Policy Briefing: Urban Energy Access

Interim off-grid solar electricity for un-electrified informal settlements

Introduction

The priority of South African municipalities to provide free basic services (including energy) to their indigent residents is clearly articulated in the 2005 National Framework for Municipal Indigent Policies (NFMIP), as well as the related laws, policies, policy guidelines and policy & funding frameworks – all of which are aimed at providing the practical guidelines and financial resources for the sustainable and equitable delivery of these free, basic, indigent services.

However, there are a number of inconsistencies, restricting conditions, or outdated assumptions within the policy landscape that reinforce delays and barriers to service delivery in urban and peri-urban informal settlements via *alternative* solutions such as renewable technologies.

The majority of these policies and guidelines are at least 10 years old and there appears to have been little official revision in the interim to build on the solid pro-poor principles that were established in these foundational documents. In stark contrast, the technical developments and cost-reductions that have come about in the renewables industry over the past 10 years have been revolutionary - making a range of new options for cost-effective interim service delivery both possible and financially viable.

The focus of this briefing document is to make a case for the policy opportunities for using off-grid solar electricity technology - specifically Solar Home Systems (SHS) - as part of an impactful, cost-effective, non-wasteful, but temporary investment in free basic energy delivery to eligible indigent residents of urban informal settlements.

A holistic reading of the existing policy landscape does *not* preclude the capital and operational funding of SHS to provide temporary electricity to indigent residents of urban informal settlements (as part of a free-basic energy package). Indeed, innovative municipalities such as Stellenbosch and Nelson Mandela Bay have already implemented this concept (albeit on a pilot basis). However, the proposals in this briefing for certain policy interpretations or amendments are intended to make this service-delivery option more explicit and therefore more normative throughout South Africa.

Summary of key points and recommendations

- Free basic energy for indigent citizens should, according to South African policy, provide sufficient energy to allow for **lighting, access to media and cooking**[1].
- South Africa's indigent policy landscape makes provision for the progressive realisation of services from 'basic' to 'full service'. This includes using **different technologies for the different phases of delivery.**
- When the grid is unavoidably delayed, temporary energy technologies, such as SHS, should be used to provide an interim, basic service. The use of **temporary sanitation solutions provides a precedent for this approach.**
- Widespread use of **SHS for rural areas has always been intended as a *temporary* intervention,** prior to grid delivery.
- Although there are examples of state-funded SHS services in urban or peri-urban informal settlements, the existing policy landscape is not sufficiently clear that **this urban demographic should be eligible for SHS funding in cases where grid provision is delayed** by three or more years.
- In addition to the direct socio-economic and health & safety benefits for the household, **SHS contribute to wider positive impacts for the community and municipality** including green skills development and job creation; bringing previously excluded communities into the institutional systems of government; reducing health and (fire) safety risks for the community; reducing the costs of emergency-services for the municipality; reducing service delivery protests.
- Owing to significant technological advances and competition in the SHS industry, the combined capital and maintenance cost, per household, of a large-scale (>1000) SHS service - spread out over a minimum 3-year period - is significantly lower than a municipality's monthly grid-maintenance cost (per grid-connected household). **This counter-acts the risk of wasteful capital expenditure on temporary infrastructures.**
- Whether or not capital grants (eg MIG, INEP) are used to help fund the delivery of a temporary SHS service, **the capital cost of the SHS should be financed by the appointed Service Provider (rather than paid for up-front by the state)**. The Service Provider's finance and asset-depreciation costs should be recovered from a fixed monthly service fee subsidy paid by the municipality and tied to the delivery of the Service Provider's comprehensive client-management and maintenance service.
- Once fully depreciated **the ownership of the SHS should transfer to the household** (subject to certain conditions and co-payments from the end-user).
- **The end-user should only pay for optional system-upgrades and *ad hoc* maintenance** (eg fixing internal wiring, replacing light-bulbs), and not pay for routine maintenance (eg biennial replacement of batteries).
- Although the Equitable Share is the nominal operational grant that national government provides to municipalities to pay for the delivery of free basic services, it is not possible to cover the full operational and consumption cost of free basic grid electricity from this grant. Municipalities use other internal revenues to further cross-subsidise free basic electricity delivery. Similarly, **an interim SHS services should also be internally cross-subsidised**.
- Since SHS technology can only provide power for lights and media, subsidised heating and cooking fuels should be incorporated in the free basic package. (In line with the National Framework for Municipal Indigent Policies (NFMIP), **the FBE and FBAE Policies should therefore be applied *in conjunction* when grid electricity is not yet available**).

[1] Although Solar Home Systems can meet energy needs for basic lighting and media, additional technology or sources of energy are required for cooking.

