Financial Case for SWH Mass Implementation Businesses in South African Cities

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Background

Solar water heaters (SWH) have for many years been one of the most feasible sustainable energy technologies available in South Africa. They can reduce a household's electricity bill by typically 20%, but this could be as high as 30% with an additional timer installed. SWH technology is robust and proven, and can be more financially feasible than an electric geyser in an average house over 6 to 8 years (based on current electricity prices). Eskom has recognized the energy saving and peak load reduction potential of SWH's and is currently rolling out a SWH incentive scheme through its Demand Side Management (DSM) programme. This scheme will effectively reduce the capital cost of SWH's by up to 20%. The scheme will be initially targeted at the high energy consuming mid to high income residential sector.

Eskom has set SWH implementation targets of 900 000 SWHs installed in the next 5 years, and has requested that Government assist them in attaining these targets. The current positive climate for solar water heaters makes mass SWH implementation businesses feasible. Cities in South Africa have recognized this and some are focusing on facilitating the establishment of such businesses.

Cities will not play the role of SWH system implementers in the plan. There is little capacity for this, nor is it a core function. The aim is to create a conducive environment for private sector and other players to deliver SWHs on a mass scale. The conditions are ripe for such delivery if the right signals are given by provincial and local government. Cities will do this by **endorsing** selected SWH Implementing Agents who match up to approved criteria, and **provide marketing support** for these endorsed Implementing Agents. In so doing credibility and consumer confidence in the Implementing Agent will be provided.

The SWH Implementing Agents will be asked to pull together the end-user financing, the Eskom incentive and potential carbon revenue to create an attractive package for the SWH buyer. The Implementing Agent will be required to organize attractive monthly payback terms for the SWH. In the current climate when considering a new build or blown geyser scenario, this will effectively mean that the household will be paying the same or slightly less than they currently do for water

heating, making it a highly attractive proposal. As electricity prices increase (as forecast), the savings realized will grow substantially over time.

It is important to note that there is a **significant difference** between SWH installers and the abovementioned Implementing Agents – the latter will provide an **attractive, optimized financial package** in addition to SWH hardware supply, whereas the installer normally only deals with the hardware aspects. There are a number of reputable installers in existence around the country. There are almost no Implementing Agents in existence at present. A key component of this SWH implementation plan is therefore creating the right environment for the emergence of suitable Implementing Agents.

Cities will work closely with Eskom in this project, and much of the work (Meeting standards, Monitoring and Verification (M&V)), will be carried out by Eskom.

It is anticipated that this plan will stimulate the uptake of solar water heaters in the country, making them a far more attractive option to the consumer than they currently are. This will be done by removing the high capital cost barrier and increasing consumer confidence in the product. The positive benefits – less CO_2 emissions, employment creation, reduced energy consumption and increased energy security- will do much to create cleaner, healthier and more energy efficient cities in the future.

Overview

This document looks into the viability of solar water heater (SWH) mass implementation businesses which employ a monthly repayment mechanism to remove the high capital cost barrier of the technology.

The business case needs to be made in comparison with self financed purchasing of SWHs (ie bonding the expense), as well as with a similarly sized electric geyser. Initially, it is anticipated that the competitive advantage of business will come from unit cost reductions due to bulk purchase, and attractive financing. This can be further enhanced in future through carbon credits and the Tradeable Renewable Energy Certificate (TREC) market currently being established by the Department of Minerals and Energy.

When looking at financed business cases for SWHs it is necessary to compare them against similar electric geyser installations from both a capital and operating cost perspective eg. What are the combined capital and operating (electricity mainly) costs of a 150l SWH against those of a 150l electric geyser? Within this context it is also necessary to note two specific scenarios in which people will purchase a SWH:

i) New build/'blown' geyser scenario – the end user needs to make a capital investment in a water heating system. In this case, when comparing the capital and operating costs of the two technologies the capital cost of the electric geyser is included.

ii) Retrofit scenario – the end user chooses to replace a working electric geyser. In this case when comparing the capital and operating costs of the two technologies the capital cost of the electric geyser is not included.

