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Acronyms

CDM	Cleaner Development Mechanism
CLO	Community Liaison Officer
DEA	National Department of Environmental Affairs
DoE	National Department of Energy
DoHS	Department of Human Settlements
DoRA	Division of Revenue Act
DSM	Demand Side Management
EEDSM	Energy Efficiency and Demand Side Management
EPWP	Extended Public Works Programme
Escos	Energy service companies
FBAE	Free Basic Alternative Energy
FBE	Free Basic Electricity
HP	High Pressure (SWH system)
LP	Low Pressure (SWH system)
M&E	Monitoring and Evaluation
MYPD	Multi Year Price Determination
NMBMM	Nelson Mandela Bay Metropolitan Municipality
NSWH	National Solar Water Heater Programme
QC	Quality Control
PTFE	Polytetrafluoreothylene (Teflon)
RfI	Request for Information
SEA	Sustainable Energy Africa
SSN	SouthSouthNorth
SWH	Solar Water Heater
SPM	Sol Plaatjie Municipality
TOR	Terms of Reference
UEMP	Urban Environmental Management Programme

1. Introduction and report objectives

The potential of solar water heating to address household energy needs while reducing electricity demand, and consequently global emissions, has long been understood in South Africa[1]. The additional job creation potential this technology offers relative to conventional electricity is also well accepted. By 2009 much of this work and thinking had been consolidated into a commitment by the Minister of Energy to deliver 1 million solar water heaters by 2015 and a national Solar Water Heating Framework. The National Solar Water Heater programme that ensued in 2010 drew funding from National Treasury, through the Division of Revenue Act (DoRA) (2009 – 2012) and Eskom Multi Year Price Determination MYPD 2 (2012/13 financial year, as well as allocations for 2014/15 and 2015/16, though the latter did not materialise as Eskom faced financial crisis). The programme was directed by the Department of Energy and administered and managed through Eskom.

This report will focus on the Social Programme component within the national programme, i.e. that component previously implemented by Eskom at various municipal sites and directed at the provision of hot water services for *low income households* through low pressure solar water heater systems. Through desk top reading and a series of interviews with municipal staff, suppliers and installers, this review has explored the rollout experience from a municipal perspective, considering the process from pre-installation through to post-installation and maintenance. A set of 'best practice' recommendations has been developed for the core components of the programme.

1 Ward, S, 1999; SEA, 2006.

2. Overview of the Solar Water Heater Social Programme Rollout

An understanding of the development of the national solar water heating programme progression over the years is informative in understanding some of the subsequent challenges and opportunities, and the experience and role of local government in the programme. In 2008 Eskom initiated a rebate programme, the Geyser Load Reduction Programme, to subsidise solar water geyser systems as part of a national load reduction scheme. Although targeting high-end electricity consumers, a couple of municipalities realised that the subsidy could effectively render low pressure solar water heaters "free" and as this was in line with city goals of achieving greater levels of renewable energy and addressing household energy services, metros such as Nelson Mandela Bay and eThekwini embarked on such rollouts.

This involved appointing a service provider from a pre-approved Eskom list, and it was up to the service provider to draw down the subsidy from Eskom to cover their costs. Municipalities believed at the time that carbon finance would be available to support longer term maintenance, though this never materialised. Municipalities and supplier/installers undertook the process of community engagement together, sort of 'making a plan'.

In 2009/10 the National Solar Water Heater programme was put in place. This was designed to accelerate roll out of solar water heaters towards achieving the Department of Energy's aspirational target of meeting 50% of South Africa's residential water heating through solar water heating technology by 2020[2]. The service delivery model looked at providing systems and supply chain processes tailored to suit different market segments. The business model looked to ensure universal access to all houses in South Africa through a sliding scale system with upper income households contributing significantly to the cost through to indigent homes receiving a "virtually free" SWH system. Within the Social Programme component, funding was sourced through National Treasury from 2009-2012 and further funding was then built into Eskom's MYPD 2 for the years 2013 – 2016. However, the Eskom financial crisis resulted in this programme being halted in October 2013.

Within the NSWH Programme Eskom was appointed by the DoE to manage the Social Programme. Eskom appointed sub-contractors to an allocated installation area for a street by street installation process. The criteria for the selection of municipalities to participate in the initial DoRA-funded programme is not clear; within the Eskom MYPD 2-funded phase a Request for Information (RfI) was issued in 2012 to municipalities by the DoE. Responses were poor and allocations were ultimately spread across the 54 municipalities which had either participated in previous geyser load reduction schemes or had responded to the RfI. Although most provinces received funds, the majority of allocations were in the provinces of the Eastern Cape, Western Cape, Gauteng and Kwa-Zulu Natal. This was due to poor response from municipalities in other areas.

Understanding the figures and which installations were under which programme is fairly difficult and the municipalities themselves are often a bit unclear on this. The DoE reported to parliament, in 2014, that a total of 395 088 systems had been installed[3]. Although reported to parliament as if directly related to the Social Programme, this figure is in fact a total for the country under all schemes since 2008 –high and low pressure systems, those delivered through the DoE fiscus-funded and Eskom schemes[4]. A 2012 article by UrbanEarth indicates that of the country's (at that point) 260 000 units delivered, 30 768 were low pressure (LP) units delivered through the DoE fiscus-funded Social Programme; 180 000 were LP systems delivered through the Eskom rebate programme; and 50 000 were high pressure (HP)

2 Department of Energy National SWH Conference, 2009.

3 Parliamentary Monitoring Group, February 2014.

4 Parliamentary Monitoring Group, November 2014.

Table 1: Overview of the Eskom rebate and National Solar Water Heater Programme Social Programme 2008 - 2015

Site of programme delivery	Funding allocated (ZAR mill)	Units delivered	Status/comments
Eskom rebate scheme			
Across the country, including the NMBMM Zanemvula and eThekwini rollouts; also City Power possibly drew down from this fund.		approx 230 000 by 2012; of which some 180 000 were LP systems.	
2009 – 2012 DoRA funded			
Tshwane Metro	R 104		
Sol Plaatjie Municipality	R 59	7 837	R54 million initially and an additional R5 million for pre and post installation issues (e.g. water connections).
Naledi Municipality	R 59		
Polokwane and Musina	R 54		Programme halted before roll out. Polokwane has 250 delivered through the previous rebate scheme programme.
Buffalo City	R 54		
Total funds	**R 332**		
2012/13 Eskom MYPD 2 EEDSM Funded: total of 54 municipalities identified.			
Total funds	**R 1 450**		
Allocated for 2014/15	R 1 600		*Programme halted*
Allocated for 2015/16	R 700		*Programme halted*
Total UNITS		**395 088**	**This figure for entire NSWHP HP and LP**

systems delivered through the Eskom rebate programme. These figures are worth some consideration as the rebate programme appears, at least superficially, to have been most effective in delivering systems at least from a sheer numbers perspective.

Broad challenges identified within the overarching programme have included the lack of clarity around the programme objectives. This began as a load reduction programme, but shifted to a Social Programme with job creation and household services as a central objective. However, the funding and contracting structure did not follow, or adjust to meet, this change in objective.

The early installations were also often characterised by 'fly by night' companies out to make a quick profit, who would source the cheapest, imported systems and undertake poor quality installations[5]. Even where

5 This was noted across a number of the interviews.

companies were not out to make a quick profit, the pressure to find affordable solutions, such as in Kuyasa, often led to the procurement of lowest cost, imported products, which in time were found to be defective.

An outcry developed, particularly from amongst organised labour, that the programme was subsidising imported and defective products. A revised contracting model was developed, bringing in the requirement that 70% of the SWH system should be locally manufactured – "local content". Although this is strongly supported by the industry, a lack of communication as to the exact specifications of this content (e.g. must all systems by flat plate – South Africa doesn't have the capacity to manufacture tubes – or can there be use of imported tubes with higher levels local content elsewhere in the system?) has meant a number of factories have had to close or retrench staff. This remains an outstanding issue and has severely impacted on jobs – undermining one of the central goals of the programme.

Theft of systems, as well as communities not seeing the benefit of the programme, has also been noted as a concern[6]. Although municipalities selected the beneficiary area, they had no involvement in the appointment of contractors and limited involvement in the management of the installation. The NSWH Programme framework model indicated that sub-contractors would be required to establish local area offices to undertake after-sales service, maintenance and local skills and capacity development, however the indications are that this did not take place and challenges experienced in the programme rollout have resulted in the Department of Energy recalling the rollout from Eskom and back into the department.

6 Parliamentary Monitoring Group, 2014.

3. Study municipalities: a detailed programme review

This study identified Sedibeng District Municipality, Musina Municipality, the City of Cape Town and eThekwini Metro for detailed review. In addition the experiences of City of Johannesburg, Sol Plaatjie Municipality and Polokwane have also been drawn on. Reports from the early Zanemvula rollout in Nelson Mandela Bay have also been reviewed. Although SWH rollouts have been undertaken, and/or the municipalities have been identified to receive NSWH funds, on review very few municipalities were in fact active participants of the NSWH Social Programme. Sol Plaatjie received funds through the initial DoRA allocation. EThekwini initiated its rollout through the early Eskom rebate scheme (as did Nelson Mandela Bay). Polokwane and Musina were allocated funds through the DoRA allocation, but the programme was halted before any rollout took place (Polokwane did see the rollout of some 250 units through the previous rebate scheme). Sedibeng was scheduled for funding in the MYPD 2 allocation, but withdrew from the Programme as it excluded municipal appointment of service providers. Similarly the City of Johannesburg has its own programme (through its own funding) underway; Cape Town has not received funding through the programme. However, all cases across provide useful experience and insight into the process followed by municipalities and best and worst practice emerging.

3.1. Project management: Institutional and financial arrangement

3.1.1. Municipal Engagement with Solar Water Heater Rollout

Most municipal engagement with SWH rollout projects has originated from municipal goals and strategies relating to sustainable energy development. Although the DoE NSWH Social Programme has involved both top-down selection and soliciting of proposals from interested parties, the top-down selection was predominantly based on some degree of pre-existing sustainable energy engagement, or SWH rollout under the Eskom rebate programme, by the municipality.

EThekwini's engagement with SWH rollout programmes emerged out of their internal strategies and commitments relating to environmental and social (sustainability) goals. Action plans for SWH rollout were developed by the municipality in response to the inclusion of SWHs within the city's Energy Strategy (2009) and a renewable energy potential study undertaken for the Environmental Management Department. The municipality's participation in the NSWH programme was also in response to the electricity crisis and the municipal commitment towards contributing to the national 10% demand saving goal. This meant that the municipality was proactive in engaging with the first Eskom rebate programme, appointing contractors under the Geyser Load Reduction Programme. They were thus already on-board and readily identified for funding in the national programme that followed. Strong relations and good communication with the national DoE also helped to facilitate eThekwini's engagement with the national programme.