- Until such time as the use of SHS becomes a normative and generally accepted mode of *interim* service delivery, any **early projects supported by municipalities should only be delivered at the request of communities themselves**, and individual households should voluntarily opt into the service. The SHS service should not be delivered in a top-down response to informal settlement grid-electricity demands. Where possible, independent community organisations should first work with democratic representatives of candidate informal settlements to establish a good understanding of SHS technology (including its limitations), and help communities to decide whether or not they would like to request a municipal subsidised interim SHS service prior to grid electrification.
- There are a growing number of additional features and benefits to SHS and **related technologies which the Service Provider should make available to end-users on an affordable (and preferably financed) basis** in order to make the SHS more attractive and aspirational as well as maximise the positive socio-economic benefits to the households and wider community. These include low-energy DC appliances such as colour televisions with access to digital channels and other media as well as affordable Internet access.
- Although significant advances in technology have drastically reduced SHS maintenance requirements and costs, the contracted Service Provider should establish a permanent presence in the target community for the duration of the service contract and **run the service as a professional utility with a comprehensive, web-based quality-management and client-service system.**
- The service contract between the municipality and the Service Provider should **mandate local skills development and job creation targets**.

The right to free basic electricity?

South Africa's national law and policy landscape, as well as constitutional case-law establishes the legal requirement of municipalities to provide **free basic services, including energy, to indigent** residents.

1. ***The Municipal Systems Act* (Act 32 of 2000) (MSA)** requires that all members of the local community have access to at least the minimum level of *basic municipal services* (Section 73). Section 74(2c&e) provides *inter alia* for direct or indirect subsidisation of poor households in order that they have access to at least basic services, and that this subsidisation can come from sources other than revenues generated from the service provided.
2. The ***Constitutional Court*** found (in Joseph v. the City of Johannesburg 2010 (4) SA 55 (CC)) that *electricity is an important basic municipal service* and ruled that local government therefore has a constitutional and statutory obligation to provide electricity.
3. The ***National Framework for Municipal Indigent Policies*** (2005) **(NFMIP)** identifies 'Basic Energy' as one of a suite of essential services falling within a 'Social Safety Net' that the municipality is obliged to provide *for free* to indigent households, as a priority.
4. The ***National Energy Act* (Act 34 of 2008) (NEA)**, requires that the department of energy provides universal access to appropriate forms of energy or energy services, taking into account, *inter alia*, the state's commitment to provide free basic electricity to poor households (Sections 5(1) and 5(2)).
5. The ***Free Basic Electricity (FBE) Policy*** (Electricity Basic Services Support Tariff Policy, 2003) provides for municipalities to give 50kWh or more of free electricity to its indigent residents each month.[2]
6. The **Free Basic Alternative Energy (FBAE) Policy (2004)** makes provision for subsidised alternative energy sources (such as cooking fuels) for indigent households that do not have access to grid electricity or off-grid solar home systems.

Notwithstanding this expansive commitment to free basic electricity for indigent households, both the MSA (Section 73(2)) and the NEA (Section 5(2)) also require that principles of financial and environmental sustainability, affordability, cost-effectiveness and efficiency be taken into account when delivering on this commitment to the poor. However, these prudent qualifications should not be read as a 'get-out' option for municipalities, particularly when there is an ever-growing range of technical and financial solutions that do enable the sustainable, affordable and cost-effective delivery of free basic electricity.

Who are indigent and what is 'basic energy'?

For urban contexts, free basic energy should be provided in the form of electricity, and the 'basic' allowance should provide "sufficient energy to allow for lighting, access to media and cooking" according to the National Framework for Municipal Indigent Policies (NFMIP). How such energy services are technically delivered, is according to this policy guideline, left to the municipality to determine, dependent on the nature of settlement conditions. Equally, identifying and targeting eligible indigent residents is left to the municipality, but the NFMIP clarifies that 'indigent', (meaning 'lacking the necessities of life'), would include anyone who does not have access to a basic suite of services, including basic energy. There are a number of possible methods or proxies that municipalities use to target indigent residents, including the value of the resident's property. (This, for example, is the method used by the City of Cape Town). By this definition any household

[2] The NFMIP questions the adequacy of 50kWh to meet basic electricity needs. Municipalities have discretion to increase this. For example, Cape Town municipality provides a maximum of 60KhW/month and Stellenbosch Municipality provides 100kWh/month.

in an informal settlement would qualify as indigent and would thus have a right to free basic electricity according to South Africa's laws and government policy. Indeed, Stellenbosch Municipality deem any informal settlement resident to be indigent without needing to apply separately for indigent status.

Interim energy solutions for informal settlements: the sanitation precedent

South Africa's housing policy 'Breaking New Ground' (BGN) prescribes the 'phased *in situ* upgrading' of informal settlements. However, this frequently translates to long waiting periods before conventional services, can be delivered, particularly when those services, such as grid electricity, rely on the reticulation of centralised infrastructures. However, the legal framework for service delivery does not appear to make allowance for extended delays in service-provision simply because conventional services are unavoidably delayed. Thus, a logical conclusion is that alternative energy services, albeit temporary, should be provided as an option to unelectrified communities. Indeed, unelectrified communities are after-all *most in need* of the state's commitment to providing indigent relief.