For this analysis, a 150l SWH is compared to a 150l electric geyser. The 150l system was chosen for the reason that it is the least economically feasible SWH. As the size increases, so do the financial benefits, provided of course that the SWH is matched to the user's needs and is not oversized.

This analysis also considers only SWHs that have been approved through the Eskom SWH programme, in order to keep the SWHs analysed linked to nationally acceptable standards.

It is important to note that the figures coming from this analysis are an indication of what is possible. However, each business case for a specific SWH system will differ, and a full analysis for each specific system is warranted.

It is the intention of this document to highlight the potential of a SWH mass implementation business, and to generate a thorough investigation from interested parties into their specific product and service.

SWH cost analysis using all present and future potential reductions

The following table shows the potential for capital cost reduction of a SWH unit when considering a bulk purchase and installation approach. The average SWH cost is taken from the average cost of approved SWH units from the Eskom SWH programme website, and includes installation and a timer. These figures are indicative, but not specific, and form the basis of all future calculations in this analysis.

Average SWH Cost (150l)	**R 17,000**		
Immediate reductions		**Benefits**	**Paid to**
Bulk Purchase	R -2,000[*1]	Implementing Agent	Implementing Agent
Eskom Incentive	R -2,500[*2]	End user	Implementing Agent
Immediate End user SWH cost	**R 14,500**		
Immediate IA Cost SWH Cost	**R 12,500**		
Future Reductions			
CDM/Voluntary market	R -1,000[*3]	End user	Implementing Agent
TRECs	R -2,000[*4]	End user	Implementing Agent
Future End user SWH cost	**R 11,500**		
Future IA Cost SWH Cost	**R 9,500**		

[*1] bulk purchasing is an unknown quantity, this figure could be substantially greater

[*2] varies according to performance of unit in SABS testing

[*3] uncertainty over where this market is going makes it difficult to allocate large figures to it, though were it to function correctly over the next 10 years this figure could be R2000-R4000

[*4] Tradeable renewable energy certificates (TRECs) is a system being developed by the Department of Minerals and Energy (DME) which generates certificates for green energy or offsets of dirty electricity, which can be sold on the open market. 1 TREC = 1MWh generated or offset. SWH typically generates 20 TRECS over 10 year lifespan, which can translate to R2000, though this price is market and demand driven.

Financial Analysis of Scenarios

The modeling is based on a five year business plan. It is expected that the unit provided will perform to specification for at least this period, and will typically continue to function effectively for up to 10 years.

Note that various businesses will have financial models which are significantly different. For example if repayment of financing can be done over longer periods, market penetration and competitive advantage will increase.

The following general assumptions are made:

Finance Rate	15.5%	
Cost of Electricity	65 c/kWh	(current CoCT rates for 400-800kWh users)
Predicted annual increase in Electricity	20%	(conservative estimate as expected to double over next 3 years)
Average Cost of 150l SWH after Eskom incentive (installed, with timer)	R14500	(Average of all Eskom approved SWH units-2008)
Average Cost of 150l electric geyser (installed)	R6900	(Average of quotes from CT installers)
Daily Hot Water Use	150l	(50l per day per person)
Electricity Savings for SWH	60%	(with timer - conservative estimate based on independent SESSA SWH Study)
Discount Rate	15%	(bring costings to present day prices)
Geyser Thermostat setting	60 degrees C	(conservative – most geysers set for 70 degrees and result in higher electricity use)

Analysing Scenario 1: New Build/'Blown' geyser replacement with a SWH

In this scenario, the end user has a choice to install either a SWH or an electric geyser. This occurs in

1. a new build scenario
    i) a new house or
    ii) an extension which requires additional water heating
2. a 'blown' geyser scenario

When analyzing this scenario, the effective extra capital cost of a SWH is the difference between the SWH and electric geyser costs.

