Evaluation of Rural Electrification Concessions in sub-Saharan Africa

Detailed Case Study:

The South African Solar Home System (SHS) Concessions

Report to World Bank

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Executive Summary

History: In 1994 South Africa's first non-racial democratic government was determined to erase apartheid's legacy of unequal access to basic services. Concerted efforts since then have increased total electricity access from 65 percent to 85 percent, while the rural electrification rate has increased from 28 percent to around 67 percent. Almost all of this increase has been achieved by grid extensions, mostly done by Eskom, the state-owned utility.

Objectives of Solar Home System Concessions: To reach non-grid areas, the government introduced a system of Solar Home Concessions in 1999. Following a competitive process, concessions were awarded to six companies. The concessions conferred a five-year exclusive right to access government subsidies for installation of solar home systems in the concession area. The subsidy was set at 80 percent of the capital cost of each solar home installation. The concessionaire was to finance the remaining 20 percent of the cost, install the system, and then maintain each system for 20 years. The concessionaire's revenue would come from monthly fees from the users. Many users would be poor, and therefore eligible for grants toward the monthly cost of the service. These grants would be paid by municipalities under South Africa's Free Basic Electricity policy. The plan was to install 50,000 subsidized systems in each concession area.

Results: The number of systems installed per concessionaire is only a portion of what was planned. The concession system has so far resulted in the installation of around 100,000 solar home systems. While by some measures an impressive achievement, only around 60,000 of these are still operational. Only three of the six concessions that were set up around 1999 are still operational in the same format as they were at the outset. While some are barely profitable at an operational level, the returns on investment to the private investors have been lower than expected.

New Directions: The three surviving concessions still operate on the basis that they undertake both installations and maintenance. However, moving forward, the Government has moved away from the original concessionaire approach to a model where the Government pays independent service providers directly for installations and hands over maintenance to user cooperatives. This will be the basis upon which the off-grid solar home system program will be run in the future.

Reasons for Results: A number of reasons can be ascribed to the disappointing performance of the concession model:

- One of these was a lack of thorough planning on the part of Government at the outset. The contracts had not been designed at the time the tender was advertised, the start of operations were delayed, and an ambivalence about the approach led to a scaling back of original deployment plans. Extension of the grid has been the primary tool for increasing access to electricity and solar home systems are seen as merely temporary measures until grid electricity is available.
- The concession model was not fully compliant with legislation passed at around the same time concerning procurement by the state. Only small areas were approved for subsidized installations each year, crippling the concessionaires' business model as an investible proposition and thereby limiting their impact.

- Other problems included difficulties in getting customers to pay; difficulties in getting municipalities to pay the Free Basic Energy grants; and extension of the grid into areas which, previously, had been thought of as areas that the grid would not reach. Grid extensions led to customers abandoning their solar home systems.
- In general terms, customers are pleased to get solar home systems but these are seen also seen as a poor alternative to grid electricity.

Key Lesson: While solar home systems are an increasingly viable option for rural electrification across Africa, the concession model cannot be recommended to all countries. It requires large government subsidies for large numbers of solar home systems. To conserve scarce fiscal resources, a better approach would be to boost the already rapid development of competitive private markets for solar home system sale, installation and maintenance. This can be done through measures to increase access to finance for consumers and suppliers. Quality certification will also help. Where subsidies are desired, vouchers could be used, so that the subsidies work with the competitive supply chains, not against them.

1 Introduction

Starting in 1999, the Government of South Africa used concessions to have private operators deploy solar home systems in three of the most rural parts of the country. The purpose of this report is to review South Africa's experience with these concessions. A rural electrification concession is a public-private partnership in which a private entity is granted a long-term right to provide electricity service in rural areas, through a distribution grid or through home-based systems. This case study is one of six detailed case studies that form a body of evidence on the experience and successes of rural electrification concessions across sub-Saharan Africa.

Background on South Africa's power system and its approach to rural electrification is presented in Section 2. Profiles of four concessionaires—Solar Vision, NuRa, KES and Ilitha—are presented next, in Section 3. The concession design is reviewed in detail in Section 4. The report concludes with an assessment of the concession model in South Africa, in Section 5.

2 South Africa Background

To put South Africa's rural electrification concessions in context, we first present the historical, economic and political context. Table 2.1**Error! Reference source not found.** gives reference statistics for South Africa.

Table 2.1: South Africa Summary Statistics

Indicator	Value
Demographics	
Population, total (2014)	54,001,953
Population growth, 10-year average (2004-2014)	1.43%
Rural population (% of total population) (2014)	35.70%
Rural population growth, 10-year average (2004-2014)	0.05%
Population density (people per sq. km of land area) (2014)	44.5
Economy	
GDP per capita (2014, current US$, market exchange rate)	6,477.8
Real GDP per capita growth, 10-year average (2004-2014)	1.68%
Debt to GDP (2014)	47.30%
Electricity Sector	
Access to electricity, rural (2012, % of rural population)	66.90%
Access to electricity, national (2012, % of total population)	85.40%
Electric power consumption (kWh per capita) (2012)	4,405
Governance	
Ease of Doing Business index (2015 ranking out of 189 countries)	43
CPIA property rights and rule-based governance rating (2014) 1=low to 6=high	N/A
Government bond ratings (S&P Long-term)	BBB+ (2014)
Corruption Perceptions Index (2014) - scale of 0 (highly corrupt) to 100 (very clean)	44
Legal system	Mix of civil and common law
Administrative tradition	English
Fragile or conflict-affected state (any year, 1990-2015)	No

Economy and demographics

South Africa is a county of 54 million people. It is classed as a middle income country. Over the last 20 years, the population has been growing at 1.5-1.6 percent per year, while real

GDP per capita as grown at 1.68% per annum on average over the last ten years. In 2010, over 60 percent of South Africa's population was urban.[1]

Politics and governance

South Africa gained full independence from Britain in 1910 but only became a non-racial democracy in 1994. The country has been ruled by the African National Congress (ANC) since 1994, following South Africa's first inclusive democratic election.

Transparency International's corruption perceptions index for 2014 gives South Africa a perceived level of public sector corruption a score of 44 (0 being highly corrupt 100 being very clean) which ranks the country at 67 out of 175 globally. The legal system is based on a mixture of common and civil law. The administrative tradition is English.

In the time that the Solar Home Systems concession has been in place (2000 to present), the security and humanitarian situation has been relatively stable. South Africa is not a fragile or conflict-affected state.[2]

2.1 Power Market Structure

The Department of Energy is the South African Government's policy-making body with responsibility for achieving the government's energy objectives. NERSA regulates the sector.

The power market in South Africa is presented in Figure 2.1.

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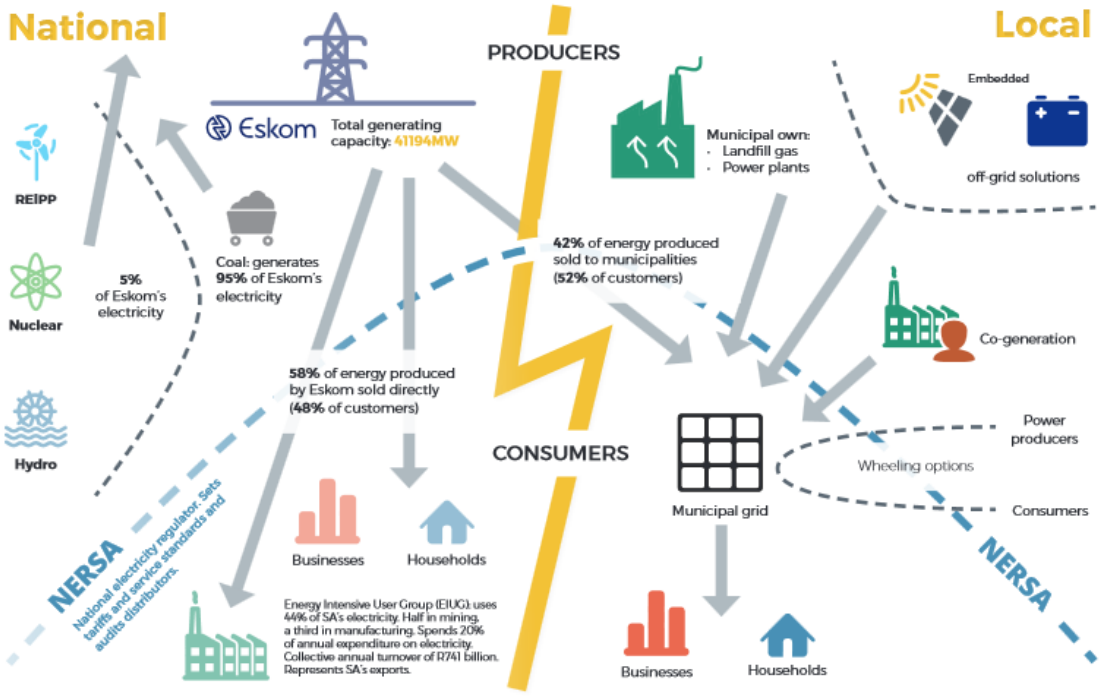
[1] Ivan Turok, "Urbanization and Development in South Africa: Economic Imperatives, Spatial Distortions and Strategic Responses, International Institute for Environment and Development United Nations Population Fund," *Urbanization and Emerging Population Issues*, working paper 8 (October 2012), accessed September 23, 2015, http://pubs.iied.org/pdfs/10621IIED.pdf

[2] World Bank Group, "Harmonized List of Fragile Situations for Fiscal Year 2015," World Bank, 2015, accessed September 23, 2015, http://www.worldbank.org/content/dam/Worldbank/document/FY15%20Fragile%20states%20list.pdf.