The NFMIP is clear that unregulated settlements must be brought into the municipal system so that residents are not excluded from indigent support. The policy guideline provides for a 'zone of flexibility' for peri-urban settlements in terms of what technical solutions are provided. This, read together with Section 73(2e) of the Municipal Systems Act, which requires that services are "regularly reviewed with a view to upgrading, extension and improvement", supports the idea of transitioning across different technology solutions over time, as appropriate. For example, the provision of basic sanitation services in informal settlements (eg. chemical toilets) illustrates the use of different technologies for different phases of service-delivery/upgrading, ranging from 'essential' or 'basic' through to 'full service level' (Section 6, NFMIP).

Alternative Basic Energy for informal settlements: Off-grid Solar Home Systems

Using temporary sanitation as a precedent, similarly the use of off grid Solar Home Systems (SHS) is an equivalent temporary or interim technology that can provide 2 of the 3 essential energy functions stipulated in the NFMIP (namely lighting and media, but excluding cooking) until such time as grid-electricity can be provided during a later phase of the informal settlement upgrading.

SHS have been used extensively in rural areas where it has been difficult or too expensive to extend the national grid. However, the Integrated National Electrification Program (INEP), which provides the capital funding for 'Non-Grid Electrification', is clear that even in the rural roll-out the service is temporary:

> "….non-grid electrification was identified as an interim solution. The non-grid electrification program is designed to temporarily give deep rural communities access to limited electricity until such time that grid connections are possible."[3]

Similarly, the Non-Grid Electrification Policy Guidelines (2012) states that "Solar Home Systems (SHS) have been identified as a suitable temporary alternative to grid electricity"[4] (for the rural consumer).

Notwithstanding the discretion (subject to various conditions[5]) and the 'zone of flexibility' given to municipalities to use whichever technologies are most appropriate for a particular settlement's needs and constraints, South Africa's existing policies and policy guidelines which deal with the provision of free basic

[3] http://www.energy.gov.za/files/INEP/objectives_of_policy_guidelines.html
[4] Non-Grid Electrification Policy Guidelines (2012)
[5] See Section 73, Municipal Systems Act

electricity tend to make a distinction between rural and urban contexts - prescribing grid electricity for the former and SHS for the latter. However, these policies appear to ignore that many urban settlements face the same grid constraints as rural areas and are thus equally suitable candidates for temporary SHS provision when these constraints lead to protracted delays of three or more years. The FBE Policy prescribes that "non-grid electricity connections will be provided in rural, poorer communities where grid electrification will not be a viable option for some time." Although this policy recognises that approximately 30% of households in South Africa did not have access to grid electricity in 2003, with long ongoing delays likely, it did not clearly address the challenge that many of these unelectrified households are in urban areas. (A more inclusive provision for temporary off-grid solutions should read: "non-grid electricity connections will be provided ~~in rural, poorer communities~~ where grid electrification will not be a viable option for some time.")

There have been a number of municipalities in South Africa that have nevertheless taken the lead and applied their discretion in providing SHS services to urban or peri-urban informal settlements including Nelson Mandela Bay in the Eastern Cape, Stellenbosch in the Western Cape, Kheis Municipality in the Northern Cape[6].

Following a review of the rural SHS programme, the 2012 Non-Grid Electrification Policy Guidelines states that the Department of Energy will roll out the non-grid electrification programme to areas that fall outside of the rural concession areas (although it is not made clear whether this would include urban or peri-urban areas).

Benefits/Impacts of SHS

This briefing does not advocate for the use of off-grid SHS as a permanent alternative to grid-electricity for the urban poor, particularly if this ends up being the only safe, clean and reliable energy source that the household has access to. The quantum of electricity that can reasonably be extracted from an off-grid SHS is insufficient to meet the long-term energy needs of an urban household. Nevertheless, there are considerable positive impacts in the short and medium term (both for the household and the wider community and environment) when a family is able to switch from the use of unhealthy and unsafe fuels for (poor-quality) lighting to clean, safe and convenient LED lighting and simultaneously be able to access digital content in their own home. The socio-economic and health & safety benefits to the household are self-evident.

The wider positive impacts for the neighbourhood and community, including the municipality - while difficult to quantify - are likely to include the following:

1. **Local, 'green' economic opportunities and job-creation** when the SHS roll-out incorporates a program of green-economy skills training and meaningful job-creation within the target community.
2. **Redressing institutional failures: providing a basis for better inclusion.** The SHS service helps to bring marginalised poor communities into the core administrative and institutional systems of government - systems that the poorest are most in need of and are yet most likely to be excluded from.
3. **Establishing a transactional relationship between service provider and end-user.** While the basic service should be provided for free (in line with indigent policy), certain additional services such as *ad hoc* maintenance or technology upgrades would require co-payments from the end-users. Cash-less payment systems enable flexible and convenient payment options.