In Sedibeng the office of the Executive Mayor defined clean energy as a focus area of the municipality and in 2011 the municipality extended their traditional environment department to being Environment and Clean Energy. Sedibeng was then selected to be a recipient of the Danida Urban Environmental Management (UEMP) Programme funding and the donor-funded SWH pilot project was a showcase project for this new area of work. This existing pilot was likely a strong factor in the selection of Sedibeng for funding within the NSWH programme. However, the project never materialised after failure to reach agreement on the rollout model (Sedibeng wanted to be able to appoint and manage local suppliers and installers).

Cape Town has had two major rollout programmes relating to low income SWHs, Kuyasa and Joe Slovo. Kuyasa was developed by the NGO SouthSouthNorth (SSN), as a national programme, for the City of Cape Town in line with their Energy and Climate Change Strategy. It was a pilot CDM project that achieved a "Gold standard" CDM rating. The Joe Slovo implementation was part of an energy efficiency housing pilot project of the national

Table 2: Overview of the study municipalities SWH rollout programmes

Municipality	Roll out model	Time frame	Units installed	Type of system	Comments
City of Cape Town	Kuyasa – DEA grant funding; Joe Slovo – DoHS (Danida funding)	2008-2010	2 000; 1 500	Initial systems not good; replaced with excellent local system with lifetime guarantee against corrosion; Joe Slovo – 100L passive system.	Warranty on systems/ installation in Kuyasa was 3 years; but this found to be too short – failed after 5 years; Joe Slovo insisted on a 5 year warranty.
City of Johannesburg	City Power funded through internal DSM levy and Carbon finance (R800 m project; 3 years)	2011-2014	70-80 000	200 litre. Passive.	Warranty on parts and workmanship: 2 years; warranty on installation: 5 years. Carbon finance scheme in place.
eThekwini Metro	Eskom rebate and NSWH Social Programme	2009-2013	20 000	Both flat place and tubes used. Passive.	
Musina Municipalitiy	NSWH Social Programme allocation		-	-	Programme halted before rollout.
Polokwane Municipality	Eskom rebate; NSWH Social Programme	2012	250	100l roof mounted LP; tanks locally manufactured; tubes and stands imported. Passive	1 – 2 years warranty on systems. NSWH Programme allocation for further 3 500 halted before rollout, Eskom did appoint a company who did a feasibility report.
Sedibeng District Municipality	Danida-funded Urban Environmental Management Programme pilot	2010	1 500	Direct and indirect systems used. Passive.	Designed as Phase 1. A Phase 2 was planned; and they were allocated funding under NSWH Programme but turned it down after negotiations broke down with Eskom and DoE around centralised rollout.
Sol Plaatjie Municipality	First phase of NSWH programme	2010-2011	7 837	Stainless steel (304) tank with standard geyser fittings; solar collector x 12 1.8mm glass evacuated tubes. Passive.	

Department of Human Settlements and Western Cape Province. Both projects involved not only the installation of SWHs, but also other efficiency interventions. In Kuyasa the retrofit included insulated ceilings and energy efficient lighting. Joe Slovo was a new build social housing pilot that included thermally efficient housing design. Neither programme involved the municipality beyond the role of community liaison facilitation.

The City of Cape Town has thus not yet itself undertaken a low pressure rollout programme. They did not apply for funding from the NSWH programme in part due to the rollout model in which the local municipality had no powers to appoint service providers through their supply chain processes and yet knowing, from their experience with Kuyasa, that they would be ultimately responsible for the systems. Cape Town would like to apply now as they see that they could develop a model which would be beneficial to the City, in which they could use national funds for capital financing of the systems and develop their own internal maintenance service model. However, given the need for the poorer provinces to receive a proportional allocation of the funds (they have received little to date) City of Cape Town energy office staff consider it unlikely that they would receive funding in the near future.

SWH activity began in Polokwane under the initial Eskom rebate programme. This rebate enabled Eskom accredited service providers to offer a rollout, and then they applied for the subsidy which covered their costs and enabled a viable business proposition for them. This was found to be problematic in Polokwane as a number of companies arrived and engaged councillors and communities, raising expectations, which were later not able to be met. For example a company offered SWHs to a community and then, on discussion with the municipality, the proposal had to be turned down as the water quality in the area was not good enough. The municipality was then made to look as if it were the reason for the disappointment. Polokwane did see a rollout, under this scheme, of some 250 units.

Musina and Polokwane were then invited by a DoE to a provincial briefing session and to submit proposals (RfI) within the NSWH Social Programme (DoRA allocation), which they did. On this basis they were allocated funds. Polokwane has been very involved in the DoE's EEDSM programme, and was also in a process of developing an Energy Strategy through SALGA-led support (SDC funded). It is likely that this put them in a strong position to be identified for funding. Funding allocated to Musina was linked to that of Polokwane. Musina do not have any form of energy strategy, but were motivated to apply as they believe they have a massive solar resource and that the programme could reduce load on the grid. However the programme was halted before any rollout under this funding scheme took place in either Polokwane or Musina. Musina municipality was disappointed, and felt that communication from DoE was poor as they had been instructed to pursue the work and were not informed that the programme had been put on hold. Polokwane feel that there has been little continuity, and are anxious of further promises that don't materialise, or installations followed by companies disappearing.

The City of Johannesburg, through City Power, embarked on their own rollout programme. This has been funded through a local DSM levy (1 – 2c/KWh on customers using above 500KWh/month). Their rationale for not pursuing participation in the NSWH Social Programme was that this route was too slow (too many hoops to jump through) and they could not appoint service providers without a source of revenue (firm commitment that the funds were secured) – in fact they could not appoint their own service providers at all within the rollout model.

3.1.2. Core objectives of the programme and institutional location

As noted, the very first SWH programme was Eskom's Geyser Load Reduction Programme, which was specifically intended to reduce load/electricity demand. Despite the electricity crisis post 2008, some municipalities were still not enthusiastic about engaging in a programme that would lead to reduced sales. The understanding of the role of SWHs in relation to revenue and demand and load management has since become a lot more sophisticated, with more municipalities seeing advantage here, but initially it was only pioneers, such as eThekwini and Nelson Mandela Bay Municipal Metro who moved into the space. For NMBMM the motivation was to contribute to Eskom's proposed Power Conservation Programme, that was to require a 10% demand, or load, reduction across the board, and to improve community members access to hot water.

With the launch of the NSWH Programme and its Social Programme component, the stated programme goal has shifted from load reduction to an emphasis on the social goals of universal access to SWH services for all, addressing energy poverty, enterprise development and job creation and skills development. However, the experience of municipalities and service providers has been that the indicators to monitor the programme do not match the stated goals and, further, the contract specifications and funding has also failed to adjust to the new goals. Indicators measure numbers of units installed and number of jobs created and a "chasing the numbers"

approach is common: this fails to measure the quality of skills developed, the ability to achieve long-term, sustainable jobs, the community buy-in and ownership of the new technology. Funding also fails to duly support these more complex, social goals.

There is a fundamental difference in aim and method between a "DSM project" and a social welfare project. It was frequently mentioned that despite a social aim, the actual contracting arrangements did not support this: for example the Sol Plaatjie contractor in fact submitted a maintenance plan in their proposal, but this aspect of the proposal was rejected; similarly within the City Power tenders, despite the social intention, the maintenance element was left out of the contract. Service providers mentioned that the community education and liaison requires time and effort; supporting the development of emerging contractors in installation also involved complex bridging finance arrangement undertaken by larger suppliers and the relationships around this, and risk undertaken, were in a sense 'pro bono'.

The goal of the programme also impacts on the institutional location of the programme. The initial emphasis on load reduction has resulted in the programme being commonly located within and driven by Electricity departments, or Energy offices (NMBMM, Polokwane, eThekwini, City Power). An interesting experience in the City Power rollout was where the systems could not be stored within City Power as the parts had no SAPs coding within the department system. This was because the parts are not electrical – low pressure systems rather relate to plumbing. This raises the critical point that low pressure SWH installation is largely a water department functional issue – relating to piping, plumbing, etc. The City Power staff from procurement and legal know the wiring and electrical codes well, but don't know the plumbing story at all.

Consideration must be given to matching the functions required, from a procurement and installation and maintenance perspective, to the capacities of a particular department. Thus, SWH rollout should possibly be located within Water departments, even if the outcome of the installation, and motivation for the installation, relates to energy and electricity. Within eThekwini the programme has been located within the Human Settlement and Infrastructure cluster of the municipality and managed by the Energy Office, in collaboration with Eskom, the eThekwini Housing Department and eThekwini Water and Sanitation Department. This has ensured smooth cooperation amongst all key stakeholders, particularly within the municipality where the rollout relates to housing, water and energy services.

3.1.3. Ownership clarity and clear delineation of the benefit, or service, being delivered

A big stumbling block experienced in the relationship with the beneficiary community, particularly in relation to post installation maintenance issues, was the lack of clarity as to the exact nature of the benefit or service being delivered and where the responsibility of the home owner begins and ends. This is particularly important for municipalities as in all instances within the study, the home owners assumed that issues arising with the systems post installation were the responsibility of the municipality – irrespective of whether the municipality had delivered the system or not.

This is currently unclear and likely to remain so for a while – it is likely to be an evolving area, dependent to some extent on community take-up, sense of benefit and 'ownership' of the initiative and technology, which in turn is dependent on the programme investment in community education and awareness. In SPM, for example, the understanding was that once the units were installed, they were handed over to households who become the owners and responsible parties. Similarly, in Johannesburg, when City Power wanted to get insurance for the systems they had installed – knowing that a bad storm could potentially damage thousands and that the municipality would be expected to replace system parts - their legal and financial staff said they couldn't get insurance as technically, post installation, the units did not belong to City of Johannesburg, but to the residents themselves. However, as noted, in practice residents are poor and simply cannot afford the longer-term maintenance, resulting in a disjuncture.

It is a complex issue: Polokwane noted that households that suffer damage through leakage resulting from the installation will not be able to claim insurance on damaged goods as the leakage will be deemed to be their responsibility.

3.1.4. Beneficiary identification

Within all rollout programmes (NSWH Social Programme, donor-funded, municipal) the municipality has been responsible for identifying the beneficiaries of the units; this necessarily flows out of the programme goal and the vague brief ("low cost households") made this challenging. Problems that emerged were the exclusion of clinics and old age homes, and in some instances homes with existing geysers (SPM).

The number of beneficiaries that can be serviced also depends on the costing per unit. In SPM beneficiary

identification happened before the costing had been done and the municipality had to go back to the community to find additional beneficiaries. This was time consuming and clumsy. This was also done, in SPM, not on a block basis, but on an income basis (i.e. households spread across all 28 ward areas), which created enormous conflict.