Figure 2.1: South Africa Power Market Structure



Eskom is at the center of the system, generating almost all power, operating the transmission systems, and also operating distribution grids that sell directly to households and other customers, especially in rural areas. In many urban areas, distribution is via municipally-owned distribution companies.

Eskom has a total generating capacity of 41 GW. In the year ended 31 March 2015 it supplied 216,274GWh to the national grid.[3] By generating capacity, it is the fifth or sixth biggest electricity utility in the world.[4] While historically a strong, engineering-dominated entity that achieved high reliability, failure maintain plant and bring new plant on line quickly enough has brought regular bouts of load-shedding to South Africa for the first time in more than 30 years. Independent Power Producers are now being procured to supply renewable energy to the grid.

Eskom's electricity price is still amongst the cheapest in the world,[5] especially for industrial users[6] but this position is changing quite rapidly. In 2015, Eskom's average selling price per kWh is ZAR 0.83 (around US$0.10/kWh).

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[3] Eskom, "Company Information," accessed September 23, 2015, http://www.eskom.co.za/OurCompany/CompanyInformation/Pages/Company_Information_1.aspx.

[4] "The Top 10 Biggest Power Companies of 2014," Power Technology, October 1, 2014, accessed September 23, 2015, http://www.power-technology.com/features/featurethe-top-10-biggest-power-companies-of-2014-4385942/.

[5] Shrink That Footprint, "What's the Average Price of Electricity In…," Clean Technica, September 30, 2013, accessed September 23, 2015, http://cleantechnica.com/2013/09/30/average-electricity-prices-around-world/.

South Africa's economy is one of the most electricity intensive by kWh required to produce a unit of GDP. South Africa's energy (and with it electricity) intensity doubled over the period 1990 to 2007.[7]

2.2 Rural Electrification Approach

Since the end of apartheid, South Africa has boosted total electricity access from around 65 percent to 85 percent in 2012. The rural electrification rate has increased even more markedly, from 28 percent at the end of apartheid to around 67 percent in 2012 (see Figure 2.2). More than 40 million people more now have access to electricity (Figure 2.3).

Almost all of this increase has been achieved by grid extensions, mostly done by Eskom. However, from 1999, the government supplemented grid extensions with non-grid concessions, in which private firms were awarded service territories and received subsidies to install and maintain solar home systems.

Grid extensions

Work on mass electrification had commenced prior to 1994.[8] However, Apartheid policy had resulted in a racially determined differentiation in infrastructure provision and high levels of inequality. The 1996 census, the first which surveyed all South Africans, indicated that less than 60 percent of the population had access to electricity away from the urban areas. The percent of black people with access to electricity was below 25 percent in 1996.[9]

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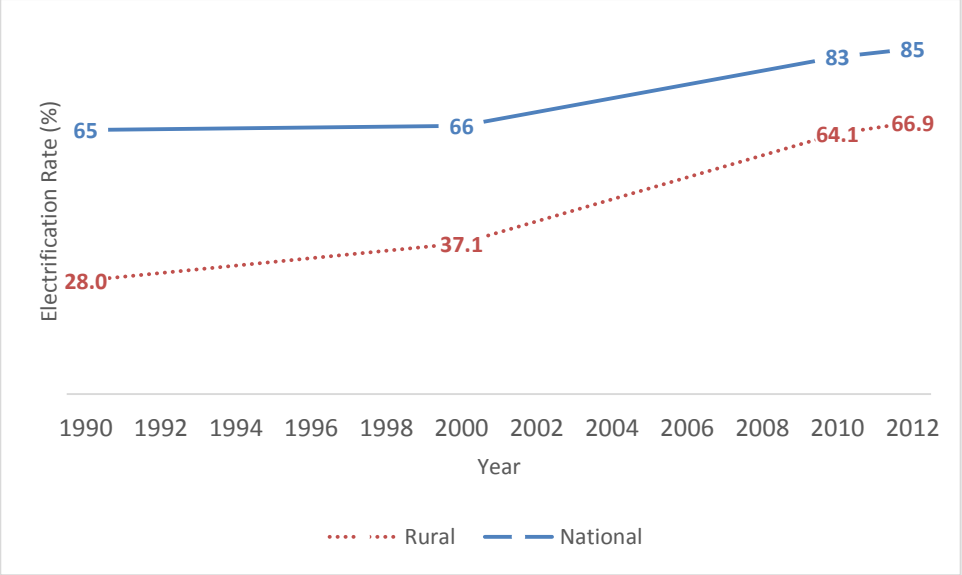
[6] George A. Thopil and Anastassios Pouris, "International Positioning of South African Electricity Prices and Commodity Differentiated Pricing," *South African Journal of Science* 109, no.7/8 (July/August 2013), accessed September 23, 2015, http://www.sajs.co.za/sites/default/files/publications/pdf/Thopil_Review%20Article.pdf.

[7] Roula Inglesi-Lotz and James Blignaut, "Electricity Intensities of the OECD and South Africa: A Comparison," Economic Research Southern Africa*, Working Papers* 202 (2011), accessed September 23, 2015, https://ideas.repec.org/p/rza/wpaper/204.html.

[8] Andrew Marquard, Bernard Bekker, Anton Eberhard and Trevor Gaunt, "South Africa's Electrification Programme an Overview and Assessment" (working paper, Graduate School of Business, Cape Town, 2007), accessed September 23, 2015, http://www.gsb.uct.ac.za/files/SAElectrificationworkingpaperfinal.pdf

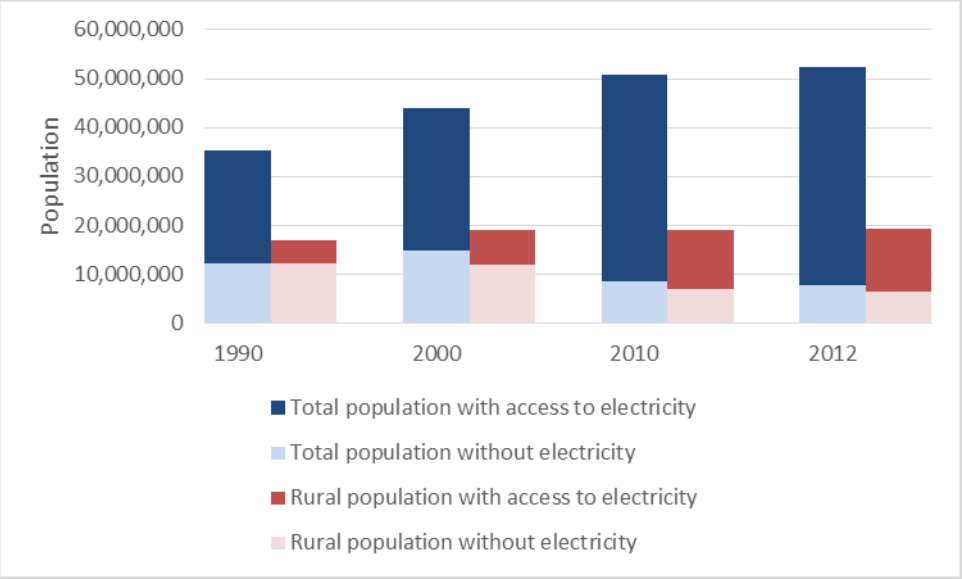
[9] Pali Lehohla, "Census 2011 Provinces at a Glance*"*, Statistics South Africa, 2011, Report No. 03-01-43, accessed September 24, 2015, http://www.statssa.gov.za/census/census_2011/census_products/Provinces%20at%20a%20glance%2016%20Nov%202012%20corrected.pdf

Figure 2.2: South Africa Electrification Rate (1990-2012)



Source: World Bank Open Data

Figure 2.3: Population with Access to Electricity, South Africa (1990-2012)



Source: World Bank Open Data

In 1994, the new ANC-led government announced its Reconstruction and Development Program (RDP). One of the RDP's ambitious goals was to connect 450,000 households annually. Eskom was expected to connect 300,000 households per year, with local municipalities doing the remaining 150,000. Eskom, which at the time was relatively

ungeared and had significant excess capacity, was able to play a significant part in the roll-out of electrification.[10]

The RDP goal was comfortably exceeded. Between 1994 and 1999 more than 2.5 million households were electrified— an average of over 500,000 per year. The rapid rate of electrification in the 1990s was due to Eskom's direct involvement. Until 2001, Eskom largely financed the electrification program from cross-subsidies of industrial users and bulk sales to local authorities.