Analysis results summary:

1. Unit cost R14500 (Eskom incentive only):
    - ✓ End user pays R64 extra pm in year 1 than for an electric geyser, saves money from year six, SWH pays for itself in year 10.
    - ✓ Net Present Value (NPV)
        i. Year 5: -R519
        ii. Year 10: R9779
2. Unit Cost R12500 (additional bulk purchase reductions):
    - ✓ End user pays R14 extra pm in year 1 than for an electric geyser, saves money from year 3, SWH pays for itself in year 9
    - ✓ Net Present Value (NPV)
        i. Year 5: R1808
        ii. Year 10: R12107
3. Unit cost R11500 (additional carbon funding):
    - ✓ End user saves R11 pm in year 1 than for an electric geyser, SWH pays for itself in year 8 (see table below)
    - ✓ Net Present Value (NPV)

i. Year 5: R2972

ii. Year 10: R13270

	Year									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SWH										
Financed payments	R 3,471	R 3,019	R 2,625	R 2,282	R 1,985	R 0	R 0	R 0	R 0	R 0
Electricity	R 786	R 820	R 856	R 893	R 932	R 973	R 1,015	R 1,059	R 1,105	R 1,153
Total (Annual)	R 4,258	R 3,839	R 3,481	R 3,176	R 2,917	R 973	R 1,015	R 1,059	R 1,105	R 1,153
Total (Cumulative)	**R 4,258**	**R 8,097**	**R 11,578**	**R 14,753**	**R 17,670**	**R 18,643**	**R 19,658**	**R 20,717**	**R 21,822**	**R 22,976**
Electric Geyser										
Financed payments	R 2,083	R 1,811	R 1,575	R 1,369	R 1,191	R 0	R 0	R 0	R 0	R 0
Electricity	R 2,313	R 2,413	R 2,518	R 2,628	R 2,742	R 2,861	R 2,985	R 3,115	R 3,251	R 3,392
Total (Annual)	R 4,395	R 4,224	R 4,093	R 3,997	R 3,933	R 2,861	R 2,985	R 3,115	R 3,251	R 3,392
Total (Cumulative)	**R 4,395**	**R 8,620**	**R 12,713**	**R 16,710**	**R 20,642**	**R 23,503**	**R 26,488**	**R 29,604**	**R 32,854**	**R 36,246**

Annual Savings from choosing a SWH instead of a geyser	**R 138**	**R 523**	**R 1,135**	**R 1,956**	**R 2,972**	**R 4,860**	**R 6,830**	**R 8,886**	**R 11,032**	**R 13,270**

	Year									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SWH										
SWH Electricity Savings	R 1,526	R 1,593	R 1,662	R 1,734	R 1,810	R 1,888	R 1,970	R 2,056	R 2,145	R 2,239
SWH Annual Payments	R 3,471	R 3,019	R 2,625	R 2,282	R 1,985	R 0	R 0	R 0	R 0	R 0
Difference (annual)	**-R 1,945**	**-R 1,426**	**-R 963**	**-R 548**	**-R 175**	**R 1,888**	**R 1,970**	**R 2,056**	**R 2,145**	**R 2,239**
Cumulative	**-R 1,945**	**-R 3,371**	**-R 4,334**	**-R 4,882**	**-R 5,057**	**-R 3,169**	**-R 1,199**	**R 857**	**R 3,003**	**R 5,241**
Electric Geyser										
Geyser Electricity Savings	0	0	0	0	0	0	0	0	0	0
Geyser Annual Payments	2083	1811	1575	1369	1191	0	0	0	0	0
Difference (annual)	**-R 2,083**	**-R 1,811**	**-R 1,575**	**-R 1,369**	**-R 1,191**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**
Cumulative	**-R 2,083**	**-R 3,894**	**-R 5,469**	**-R 6,838**	**-R 8,029**	**-R 8,029**	**-R 8,029**	**-R 8,029**	**-R 8,029**	**-R 8,029**

Table 1: This table shows that immediate savings from a 150l SWH can be achieved for the end user if the unit capital cost is reduced to R11500.

Recommendations

1. Based on this analysis a strong case can be made to an end user for a SWH, even with only the Eskom incentive in place (capital cost of R14500). With a further capital cost reduction of R3000, the unit will save the end user money from year 1 as can be seen from the table above.

2. It is imperative that the expected operational lifespan of the SWH system is at least 5 years in order for the financial benefits of the investment to be realized[*1] in units costing R14500.

[*1] Most SWHs carry a 5 year minimum guarantee.