City Power/COJ looked at the number of houses that had been electrified (110 000) and used this as their target. As they were intending to undertake a comprehensive rollout and could draw on own funding they were able to use such an approach. In Sedibeng, where the pilot project involved a limited number, the municipality avoided the bigger townships (Sebokeng and Sharpville), and looked instead for a community where they could cover the entire area with systems, so as to avoid conflict within a community. Kanana and Ruster-Vaal were identified, as they had sections in the community with the right number of houses.

In Polokwane criteria was simply a RDP house with running water. The rollout of 250 was not done on a 'area block' basis and this resulted in some confusion – community members were not able to understand the criteria as to who was selected for rollout.

Within eThekwini the Housing Department was responsible for identification of areas for rollout. Only low cost government houses qualified for SWH installations. Areas chosen were decided by the municipality and based on technical requirements such as water and electricity connectivity (had to have meters), roof quality, roof slope, water quality. The councillors together with the installation company would decide on actual households getting the SWHs. Generally it was a first come first serve basis. The municipality did not experience any problems with this approach when a good installation company was used.

Thus, broadly the selection criteria in identifying the community have been:

- The community needs to be poor – sizeable number of indigents;
- The community is a recipient of RDP housing
- There must be a water supply to each house
- Within an area, allocation of a SWH would depend on structural strength, and pitch, of the roof (defined in NMBMM as having 9 trusses).
- For City Power and NMBMM there was the additional "economies of scale" component: sufficient (ideally 1 000) qualifying households within the rollout area for efficiency in installation and the establishment of a functional central site office.

In terms of area identification City Power used GIS maps to identify certain erf sizes. Locating plots in eThekwini using erf numbers was complicated, sometimes multiple plots had the same erf number.

3.1.5. Procurement

The programme management of the NSWH was vested with Eskom, who advertised nationally for sub-contractors to supply and install; as well as for project management service providers. Local municipalities were not involved in the tender or appointment process. The experience of those involved was that few specifications were given and key elements of proposals, particularly relating to pre-feasibility and maintenance plans, were excluded from contracts (SPM). As the municipality undertook the beneficiary identification and selection and community engagement they were seen by the beneficiary community as responsible for the project and any related problems, although they had nothing to do with the appointment or management of the suppliers and installers. The municipality was required to play a fairly large role, yet were not provided with the resources or support to do this.

EThekwini's initial involvement was through the rebate programme which involved an open system of drawing on any suppliers registered on the Eskom database. In their experience this bypassing of the usual supply chain procedures meant that there were 'fly by night' companies which produced poor workmanship. A maintenance component was built into the contracts, but some companies simply shut up shop on completion of the installations and departed. As appointments were often political, there were no repercussions for such companies.

As part of a donor funded initiative, Sedibeng drafted their own TOR (drawing on experience of metros such as Ekurhuleni and COJ) which included supply, installation and 3 year maintenance period. This also included a requirement that the service provider train community based people to do the maintenance. Sedibeng felt so strongly about their role in the project management and appointment of local service providers that they ultimately turned down the R30 – R50 million NSWH allocation for some 10 000 systems as they would not be able to undertake the service provider appointment. Sedibeng felt strongly that there was an expectation in the community that local installers would benefit and they could not abandon this approach.

Sedibeng has explored alternative approaches, putting out 2 – 3 calls for quotations in which a service provider looked at how they could undertake a SWH rollout and source funding to do it. Two companies were in fact appointed, on the basis that they source the funding for the rollout, but nothing has materialised out of this yet. This means that they have not yet had to face the challenge that would emerge in this approach, as per the DoE/Eskom model, as to whether the municipality or appointed service provider would appoint the installers. The appointed service providers are not local to Sedibeng and the sense is that this approach won't really fly in Sedibeng.

Although municipally driven, the City Power rollout, on the other hand, did not include a maintenance component. The programme was initially drafted with a 3 phase process in mind: supply of systems, installation and maintenance, however the maintenance component never made it into the TOR or subsequent contracting. The separation of systems supply and installer contracts is a fairly common model of rollout (the rebate programme also used this approach). While this separation enables smaller installers to be engaged it also led to a number of difficulties. Allocation of installer to supplier in the City Power rollout was done somewhat randomly, i.e. no provision was made to ensure that the installers were from the area, or matched (language, culture-wise) with the community. Also, this resulted in suppliers being dependent on installers with whom they had had little previous relationship.

Installer contracts amongst the 20 installers in the City Power rollout were all the same, and noted the potential number of installations. Every six months the actual number was allocated on the basis of a Works Order. While the contracts amongst the 20 installers were equal, the allocations were not, which resulted in tension amongst contractors. Contractors included small, emerging companies and larger companies. The bigger companies could do many more installations. Again, working with this requires clarification of the mandate – is volume and numbers the goal, or development of small businesses. If the latter (as ostensibly the case) then the programme should be given adequate time to allow for slow rollout; if volume is important then this will automatically exclude smaller companies. Those who worked in the City Power rollout believe that both of these goals can be achieved, but then this difference in goal must be reflected in slightly different contracts.

Where there are different service providers supplying systems and installing them then clear lines of responsibility over clearly defined areas of operation need to be in place. In Johannesburg suppliers held responsibilities across different components of the rollout, including within the installation component, and this was not ideal (e.g. supplier also being the manager of the CLOs).

The lack of transparency in appointment of service providers within the eThekwini rollout has had a negative impact on the willingness of installation companies to participate in the programme going forward. This relates to having to carry the burden of maintenance where other companies simply closed up shop and departed, yet suffered no consequences. The sense is that the PV and high pressure SWH market is expanding rapidly and there is less need to participate in government-led tenders. The concern here is that quality companies may leave the space and low income SWH delivery suffers.

3.1.6. Management structure

Although a management company was appointed within SPM, the experience was that the municipality undertook many of the project management tasks. In response to a lack of coordination and communication, the municipality (through the Sustainable Energy and Climate Change Unit) pushed to establish a steering committee. This included the municipality (both official and political), contractors and Eskom.

The project management contractor tasks in SPM included inspection and sign-off of work. There was a disjuncture in the appointment of project management and quality control agents and the installation process that resulted in challenges relating to invoicing, sign-off and cash-flow for the installers. Very similar problems were experienced in the City Power rollout. The SPM experience was that there were too many parties reporting up a line of responsibility making communications and project decision making complex and cumbersome.

Project management in Sedibeng rollout was held by the Environmental department within the municipality. Although the person who held this has since moved on, as she has moved to the eThekwini Energy Office, the capacity developed is not lost to the country as a whole.

Overall project management in the City Power rollout was unclear. This sat partly with the municipality and partly with the suppliers who had roles in terms of installer training and management of the Community Liaison Officers (CLOs). In practice, when the Quality Control people were appointed during the last 8-9 months of the project they effectively took on this role, particularly the facilitation amongst all the various stakeholders and contractors.

eThekwini have held a project management role within their Energy Office. Like SPM they have established collaborative structures with Eskom, the eThekwini Housing Department and eThekwini Water and Sanitation Department in order to keep lines of communication open amongst all stakeholders. Responsibility for the supply and installation, training, local employment, administration and some monitoring and verification was vested with the four private sector service providers. They also accessed the Eskom subsidy on behalf of the programme and co-manage the carbon finance. The service providers also conducted awareness-raising programs in the community.

In all instances the municipalities have employed, as per standard municipal procedure in any community-based project, Community Liaison Officers (CLOs) who have been the go-between between the community and installers and project managers.

In addition in eThekwini the Water and Sanitation (EWS) Department allocated four water inspectors to assist with the quality of installations that take place and to check whether the installations comply with the municipal by-laws. The Energy Office, together with Housing and Water, were responsible for all the reporting to Eskom, indicating a close level of inter-departmental cooperation and collaboration.

Although Musina never reached implementation, the initial work was pursued by the Senior Technical Manager from the Infrastructure department. This location in a smaller municipality makes good sense as it draws on the technical departments of electricity, water and housing (where held in the municipality).

3.1.7. Maintenance and long-term sustainability

In the majority of instances, no proper maintenance contract or even a maintenance plan has been put in place, only a warranty on the installation and the product itself. This situation exists despite there being a general consensus amongst municipal staff and installers that the households cannot afford the upkeep, nor have the skills required to undertake regular maintenance, which may result in the non-functioning of systems, defeating the goals of the programme and affecting the beneficiary community 'ownership' of the new technology.

The Sedibeng experience also affirms that even where there is a maintenance period built into the contract, once the installation is completed, the municipality in effect becomes the responsible party – complaints are directed here and there is an expectation that a response should be forthcoming from the municipality. CLOs in Sedibeng were thus asking the municipality for money to fix systems and this situation couldn't work in terms of the municipal procurement process.

Sedibeng officials indicated that over time people have started to realise that the SWH is their asset and if there are problems they should find the means to fix it as most problems are very small – R20 jobs (e.g. new valve). So, people do tend to take ownership over time. A clear line does need to emerge, however, where personal responsibility ends and municipal responsibility takes over. Poor residents simply can't afford parts replacement and ultimately it is the municipality's responsibility.

None of the municipalities reviewed had given real consideration to what happens once parts begin to break and systems reach the end of their lifespans. In Sedibeng the broad sense has been that the project would create a market for SWHs and thus drive down the unit price, enabling a market system to being to take over the subsidy space. It was also noted, however, that the rollout has been packaged into big tenders and SWHs have, as a result, become 'tendering product' rather than a product for sale in small units, across markets.

A number of the municipalities relied on anticipated carbon finance streams to cover down-the-line maintenance and replacement costs. The Kuyasa project in Cape Town was designed to bring in carbon credit money to finance the maintenance of systems. An agreement was signed with the City for the good management of the carbon financing, but the carbon market fell through and no carbon finance has been received to date. The project did not have a maintenance contingency plan in place and to date no systematic maintenance is in place. This has caused enormous problems within the community, with the local community person who had been employed as a liaison person in the installation phase being targeted and fearing for his personal safety.

EThekwini also packaged their programme as a Clean Development Mechanism (CDM) "Programme of Action" (POA) to save carbon emissions and earn carbon credits that was meant to fund the long term maintenance on the SWH units. When the carbon finance was not forthcoming some companies had to absorb the costs; in other instances, where the companies had closed up shop, maintenance on these units was funded by government. Each SWH has the contact details of the installation company as well as the contact number for complaints. Some companies attended to maintenance issues unfunded as their products had 5 year warranties.

Additionally, some installers performed their own yearly services on the units.

Standard Bank has developed a CDM Programme of Action available for use on SWH projects and City Power does have a carbon finance stream coming from registration and participation in this scheme. However, given the collapse of the carbon market this is currently far below what is required to pay for maintenance.