Despite the increase in total electrification, an urban-rural divide remained: electrification in 1999 was 46 percent in rural areas and 80 percent in urban areas.[11]

Non-grid concessions

Recognizing a need for a change in approach, the Department of Minerals and Energy (DME) initiated a rural non-grid electrification program in 1999. This program sought to provide Solar Home Systems (SHS) to those lacking access to the electricity grid. To ensure proper installation and maintenance of the system, the solar homes systems would be installed and maintained by companies. The companies would continue to own the system once installed, and sell electricity from it to the household. Government would subsidize the capital costs, and the operations. This was known as the 'concessionaire' or 'fee for service' program.

Solar home systems were not new to South Africa. Around 40 000 to 60 000 solar home systems had already been installed on a commercial basis. However, sales had dropped off after Eskom announced an 'Electricity for All' campaign and rural communities came to expect grid electricity to be provided to them.

In 1995 the DME had entered the solar home business directly by setting up Renewable Energy for South Africa (REFSA) Pty (Ltd). REFSA sold solar home systems on credit in deep rural areas. However, the overheads of delivering and maintaining the systems in these areas rendered the operation uneconomic, and DME shut it down.

In 1998 Eskom and Shell announced a joint venture to install 50,000 solar home systems in rural areas. This venture was launched by (then) President Mandela in early 1999. The joint venture's technology involved the use of solar home systems with pre-paid cards. Customers would pay for the use of the system each day by buying credit on the cards and then inserting these into the solar unit.

The Eskom-Shell model, the DME's own experience in trying to supply solar home systems, and a 1998 White Paper[12] signaling a shift to greater private sector involvement in electricity,

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[10]Repositioning electricity planning at the core: An evaluation of South Africa's Integrated Resource Plan a study undertaken by Trade &Industrial Policy Strategies (TIPS) for the National Economic Development and Labour Council (Nedlac) 2014 http://electricitygovernance.wri.org/files/egi/TIPS%20%20NEDLAC%20-%20Review%20of%20SA%20IRP%20-%20Final%20Report%202014.pdf and Administered Prices – Electricity: A report to National Treasury by Grové Steyn http://www.treasury.gov.za/publications/other/epir/Electricity.pdf

[11] Zandile Mavuso, "Can SA Meet its New Target for Universal Electricity Access?" Creamer Media's Engineering News, 28 February, 2014, accessed September 23, 2015, http://m.engineeringnews.co.za/article/can-sa-meet-its-new-target-for-universal-electricity-access-2014-02-28/rep_id:3182

[12] Department of Minerals and Energy, "White Paper on the Energy Policy of the Republic of South Africa," (December 1998):48, accessed September 13, 2015, http://www.energy.gov.za/files/policies/whitepaper_energypolicy_1998.pdf.

were all factors DME's decision to adopt the concession model for delivering solar home services.[13]

The plan was to award seven area based concessions. In each area, 50,000 solar home systems were to be installed by the concessionaire[14]. The concessionaire would receive a capital subsidy of 80 percent of cost, and finance the rest itself. The concessionaire would cover its operating and maintenance costs, and earn a return on investment, from a revenue stream of monthly fees charged to the users. Municipalities would contribute to the revenue stream by paying the concessionaires to provide basic levels of service for poor people, in accordance with South Africa's Free Basic Energy program. The financing and risk transfer arrangements were designed to fit within the Government's rules relating to Public Private Partnerships.[15]

As described below, in reality the government did not provide the funding for the 50,000 connections promised in each area. The concession program fell short of its original design. Around 2.2 million households (roughly 8 million people) still do not have access to electricity and a good proportion of these are in rural areas not yet serviced by the grid.[16]

De facto, the approach has since moved away from an area-based concession model to a cooperative model. Private installers put in the solar home systems, and a cooperative maintains them and collects the fees. This policy is expected to be officially announced in a new Household Electrification Strategy to be published in the first half of 2016.

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[13] The preceding paragraphs are based on: University of Cape Town Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," March 2004, accessed September 24, 2015, http://www.erc.uct.ac.za/Research/publications/04ERC-Solar%20electrification%20Eastern%20Cape-baseline.pdf.

[14] Known as an Energy Service Company or ESCO.

[15] The South Africa National Treasury, "Public Private Partnership," accessed September 23, 2015, http://www.ppp.gov.za/Pages/whatisppp.aspx.

[16] University of South Africa, "Population and Household Projections for South Africa by Province and Population Group, 2001-2021," UNISA, accessed September 13, 2015, http://www.unisa.ac.za/contents/faculties/ems/docs/Press364.pdf.

3 The Solar Home System (SHS) Concessions: Process and Experiences

In January 1999 DME issued a call for proposals for firms to offer to supply non-grid electrification services in the provinces of Eastern Cape, KwaZulu-Natal and Limpopo. Twenty eight proposals were received. Six of these proposals were accepted, as shown in Table 3.1.

Table 3.1: Concession Agreements Awarded for Installation and Management of Off-grid Solar Home Systems (1999)

Concessionaire	Province
Solar Vision	Northern Province
Nuon RAPS	KwaZulu-Natal
Electricite de France-Total	KwaZulu-Natal
Renewable Energy Africa	Eastern Cape
Transenerge	Eastern Cape and the North West Province
Eskom Shell	KwaZulu-Natal and the Eastern Cape

Source: Shauna Mottiar and Shelton George, "Electrification of the Rural Poor: Lessons from an Interim Concession", Centre for Policy Studies (Johannesburg), Research report 104, September 2003.

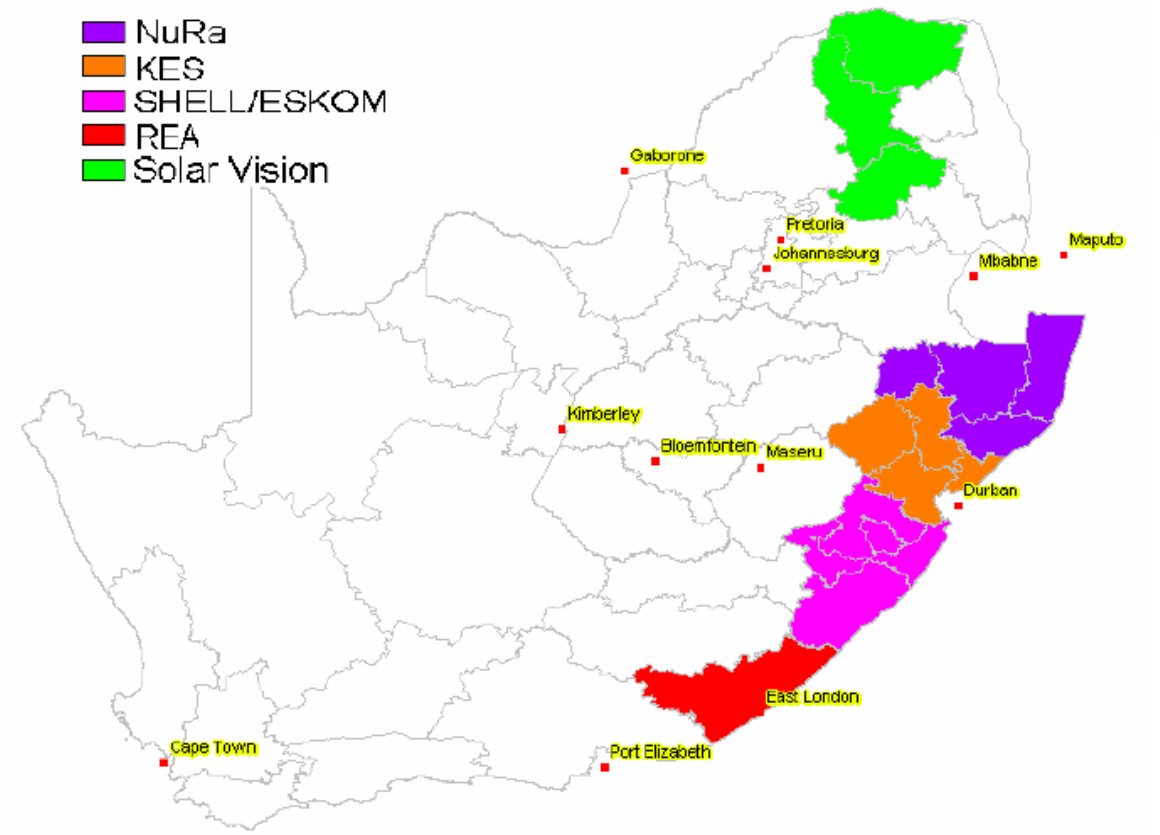
At the time of the tender, contracting, licencing and subsidy arrangements had not been fully defined. Negotiations took some time, and some of the bidders' international partners threatened to pull out. To keep the plan moving forward, interim contracts were issued to five of the six in 2001 and 2002.