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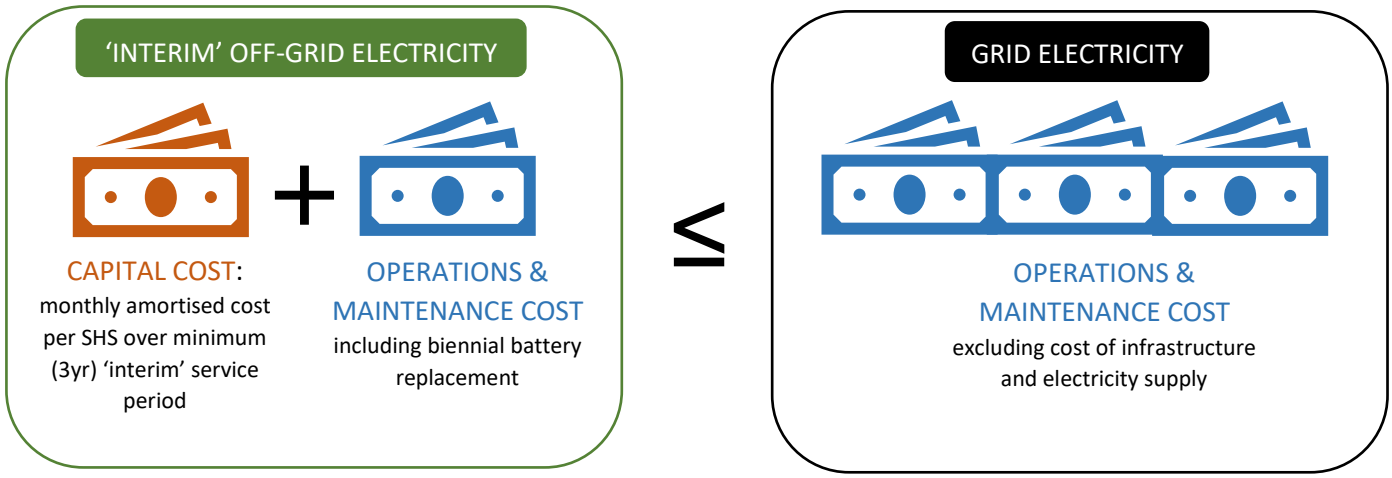
[6] Nelson Mandela Bay - Seaview: http://www.nmbbusinesschamber.co.za/blog/posts/microcare-manufactures-its-5000th-12v-solar-home-system-shs ;
Stellenbosch – Enkanini: https://www.youtube.com/watch?v=Rt6-uuKgBeI ;
Kheis – Groblershoop: https://www.youtube.com/watch?v=jMpg61ulv2g

4. **Building community.** The physical location of each SHS within individual household places risk of theft within the loci of the household. However, experience in pilot projects has shown that this individual risk, when experienced by large numbers within the settlement, results in a collective vigilance and a very low rate of theft.
5. **Reduced financial burdens on local municipalities** for the provision of emergency, health and security services by reducing the consumption of dangerous, unhealthy fuels (which reduces the risk of shack fires and respiratory diseases).
6. **Reducing political unrest and service delivery protests** by providing a viable, scalable and affordable mechanism for community-led access to a basic amount of clean electricity.
7. **Boosting the market demand for ongoing innovation** in climate friendly, sustainable renewable energy technologies which in turn provides a long-term pipeline for scaling the service (such as adding refrigeration, heating and cooking).
8. **Providing household access to educational media platforms** (such as TV, Internet) which increases opportunities for informal learning for children, and which ultimately has a significant positive impact on economic growth.
9. **Mitigation of climate change effects and costs.**

Cost-benefit – avoiding wasteful investments in infrastructure

In order to limit the draw-down on the state's finite capital resources for the cost of temporary energy infrastructures the principle should be applied that the combined capital, operations and maintenance costs of any interim energy service should, over the period of the interim service, be no more that the monthly operations and maintenance cost of the final 'full service level' (ie grid electricity) – as illustrated below.



A highly competitive renewables industry has resulted in significant investment and innovation in SHS development over the past ten years. SHS are now able to provide a cost-effective basic energy service (for lights and media) at a significantly lower cost (capital + maintenance) than the typical cost to a municipality of maintaining grid connections to each of its grid-connected customers.