Building on some of the experiences of earlier rollout projects, the national Department of Human Settlements/ Western Cape Province Joe Slovo pilot project included a longer guarantee on systems and a maintenance plan that involved local community members trained to provide maintenance services, run by a maintenance company. A person in the community was appointed as the go-to person for any SWH related issues and this person liaises with the local maintenance company.

A post-installation survey within NMBMM[7] recorded that the vast majority (around 95%) of maintenance issues experienced within the months after installation related to leakage. Zero tolerance on roof leakage and good education around understanding overflow are crucial. Good installation and good communication can thus greatly reduce the early maintenance issues. On-site maintenance staff, with quick response time, was noted by most municipalities as critical. Longer-term maintenance, as systems begin to break down, requires dedicated funds and clear vision as to the ongoing future of the systems within the municipal services framework.

3.2. Technical review and processes of quality control

3.2.1. Type of SWH and installation

In general the typical installation within any social programmes are low pressure stainless steel (100 or 200 litre tank) with standard geyser fittings. Solar collectors have included both flat plate and evacuated tubes (twelve 1.8mm glass evaluated tubes). Direct and indirect systems have been used. All systems are passive, i.e. no electrical back up. A mixing valve is usually included to ensure water is tempered (vital on hot days when temperatures can reach 90 degrees Celsius and become dangerous to users).

Units are mostly roof mounted on painted steel stands, facing north. Where north has not possible, west-facing and some north-east installations have been undertaken.

Costing of systems is approximately: R5 000 for the system (inclusive of capital equipment – tank, collector, piping – and all management, storage and transportation costs); and R1 120 for installation (again full cost).

On the whole the study municipalities did not report major issues with the systems or installations. Sedibeng mentioned not more than 100 complaints since the initial installation, and eThekwini installers mentioned 1 or 2 complaints every couple of months. There have been certain, notable "teething problems", which points to the importance of system and installation warranties that are of sufficient length. In Kuyasa the initial systems sourced were cheap, low quality Chinese systems. Only after the first 1 500 installations was it realised how bad the quality was. In 5-6 cases systems have actually fallen through rooftops, because the stand/cradle on which the tank rested rusted through causing the tank to drop onto the roof from a height of 1.5m. The SWHs would often boil the water which was then lost through an overflow pipe onto the roof of the building. This would result in water wastage and could result in roof damage. Local systems were sourced for the remaining 500 units. This was more expensive, but they were of a much better standard. They included a system where the boiled overflow water was captured and circulated back into the system. The tank cradles were more robust. Certain problems with these systems only emerged nearly five years after the installation.

In NMBMM leakage was noted as the main cause of dissatisfaction with the programme post installation. It also emerged that the difference between overflow and leakage was often unclear for households, resulting in dissatisfaction that could be easily avoided.

Typical problems encountered across all study sites include:

- Households did not have a water connection and had to be skipped until a connection was installed.
- Hard water (for example in SPM) results in scale build-up which needs to be dealt with.

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- Copper piping susceptible to hard water, increasing the chances of maintenance issues later.
- Mixing valve struggling to deal with the 4 bar cold water municipal pressure on the one side and 2.5 bar gravity fed hot water on the other.
- Breakage of evacuated tubes.
- In some instances stabilisation of roofs was necessary.
- Water quality and content of the water supply hugely affects the low pressure systems.
- Through-roof penetrations leaking when it rains.

3.2.2. Quality control measure and monitoring

Within the City Power rollout 2 levels of inspection were in place: the first was done by the suppliers and the second by an appointed quality control contractor (the QC). The second involved a random 10% sampling in which an 80% pass rate was required – or installers would be required to fix the whole batch. Although the system was thorough, the snag was that the time required between installation, first inspection and second inspection was too long, and installers suffered from cash flow challenges.

A more rapid inspection process had to be introduced and the learning was that the emphasis should be on upfront training of installers and very clear, "zero tolerance", standards to ensure quality. This lesson is borne out in the fact that the "problem installers" in the City Power rollout were generally those where there was a more frequent turnover of managers and labour and this meant that new staff had not received the training from the suppliers. Experience in SPM also indicates that it is critical to have very clear technical specifications which the QC may sign off against.

Where the supply and installation contracts were separate, as in the City Power rollout, system non-performance resulted in tension between the contractors and the difficult question of whether the issue related to the product or the installation.

In eThekwini installation companies were paid as the project was completed, without the units being audited. This resulted in poor workmanship as companies were not held liable thereafter. Although there were auditing processes, this was also felt to have been inconsistent across the different contracts.

Quality control contractors noted that it is difficult to provide accurate figures for monitoring. There is the system supply stage, the installation stage and final payment on completion and passing of quality control. So figures of systems installed may get skewed along this continuum: figures may include those supplied but not installed; later these may be recounted when the count focusses on total installed over the period.

EThekwini municipality had intentions to develop a database to aid in M&E but did not have the human or financial resources to undertake this mammoth task: the process of capturing information is onerous and would take too long to complete. Experience has shown that installers do not capture data adequately and correctly and data thus needs to be verified and/or redone before capturing can take place in the database fully.

3.3. Job creation, skills development and enterprise growth

All study municipalities consider that such a programme is an important opportunity to create jobs within a local community. In SPM the local labour component of installers was about 70%. Within the City Power rollout they drew on the Extended Public Works Programme (EPWP) through which two local people were employed per area of installation. Sedibeng rollout also drew on local community based labour. It is also worth noting that the NMBMM post installation survey indicated that the rollout had little impact on job creation. While 24 local people were employed, this employment was very short-term. The rollout resulted in the creation of 1 permanent, part time position[8].

Upfront training of the EPWP workers was done by the suppliers in Johannesburg and was good. In SPM the local labour was also trained by the supply and installation company, but the municipal perspective was that training and capacity building essential for skills development was erratic and disappointing. Also raised by municipalities was the issue of good intention, but short sighted processes where often the numbers

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employed are counted, rather than the quality of the skills developed, the length of employment and the opportunities for longer term employment.

Sedibeng noted that use of local community members is a complex process, with all the usual challenges relating to who is selected and how payment is done, arising. The initial process of payment on a daily basis was soon shown to be detrimental – it was in the interests of the local labour to work slowly in order to maximise the number of days. The contractor soon realised it was better to pay on an output basis – per installation. In general, however, the use of local labour worked well and in some areas these people are still working – involved in the maintenance of systems.

eThekwini installers noted that job creation requirements included gender equity, but the nature of the job, involving a lot of labour intensive work, resulted in many women quitting and this impacted the delivery timeframes as new staff from the community needed to be trained again.

All municipalities and suppliers/installers noted that training community members is time consuming. If this is a goal of the project then it must be realistically costed to make it in the interests of the service providers. Further, the identification of who is to receive training is complex and requires time and attention. This is inevitably a role that the municipality has to oversee.

In terms of broad enterprise development substantial experience has developed. During the first engagement in low income rollout, in the Zanemvula community in NMBMM, Tasol suppliers used local franchisees as installers and project management on site; during the second phase they opted to sub contract all allocations to emerging energy service companies (Escos) as part of a development programme. Tasol trained these guys and the system worked relatively well, with 9 sustainable companies emerging; in a third phase of development these companies applied directly to Eskom for contracts/ allocations, with Tasol supporting them through providing bridging finance on condition they purchased systems from Tasol.

In the City Power rollout the system worked less well as Tasol had no control over which emerging installers they were to work with – there was no previous relationship or training process that had been undergone.

Tasol note that the big issue for emerging companies is the financing gap: they have to have cash flow to pay labour (within the NSWH Programme the Eskom turnaround time was around 3 months). In general this labour – often community-based - has to be paid at week end. This finance gap must be given consideration if a programme wants to bring in smaller, emerging businesses. Tasol created a system where they provided financing (advance payments) but had a third party payment agreement with Eskom, i.e. Eskom paid them and they deducted the advance payment and gave the rest to the installer companies. While this can work well, it does require that the bridging finance company (in this instance Tasol) takes all the risks. Kwikot have followed Tasol with this model. Developing trust and relationships between all the parties is key, particularly as it deals with sensitive issues relating to money and contracts.

Another model piloted by Tasol within the City Power rollout relates to maintenance. In Alexander a local community worker was trained as an installer and then supported to establish a small call centre. This enables Tasol to effectively delivery on their warranty and maintenance commitments. Tasol has donated a vehicle and provided computer skills training. The community worker has extended this business into basic plumbing, building up his own business this way. There is scope for plumbing shops in these areas and this would be beneficial also for municipalities for whom water leaks are a sizeable challenge. However, Tasol still believe that for long term sustainability some ongoing funding stream will be required to keep him in business.

Suppliers and installers feel that, in the main, government has noted that community upliftment, job creation and enterprise development are the main goals of the programme, but they do not provide enough support towards seriously achieving those fairly complex goals and that, to date, the private companies have ended up paying for this. This is not a sustainable situation and puts the emerging enterprises at risk.

On a less positive note, the hiatus in the NSWH programme, and the lack of clarity and communication with manufacturers around the specifications of the local content requirement, has severely negatively impacted the local industry and resulted in substantial job losses. In Polokwane, Kgabo Developers, manufactured tanks and were delivering to Tzaneen, Ekurhuleni and Polokwane, using 5 certified installers, which were drawn from the local community and trained by Kgabo Developers. However, the business has since shut down. Without the mass rollout business has been too slow to keep the factory going. Tasol had employed some 500 staff members with their establishment of a flat plat manufacturing plant; however lack of communication about the programme future and the specifications of the 70% local component

(which is strongly supported) has meant that they have had to retrench 450 people.

3.4. Community benefit, engagement, consultation and education

In very few instances have any proper impact studies been undertaken. A monitoring process of four households in Joe Slovo indicated that energy savings in houses measured varied sizeably (8 – 100kWhs per month), due to the amount of hot water used by the household. This translated, in 2013 price/tariff terms within Cape Town, to monthly savings of R7 – R91 per household. A community survey indicated that 98% of beneficiaries felt that their life had improved since getting the SWH, indicating a high level of satisfaction with the new service.

A survey undertaken undertaken in Zanemvula (NMBMM) noted that it may be too early to harvest impacts, but that initial outcomes have been, largely, extremely positive. The SWH installations resulted in avoided paraffin and electricity usage, and enabled greater electricity usage to meet other needs, such as for cooking household heating and lighting, which in turn displaced use of paraffin, resulting in improved welfare amongst households[9]. Beneficiaries expressed that life is easier with the SWH, and that is saves both time and money.

Those engaged in the quality control of the final phase of the City Power rollout had a strong sense that the project impact is very positive, and that such an intervention is very worthwhile. Similarly in Sedibeng the municipality reports that the majority of the community have been very excited about the installations. For Sedibeng there are multiple health benefits as coal is used in these communities for heating water, which is a huge indoor and local air quality issue. Sedibeng certainly see the programme as having enormous local and global health and environmental impacts; it can save electricity costs for households, ease the lives of the elderly and create jobs in the community.