The location of the concessions is presented in Figure 3.1. The concession areas were selected because they are the most rural areas of South Africa and among the most under-developed. The areas overlap with the former independent "homelands" for blacks set up by the apartheid government, for example: Ciskei, Transkei, Kwazulu and Venda.

The service areas identified include many areas with grid access. The plan was that pockets in need of non-grid service would be identified in these areas, and solar home systems installed there. A process for identifying these small pockets was established whereby concessionaires consulted with the appropriate grid utility, usually Eskom, on an annual basis.[17]

[17] University of Cape Town Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," March 2004, accessed September 24, 2015, http://www.erc.uct.ac.za/Research/publications/04ERC-Solar%20electrification%20Eastern%20Cape-baseline.pdf, pg. 3.

Figure 3.1: Off-Grid SHS Concessions (2001-2002)



Source: e7, "UNEP Rural Electrification Workshop Nairobi" (2006).

Conventional concessions often confer an obligation to serve an area, and with it the exclusive right to serve the area. Some thought was given to using this approach for the solar home concessions, but in the end neither exclusivity nor a service obligation were granted. Rather, what the concessionaire got was an exclusive right to access government subsidies for rural electrification in its area for the first five years. Then, for each solar home system installed, the concessionaire would then have an obligation to maintain the system for 20 years, coupled with a 20 year right to collect payment from the customer (and from municipalities under the Free Basic Electricity program). The tender documents had stated that 50,000 units would be installed in each concession area. The magnitude of the number of units that government indicated it would subsidize is what made the concessions attractive.

What actually happened was quite different from what was stated in the tender documents. Rather than quickly rolling out service to 50,000 homes, only small pockets were identified to be served at time.

Moreover, when areas to be served were identified, they were, in time, put out to be bid rather than automatically going for the concessionaire for the area. Typical package sizes were 1,000 to 3,000 units[18].

In practice the concessionaires won the bids, as they were the only entities with the requisite scale and capacity in the area. However, the diminished numbers and slow, disjointed rollout reduced the impact of the program (compared to what had been planned). It similarly crippled the financial performance of the concessionaires.

Solar Vision installed around 20,000 units, and Nura installed around 26,000 units. This is less than half what was expected. Moreover, only between 30 percent and 70 percent of those units are now still operational.

In about 2006, the Shell-Eskom concession was disbanded. Three "maintenance-only" companies took over parts of the Shell-Eskom concession area in Eastern Cape: Ilitha Cooperative, Shine the Way and Summer Sun Trading.[19] Two of these new concession companies were not operating at the time of the research. Summer Sun Trading went out of business in February 2010, citing the loss of their clients to grid electrification.[20] Shine the Way went out of business before 2010, unable to make money.

The EDF-Total concession became Kwazulu Energy Services (KES), later renamed Kukhanya Energy Services. As of 2010, the concessionaires operating in the non-grid electrification program included:

Table 3.2: Operational South African Off-Grid Concessionaires (2010)

Concessionaire	Province
KwaZulu Energy Services (KES) – later renamed Kukhanya Energy Services	KwaZulu-Natal & Eastern Cape
Nuon RAPS Utility (Pty) Ltd	KwaZulu-Natal
Solar Vision (Pty) Ltd	Limpopo
Ilitha Cooperative- surviving operator of former Shell-Eskom concession	Eastern Cape

Source: Department of Energy

We interviewed the directors of each of these companies. Their stories are presented below, after which common features of the concession are summarized.

3.1 Small Concessionaire Case Study – Solar Vision

Solar Vision was founded in 2000 and began installing solar home systems in 2001. The company has between 6,500 and 6,600, all located in Limpopo province.

[18] Jake Jacobs Interview

[19] Holle Linnea Wlokas, "A review of the solar home system concession programme in South Africa", 2010.

[20] Holle Linnea Wlokas, "A review of the solar home system concession programme in South Africa", 2010.

The company is run by Jakes Jacobs. Solar Vision bid on the SHS Program under the understanding that each of the concession areas would quickly have 50,000 units connected. It was on this basis that the first companies to participate in the program bid. It is also the basis upon which the companies were able to attract foreign investors. In the case of Solar Vision, REC, a Norwegian-based commercial solar PV developer/manufacturer was the foreign investor.[21]

In order to participate in the tender, Solar Vision needed to demonstrate available funding facilities of ZAR10 million (equivalent to around US$1.5 million in the year 2000). The company also needed to have the systems and operational expertise to undertake such a program. For example, being able to track customers is important and this requires a customized database. This required Mr. Jacobs to invest in a customer database that alone cost around ZAR550,000 (around US$80,000 in the year 2000).

The actual program roll-out occurred via a series of discrete tenders for 1,000 to 3,000 SHS units each. There have been several of these over the years but together they have amounted to far less than the initially advertised 50,000. For this reason, Solar Vision's investor REC departed from the business in 2007 and is no longer involved. For a period after 2005, the tenders which have been published in regular intervals ceased and only recommenced after about 2010.

Mr. Jacobs estimates that if the concessionaires are able to pare down all unnecessary costs, 10,000 customers can be serviced on a break-even basis.

Solar Vision collects most of the monthly fees directly from the municipalities in the form of FBE grants. The municipalities that pay Solar Vision include:

- Thulamela Municipality
- Polokwane Municipality
- Makhado Municipality
- Mutale Local Municipality
- Greater Thubatse Municipality

The monthly maintenance fee collected from the local municipalities for the FBE is now at ZAR89. The monthly fee is collected from these municipalities in terms of their FBE budgets which are, in turn, funded by the national government to provide free basic electricity services. Solar Vision attempts to recover a further amount of ZAR30/month from end customers. These fees are often uncollected. A discussion with the company's accountant shows that of total monthly maintenance revenues, over 82 percent is made up of the FBE fee and the balance of 18 percent is made up from fees obtained from customers directly.

The agreements with the local municipalities, drafted by Solar Vision, include a service level agreement that reflects Solar Vision as the concessionaire and a funding agreement, renewed on a 3-year rolling basis, which requires that the municipality concerned pays the money owed for customers actually serviced by the concessionaire.

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[21] REC Group, "Company History," accessed September 24, 2015, http://www.recgroup.com/en/aboutREC/history/

Over the various tenders that have been issued, Mr. Jacobs estimates that Solar Vision has installed roughly 20,000 units. However, only 6,500-6,600 remain on the system. Most defecting customers do so as they are able to be serviced by grid electricity. To understand this better, many rural villages, covered by the Solar Vision concession, are have relatively high population densities and happen to be in closer proximity to the national grid. This settlement pattern and grid proximity means that Solar Vision loses customers to grid encroachment at a higher rate than other areas.

Figure 3.2: Light Fixture in Home of Solar Vision Customer

Source: Solar Vision

Against the issue of each tender and its subsequent award based on indicative pricing tendered, there is first a period of negotiation on the final price to be paid to the concessionaire. The principle established by the Department of Energy is that it subsidizes 80 percent of the costs of an installation and the concessionaire is able to recover the balance over the period of the contract (20 years). In reality the price or subsidy level is a result of negotiation and the agreed subsidy level becomes the floor price of what an installation ought to cost the concessionaire.

For Solar Vision, grid encroachment entails the de-installation of systems and is a significant part of what Solar Vision does. All equipment remains the property of Solar Vision. However, only part of the system can be removed.

In general terms, only the solar panel can be recovered and to some extent, some of the electronics inside the DB Box. Some of these items can be re-sold in the second hand/used products market. There is a significant amount of shrinkage and damage to the recoverable items. On a value basis then, on average about 20 percent of the value of any one installation can be recovered and be re-sold.

3.2 Small Concessionaire Case Study – NuRa

NuRa is an energy services company set up to implement the concession won in 1999 to provide energy services to rural households in parts of Kwazulu-Natal. The company is 80 percent owned by Nuon Duurzame Energie, a Dutch utility company. An employee share trust owns the balance of 20 percent. The company has around 18,000 solar home system customers. Mr. Sifiso Dlamini is the Managing Director of NuRa.

The NuRa concession area covers large parts of the Umkhanyekude District Municipality in the extreme northern parts of KwaZulu-Natal province and includes the municipal areas of:

- Umhlabuyalingana
- Jozini
- Mtubatuba
- Hlabisa
- Big Five False Bay

NuRa's service area is deeply rural.