Sophisticated battery management and charge-control algorithms coupled with highly efficient appliances that take advantage of LED technology and Direct Current (DC) efficiencies now make it possible for a 50Wp SHS with a relatively small and inexpensive battery to provide sufficient DC electricity to meet the basic

lighting and media needs of a typical low-income household. At current (2018) prices the 3-year amortised cost of such a system, installed in a large-scale roll-out (>1000 households), is approximately R100/month. Similarly, the routine maintenance cost (including biennial battery replacements) can be as low as R100/month.

Thus, notwithstanding that a SHS cannot provide a level of energy utility that is equivalent to a grid-connection, as a temporary basic service it is a cost-effective option that meets the principle of avoiding wasteful over-expenditure on infrastructure.

Funding

The NFMIP lays out the fiscal framework for the sustainable funding of basic services (as opposed to higher level services which need to generate revenues to cover costs and subsidise other services). The policy identifies capital grants such as the Municipal Infrastructure Grant (MIG) and operating grants (specifically the Equitable Share) as sources of funds for the implementation and ongoing running costs of the basic energy service. However, there are a number of inconsistencies or constraints on these sources of funding when trying to make use of them for SHS in urban informal settlements.

Capital Funding

As argued above it is conceivable that both the capital and operations cost of a temporary (3 year) SHS service can be funded from a combination of municipal revenues and the Equitable Share. It would be possible to structure a Service Level Agreement (SLA) with a private SHS Service Provider whereby the Service Provider self-finances the capital cost and recovers the finance and depreciation cost over three years from the monthly SLA revenues (rather than the municipality paying the upfront cost of the capital). The advantage of this approach (to both the municipality and the target community) is that it would compel the Service Provider to allocate adequate support and maintenance resources for the entire duration of the contract and would avoid the service ending up as yet another poorly maintained hand-out.

However, for a more conventional approach, there are provisions for capital grants for interim or basic-services infrastructures, albeit with some out-dated constraints.

Although the principles governing the allocation of the Municipal Infrastructure Grant (MIG) for ‘basic’ infrastructure targeted for the poor appear to make this grant ideally suited to the provision of a temporary SHS service for urban informal settlements, unfortunately, the MIG Policy Framework (Section 5.1) explicitly excludes the funding of infrastructure on residential properties unless it is for 'on-site' sanitation. This restriction fails to recognise the opportunities for cost-effective basic service provision afforded by alternative off-grid (‘on-site’) technologies. This entrenches service-delivery delays by restricting the MIG-fundable energy service modality to grid electricity only.

An alternative source of capital funding is the Integrated National Electrification Program (INEP) under the Department of Energy (DOE), which provides capital funding for the roll-out of SHS in the rural concession program and has piloted an urban roll-out in Nelson Mandela Bay. INEP appears to be the most viable source of capital funding. However, accessing this funding for urban off-grid projects will likely be contingent on the municipality committing sufficient funds towards the operations and maintenance of the service (based on the DOE’s hard lessons from the rural concession program – see ‘Lessons from the Rural Concession Programme’ below).

Operational Funding

The Equitable Share is distributed to municipalities from the Department of Cooperative Governance and Tradition Affairs (COGTA). It is intended to support the provision of free basic services based on the estimated number of indigent residents within each municipality. Again, municipalities have discretion in how to use their grant allocation. For indigent households with grid electricity they might receive an allowance of free electricity each month (as is the case in Cape Town), or below-cost tariffs for the first tier of consumption, but no free units (as in Johannesburg). In the case of households *without* grid electricity, Stellenbosch Municipality, as an example, has opted to use some of their equitable share to contribute towards the operations cost of a 'free basic' SHS service operated by a private Service Provider in one of the municipality's largest informal Settlements.[7]

The FBE policy allows for the Equitable Share to subsidise only 80% of the operational running costs of SHS to power basic lights and media. The policy states that the balance of the SHS running costs should be recovered from the end-user. In contrast, for a grid-connected indigent household, the same policy prescribes "sufficient free electricity to meet their needs for lighting, media access and limited water heating and basic ironing (or basic cooking)" without requiring co-payments from the consumer. This makes for an unequal entitlement between grid-connected and off-grid residents.

The FBE Policy should be amended to provide for full subsidisation of the operational running costs of the SHS service (including the routine replacement of batteries) through government grants or municipal cross-subsidisation. The Policy should also clarify that the SHS is only a partial fulfilment of the indigent right to free basic energy (since Section 6 of the NFMIP makes it clear that free basic energy should include cooking in order to maintain basic health and safety). Thus, when used to provide an off-grid service, the FBE policy should work in tandem with other vehicles, such as the Free Basic Alternative Energy Policy (FBAE), to give full effect to the NFMIP requirements.

The FBAE Policy (2004) makes provision for the subsidisation of fuels for citizens who do not have access to electricity. Unfortunately, the policy *excludes* citizens who have SHS even though the SHS does not provide energy for cooking. In order to be more equitable and more consistent with the NFMIP, as well as the higher standard that is set in the FBE policy for grid-connected households (ie free electricity for lighting, media and basic heating and/or cooking), the FBAE should be used to *supplement* off-grid electricity in order to provide for the cooking aspect of the free-basic entitlement.