Possibly the greatest benefit and greatest appreciation of the service, has been amongst the elderly and in particular women (Sedibeng and Kuyasa). The reason, Sedibeng officials believe, is that the elderly know the real hardship of growing up without hot water and no access to electricity; also the elderly and women are the people who are often looking after the babies and young children and they must bathe and get them ready for school each morning and this hot water makes this job far easier. The NMBMM survey also indicated the greater ease in terms of preparing children for school, keeping babies clean and healthy and the ability to warm babies' bottles.

There were no definite reports of theft of systems being a big factor, but it was noted in Johannesburg and eThekwini as possibly being an issue.

Municipalities consider that the education and awareness process undertaken by the installer to have been key in achieving the felt benefits by the community (notably Sedibeng and Kuyasa). Education and awareness of community is a lengthy process. If this is to be a big part of the project then this must be accommodated in the budget. The eThekwini installers noted that these requirements were time consuming yet the total value of the contract remained the same, inevitably resulting in contractors short changing this aspect of the rollout. SPM also noted that the project management company was meant to develop information pamphlets on use of the technology, but this had not been properly followed through. City Power contractors also noted that community engagement can be challenging and that this needs to be acknowledged and planned for – right down to the gun at head, knife at throat situations which can and do arise. Given that this will be a part of the process, there was some query as to whether such situations can be handled through a long process chain going all the way back to a centrally/nationally held contract.

An important part of developing the community's sense of benefit is also to clarify the nature of the service – it is not a "free" service when the households are expected to fix and maintain, but if there are clear lines of responsibility and quick response time from the municipality or supplier, then a sense of 'ownership' and responsibility amongst beneficiaries will emerge. This aspect of the rollout is crucial; the NMBMM SWH rollout survey undertaken indicated that people expressed high levels of anger and fear around who would pay for the ongoing maintenance of systems. This is thus an emotive issue and must be addressed upfront and with great clarity and thorough engagement with the beneficiary community.

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4. The scope and role of Local Government in the rollout of a national solar water heater social programme: best practice recommendations

SEA's State of Energy in South African Cities, 2015, again indicates the critical role of solar water heating in any lower carbon future trajectory for the country[10]. A detailed cost benefit analysis undertaken for the City of Cape Town (looking at both mid-high and low income rollout) further indicates that such an intiaive appears to be economically efficient[11]. Numerous municipalities have energy strategies in place and these include targets relating to SWH installations. Much experience has been gained on the rollout process over the past six years, and new initiatives, including the New National Solar Water Heater Programme, are underway.

It is a strongly held belief that local municipalities need to be involved in all the development initiatives which take place within their municipalities; and the DoE have also noted that municipal participation is key to the successful delivery of the NSWH programme, particularly the social programme elements of capacity building and community support (comments by Members of Parliament at the 2014 briefing by DoE on the NSWH programme).

In terms of the constitutional obligations of municipalities, as detailed in the Municipal Systems Act, Section 73 (1), (2) relating to general duties, municipalities are obliged to undertake their activities and deliver services in a manner that is financially prudent and does not harm the environment; further, Section 78 requires that municipalities take into account the following when taking a decision about the mechanism of service delivery:

Section 78

a. it must first assess
The direct and indirect costs and benefits associated with the project, including the expected effect on the environment and on human health, well-being and safety;

iv. The likely impact on development, job creation and employment patterns in the municipality;

v. The views of organised labour; and

b. It may take into account any developing trends in the sustainable provision of municipal services generally.

This provides a strong foundation for the consideration of SWH hot water services within a package of basic services – as it ensures more equal access to services, displaced environmentally harmful electricity usage and negative health impacts from indoor use of coal or other dirty or unsafe fuels for water heating. Municipalities may engage in SWH delivery through the New NSWH Programme, but also through other mechanisms, as demonstrated by the City Power rollout model. Should the carbon market

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11 Strategic Economic Solutions, 2013. This report notes that the single negative would be the electricity revenue losses to the City, but that the overall effect when taking into consideration local industrial growth and household income, is positive. This includes mid-high income rollout; a low-income rollout may in fact have a positive impact on City electricity businesses.

become viable again, this would also be another potential source of financing.

Although municipalities have been keen to embark on SWH programmes due to environmental and welfare considerations, there has been anxiety that the programme will result in revenue losses, through reduced electricity sales. However, this long-held belief is now being challenged. Both the City of Cape Town and Johannesburg (City Power) electricity departments indicate that there is a strong financial case for municipalities to consider SWH rollouts: within Cape Town electricity consumed on the low-income (Lifeline) tariff is 50-60% subsidised on top of FBE. This means that every time a low-income household uses electricity, the City loses 50% of the value of that kWh. This creates a strong case for Free Basic Alternative Energy such as SWHs. The sense amongst electricity departments is that the current subsidisation model cannot continue indefinitely. The electricity price to low-income users will have to increase. SWHs for low income households would be a good investment for the City. It will represent the provision of a service to households, as well as remove a financial drain on the City.

4.1. Municipal strategy and clear programme goal

The indications from the study are that SWH programme engagement or SWH rollout is optimised where there is a strong political commitment within the municipality and a clear and well developed strategy within which the SWH programme is located. Moving forward the indication is that real sustainability and success for a SWH programme will be achieved where it is increasingly brought within and considered within the service delivery framework of municipalities.

Successful delivery is important. The process must be undertaken well: experience in eThekwini indicated that quality companies may leave the low income rollout space if they must carry costs unfairly (particularly relating to training, community engagement and maintenance). This would potentially leave the programme at the mercy of 'fly by night' companies, which would be very damaging for service delivery and for the industry at large.

For municipal commitment to develop there is a need to "make the case" for SWHs. This requires ongoing and rigorous analysis (almost optimisation studies) of the costs and benefits, in terms of municipal priorities, of SWHs in the provision of household hot water services. This sort of examination is beginning to take place within City Power and City of Cape Town electricity department, but further detailed research on the impact of SWHs in low income housing on electricity peak demand and electricity saving is required.

This information, and a simple but strong 'case' for SWH as a municipal service, should be developed and disseminated through bodies such as SALGA and the AMEU. A clear message or case that demonstrates how SWH service delivery fits within municipal obligations must be made in terms of the local goals and objectives of municipalities: these are usually multiple: service delivery, job creation, revenue, environment, health and welfare, electricity demand reduction/energy security or alleviation of losses. In addition this must ensure that electricity and finance departments understand the benefits and risks to revenue and are comfortable with it and support the programme. Jobs are the biggest political driver, however in reality if anything is perceived as a threat to revenue this will be effectively blocked.

Municipalities should make SWH delivery a component of their long term goals and plans and a part of longer-term municipal service delivery – this would assist in driving the quality of service rather than numbers and provide an incentive for supply and installation companies to do a good job as they would then be showcasing their ability to undertake such work into the future. The short-term tender approach runs the risk of attracting contractors with an 'out for a quick buck' attitude. This would also provide an opportunity to use the process of intervention to include other efficiency services – efficient light bulb rollout, ceilings, etc. This was shown to be a very sound approach within the Kuyasa and Joe Slovo pilot projects. It also opens up the possibility of beginning to bring SWH installation into government housing delivery rollout (one contract), which can ultimately be a more cost effective approach than that of a retrofit.

It is really important to clarify the objectives/mandate upfront and ensure that it is reflected in the procurement process and adequately funded. It is also vital that the programme is located within a department whose goals align with that of the programme. If it is not seen as important – or aligned to department objectives – then it simply won't receive the attention and resources (human capacity) that it requires. Within electricity departments revenue is critical and issues such as revenue collection, for example, are considered a far higher priority than low income household energy services, therefore receiving greater resources. The programme must be framed in terms of key performance indicators of the host department.

4.2. Upfront programme design and Municipal SWH 'masterplan' development

If seen as an energy service, or household service (hot water) then the programme begins to develop a longer term commitment from within the municipality and, at the very least, a lifecycle support of the rollout. Detailed upfront design is required and consideration must be applied to the longer term requirements of such an intervention or service development.

It is worth considering drawing on experienced facilitators (experienced not only in facilitation, but also SWH programme management,) to undertaken a detailed design exercise with municipal departments. This would result in ideas, education and awareness within the municipality and drafting of a SWH masterplan. This should include elements – many of which are discussed in more detail, with the aim of providing input into a planning process, in the sections following - such as:

- Clarification of the programme goals.
- Programme design: this may include different approaches to different social or market segments within the municipality. For example, a 'free' allocation to registered indigents, but a 50% subsidy programme to other low income/RDP households. Programme design should consider (and answer) the ownership issue below. Part 'own' payment by a household may promote a sense of ownership by the household and assist with maintenance approaches.
- Consideration and clarification of 'ownership' of system post installation and a clear delineation of responsibilities amongst municipality, suppliers, installers, householders: is it 'free' with ongoing municipal servicing; or does it come with ownership responsibilities down the line? As above, this may be slightly different within different community segments.
- Designation of project management and departmental cooperation structures, as well as the identification and provision of suitable resources to do this (human resources notably).
- Developing a process for area and beneficiary identification. This should be part of a big plan, rather than ad hoc, i.e. a steady and strategic attempt to reach all qualifying beneficiaries as per the municipal social upliftment goals.
- Procurement specification detail, relating to all areas, but also including systems for damage to houses during installation (who bears the cost, how quickly it is fixed, etc.).
- Processes to match installers with areas for 'best fit' language, local-ness, and culture-wise.
- Consideration and planning for what happens at the end of the life of the system – as parts break down: will the system just be abandoned or is there a full maintenance and parts and system replacement programme in place? What should this look like? It could be private sector enterprise driven, or developed through municipal employment and service unit development.
- Consideration must also be given to where parts/ systems go as they break down.

This design or programme plan should be community focussed and local government led. It should be the common plan to all parties involved in the process.

It is also worth considering undertaking a quantitative and qualitative survey in order to establish a baseline. This will enable the programme to be assessed down the line in terms benefits through the investment in the SWH. Local tertiary education or research institutions could assist.

4.3. Financing or funding a SWH programme

Municipalities are hard pressed to meet existing service delivery demands. External funding is therefore an important factor in initiating SWH rollout in a municipality – at least until the benefits are very visible. The new NSWHP comprises of two components, namely, the Social and the Load Reduction components. The Social Programme which will be implemented in partnership with the municipalities will be fully funded by DoE. The implementation and management of the programme will be done by the DoE including contracts for various services such as procurement of manufacturers, installation companies and training providers. There is no funding transfer to municipalities. Municipalities are expected to play an important role in all phases of the programme such as social facilitation, technical feasibility, training and designating installation areas. Experience indicates that developing strong relationships with the national DoE is important, as well as a demonstrated commitment and the presence of political commitment and/or an overarching holding strategy. Attending national departmental briefings and allocating a contact person through which the department can communicate with the municipality will help to bring a municipality

to the attention of the department and facilitate an easy flow of communication.