As with the other concessionaires, NuRa was established in 1999 following its winning bid with the Department of Energy and Mineral Affairs (now known as the Department of Energy). The terms of reference for the bid proposed that these concessions would increase to around 50,000 customers.

The issuing of new tenders has been somewhat erratic. The first few tenders were regular and then there was a lull between 2006 and 2010 and re-commenced only thereafter. This made long-term planning a very difficult process.

Mr. Dlamini mentions that although each tender is theoretically open to anyone who would like to provide the service, in reality, the requirements to tender mean that those participating need to show expertise, the willingness to commit to a 20-year maintenance agreement and the ability to provide a guarantee for each installation phase. Obtaining commercial or trade finance is impossible. This is why the presence of Nuon who is able to provide financial guarantees is critical.

Each new tender requires that those responding provide a costing of the installations against the specifications set out by the tender document. Following submission of tenders, the Department of Energy convenes a meeting where the final price for the installations is negotiated. The final price is fixed somewhere between the highest and lowest tender of all concessionaries.

NuRa has lost some customers to grid encroachment. However, it maintains a customer base of around 18,000 households from an estimated 26,000 installations (or a 70 percent retention rate). Almost all monthly maintenance fees of ZAR90 are recovered directly from customers. Very little comes from the local municipalities' Free Basic Energy program. NuRa maintain a long and laborious fee recovery system.

3.3 Small Concessionaire Case Study – KES

Kukhanya Energy Services or KES (formerly KwaZulu Energy Services) started out as an off-grid electrification joint venture between Total Renewable Energies and the French power utility EDF. A local black-owned investment company, Calulo Investments, acquired a 15 percent stake in the company.

The KES concession area is in Kwazulu-Natal in the following areas:

- Msinga
- Maphumulo
- Ndwedwe

In 2005 a separate tender was issued by the Kreditbank fuer Wiederaufbau[22] (KfW) and the Department of Energy for an area in the Eastern Cape that included Mount Fletcher and Tsomo. KES won this tender and now serves this area.

KES is managed by Vicky Basson who was interviewed. Ms. Basson says that the Kwazulu-Natal concession area has seen six successive rounds of contracts. Concessionaires work with municipalities to identify non-grid areas to be electrified. A municipal resolution is passed which entitles the municipality to a sign a service level agreement. Once this is done, the concessionaire liaises with local community leaders to identify customers. The customers must then apply for service. Most customers are entitled FBE. However, getting this paid by the municipality is a challenge, in particular because the contracts that allow this have to be re-signed every year.

Across the two concession areas, KES services about 30,700 customers. Like other concessionaries, KES suffers customer churn whether through theft, non-payment or grid encroachment.

Ms. Basson estimates that for viability, a concessionaire needs at least 15,000 paying customers. Customers are serviced through 'energy stores'. Any energy store needs to serve at least 3500 customers to be viable. This is roughly the position of KES in respect of its two concession areas. Ms Basson emphasized that for viability, the customers needs to be close enough to the energy store, and to be good payers.

KES charges ZAR102 per month. Customers can pay at energy stores or from a KES employee at the customer's house. Payment rates are worse for customers who have been on the system longer, dropping to 60 percent for those who have been connected longest.

The contribution to the monthly bill from the municipal FBE payments varies from zero up to ZAR48 per month, depending on the customer. Collecting from municipalities is another challenge. The FBE allowances are paid in terms of the service level agreements. Depending on the municipality concerned, outstanding fees can remain unpaid for up to 1 year. In light of these challenges, the continued survival of KES is ascribed in large part to the support that it has received from its shareholders.

[22] KfW Development Bank, "Homepage," accessed September 24, 2015, https://www.kfw-entwicklungsbank.de/International-financing/KfW-Entwicklungsbank/

3.4 Small Concessionaire Case Study – Ilitha

Ilitha Co-Operative was one of three entities that took over parts of the Eskom-Shell concession in 2006. This concession is based in the Eastern Cape. At the time, the total number of Eskom-Shell installations amounted to around 6,000 units. Ilitha took over 1,850 units located in:

- Mataliele
- Umzimbuvu

Unlike other concessionaries, Ilitha does not participate in the bidding process for new installations. Instead, new installations are commissioned directly from the Department of Energy to companies such as *Specialized Solar Systems*[23] which when completed are handed over to Ilitha to administer. Ilitha now operates roughly 6 300 installations but derives monthly fees of ZAR60 from just 1,440 installations in Mataliele and roughly 200 installations in Umzimbuvu.

Mr. Mzenzi, the Director of Ilitha Co-Operative, ascribes the fact that Ilitha has continued to operate to the fact that it is a co-operative (a mutual) organization[24]. These co-operatives are somewhat like business trusts or non-profit trading entities. This enabled Ilitha to survive despite difficulties in securing the maintenance fees.

There are two types of fees: a fee for the 'two light' installations done in the earlier years (ZAR14) and a fee for the 'four light' systems installed more recently. In the Ilitha concession area there is considerable resistance to paying the monthly fee. The culture of non-payment might have emerged in the years where these concessions were run by the Eskom-Shell joint venture, which reportedly made little effort to collect monthly fees from the end-customers. Mr. Mzenzi is attempting to turn this situation around by mounting an information campaign explaining that payment of the monthly fee is necessary to keep the program running.

However, Mr. Mzenzi believes the most important issue for Ilitha is getting municipalities to pay the Free Basic Electricity payment. To make these payments, municipality needs to maintain a database on 'indigents'—that is, those who are eligible for the subsidy. Such records are not maintained. As a result, the municipalities do not pay the monthly fees due for all installations operated and managed by Ilitha.

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[23] Specialized Solar Systems, "Specialized Solar Systems Company Profile," accessed September 24, 2015, www.specializedsolarsystems.co.za/index.php/home/company-profile

[24] Republic of South Africa Department of Trade and Industry, "Economic Empowerment," accessed September 24,, 2015, www.thedti.gov.za/economic_empowerment/co_ops.jsp

4 Concession Design

Having considered a large scale delivery of non-grid systems but rejecting that route, the government took the view that challenges relating to planning, funding, maintenance and affordability of large-scale non-grid electrification was best addressed through a privately-owned utility delivery model[25]. In order to push some of the risks to the private sector, to ensure the continued presence of the concessionaire for the 20-year maintenance period and to contain costs, the government would subsidize 80 percent of the capital costs of an installation which the concessionaire was to recover by subsequent maintenance fees.

4.1 Key Objectives, Challenges and Risks

The objectives of the SHS concession system were to:[26]

- Accelerate delivery of electricity to remote areas that would not receive grid electricity in the medium-term
- Improve access to a range of fuels, including gas, paraffin, SHS and mini-grid systems
- Attract large, well-organized private companies
- Tap private sources of financing
- Obtain economies of scale
- Create private sector vehicles to channel donor funding
- Stimulate the renewable energy market.

The main risk identified was that the solar home systems could be prone to misuse or vandalism because they were under the control of the user, but under the ownership of the utility.[27] This risk was expected to be mitigated through professional customer care.

4.2 Allocation of Functions and Risks

The concessionaire owns the solar home system, charges the user for the service, and maintains and services the equipment. Thus the concessionaire takes the risk on installation costs, operations and maintenance costs, we all as on demand and collections.

These risks were mitigated and the whole system model made more affordable for customers by a government subsidy originally set at 80 percent of the capital costs. The concessionaire

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[25] University of Cape Town Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," March 2004, accessed September 24, 2015, http://www.erc.uct.ac.za/Research/publications/04ERC-Solar%20electrification%20Eastern%20Cape-baseline.pdf pg2

[26] University of Cape Town Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," March 2004, accessed September 24, 2015, http://www.erc.uct.ac.za/Research/publications/04ERC-Solar%20electrification%20Eastern%20Cape-baseline.pdf, pg 3

[27] "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," pg. 3

was to finance the remaining 20 percent. Officially, the concessionaire co-owns the equipment with the Department of Energy.[28]

The concessionaire also takes the risk on getting municipalities to make the Free Basic Energy payments to cover the cost of serving poor people. It is a legal requirement that municipalities do this, but many avoid it in various ways.