Analysing Scenario 2: Retrofit – replacing existing electric geyser with a SWH

In this scenario, the end users have made the choice to install a SWH to replace their current functioning electric geyser

When analyzing this scenario, the effective extra capital cost of a SWH is the full cost of the electric geyser.

Analysis results summary:

1. Unit cost R14500 (Eskom incentive only):
    - ✓ End user pays R238 extra pm in year 1 than for an electric geyser, saves money from year 6, SWH pays for itself in year 10.
    - ✓ Net Present Value (NPV)
        i. Year 5: -R8548
        ii. Year 10: R1750
2. Unit Cost R12500 (additional bulk purchase reductions):
    - ✓ End user pays R187 extra pm in year 1 than for an electric geyser, saves money from year 6, SWH pays for itself in year 9
    - ✓ Net Present Value (NPV)
        i. Year 5: -R6221
        ii. Year 10: R4078
3. Unit cost R11500 (additional carbon funding):
    - ✓ End user pays R162 extra pm in year 1 than for an electric geyser, saves money from year 6, SWH pays for itself in year 8
    - ✓ Net Present Value (NPV)
        i. Year 5: -R5057
        ii. Year 10: R5241

	Year									
	1	2	3	4	5	6	7	8	9	10
SWH										
Financed payments	R 3,471	R 3,019	R 2,625	R 2,282	R 1,985	R 0	R 0	R 0	R 0	R 0
Electricity	R 786	R 820	R 856	R 893	R 932	R 973	R 1,015	R 1,059	R 1,105	R 1,153
Total (Annual)	R 4,258	R 3,839	R 3,481	R 3,176	R 2,917	R 973	R 1,015	R 1,059	R 1,105	R 1,153
Total (Cumulative)	**R 4,258**	**R 8,097**	**R 11,578**	**R 14,753**	**R 17,670**	**R 18,643**	**R 19,658**	**R 20,717**	**R 21,822**	**R 22,976**
Electric Geyser										
Financed payments	R 0	R 0	R 0	R 0	R 0	R 0	R 0	R 0	R 0	R 0
Electricity	R 2,313	R 2,413	R 2,518	R 2,628	R 2,742	R 2,861	R 2,985	R 3,115	R 3,251	R 3,392
Total (Annual)	R 2,313	R 2,413	R 2,518	R 2,628	R 2,742	R 2,861	R 2,985	R 3,115	R 3,251	R 3,392
Total (Cumulative)	**R 2,313**	**R 4,726**	**R 7,244**	**R 9,871**	**R 12,613**	**R 15,474**	**R 18,459**	**R 21,574**	**R 24,825**	**R 28,217**
Annual Savings from choosing a SWH instead of a geyser	**-R 1,945**	**-R 3,371**	**-R 4,334**	**-R 4,882**	**-R 5,057**	**-R 3,169**	**-R 1,199**	**R 857**	**R 3,003**	**R 5,241**

	Year									
	1	2	3	4	5	6	7	8	9	10
SWH										
SWH Electricity Savings	R 1,526	R 1,593	R 1,662	R 1,734	R 1,810	R 1,888	R 1,970	R 2,056	R 2,145	R 2,239
SWH Annual Payments	R 3,471	R 3,019	R 2,625	R 2,282	R 1,985	R 0	R 0	R 0	R 0	R 0
Difference (annual)	**-R 1,945**	**-R 1,426**	**-R 963**	**-R 548**	**-R 175**	**R 1,888**	**R 1,970**	**R 2,056**	**R 2,145**	**R 2,239**
Cumulative	**-R 1,945**	**-R 3,371**	**-R 4,334**	**-R 4,882**	**-R 5,057**	**-R 3,169**	**-R 1,199**	**R 857**	**R 3,003**	**R 5,241**
Electric Geyser										
Geyser Electricity Savings	0	0	0	0	0	0	0	0	0	0
Geyser Annual Payments	0	0	0	0	0	0	0	0	0	0
Difference (annual)	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**
Cumulative	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**	**R 0**

Recommendations

1. Based on the table above, it is clear that a strong financial case for SWHs in the short term cannot be made, as the end user will have to pay extra for five years. A strong 6-10 year case can be made though. In this case, further reduction of unit price, or longer payback periods would make the unit more attractive.