The City Power rollout demonstrates that **'own' municipal** funding of SWH rollout is possible. City Power has done this through a DSM levy of 1 – 2c/kWh on units above 500kWh consumption levels (i.e. high end users, predominantly commercial customers). The rationale is that these higher end customers subsidise low end electricity consumers, and that investment in solar water heating now will reduce the ongoing subsidy demands on this group of customers. The City of Cape Town is considering this approach. The indication from the City of Cape Town is that an ideal funding mix would be to have the capital / installation funded from a national programme and the City establishing a fund to manage the ongoing maintenance and replacement of systems within the programme.

Carbon finance holds some potential as a funding stream, but this has proven unreliable given carbon markets. In addition, the funding kicks in only some 18 months post installation and thus its potential is limited to ongoing maintenance rather than upfront capital instalment costs. (Detail on carbon finance streams below).

4.4. Institutional development: Lead department and Project Management

Project management is key to the process and requires substantial capacity. The strong feeling amongst stakeholders was that ideally the overarching project management role should reside with the local municipality and build capacity (external consultants leave with all the institutional knowledge and this is not ideal). However, it was noted that **this requires that the municipality give it due attention and resources (human capacity). These are large projects and a unit, or team, with permanent staff, should be established and given the authority to manage such projects.**

The lead department should be that department where the service best fits and aligns with existing priorities. This may differ amongst municipalities and it is probably best for each municipality to decide this. The eThekwini experience also indicates the importance of involving all relevant sector departments (Water, Electricity, Energy and Housing) to ensure good coordination and collaboration.

Given that it is a new technology for municipalities, staff need to be trained to understand the technology and what to look out for in order to be able to manage and monitor the contracts and be able to respond quickly to complex technical, community or contractor challenges as they emerge.

Contracts must also include a skilled on-site project manager who knows what the problems are and has the ability to troubleshoot. On-site, 'micro' management can respond to issues as they arise and also develop a 'learn by doing' approach – enabling innovation and dynamic response to challenges. Strong facilitative skills are required within the project management mix as the rollout may involve multiple contracts, multiple communities, inclusion of other programmes (such as EPWP), smaller and larger companies with different needs and requirements.

Given multiple parties, there is a strong need for open and transparent communication and actions. This is best achieved when all parties are working according to a programme plan common to all parties (as above).

4.5. Beneficiary identification and minimum requirements for SWH installation

The municipal objectives and goals relating to the programme will guide the beneficiary and area selection. This should be strategic and long-term, rather than ad hoc. Best practice indicates the following when setting criteria or undertaking area/beneficiary selection:

- The identification of whole areas or communities, e.g. a suburban block approach rather than beneficiaries as per income, in order to avoid conflict and radically reduce installation costs through streamlined delivery.
- Areas should be "needy enough": select a geographic area where the majority are needy, even if there are some non-indigent within the area.
- There should be enough houses in the selected area in order to achieve economies of scale. In this regard 50 – 200 houses is ok, but 1 000 is much better. Areas could also be neighbouring, thus achieving sufficient scale. It is not only economies of scale, but it is important that the team of installers are in the area for a couple of weeks and thus able to respond to immediate issues, return to houses when QC comes in and has things have to be re-done.
- Areas may be unelectrified – no electricity supply involved, and as welfare or social upliftment project, such areas in fact should be high priority. The challenge here is that often these houses are not structurally strong enough to support the system.

- It is best if the majority of houses within the area don't have pre-existing geysers.
- Include and make provision for old age homes, orphanages and clinics. Hostels can be trickier as 'per family' is much easier to manage, but this has been successfully done at Lwandle in Cape Town.
- Single story houses are easier; double can be done, but there should again be upfront planning for this as it requires different installation approaches and equipment (more plumbing, different accessibility, ladders) and is thus a different job with different costing.

Specific technical requirements include:

- Areas should have water supply and water drainage systems and the water should be clean enough to prevent crud in the system (ability to flush, or filter upstream). Water quality should comply with SANS 241:2005.
- Water pressure must be above 3 bar, but below 6 bar for Low Pressure system. Extremely low pressure water supply is problematic as cylinders may still be empty in the morning and then may overheat.
- On average 15 – 20 litres of water per household occupant: thus household size for a 100 litre tank should ideally not exceed 5 persons.
- Houses should have a 'good enough' roof. Asbestos roofs, which are common to early RDP housing, are not great (these are toxic, brittle, and the supporting beam is hard to locate), but can be done. These do not need to be precluded, but should be treated with respect.
- Roofs must be strong enough to support 250kg (for 100 litre tanks). NMBMM point to the presence of 9 trusses as indicative of sufficient roof strength. Roof mounting must be able to support the geyser frame.
- The solar collector must be installed at an angle, between 30 and 60 degrees. Optimal latitude to be established in each location.
- The geyser should face north and deviate from that position as little as possible; however, late afternoon heating is generally preferred in South Africa, thus if North facing not possible, West facing is preferred to East facing. Facing direction should be limited to between West, North and North-east, heading 270 to 45.

It is recommended that GPS coordinates (rather than erf numbers) be used to identify and locate plots. This avoids complications from multiple plots on a single erf and will also assist with maintenance and monitoring/auditing. Aerial photography can also be used.

Given that not all houses will qualify (e.g. older RDP houses may have roofs that are not sufficiently strong), municipalities could consider supplying alternative water heating technologies, such as a simple black box heating system, in such areas. Good communication of the criteria and the technical constraints is vital if uneven rollout is not to lead to dissatisfaction among parts of the community (those who cannot qualify).

4.6. Feasibility study

A feasibility study will confirm that the identified area does indeed fulfil the qualification criteria. This should develop a database of potential dwellings, noting:

- the number of households per area
- household size
- water pressure
- water connections
- water quality
- housing type
- roof type and orientation
- electricity connection
- other structural problems

Such a study may also identify clinics, orphanages and old age homes and undertake a rapid assessment of the number of households who would wish to get a SWH, or not.

4.7. Community engagement

Once an area has been selected, the next step would be to engage the identified community and register beneficiaries. Communities want to and should be involved early on in the process. Poor publicity and bad experiences in the past relating to the SWH technology (such as roof damage), which have cost households, have resulted in a degree of suspicion. There is a need to create and develop confidence in the technology. This requires dedicated time and resources to upfront community engagement explaining the technology.

The following is recommended:

- Establish a process for structured engagement, following the standard municipal procedures for community engagement:
  - Establish the local project implementing committee.

  - Appoint Community Liaison Officers (CLOs).
  - Formalise the role of the CLO though a contract, MOU, or letter of understanding that identifies exactly what they are and are not responsible for, who pays them, lines of communication and authority.
- CLOs should engage runners within the area for effective and efficient communication.
  - Undertake a detailed process of information provision to the community about the technology, the installation process, the benefits and clarity on ownership and responsibilities post installation.
  - The community need to know exactly what procedures will be in place for damage claims during installation.
  - Consider a variety of approaches: the elderly may have greater appreciation of the benefit; youth have a greater attitude of 'what's in it for me', so consider demonstrating visible benefits for youth.
  - Once sufficient information has been provided, beneficiaries should sign up for the installation.
  - The process should allow for 'late joiners' – sometimes people say no, but once they see systems installed they change their minds; sometimes people are away at the time of sign up.
  - Where a community has big issues, it is probably best to walk away as these cannot necessarily be resolved in the project and can break a project.
  - There should also be a simple contract designed for the homeowner so they the homeowner understands the contract and their responsibilities.
  - During and after installation a quick response to community complaints is vital to build confidence in the new service/technology.
  - "Happy letter" sign off should be standard across all installers.

Additionally, community members should be capacitated on the use of the SWHs and what defects to look out for so that problems can be dealt with as they arise. Educate and raise awareness within the community, including schools (bring message home). This will help to develop the 'first line' maintenance response and should include:

- Introduction to the system and how to get the best out of the system.
- Procedure if breakage or damage occurs during installation.
- An understanding of the structural load and the importance of not structurally altering the house, particularly relating to supporting structures.
- Issues such as tempering: systems may flow better without tempering valves and community members may be tempted (or convinced by local plumbers) to remove them, but without the tempering valves there is the risk of children scalding themselves on excessively hot water
- Alert householders to the possible additional water costs if water usage increases.
- Clarify the ownership issue: that the SWH is not a 'free' thing, but comes with costs, responsibilities, and liabilities.
- Introduction to basic maintenance and problem solving: e.g. overflow because too hot, what to do if the ball valves break, how to isolate and identify common problems.
- Cleaning of filters.

Addressing leakage and ensuring that the community understands the difference between leakage and overflow is the easiest way to ensure satisfaction with the systems. Best practice information and training materials from rollouts undertaken across various municipalities should be compiled for easy reference and cost saving across municipalities. These could be stored on the South African Urban Energy Support website: www.cityenergy.org.za. Alternatively, these could be compiled into a training manual for use by municipalities.

4.8. Procurement/Product description

This section only applies to municipalities who are engaging in SWH service provider procurement themselves and are not part of a national procurement programme.

The upfront design, or SWH masterplan, will need to consider the use of one contractor from supply through to installation, or multiple contracts. Multiple contracts (supply and installation) allows a greater space for emerging companies and achieving the goal of local economic development. It may be worth considering different contracting formats for different size companies in order to give space to emerging companies, but also ensure that the numbers can be achieved: larger companies can produce the volume, smaller companies

can be provided the opportunity to grow without huge volume pressures. Where multiple contracts in place, make each contractor responsible for their component, rather than responsible for portions across component parts of the rollout (e.g. supplier should not also be in charge of CLO management and payment as this then moves into the installation component of the project).

Alternatively have one contractor responsible for all components of the project. The advantage of this is that the contractor can build up their own support office in each area. As the manufacturers brand is on the system, it concerns them to have no control over the installation as it is their reputation at stake when things go wrong. This also provides a strong reputational incentive to respond to complaints. Difficult issues relating to system non-performance (identifying whether it is a system issue or installation issue) can be avoided. The limitations is that it would likely exclude emerging companies.

The terms of reference (TOR) and related costing, need to provide a clear mandate to the service providers and ensure that these reflect the goals of the programme. Very detailed and comprehensive procurement documents have been developed within the programmes already undertaken and these can provide useful guidance, for example the documentation within the Joe Slovo project was very thorough and could be provided to all municipalities. As above this could be loaded onto the urban energy website, or compiled into a user-friendly manual for municipalities.