4.3 Decisions on Areas to Serve

The process to decide on new off-grid areas to serve is as follows:

- The operator in a concession area submits an application to the Department of Energy, requesting approval and support for providing SHSs in an identified area. The application must include Eskom's grid electrification plan (to show the area will not be served by the grid) and proof of engagement with the affected communities.
- The Department of Energy engaged with the community and checks that the proposed area meets the criteria for support.
- If the area meets the criteria it will be included in the non-grid plan for the following financial year.[29]

4.4 Operations and Management

The concessionaires generally operate energy stores from which they cater to customers in a radius of up to 50 km from the store. The store is the point of sale for the solar home systems. The stores manage sales on credit, applications for installations, customer complaints and plan maintenance. Some of the stores also offer other energy services, such as Liquid Petroleum Gas (LPG) or solar lighting products.[30]

The stores also are the base for mobile technicians who use trucks or motorcycles to travel to sites for maintenance calls. NuRa reported in 2006 that it needed approximately 1 technician per 600 customers.[31]

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[28] In policy documents the concessionaire is variously referred to as the "service provider", the "utility", the "concessionaire" and "energy services company (ESCO)". See for example: Republic of South Africa Department of Energy, "Non-Grid Electrification Policy", March 19, 2012, accessed September 13, 2015, http://www.energy.gov.za/files/policies/electrification/NON%20GRID%20ELECTRIFICATION%20POLICY%202012.13.pdf.

[29] University of Cape Town Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," March 2004, accessed September 24, 2015, http://www.erc.uct.ac.za/Research/publications/04ERC-Solar%20electrification%20Eastern%20Cape-baseline.pdf

[30] e7, "UNEP Rural Electrification Workshop Nairobi" (2006).

[31] e7, "UNEP Rural Electrification Workshop Nairobi" (2006).

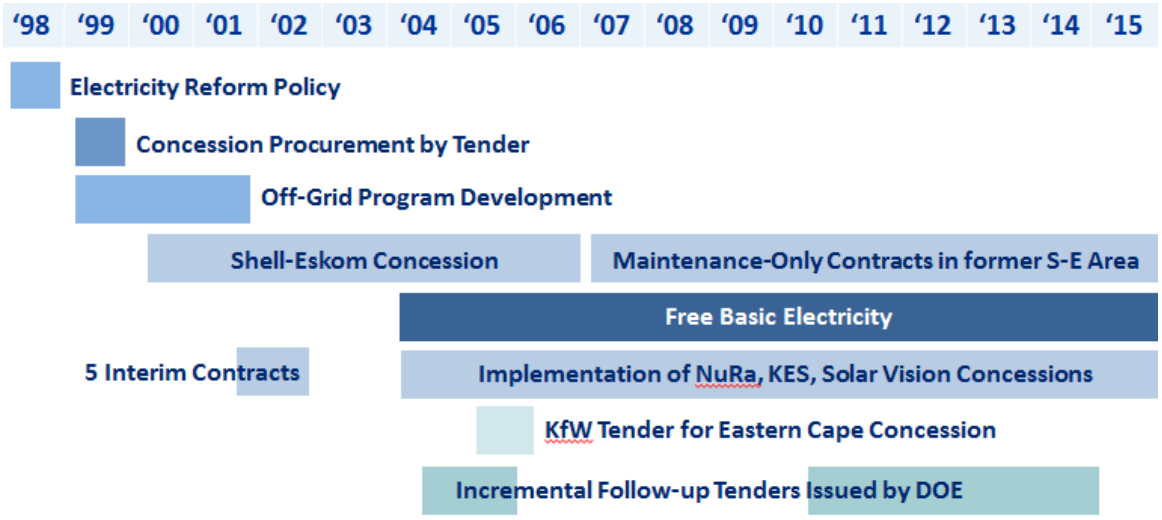
Figure 4.1: KES Technician

Source: Kukhanya Energy Services

4.5 Stages of Development

A timeline showing the major stages of development leading up to the concession is presented in Table 4.1.

Table 4.1: Stages of Development of SHS Concession (1998-Present)



4.6 Financing Capital Costs

The subsidy for each 50Wp SHS installation was originally fixed at ZAR3500 until individual arrangements were made with each concessionaire.[32] Now the capital subsidy is meant to be equal to 80 percent of the capital cost of a solar home system. Reportedly, concessionaires

[32] University of Cape Town Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," March 2004, accessed September 24, 2015, http://www.erc.uct.ac.za/Research/publications/04ERC-Solar%20electrification%20Eastern%20Cape-baseline.pdf

are encouraged to inflate their capital costs so as to receive a subsidy equal to the full (non-inflated) cost of the SHS.

The lead acid battery and other consumables represent roughly a third of the initial capital investment and the batteries need to be replaced every two years. To finance the operations in the medium and long term, the private operators need to earn enough income to replace the batteries.

4.7 Operations and Maintenance Cost Recovery

Operations and maintenance costs are covered from the fee charged to customers and Free Basic Electricity (FBE) grants from municipalities covering the cost of service for poor families. FBE is an important portion of the revenue of the concessionaires, but is often not paid as is should be:

- Solar Vision collects 82 percent of its revenue from the municipalities. The remaining 18 percent of Solar Vision's revenue is directly from consumers. Solar Vision receives ZAR89 (US$6.5) per connection from the municipalities.[33] It attempts to collect ZAR30 (US$2.2) from end customers.
- KES charges ZAR102 per month and of this the FBE varies from 0 to ZAR48 per month. Collecting the FBE is a constant challenge. Depending on the municipality concerned, fees can remain unpaid for up to 1 year.
- NuRa is less dependent on the FBE. Almost all monthly maintenance fees of ZAR90 are recovered directly from customers and very little from the local municipalities. NuRa maintain a long and laborious fee recovery system. Of the current 18,000 households, the recovery rate is around 70 percent. This is a relatively high number and might be a consequence of NuRa being the only provider of electricity of any type for the areas that it services.

4.8 Contractual Arrangements

The main concession contract is between the Department of Energy and the concessionaire. This provides for the subsidies for the capital costs of the SHS, and imposes the 20 year maintenance obligations. In addition, firms may have service provider contracts with the Department of Energy for maintenance arrangements outside their concession areas.

Some concessionaries have contracts with municipalities which include service levels, and provide for the payment of Free Basic Electricity Grants. Solar Vision has such agreements, drafted by the head of the company. Municipalities can't legally enter into 20-year agreements due to the Municipal Finance Management Act of 2003, so these agreements are shorter-term.

4.9 Technological Approach

The electrification technology deployed by the concessions is exclusively off-grid solar home systems. The concessionaires do not manage grid extension projects or mini-grid projects, and the concessions do not interact with the existing transmission and generation sectors.

[33] 89 South African Rand is equivalent to around US$6.5 in October 2015.

Some concessionaires do sell other energy products. NuRa markets LPG, KES markets solar lighting equipment, and Solar Vision markets solar water heaters.

The 2001 specifications for the solar home systems were:

- A 50Wp photovoltaic (PV) panel
- A charge controller/DB board
- Wiring & outlets for small appliances
- A lead-acid battery of 105 amp-hour
- Two compact fluorescent lights.

Since 2001, the specifications have increased. Now a 95Wp PV panel with four energy efficient compact fluorescent lights is required. Figure 4.2 shows a PV panel used in the SHS installed by Solar Vision.

Given an annual average of six hours of effective sunlight, a 95Wp panel generates roughly 400-500Wh/day[34], which over a 30-day month is 12–15kWh (the FBE is 50kWh/month). According to a 2012 Department of Energy policy document, the more recent specifications allow for the use of a black and white television for four hours, four hours of quality lighting using high efficiency lights, the use of a portable radio for ten hours and the charging of cellphones.[35] The most recent technical specification is in Annex 4.

[34] Plan My Power, "Photovoltaic Solar System Calculator," accessed September 13, 2015, http://www.solarpanel.co.za/solar-power-calculator.html.

[35] Republic of South Africa Department of Energy, "Non Grid Electrification Policy Guidelines," March 19, 2012, accessed September 13, 2015, http://www.energy.gov.za/files/policies/electrification/NON%20GRID%20ELECTRIFICATION%20POLICY%202012.13.pdf

Figure 4.2: Solar Home System PV Panel, Solar Vision

Source: Solar Vision

4.10 Regulatory Arrangements

The off-grid SHS falls outside the traditional regulation of the electricity supply system. Regulation is via agreement with the Department of Energy and agreements with the local municipalities who pay the FBE grants to the concessionaries.

The permitted tariffs are regulated. They are set such that the concessionaire is entitled to "generate enough revenue to cover reasonable operational and maintenance costs, national taxes, and earn a fair rate of return on capital employed".[36]

[36] See clause 8.2 of Agreement for the Installation and Maintenance of Solar Home Systems - Annex 3

5 Assessment of Concessions

The concessions have each succeeded to varying degrees, especially when weighing different means of evaluation. This section analyzes these results.

5.1.1 Access

The concession program has fallen short of the original targets. In the four original concession areas, there was an expectation that as many as 200,000 solar home systems (or 50,000 for each concession area) would be deployed. However, only 100,000 have in fact been installed, and only around 60,000 are still in operation.[37]

There are distinct differences between the number of households that each concession services. It is estimated that each concession has bid on and installed roughly 20,000-26,000 units since inception and through about seven bidding rounds.[38] Of these, NuRa in the deep rural areas of Kwazulu-Natal, has been most successful in retaining customers. NuRa is also the least dependent on FBE remittances from the local municipalities and receive almost all its monthly fees from end-users directly.