2. However, the likelihood of an existing high pressure electric geyser not needing to be replaced over a 10 year period is very low. It is reasonable to consider that at some point additional financed costs will be incurred for the electric geyser. Naturally, the point at which this occurs will affect the point at which a SWH becomes more financially feasible.

3. Even in the most unlikely (worst case) scenario of no electric geyser being replaced, this model is feasible should the SWH system installed be of sufficient quality to last at least 8 years. Business should ensure the system is capable of this for end user to reap the full benefit of the system.

SWH Mass Implementation Business Case

For this to be a viable business, some profit needs to be taken off the monthly repayments received. This can come both from a capital cost mark up and from securing attractive bulk financing rates.

In this analysis it is assumed that a finance rate of 2% below that charged to the end user is secured, and that the SWH unit is installed at a cost R2000 less than that quoted to the end user. This business case applies to scenarios 1 and 2 above, as the monthly repayments do not differ between scenarios.

It should be noted that businesses are strongly encouraged to optimize the business model to make the 'package' offered to end users as attractive as possible.

Business Case (150l system)

End user pays	R 14,500
Business pays	R 12,500
Interest rate of (pa)	13.5%
Over (yrs)	5
Business Monthly repayments	R 299.78
Customer pays/month	R 364.74
Cumulative income/unit/year	R 779.51
NPV (5 years,10% discount)	R 2,955

The table above shows that a gross profit of R780 per unit per year can be achieved. Translated over 5 years with a discount rate of 10%, this equates to nearly R3000 per unit.

The following table shows the potential income in today's terms (Net present value or NPV) from the business based on installation quantities. As a mass scale business, obviously the more units signed up, the more profit can be achieved.

Signed up SWHs	Gross profit for Business (5 years, NPV 10%)
1000	R 2,954,941.36
5000	R 14,774,706.82
10000	R 29,549,413.64
50000	R 147,747,068.19

Analysing Scenario 3: Bonded 'passive' Case – Eskom Subsidy only

This scenario involves a passive business as usual approach with the end user sourcing a SWH from a supplier and placing the capital cost of the SWH unit on a bond over 10, 15 or 20 years. This scenario looks only at the new build/'blown' geyser replacement scenario.

Analysis results summary:

1. Unit cost R14500 (Eskom incentive only), 10 yr bond:
    - ✓ End user pays R1 extra pm in year 1 than for an electric geyser, saves money from year 2, SWH shows cumulative profit from year 7.
    - ✓ NPV
        i. Year 5: R2375
        ii. Year 10: R9716
2. Unit cost R14500 (Eskom incentive only), 15 yr bond
    - ✓ End user saves R16 pm in year 1 than for an electric geyser, SWH shows cumulative profit from year 7.
    - ✓ NPV
        i. Year 5: R3192
        ii. Year 10: R10939
3. Unit cost R14500 (Eskom incentive only), 20 yr bond
    - ✓ End user saves R23 pm in year 1 than for an electric geyser, SWH shows cumulative profit from year 7.
    - ✓ NPV
        i. Year 5: R3514
        ii. Year 10: R11421

	Year									
	1	2	3	4	5	6	7	8	9	10
SWH										
Financed payments	R 2,381	R 2,070	R 1,800	R 1,565	R 1,361	R 1,184	R 1,029	R 895	R 778	R 677
Electricity	R 786	R 820	R 856	R 893	R 932	R 973	R 1,015	R 1,059	R 1,105	R 1,153
Total (Annual)	R 3,167	R 2,891	R 2,656	R 2,459	R 2,293	R 2,156	R 2,044	R 1,954	R 1,884	R 1,830
Total (Cumulative)	**R 3,167**	**R 6,058**	**R 8,714**	**R 11,173**	**R 13,467**	**R 15,623**	**R 17,667**	**R 19,622**	**R 21,505**	**R 23,335**
Electric Geyser										
Financed payments	R 1,133	R 985	R 857	R 745	R 648	R 563	R 490	R 426	R 370	R 322
Electricity	R 2,313	R 2,413	R 2,518	R 2,628	R 2,742	R 2,861	R 2,985	R 3,115	R 3,251	R 3,392
Total (Annual)	R 3,446	R 3,398	R 3,375	R 3,372	R 3,390	R 3,424	R 3,475	R 3,541	R 3,621	R 3,714
Total (Cumulative)	**R 3,446**	**R 6,844**	**R 10,219**	**R 13,591**	**R 16,981**	**R 20,405**	**R 23,880**	**R 27,421**	**R 31,042**	**R 34,756**