Although combining FBE and FBAE would enable an adequate Free Basic Energy package that is aligned with the NFMIP, the question of operational affordability may be raised by municipalities who question the sufficiency of their allotted Equitable Share to cover these operational costs. Although the FBE and FBAE deal only with the allocation of the Equitable Share towards the running costs of free basic energy services, the Equitable Share need not be the only source of operational funding for the maintenance of interim (off-grid) basic energy, since this is certainly not the case for those indigent consumers who are connected to the grid; as previously stated, the cost to municipalities of maintaining these grid connections each month (excluding the cost of subsidised electricity) is significantly higher than what the Equitable Share contribution covers. In fact, the Equitable Share makes no contribution to grid maintenance costs. Municipalities may argue that at least there is scope to generate some revenues from those indigent households who are connected to the grid once they have used up their free basic allowance each month. However, the additional electricity that these households would need to consume in order for the municipality to reach operational break-even raises the question whether such consumers should be eligible for indigent support in the first place.

If, for whatever reason, the state is unable to provide grid electricity within a reasonable time-frame, then a lower level of operational funding for alternative modes of basic energy provision is difficult to defend (since these operational funds are not drawing down on capital infrastructure grants, and there is therefore no reasonable objection on the basis of wasteful expenditure).

[7] The iShack Project: www.ishackproject.org.za

Lessons from the Rural Concession Programme[8]

Erratic operational revenue

Although there have been well over 46,000 SHS installations under the rural concession programme, this still falls well short of the original target of 300,000[9]. Despite the generally supportive policies, a lack of political will to drive the programme has been reported. This has been particularly problematic at municipal level (where the Service Providers/concessionaires rely on the FBE subsidy to maintain the service), since the DOE did not originally compel municipalities to pay the subsidy. This has compromised the sustainability of the rural SHS service and contributed to negative perceptions about SHS technology.

Fortunately, the more recent (2012) Non-Grid Electrification Policy Guidelines clarifies that where INEP-funded off-grid services are provided, the relevant municipalities "need to pay the FBE, as set out on the FBE policy, for the qualifying beneficiaries thus making sure that electricity is affordable and really benefits the poor."

Weaknesses in the structuring of Capital Funding

Under the concession programme, only 80% of the cost of the system is subsidised by the state, with the rest having to be financed by the concessionaire. Although the valid intention behind this arrangement was to ensure that the private concessionaires commit sufficient resources to the maintenance aspect of the contract (so that they are able to recover the remaining 20% of the capital investment), the problem with this is that:

- The concessionaire may be perversely incentivised to cut costs during up-front implementation
- By implication, the remaining 20% needs to be recovered from the end-user and/or the municipality, via the FBE subsidy – which, as stated above, has not been reliably or consistently paid. (In any event, the FBE contribution has historically been insufficient to cover an adequate maintenance service – which should include routine battery replacements).

The consequence is both an under-resourced maintenance service and unjustifiable financial burdens on the end-user (who should be receiving this basic service entirely for free as per the NFMIP).

Fortunately, advances in technology and competition make the capital and maintenance costs of SHS increasingly more affordable. In 2008 the cost of an 50Wp SHS, installed under the rural programme, was reported at approximately R5,600[10] (although somewhat higher figures have also been reported). Whereas today a SHS providing a similar level of energy utility can be provided (and installed) in an informal settlement for less than half this cost - despite the significant devaluation of the Rand in the interim. Some of the reasons for this improvement include:

- Running an installation program in remote rural areas is substantially more expensive than in a densely populated urban informal settlement.
- Fierce competition in the SHS industry has resulted in large reductions in costs as well as major improvements in functionality.

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[8] Global Network on Energy for Sustainable Development: Report on Off-grid Solar Home System Programme South Africa
[9] Case studies on PPP frameworks based on Energy Sector Experience in Sub-Saharan Africa
[10] Report on Off-grid Solar Home System Programme South Africa (see above)

- More advanced charge-controllers, coupled with vastly improved efficiencies in LED-based (DC) appliances enable SHS to run on much smaller batteries than originally used in the rural concession programme (as low as 20% of the original specification). Since the battery is a significant component of both the upfront capital cost and ongoing maintenance costs, any efficiency gains are a double saving for project implementation and servicing.[11]