The concession areas closest to the grid or subject to grid encroachment have been less successful. Table 5.1 sets out the number of connections of each concessionaire.

Table 5.1: Estimated Number of Electricity Connections, Solar Home System Concessions (September 2015)

Concessionaire	Province	Estimated Number of Units in Operation[39]
Kukhanya Energy Services (KES)	KwaZulu-Natal	30,700
Nuon RAPS Utility (Pty) Ltd	KwaZulu-Natal	18,000
Solar Vision (Pty) Ltd	Limpopo	6,600
Ilitha Cooperative**	Eastern Cape	6,300
Total		**61,600**

Notes: KES estimates include the KwaZulu-Natal concession and the subsequent KfW-funded concession in Eastern Cape.

5.1.2 Quality of service

Service from the concessions is subject to a service level agreement. A detailed study using a survey was conducted by the University of Cape Town's Energy Research Center into the

[37] DOE estimates that the on-grid electrification program has installed about 10,000 operating solar home systems outside of the original concession areas. These are managed by cooperatives. They are not part of the concession program

[38] Sifiso Dlamini and Jakes Jacobs, "Interview", NuRa and Solar Vision

[39] Interviews with all four concessionaires

Shell-Eskom Concession in the Eastern Cape.[40] This provides a useful insight into the way in which the SHS is seen by its customers. In short, the SHS makes a significant difference in the lives of those that benefit but it delivers well short of expectations in terms of what customers expect from electrification. People want the level of service provided by the grid. (That said, cost considerations mean that even those with grid supply can't afford the electricity for everything they would wish to use it for).

Table 3.1 compares homes with solar home systems, grid-connected homes, and non-electrified households on their monthly household expenditure on candles and paraffin. It shows that homes with solar home systems rely on traditional sources of lighting more than homes with grid connections.

Table 5.2: Mean Monthly Household Expenditure on Each Fuel According to Sub-samples

Type of fuel	*SHS-users (N=232)*	*Grid-users (N=51)*	*Non-electrified households (N=65)*
Candles	*N=165 (71%)*	*N=51 (100%)*	*N=59 (91%)*
Min	R0.8	R3	R1
Max	R68	R28	R100
Mean	R18	R9	R27
Standard deviation	10.08	6.597	21.27
Paraffin	N=207 (89%)	N=50 (98%)	N=58 (89%)
Min	R3	R4	R2
Max	R260	R263	R127
Mean	R55	R49	R51
Standard deviation	28.13	37.91	49.46

Source: Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey."

5.1.3 Sustainability

Today, the concessionaires operate in a fashion that is more similar to survivalist enterprises rather than a commercial enterprise.

The original target size of the concessions, 50,000 units, was selected to make each concession attractive to outside investors as potential sources of annuity income. The income from each unit at the outset around 2,000 was to be ZAR48 per unit secured for 20 years. On the face of it and at the time, securing the monthly fee for a 50,000 customer base would generate just less than ZAR29 million per annum and as such become an attractive commercial prospect. For example, Solar Vision was able to attract a foreign private investor at the outset on the basis of the expectation that recovering monthly fees of ZAR48 for each installation across a 50,000 unit concession represented an attractive annuity income stream.

[40] Energy Research Centre, "Solar Electrification by the Concession Approach in the Rural Eastern Cape: Phase 1. Baseline Survey," University of Cape Town, March 2004, accessed September 24, 2015, http://www.erc.uct.ac.za/Research/publications/04ERC-Solar%20electrification%20Eastern%20Cape-baseline.pdf

The envisaged scale would also permit a commitment to continue to service an installation for a period of 20 years.[41]

The Government's failure to deliver the expected 50,000 in subsidized installations per concession is the biggest reason that concessionaires are now struggling. Other major problems are the difficulties in getting municipalities to pay the Free Basic Electricity Grants; customers abandoning the service because grid supply has become available, and general difficulties in getting customers to pay the monthly fees.

Though the concessionaires would not share their financial information and their profitability, we can deduce that the biggest concessions are generally the most sustainable:

- KES estimates that it needs around 30,000 customers in its two concession areas to cover minimum operational costs, and that is the number of customers it currently has. However, KES ascribes its continued survival as an enterprise in large part to the support that it has received from its shareholders.
- Solar Vision estimates that if the concessionaires are able to pare down all unnecessary costs, 10,000 customers can be serviced on a break-even basis. Today it services 6,600 customers, which may suggest that it is operating at a loss. We estimate that Solar Vision's revenue is around ZAR705,000 (US$51,500) per month.[42]
- Ilitha is not financially sustainable as a commercial going concern but Ilitha is a cooperative. It says that it would not have been able to operate as a private company on commercial terms.
- We don't know NuRa's financial situation because we don't know the costs facing the company. NuRa should have revenue of ZAR90 monthly from roughly 18,000 customers. Accounting for a collection ratio of 70 percent, we can deduce that NuRa has revenue of around ZAR 1.13 million per month (US$83,000).

5.1.4 Efficiency

The solar home concession system is a lower cost approach to electrification than grid connection. Table 5.3 provides a rough comparison of the cost of an electricity connection to the grid compared to a solar home system.

[41] See clause 3.3 of Agreement for the Installation and Maintenance of Solar Home Systems - Annex 3

[42] This is calculated by multiplying the FBE contribution (ZAR) by the number of units (6,500) and dividing by the share of the revenue that comes from the municipalities (0.82).

Table 5.3: Estimated Cost Comparison of Grid vs Off Grid Electricity Connections (2015)

	Grid Electricity	SHS	Variances
Capital Cost, excluding wiring, lightbulbs, plugs and DB board	ZAR25,000	ZAR5,340[43]	SHS is 21% of the cost of a grid installation
Monthly Network Charge	ZAR85	N/A	SHS has no grid network charge
Monthly kWh	50	12-15	The FBE is compared with the output of an SHS on current specifications
Value to Customer on a ZAR0.63/kWh Tarff	ZAR31.50	ZAR7.60-ZAR9.45	SHS on current specs provides less value than off-grid equivalent
Monthly cost to Provider of Service[44]	ZAR171[45]	ZAR98	An increased spec would not increase the SHS monthly fee to any great extent as these fees are not based upon the size of the installation but on the running costs of a set number of units

Source: Department of Energy; Eskom; Solar Vision; Castalia calculations

The table shows the cost of a grid connection is around ZAR 171 per month, compared to a monthly cost for a SHS of around ZAR98. This is the all-in cost, including amortizing the capital cost, and adding maintenance and energy costs. This calculation suggest a cost advantage in favor of solar home systems of around 43 percent.

Offsetting this cost advantage is the fact that the SHS delivers only about one third as much energy as a typical rural customers would take from a grid system, and therefore is less valuable to the customer. Clearly the cost advantage of the SHS would be reduced if it were replaced with a grid connection before its 20 year life expired.

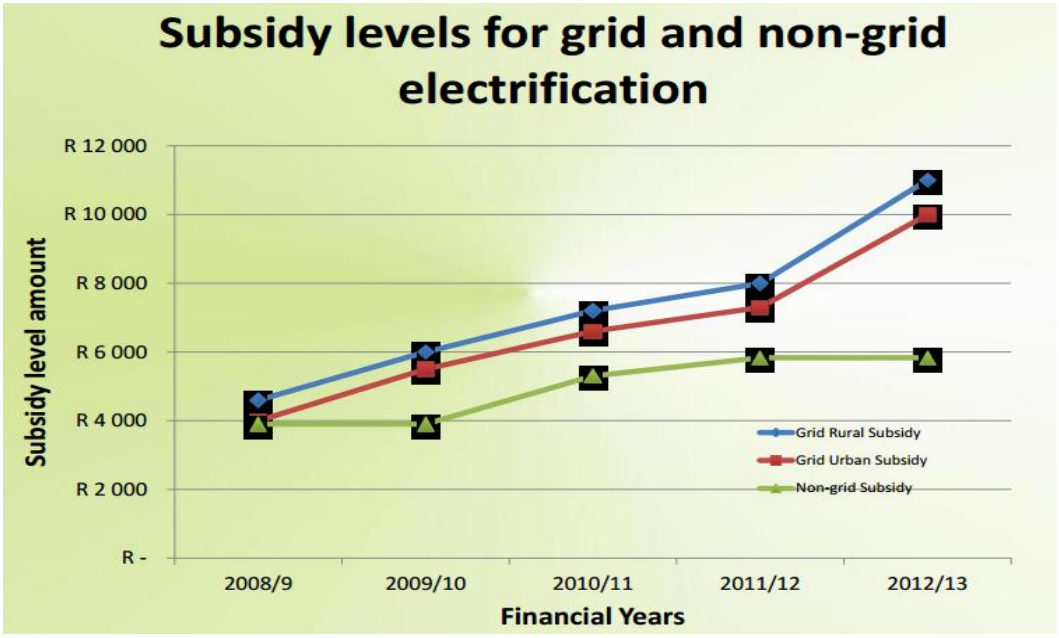
Despite the benefits of SHS to the fiscus, the subsidy directed towards off-grid solutions has not kept pace with the subsidies provided to off-grid solutions as seen in the graphic below.