Appoint companies with a track record of delivery and good workmanship. Transparent appointment of contractors is important in order to avoid contracts flowing to companies that do not have the capacity to deliver good quality workmanship.

TOR and technical/systems specification should include:

- Include upfront feasibility study. Pre-feasibility study would pick up any potential problems (e.g. households without water connections that then need to be undertaken within the rollout process) and provide a realistic time frame. Although this can mean upfront time, it may save time in the delivery/ installation phase.
- Must include a maintenance plan; this should be held by the suppliers for the first 5 years.
- Clear procedures for damage claims during installation
- Systems must be high quality with guarantee/ warranty period longer than 3 years; ideally 5 years as this is when the problems start to emerge. In addition to safeguarding on quality systems, it provides a safety net for the municipality should faults arise and the municipality is blamed by the community.
- Locally produced systems are better quality and promote local manufacture (this will be a requirement of the national programme).
- A one size fits all type of system for each of the unique housing types (where they have different needs) will harness the benefits of standardisation and large scale orders to maximise bulk buying based cost reductions and quality assurances.
- Systems should be low pressure, without electrical back-up, roof mountable on inclined stand, mains pressure filled and with tempered water temperature output.
- Where applicable a standard set of parts that must be used should be specified upfront, with clear specifications with photos attached and contact details of suppliers.
- Include reference to standards and legislation to ensure product, installation and maintenance quality, and to ensure that local content requirements are met.
- Include reference to any bylaws in municipality. For example, eThekwini has a water bylaw which requires all systems that are connected to their water reticulation system be SABS approved.
- Differing pressures at the tempering valve: include feeder tank for the cold water and the addition of a float valve as well as the overflow feeding back to the main tank. This will eliminate any water wastage (as per Kuyasa).
- Include provision for 2 taps (currently usually just one) – this enables a household to have hot water in both kitchen and bathroom, greatly enhancing the benefit received.
- Use of PTFE piping outdoors rather than copper (which runs risk of theft, and is less effective)
- Tenders can be used to encourage additional benefits to be offered by the tenderer, for example in Joe Slovo additional solar powered courtyard lighting was received through the SWH tender.

The process should bear in mind that while standardised systems can help with maintenance – one type of spares applicable in all situations; the programme should not inhibit constant change and adjustment with systems

improvements (i.e. no technology 'lock in'). The industry is maturing and new devices may come on market that are more applicable and should be embraced (e.g. high pressure non-vented system off main pressurised system). It is recommended therefore that any programme should remain flexible around technology, and allow for innovation with regards to the supply of a range of options.

Importance of innovating 'on the job' is often stressed: unforeseen technical challenges can and will arise due to house configuration, building typology, etc. Thus it is important not to overprescribe, but at the same time to set clear specifications once a local area rollout is underway. The City Power programme innovation of building demo house installations as a reference for each different type of installation is a good way forward. This enabled the testing of innovations, teaching installers and setting the standard (visibly demonstrated) against which to measure and monitor the quality of the installation.

4.9. Installation process

A detailed outline of the installation process, including the activities of the CLOs and Runners, the various engagement processes, suggested installation team configurations, the installation process and the project management tasks is provided as an appendix, taken directly from the Feasibility Report on Solar Water Heater Installation in Polokwane, Limpopo, by Roshcon (a member of the Eskom Group)(2013).

An installation/installer unit should consist of 1 qualified plumber, 2 installers, each with 2 installer assistants. Each installer team should be able to install 6 units per day – ie. An installer unit should be able to install 12 systems per day. The total number of installer units deployed would depend on the scale of rollout.

Some important considerations to bear in mind during installation include:

- Fittings and installations should be as consistent as possible from house to house to avoid queries of fairness.
- Quality of installations should include leak-proof penetrations – quality control should have a zero tolerance approach.
- Zero tolerance on south facing orientation of systems.
- Establish a proper asset management system – serial numbers which can be tracked back to origin to avoid theft.

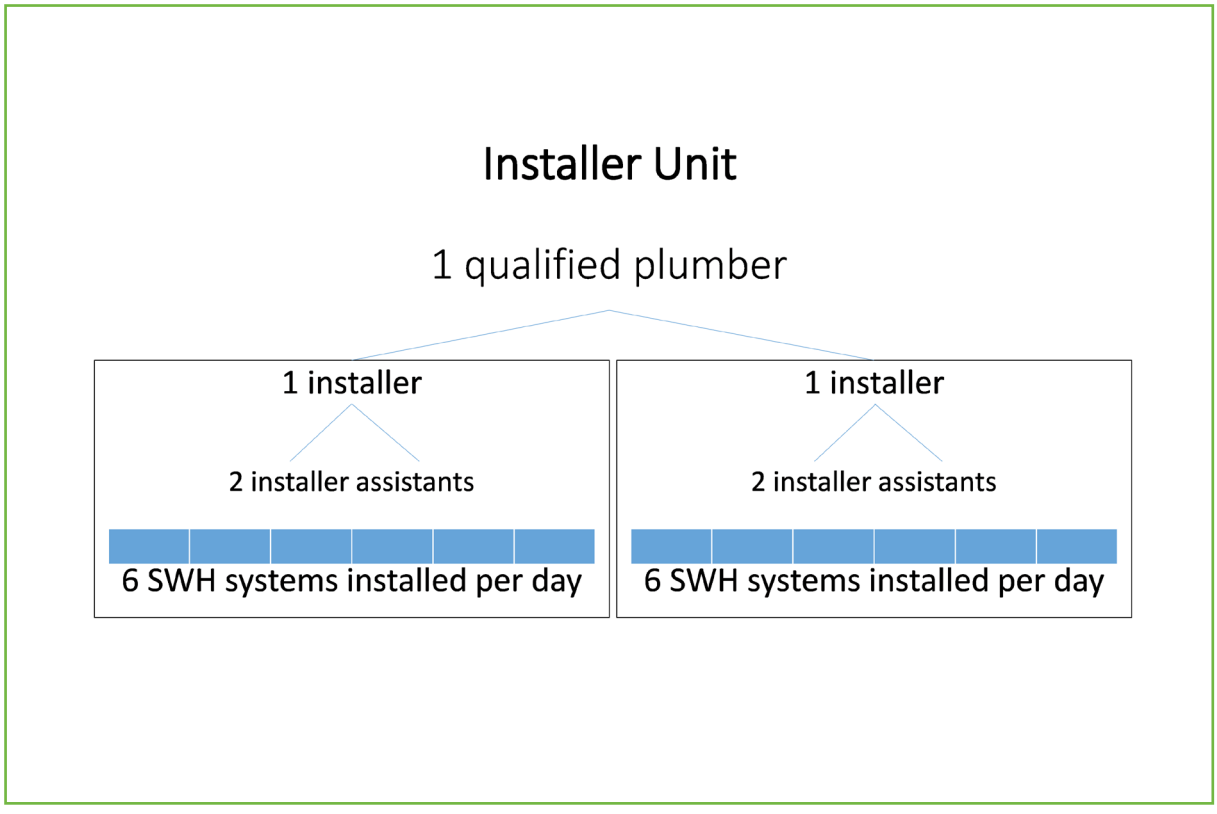

Figure 1: Installer Unit

Inclusion of SWHs within new government delivered housing programmes

Where a new project development is going to include solar water heating – this may be donor funded, funded from within the housing subsidy, or drawing on NSWH Social Programme funding, the following should be considered:

- For new build RDP houses include SWH procurement, installation and maintenance as a component of the overall construction tender, to ensure roof guarantees and effective site management.
- Reinforced roof trusses may be required to accommodate the additional load from the unit. In Joe Slovo this meant an additional cost of R220 per household.
- Double storey developments require additional plant and safety equipment to lift installers onto the roof. This can slow down the rate of installation, but in no way precludes such developments from receiving SWHs.

Source: Joe Slovo Phase 3 Lessons Learnt Document

4.10. Quality control and project payment cycle

Quality control during installation is crucial and companies must be held accountable for defects. This requires clear specifications against which inspection can take place/a clear sign off agreement for the installation of the unit, piping and all equipment such that the installer and inspector have a common and clear understanding. As noted above, the use of demo sites to provide a clear example of 'best practice' proved highly valuable within the large City Power rollout.

Regular training of installers is also indicated in quality control. Often a once-off Installers induction course is undertaken by the supplier/s; but experience indicates that this should be repeated regularly if contracts are longer-term in order to ensure that new managers and labour taken up along the way are also trained.

Quality control inspection cycles must align with payment cycles and cash flow requirements of smaller and emerging installation companies. Where the QC process is failed and work must be re-done, re-inspection must be rapidly done in order to sign off for payment. Thus, ideally there should be a system of one inspection and it should be trustworthy, thus reducing the project cycle time. Alternatively, payment with a retainer per area and this is only received with the 80% pass rate on random inspection. The project payment cycle must also consider what happens where there is lack of clarity as to whether an issue of non-performance is the supplier or installers problem. Usually it is the installer who is not paid, while the problem may rest with the supplier – which is unfair. So, a project payment cycle needs to consider all these factors.

Installers need to be trained and held accountable to correctly capture information, as well as proper use of GPS technology.

4.11. Maintenance plan

Maintenance for the first five years post installation should be a non-negotiable part of the supplier contract (as above). The suggested procedure would be for the contractor to train identified community members (who have been involved in the installation process) who can deal with queries, maintenance issues and repairs. The supplier/contractor should ensure training of this team, a local office (e.g. container), spare parts, tools and equipment and cell phones or call centre to receive complaints. This team should report weekly to the contractor and municipality and should be paid on a monthly basis to perform this function.

A plan should then be in place for maintenance beyond the scope of the broad "warranty period". The precise design of an ongoing maintenance programme will be very dependent on the upfront design process: is the system owned by the household post installation, or part of a municipal service. Although this is the greatest challenge to a successful and sustainable SWH programme, this area of the programme also offers important opportunities for job creation. Whether the programme has been delivered through a national rollout, or municipal programme, as municipalities are often the entities that receive the blame from communities for SWH maintenance issues, they should consider setting up and managing a maintenance fund (could be sourced through FBE/FBAE, or some

sort of fee-for-service from households, though most householders can't afford this).

Maintenance funding could be through retaining a portion of the implementation funds, allocating municipal operating budget and/or some degree of user payment system. Both Kuyasa and NMBMM explored the possibility of households contributing a monthly user fee towards ongoing maintenance. The indications were that households were willing to contribute an amount of between R11/month (NMBMM) and R30/month (Kuyasa). However, the collection method was never resolved in Kuyasa and this approach never materialised.