Ownership

Ownership of the SHS has been another problematic aspect of the rural programme. The Non-Grid Electrification Policy Guidelines require that where the grid is eventually delivered, the SHS must be removed by the Service Provider and redeployed elsewhere. Thus, the Service Provider co-owns the asset with the DOE[12] and the state expects the Service Provider to keep re-cycling the infrastructure through new households as the grid advances. Apart from the problem that the Service Providers have reported that they are often not informed when grid connections are implemented (and therefore are unable to plan for timeous removal of the SHS), more fundamentally, it is unrealistic to achieve this kind of durable portability and re-use. The kind of dwelling conditions that the SHS typically operate in (high indoor condensation levels, inadequate protection from the elements) tend to result in limited system life-spans. Also, it is costly to un-install a system (and then refurbish it with new batteries, etc). Therefore, it is more realistic and appropriate to write off the value of the unit after a minimum of three years and then - subject to fulfilment of other contractual terms between the end-user and the Service Provider - transfer ownership to the end-user, who may then be able to carry on extracting value from the system for a number of additional years. The concept of retained ownership by the Service Provider and the State has, in the rural experience, been undermined by the reality that households in any event regard the SHS as their property.[13] Making explicit provision for the conditional and controlled transfer for ownership (perhaps with co-payments from the end-user), would avoid the unintended consequence of wide-spread breach of contract/unlawfulness by the end-user (with all the resultant negative consequences and implications).

Programmes such as the South African solar water heater (SWH) subsidy program create a precedent for state contributions to the cost of energy infrastructure - the ownership of which is transferred to the household. While mechanisms and time-lines can be put in place for a staged transfer of SHS ownership to discourage abuse, ultimately it makes sense that the household owns and controls the asset. This will incentivise the consumer to better look after the system throughout the subsidised 'service-maintenance phase' and probably reduce the maintenance load. Also, by retaining the use of the SHS after being connected to the grid, the household has a clean and safe back-up for lighting rather than reverting to paraffin and candles if and when the metered electricity supply can occasionally not be paid for.

Supporting the above argument, Section 6 of the Non-Grid Electrification Policy Guidelines (2012) acknowledges the benefits of ongoing use of the SHS under grid connection: "There is an energy poverty

[11] The 2012 Non-Grid Electrification Policy Guidelines specify a battery of 105Amp-Hour for a 50Wp system. While it may be more appropriate to have a larger battery for rural applications where the logistical costs of exchanging batteries is somewhat higher than in urban areas, the latest SHS and DC appliance technology allows for considerably smaller batteries while still maintaining sufficient electricity supply for basic lighting and modern media needs. The non-grid electrification programme could make sufficient savings by changing the SHS specification to a well-defined and verifiable description of the end-user's energy utility, rather than limiting the specification to fixed component ratings only.

[12] Non-Grid Electrification Policy Guidelines (2012), Section 7.1

[13] The arrival of the grid in rural areas is (fortunately) not a theoretical scenario: One of the rural concessionaires reported in 2010 that 4,000 of their 11,500 SHS customers had subsequently been connected to the grid; they claim that the majority of the SHS in these grid-connected houses had been removed, vandalised, stolen or sold by the households.

alleviation benefit and an energy efficiency benefit in cases where non-grid electrification is provided to supplement grid electricity in certain areas."

The maintenance challenge

In the rural program, sustaining a high-quality maintenance service has been hampered by vandalism and tampering, long distances to remote households, and difficulties in securing payments from end-users and the municipality. Also, earlier versions of SHS technology were less reliable and robust than more recent designs.

Many of the costly logistical challenges of rural programs are less severe in an urban context where distances are short, and resources and skills more readily available. Technological advances have also helped to reduce and simplify maintenance procedures. For example, the latest SHS enable remote monitoring of system performance, battery health, tamper-detection and basic troubleshooting[14]. This can significantly reduce the number of household maintenance visits by technicians. Also, the ability to run on much smaller batteries fundamentally reduces the routine maintenance costs of a SHS service. Finally, although more prevalent in urban areas, the growing use of smart phones with Internet-based communications allows Service Providers to be in closer and more regular remote contact with end-users. Related to this functionality, payments from end-users can more readily be made via 3rd party cell-phone-based vending platforms.[15]

The negative perception of SHS

Acknowledging the prevailing negative attitudes about SHS (by comparison to the grid electricity standard), the Non-Grid Electrification Policy Guidelines prescribe a useful and comprehensive 'community awareness and education' programme (Section 11). In remote rural areas, where communities may not consider there to be any alternatives, this top-down education programme may be effective. However, in urban areas where informal settlements are located close to existing grid connections, the acceptance of an interim SHS service, as an alternative to grid-connection is understandably less likely. Therefore, for an urban program at least, there should be a number of preconditions and general understandings before a municipality should support a SHS project:

1. There should be significant barriers to grid electrification in the informal settlement which are well understood by the community. The municipality should commit to make progress towards over-coming these barriers and it should be understood that the SHS service does not replace or delay the eventual delivery of the grid (or relocation of the settlement to a site suitable for grid-electrification) and that it is simply an interim free basic service.
2. The community should, via a democratic process, formally request indigent support for the delivery of the SHS service, rather than the municipality initially promoting this option to the community. Organisations working in informal settlements (for example, Slum Dwellers International (SDI), The Federation for the Urban Poor (FEDUP), and the Informal Settlements Network (ISN)) can play a role in introducing communities to solar options by organising exchanges and discussion forums with other settlements that are using SHS.