[43] Discussion with Mr. Jacobs (Solar Vision) on split out of components to SHS installation specification

[44] Increased capacity or specifications would not increase the SHS monthly fee to any great extent as these fees are not based upon the size of the installation but on the running costs of a set number of units

[45] Based upon consumption of 100kWh/month in an urban setting

Figure 5.1: Integrated National Electrification Programme – Subsidy Levels for Grid and Non-Grid Electrification (2008-2012)



Source: Department of Energy Presentation: *Experiences* and Lessons Learned. Electrification Indaba*:* Wolsey Barnard. Executive Manager*:* INEP. 15 March 2012

5.1.5 Other impacts

The SHS systems have had social and economic impacts on the lives of its rural users. These conclusions suggest that solar home systems have had an overall positive impact on users. This impact can primarily be seen through observed higher levels of education achieved (however, correlation is not causation). Households with solar home systems also appeared to have greater access to communication and media.

Figure 5.2: Solar Vision Clients Reading Near SHS Components

Source: Solar Vision

A 2013 PricewaterhouseCoopers (PWC) study evaluated the socio-economic impact of the NuRa concession through a series of interviews with solar home system users.[46] The conclusions of the study are summarized in Table 5.4.

[46] PWC, *Foundation Rural Energy Services: Socio-economic Impact Assessment of Rural Electrification*, by Robert van der Laan, July 1 2013, accessed September 24, 2015, http://www.fres.nl/wp-content/uploads/2014/12/01072013_PwC_Socioecomonic_study_EN_F.pdf

Table 5.4: Socio-Economic Impact of Solar Home Systems in NuRa Concession (July 2013)

Impact Category	Impact of SHS	Explanation
Safety	Neutral	Counterintuitively, households with SHS had lower perceived safety than households without SHS. PWC posits that beneficiaries may be targeted by criminals or that SHS increased awareness of safety risks (for example through increased mobile phone access). Some SHS households reported increased safety from presence of outdoor light and reduced risk of fires.
Education	Positive	Children in households with SHS generally have higher educational attainment than in households without SHS. Households with SHS are far more likely to report that their children "study sufficiently".
Access to communication	Positive	Households with SHS showed higher levels of access to both radio and television. 96% of SHS households use mobile phones compared to 86% for non-SHS households
Household Income	Neutral	Households with SHS were no more or less likely to have seen a change in their income from a year before.
Household Expenditure	Neutral	Households with SHS tend to spend less of their "extra income" on food, and more on electricity.

Source: PWC

5.2 Arrangements that Could Have Delivered Better Results

In our assessment, the SHS concession approach could have done better with the following changes.

- **Setting up an independent agency with the resources to focus on the off-grid concessions program.** The concessions were largely managed by the Department of Energy, which is primarily a policy-making entity. The Department lacks technical and commercial expertise. Setting up an independent body like the one set up to procure large renewable generation projects (South Africa's Renewable Energy Independent Power Producer Procurement Program (REIPPPP) (see Appendix B) could have strengthened the institutional weaknesses described above.
- **Scaling as intended:** It was intended that each of the successful bidders would install 50,000 solar home systems during the first 5 years of the program.[47] This would enable the economies of scale required for the businesses and the program

[47] J. Zak, "Off-Grid Electrification in South Africa: Market Opening Workshop," (paper presented at UCCEE Market-Opening Workshop, Brazil, May 2002), accessed September 24, 2015, http://orbit.dtu.dk/fedora/objects/orbit:103958/datastreams/file_254f105b-fc1d-44c5-bc16-54e5987f1af8/content

to succeed. Delivering only a quarter of the expected number of installations, and doing so in small, intermittent packages, destroyed the concessionaire's business model, and limited the impact of the program.

- **Integrating long term planning for on-grid and off-grid expansion:** The planning process in place (municipalities working with Eskom and with Integrated National Electrification Programme INEP) has resulted in short-term and ad hoc agreements rather than a long-term settled plan. In addition there is no agreement between Eskom, the Department of Energy the municipalities and the concession companies regarding grid and off-grid areas. An important consequence is that a material part of the investment in solar home systems was wasted as the grid was extended into areas where solar home systems had been installed, and customers switched to grid supply. In such cases the recoverable value of the solar home system is only around 20 percent of its original cost. Moreover, areas which will not in fact receive grid supply for 20 years nevertheless expect grid supply, and therefore do not consider alternative technologies.

5.3 Replicability of Experience and Success

While solar home systems are an increasingly viable option for rural electrification across Africa, it would not be advisable for other countries to imitate South Africa's attempt to blanket large areas with subsidized SHS's through the use of concessions.

The South African system derived from a determination to undo fundamental inequalities created by apartheid. South Africa's relative wealth and administrative capacity made it plausible that solar home concession could rapidly deliver electricity to all off-grid areas. In the end, the promise of the system was not met because of a lack of fiscal commitment and administrative drive and coordination.

In most African countries the ability for government to pay for electricity investments from the budget is much more limited than it was in South Africa. Across Africa, business and households are paying for their own solar systems. A subsidized concession approach risks killing this market. A better policy solution would be assist in improving and expanding competitive private markets for sale, installation and maintenance of such systems. Markets can be expanded by creating standards and certifications to enable customers to recognize quality equipment; improving access to finance for customers and at all levels of the supply chain, and meeting equity objectives by providing the poorest consumers with vouchers that can be put toward the cost of certified systems. The Lighting Africa Program has shown how this can be done with solar lanterns, and is working on similar approach for modular solar home systems.

Appendix A: Experts Interviewed or Consulted

Name	Organization
Mr. Jakes Jacobs	Solar Vision
Mr. Sifiso Dlamini	NuRa
Mr. Gibson Mzenzi	Ilitha Co-Operative
Ms. Vicky Basson	Kukhanya Energy Services
Mr. Serame Moeketsi	Department of Energy Off-Grid Program
Mr. Rolfe Eberhard	Independent Consultant
Ms. Holle Linnea Wlokas	Independent Consultant
Mr. Rob Aiken	Restio Energy

Appendix B: South Africa's Renewable Energy Independent Power Producer Procurement Program (REIPPPP)

If mass electrification is one success of the post-Apartheid era, then the success of South Africa's Renewable Energy Independent Power Producer Procurement Program (REIPPPP) is another. As of writing, from its launch in 2011, 64 separate projects have been completed or are in the process of being built amounting to 4,944MW. This represents an investment totaling ZAR120 billion.[48]

The key feature of the REIPPPP has been the establishment of a separate and well-funded IPP office (although of an ad hoc nature) housed in the Department of Energy. The unit followed an approach that emphasized problem solving, rather than enforcement of administrative arrangements that often hinders public private partnerships (PPPs) in South Africa. The IPP office also has benefited from extensive PPP expertise and has won credibility with both public and private sector stakeholders.[49] REIPPPP operates on a competitive bidding basis which sees successful bidders entering into standard form Power Purchase Agreements with Eskom, in turn guaranteed by the state. A key feature of REIPPPP is that projects bid have had to be fully funded to prevent gaming the system with impossibly low tariff offers (known as low-balling) which can't be built. One problem with this is the very high costs of getting the project ready to bid. To be funded, projects have to submit to a technical due diligence prior to bidding because the commitment of a funder, if the project is to make financial close, is made at that point.

While the relatively high compliance costs for participating in the REIPPPP has not prevented enthusiastic participation by developers, sponsors and funders alike, these present a problem for a separate small projects program[50] which has failed to bring a single project onto the grid. Their limited size has meant that transaction costs could not be absorbed and therefore it is difficult to get private sector project finance for these types of projects[51]. Several multi-year delays in the process of getting small projects through meant that project developers, in general smaller companies, were unable to continue with the carrying costs of such projects. For the reasons set out above, a lack of commercial viability has resulted in many promising small-scale projects being abandoned by their promoters. As we shall see, there are parallels with the Solar Home Systems described below.

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[48] http://www.bdlive.co.za/business/energy/2015/09/08/independent-power-producers-commit-r120bn-to-national-power-grid

[49] http://www.gsb.uct.ac.za/files/PPIAFReport.pdf

[50] http://www.ipp-smallprojects.co.za/, (accessed September 13 2015).

[51] http://www.engineeringnews.co.za/article/small-scale-ipp-developers-facing-finance-challenges-2014-06-20, (accessed September 11 2015).