulnerability to climate changes and natural disasters. In order to prevent adverse effects and increase its resilience to disasters, the Government of Mauritius is assessing ways in which it can transition to a green economy and become more sustainable.

[21] In order to decrease its dependence on imported fossil fuels as well as further sustainable development and a transition to the green economy, the Mauritian Government is actively pursuing renewable energy installations on the island. Aside from wind and solar power, this also includes increasing the contribution of bagasse to electricity generation.

the time were also responsible for other areas of within the government's administration. The energy ministries played, primarly, an administrative role with respect to energy and electricity in Mauritius.

Initially, there was no department or unit that dealt with energy planning within Mauritian Government. This was established towards the end of the rural electrification efforts, but even then it was initially placed within the Ministry of Economic Planning and Development. It was later moved to be housed within the energy ministry, which contributed to strengthening the institutional arrangements at the time (World Bank, 1983).

Since its establishment, the CEB has been a Government-owned entity. This means that independence from political influence may not always be possible. There has not been an energy regulator in Mauritius, with this function being taken on by the CEB for electricity. As there were few IPPs at the time, it is perhaps not as crucial, when comparing the Mauritan example to other countries, that an independent regulator did not exist. For example, a number of the issues that face a regulator, such as adhering to standards and codes of distribution infrastructure, would only ever have been dealt with by the CEB. As the power sector expands though and the number of IPPs contributing to the main grid increase, it will become more important to ensure that there is independent regulation.

There was also concern at the time that the CEB lacked capacity in certain areas, specifically planning and financial performance. Two factors affected its financial performance: the oil crisis during the 1970s; and the promotional tariffs to encourage domestic electricity consumption. These issues were addressed over time, particularly as the CEB was unable to meet its own expenses. Following a World Bank recommendation,the CEB undertook to use RoR methodologies, among others, to set its tariffs at a more realistic price level (World Bank, 1983). These adjustments and changes to policy suggest that an independent regulatory authority may not have been necessary in the Mauritian example as the size of the industry was not as big as it would be for other countries.

6.3.4 Technical

When households were connected, initial consumption levels, much like South Africa, remained low. At the time, the majority of households still used kerosene or fuelwood for cooking. Promotional tariffs (discussed previously and below) were implemented to encourage increased consumption. Over the years, household consumption of electricity has increased such that households now use electricity and LPG as their primary cooking fuels (Karakezi, *et al.*, 2005).

As there were no alternate methods with which to electrify households at the time (e.g. solar home systems) issues concerning societal acceptance of the technology can be assumed to be not as prevalent as they are in South Africa.

6.3.4 Financial arrangements and incentives

Promotional tariffs at the time of electrification were used to incentivise electricity use. As there was no free electricity allocation for poorer households, the drastically reduced prices were an alternate method to make both electricity and appliances affordable. This has clearly worked, given that consumption has increased significantly over the years.

The "downside" of such tariffs, however, is that they may not provide sufficient revenues to sustain the utility. This was the case in Mauritius, where the majority of the electricity consumption was from the domestic sector. As there was no independent regulator, tariff increases had to be approved by government. This meant that political concerns entered tariff-setting exercises. Political considerations when setting tariffs can lead to a situation where profits are too low or non-existent and thus neither the programme nor the utility are likely to become sustainable operations.

6.3.5 Governance and sustainability

Governance in the sector during the time of electrification of the domestic sector was scant. There was also no monitoring and evaluation to really speak of. Karakezi, *et al.* (2005) note that due to the financial constraints of the CEB as a result of insufficient revenue, grants and loans from the World Bank and the Mauritian Government were necessary. The conditions placed on the loans and grants meant that they could only be used for earmarked activities, namely electrification. The CEB did not always abide by this. The proportion of expenditure by the CEB for electrification, as well as other efforts on their part, were not always fully documented. The lack of transparency is not ideal, but, again, given the relative size of the programme and the CEB's capacity at the time, it may not have been an imperative. Good governance and transparency, however, are ideals that should always be striven for, particularly if donors are involved.

6.4 Conclusion

The Mauritian electrification programme is set against a newly independent small island developing state that has recognized the need to decrease inequality and diversify its industrial and commercial sectors. Two primary factors contributed to the success of the programme, namely political will and the ease with which the grid could be extended as the distances were much smaller

when compared to other countries. This is inspite of a lack of robust institutional framework, adequate planning units and regulatory or governance oversight. The legal framework, although sufficient at the time, was not adequate for futher development of the sector. Steps to remedy this, however, have been taken.

Ultimately though, the Mauritian case shows that despite not having "ideal" or "perfect" frameworks, if there is sufficient poltical will and backing, universal access to clean, modern energy can be achieved.

7. Conclusion

Given the benefits of clean, modern energy, it is unsurprising that the international community is increasingly emphasising the need for universal access to be achieved. It is clear from the available statistics that Sub-Saharan is a region most affected by a lack of access to clean, modern energy.

The RECs have taken steps to develop regional straetgies for universal energy access, which provide a sound basis on which national energisation and electrification strategies and policies can be based. The RECs have set ambitious targets for their member states to achieve, but reflecting on the case studies presented, sufficient political will can be the primary enabling factor for a successful programme to achieve universal energy access.

Neither South Africa nor Mauritius had a perfect enabling environment at the start of their electrification programmes.

In the case of South Africa, the changing of the institutional home of the programme caused a delay in progress. There is also concern regarding whether the goals set are realistic. The industry itself has a plethora of stakeholders that can make coordination difficult. Societal acceptance of alternate electrification methods is also an issue that needs to be overcome.

Nevertheless, many of the features of an enabling environment were present. An electrification policy and framework, an institution playing a coordinating role, and adequate legal and regulatory environments are present. Free basic electricity allocations were also provided as an incentive to encourage electricity use. Progress, however, slowed due to the increasing difficulty of electrifying the remaining rural areas and changing the institution that housed the electrification programme.

For Mauritius, many of the features of an enabling environment were not present. There was no official policy in place and only one utility that played (and still plays) the role of a regulator. The legal framework was minimal, largely due to the small size of the sector in Mauritius, with very few stakeholders present. It did, however, provide incentives to increase electricity through setting promotional tariffs. The island was also small enough that grid extension was feasible, without having to consider alternate methods of electrification. Both cases have had laudable successes.

Neither programme had sufficient monitoring and evaluation systems in place, nor was transparency a priority. Having such mechanisms would allow modifications, where necessary, in a

timely manner. Transparency can assist in engendering trust between communities, government and implementing agencies.

As both programmes began many years ago, neither considered renewable energy technologies. This could largely be because of their relative cost and the fact that they were nascent technologies at the time. Additionally, alternate forms of clean, modern energy such as LPG were not considered. Given cost and climate concerns, renewable energy technologies could be considered by other energisation programmes going forward. Alternate forms of clean energy could also be explored.

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