[14] iShack Off-Grid Solar Electricity Data Report (Feb 2017-Jan 2018)

[15] For example, the urban off-grid iShack Project uses Whatsapp to communicate with its user-groups in a pilot project in Philippi, Cape Town. The project collects all end-user payments via a 3rd party mobile-money platform which is accessible for all residents in the informal settlement who have a basic cell-phone.

3. Households should voluntarily opt into the service and pay at least an initial joining/installation fee. Ongoing payments by the end-user should only be for additional upgrades, appliances or as a contribution towards the eventual ownership of the SHS.

4. The service should include appealing optional extras and upgrades - including the possibility of eventual ownership of the system. Also, where possible, affordable finance should be provided by the Service Provider to enable the household to pay off the cost of a DC television and/or other suitable DC appliances. Affordable Internet data should also be provided as part of the package, preferably including a modest free basic data allowance each month.

With time, as the use of SHS in urban areas becomes more standard and as the functionality of the technology improves, it is likely to become more aspirational and thus more acceptable, at least as a temporary service option.

Appointment of Service Provider

Key elements of the Service Level Agreement:

1. The appointment of Service Providers should be by open tender.
2. The Service Provider should ideally provide the finance to cover the capital cost of the hardware over the period of the service agreement (minimum 3 years). The asset should be depreciated over the contract period and this cost recovered from a monthly service subsidy paid by the municipality.
3. The Service Level Agreement (SLA) should specify detailed aspects of the maintenance service (including biennial battery replacements), pricing, installation targets, and job creation targets. The Service Provider should establish a permanent operation presence in the target community.
4. The Service Provider should train and use installers from the target community and where possible (and depending on the scale of the roll-out) develop some of these installers to become maintenance and client-service technicians or be employed in other roles within the organisation.
5. The service fee should include a provision for fire and theft insurance. The Service Provider should 'self-insure' for minor losses.
6. The Service Level Agreement must include budget for community processes. Where possible, partnerships with other community-based organisations should be promoted in order to assist communities to understand the functioning and limitations of SHS and to democratically decide whether to petition local government for temporary SHS services.
7. In the absence of independent retail options for end-users, the Service Provider should provide a range of affordable and SHS-compatible DC appliances. Where the Service Provider makes appliance financing available to end-users, reasonable restrictions should be placed on the terms of this financing (including interest rates and payment default policies) in terms of the SLA. The Service Provider should declare any direct or indirect interests in any appliance businesses or sales organisations.
8. The Service Provider's technology should provide for remote monitoring of the energy service (including monitoring energy generation and consumption as well as battery health – all of which aid troubleshooting and maintenance).

Conclusion

The state has made clear, through a wide range of progressive laws and policies, its fundamental commitment to the prioritisation of free basic services for indigent citizens. Grid-electrification remains the gold standard *energy* service for all citizens – urban and rural. However, extended delays in the grid-electrification of a large and growing urban demographic, should not result in the failure to provide any level of indigent relief via cost-effective alternative technologies, particularly since it is these unelectrified citizens who are most in need of the state's commitment to indigent support.

In the 15 years since the idea of providing temporary free basic electricity via off-grid solar home systems to rural citizens was conceived and became policy, much has been learnt. Also, the technological advances in the ensuing years have far outpaced a fairly stagnant policy landscape (as progressive as the original policies were). It is now possible to efficiently and sustainability provide cost-effective, temporary energy services (via subsidised sophisticated SHS together with clean cooking fuels) in order to meet the prescribed threshold for 'basic energy' needs.

The socio-economic and well-being benefits of a modest clean energy allowance for lighting and media are well understood. These benefits extend beyond the household to the wider community and to the municipality itself. A SHS service can begin to catalyse the engagement of under-served informal settlement residents as citizens and alleviate the "marginalisation of the poor from the core administrative or institutional systems and resources of government" (NFMIP).

Notwithstanding the stated need for certain policy updates, the existing policy landscape already implicitly provides for (and certainly does not preclude) temporary free basic electricity, via SHS, to urban informal settlements. There are already a few working examples of this approach which serve as useful sites of learning. Nevertheless, the more normative adoption of this approach by municipalities should be cautious and preferably 'community led'. Such a service would not yet be suitable in the majority of cases, and certainly only where there are unavoidable, extended delays in grid electrification. Also, the target communities should have established a good understanding of the pros and cons of technology, and should, in a democratic fashion, signal their desire for the delivery of such alternatives while they wait for eventual grid-electrification.

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