Annual Savings from choosing a SWH instead of a geyser	**R 278**	**R 786**	**R 1,504**	**R 2,418**	**R 3,514**	**R 4,782**	**R 6,212**	**R 7,799**	**R 9,537**	**R 11,421**

	Year									
	1	2	3	4	5	6	7	8	9	10
SWH										
SWH Electricity Savings	R 1,526	R 1,593	R 1,662	R 1,734	R 1,810	R 1,888	R 1,970	R 2,056	R 2,145	R 2,239
SWH Annual Payments	R 2,381	R 2,070	R 1,800	R 1,565	R 1,361	R 1,184	R 1,029	R 895	R 778	R 677
Difference (annual)	**-R 855**	**-R 478**	**-R 138**	**R 169**	**R 448**	**R 705**	**R 941**	**R 1,161**	**R 1,367**	**R 1,562**
Cumulative	**-R 855**	**-R 1,332**	**-R 1,471**	**-R 1,302**	**-R 854**	**-R 149**	**R 792**	**R 1,953**	**R 3,320**	**R 4,882**
Electric Geyser										
Geyser Electricity Savings	0	0	0	0	0	0	0	0	0	0
Geyser Annual Payments	1133	985	857	745	648	563	490	426	370	322
Difference (annual)	**-R 1,133**	**-R 985**	**-R 857**	**-R 745**	**-R 648**	**-R 563**	**-R 490**	**-R 426**	**-R 370**	**-R 322**
Cumulative	**-R 1,133**	**-R 2,118**	**-R 2,975**	**-R 3,720**	**-R 4,368**	**-R 4,931**	**-R 5,421**	**-R 5,847**	**-R 6,217**	**-R 6,539**

Recommendations

1. There is a very strong case for all 3 time frame scenarios (10,15 and 20 years) in the passive scenario. Based on this it makes a lot of sense for an end user to follow this route, as savings can be realized immediately, even on a 10 year repayment scheme with no further reductions in current SWH prices. This therefore should be the baseline that potential SWH businesses actively pursuing customers need to match or beat in order to make their financed product more attractive.

2. To achieve this obviously better interest rates and lower product prices will have to be secured, in order for the business to make a profit. The table below will look into this issue in more detail.

Summary of End User Net Present Values for 3 Scenarios over 5 yrs and 10yrs

The table below summarises the benefit of each financing approach to the end user, in order to assess which financing scheme is most effective:

	NPV	
	5yrs	**10yrs**
Active SWH Business (New build)		
Unit price R14 500	-R 519	R 9,779
Unit price R12 500	R 1,808	R 12,107
Unit price R11 500	R 2,972	R 13,270
Passive (R14 500 Bond, New build)		
10 year	R 2,375	R 9,716
15 year	R 3,192	R 10,939
20 year	R 3,514	R 11,421
Active SWH Business (Retrofit)		
Unit price R14 500	-R 8,548	R 1,750
Unit price R12 500	-R 6,221	R 4,078
Unit price R11 500	-R 5,057	R 5,241
Passive (R14 500 Bond, Retrofit)		
10 year	-R 3,206	R 1,629
15 year	-R 1,467	R 3,963
20 year	-R 854	R 4,882

This table shows that in terms of value to the end user, there is little to differentiate between an active SWH business case and a passive business as usual bonded case over 10 years with the same unit price (R14500). This means that if a mass implementation business manages to further reduce capital costs of the unit, it will be even more attractive to the end user, with the added benefit of a low monthly repayment as opposed to a high initial capital installment.

Using the above table as a case in point, should the unit cost be reduced by R3000 from current figures in the new build scenarios, there is a stronger business case at year 5 and year 10 for the business case than for the bonded scenario. The challenge therefore lies with the mass implementation business to further reduce unit costs by 20% to begin to get mass market buy in.