Key elements of a maintenance programme should include:

- Funding must be in place for maintenance.
- Maintenance should be divided into 'first line of defence' household repair work (done by the householder themselves) and second tier technical support (initially via the installer/supplier under their warranty agreement, later through the municipality). There is a fair amount that the household can undertake that is not costly. This 'first line' response needs to be developed through effective training and education around the use of the system and common leakage and fault issues. This would include for example, cleaning of filters (links to community engagement above).
- An effective call centre and response unit that can deal with maintenance and repair issues must be in place. If installation processes make use of GIS systems, then complaints could be logged on a municipal system for efficient response.
- Somebody should be in place locally to address maintenance issues. The response time must be quick. A proposed system would be for the installers to become maintenance cooperatives funded through the municipality. When a complaint is logged with the municipality they refer it to the local team/cooperative.
- Drawing on existing knowledge of typically reported faults, and drawing on the industry, develop a guideline indicating which faults typically would be warranty issues and which installation issues.
- Quality SABS approved spare parts should be widely available in local hardware shops so that it is easily accessible for the homeowner to maintain the systems themselves.
-

4.12. Jobs, skills and enterprise development

Employment of local community members within the installation programme is considered by municipalities as extremely important. Procurement conditions will determine the level of training, education and maintenance included within the rollout. These conditions must stipulate accredited training, regular training and support post installation job and enterprise creation.

Experience in Joe Slovo indicates that local, unskilled labour can form up to 33% of the SWH installation team. Labour teams should be paid on an output, rather than daily, rate to ensure alignment of interests between the installer and worker (on a daily rate it would make sense for labour to complete the task as slowly as possible).

Carbon financing potential

Many projects have been designed on anticipated carbon finance streams to cover ongoing maintenance costs. Standard Bank has a CDM "Programme of Action" (POA) available for use in SWH development projects. When this was investigated in the Joe Slovo project a carbon price of at least 2.50 Euros per ton was established as the price required for the development to cover maintenance costs through carbon financing. In recent years (2013) this has stood at 0.40 Euro per ton. In addition, the first carbon credits will only be issued 18 months post instalment. Thus programmes/projects must ensure that budget for at least the first 3 years post installation is in place, as only after this period will the carbon finance achieve a positive cash flow. Double storey developments require additional plant and safety equipment to lift installers onto the roof. This can slow down the rate of installation, but in no way precludes such developments from receiving SWHs.

Source: Joe Slovo Phase 3 Lessons Learnt Document, December 2013

Municipal project management must also include longer-term, secure employment as an important performance indicator in order to ensure that resources are allocated to developing a sustainable job creation model, i.e. not simply short-term jobs for the duration of the installation. Thus indicators should measure not just 'jobs created during the installation', but distinguish between permanent and short-term, contract jobs. It makes enormous sense to develop the locally trained installers into maintenance teams. These teams can be employed through various models:

- Draw on existing, established institutions, such as Jozi@work, for sustainable job/enterprise development in this area;
- Consider involving the supplier/installer to support a local installer or installer team to establish a maintenance office. They can be the first point of call for warranty related issues and develop their own business relating to additional repair and plumbing work.
- Develop these personnel into municipal SWH service maintenance units, or cooperatives, funded through the operational expenditure budget of the municipality.

A strong link with the installer and manufacturer is important for community based maintenance staff, so that they can easily draw in the technical experts where problems are more complicated than simple maintenance. A clear understanding of the manufacturing warrantees and installation guarantees needs to be established upfront with the community and community based maintenance staff.

Long term financing of secure, sustainable jobs needs to be considered. Initially jobs can be funded through the project funding (retain a portion of the contract to support ongoing maintenance). In the longer run, alternative sources of funding should be considered and a municipal SWH maintenance fund established. Carbon finance may, in time, provide important financing streams, but should not be depended upon. Municipalities may be able to draw on Free Basic Alternative Energy (FBAE) through the equitable grant share. While it may initially seem that drawing on municipal revenue is an impossibility given other pressing budgetary demands, it may be that once the project has demonstrated the benefits, the creation of jobs, welfare improvements and revenue support, the municipality may actually be able to bring payment of maintenance staff into normal budget allocations process.

5. Conclusion

Municipalities must be deeply involved in the development activities happening within their areas. Further, successful and sustainable SWH rollout will inevitably require a long term, hands-on role to be played by local government. Once installation is completed, any further issues relating to the SWH are brought by the community to their local municipality. Municipalities would need to plan and budget to be able to manage this role into the future.

Increasingly the indications are that SWH should be developed into a service function of municipalities over time. Permanent staff to assist with maintenance and servicing, as well as community education, would help to ensure that systems are maintained and the best use of systems is obtained by households. Given the rising cost of electricity and the imperative to supply services in an environmentally benign manner, SWH offers an excellent opportunity to provide equitable access to services without imposing high energy costs of poor households and additional global and local emissions.

Proactive strategy development, political commitment and upfront programme design is important. The development of programme implementation capacity that can be retained within municipalities is important. The goals of community engagement, local job and enterprise creation must be translated into effective procurement conditions and budgetary allocations, or they will remain weak.

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City Power, City of Johannesburg

Renee Penman, previously of Eon consulting, who were Quality Assurance contractors in final phase of the programme (15 October, 2015);
Paul Vermeulen (10 October and 3 November, 2015).

eThekwini Metropolitan Municipality

Magash Naidoo and Susanna Godehart, eThekwini Energy Office (9 October, 2015).

Musina

Ms Cheune Dinyake, Senior Technical Manager, Infrastructure (29 September, 2015).

Polokwane

Dennis Mokoala, Assistant Manager Energy, (11 November, 2015).

Sedibeng District Municipality

Musa Mahlatji, Acting Director Environment and Clean Energy and Sylvester Dube, Manager, Waste, Dept. Environment and Clean Energy (14 October, 2015).

Supplier/installers

Phil van Achterbergh, KZN Solar (eThekwini rollout) (9 October, 2015).

Clinton Ramnarain, Solar PriMeg, Sales Team Manager (eThekwini rollout) (9 October, 2015).

Tasol CEO Riaan Swanepoel (City Power rollout, Zanemvula, NMBMM) (2 November, 2015).

Ishmael Letsoalo, Kgabo Developers (Polokwane, Tzaneen rollout) (3 November, 2015).

Appendix A: Installation process – a detailed overview

Excerpt taken from Roschcon: Feasibility Report on solar Water Heater Installation in Polokwane, Limpopo (2013)

Undertaking of such a major project requires the appointment of a subcontractor(s), with the conditional involvement of the community itself.

1. CONTRACTOR TEAM AND APPROACH TOWARDS THE COMMUNITY

Below is a list of the activities and relationship of contractors and community members.

(1) CLO: COMMUNITY LIAISON OFFICER

The CLO represents the community and is a liaison between the community and the contractors. In cooperation with the CLO and contractor are **RUNNERS**, employed by the contractor, who directly engage with the local community and provide feedback to the ward councillors. CLOs act as the communication link between the community and installing company and conduct progress meetings with the appointed PMO and the installer. The CLO also interface with **INSPECTORS**, who are also paid and employed by the Contractor and work closely together with the **RUNNERS** in order to gather information.

(2) RUNNERS

The runners get trained by the contractor as their goal is mainly to inform the community of the activities to take place and to liaise the program with the community. They must also guide the inspectors to areas in which there might be an installation problem such as roof structure problems, water connection problems and trees reflecting Shade to the area of installation.

Their activities are listed below:

Engagement 1 = Sign up and survey individual houses and guide inspectors to troublesome houses

- Explain the install program to the house owners
- Collect copy ID doc and signed contracts
- Survey House as per their trained experience and report anything beyond the Norm to more
- advanced inspector
- Record Occupancy details
- Water availability
- Roof structure
- Electrical usage
- Submit docs for processing

Engagement 2 = Schedule installation

- Date planned
- Explain need for access (and risk of not having someone there)
- Ensure available person at house
- Confirm availability to installation coordinator

Engagement 3 = Sign off post installation

- Facilitate sign off from householder
- Record any issues or complaints
- Ensure close out by block

Block Audit 4 = Confirm installations

- Once a block is complete runners perform visual survey of the block and
- confirm installations by Erf , take a photo of installation and file together with the COC

(3) INSPECTORS

The Inspectors are part of the contractor's team, but trained to specifically solve and resolve technical issues before an installation takes place. The inspector should at least be an experienced plumber with 5 years or more experience, or an educated person with experience on understanding of roof strengths and technical issues related to the installation of SWH systems. If the Runners find anything out of the ordinary which might be doubtfull they should refer same back to the Inspectors to verify and to investigate for safe and proper installations.

2. MAINTENANCE PLANNING

Contractor product is warranted for a 5 year period. The suggested procedure would be for the contractor to train various community members of which at least one is a runner who can deal with queries, maintenance issues and repairs. The maintenance team will be provided by the installing company. They must bear the costs to provide the following services:

- Training
- Secure offices (container)
- Spare parts
- Tools and equipment
- Cell phones

The maintenance team is required to provide a weekly report and are paid a monthly salary for performing this function.

(1) SUGGESTED INSTALLATION TEAM CONFIGURATIONS

- At least 5 qualified plumbers
- Each Plumber has 2 teams
- Each team has 1 installer and 2 installer's assistants
- Each team should install 6 per day

(2) INSTALLATION PROCESS

- Blocks allocated to plumber supervisors
- Deliveries scheduled by installation block and delivered to houses
- Plumber supervisor allocates houses to teams
- Installation consumables issued to installers
- Installer's assistants:
- Prepare roof (re-enforcing)
- Attach frame
- Attach geyser
- Plumber supervisor instructs installer (system routing etc.) on each house
- Installer fits pipe and connections
- Plumber supervisor inspects and approves

3. PROJECT MANAGEMENT

- Infrastructure procurement and contracting (facilities, vehicles, tools and equipment, safety gear, communications equipment)
- Site establishment (layout and installations)
- Recruitment
- Training of all staff:
- All – project explanation and induction
- Employment contracts and processes
- CLO - requirements and operating methodology
- Runners – script, paperwork and admin
- Installers and assistants - solar systems and plumbing
- Admin staff - IT systems and paperwork administration
- Project monitoring and reporting
- Logistics (stock ordering, planning and controls)
- Activity scheduling
- Problem solving
- Quality management – administration, planning and installations
- Health & Safety Compliance – includes full time safety officer

4. ADMINISTRATION

- Preparing and managing the data base that controls all administration and reporting
- All documents (sign Up, COC's, sign offs) controlled and recorded by Erf
- Activity tracking and payments
- Payroll management i.e verification of invoice claims

5. APPROACH

- Detailed project plans are drawn up
- Plumber supervisors are given weekly targets
- Pre assembly processes:
- Pre-weld copper pipe pieces
- Make up installation bag containing all consumables for 1 installation
- Assemble stands
- Make up roof re-enforcement