Appliances Guide
Get super efficient appliances

bigEE

Energy efficient
Swimming Pool Pumps

Country

South Africa

Authors: Theo Covary, Thomas Götz

Published: July 2015

Prepared in collaboration by SANEDI and Wuppertal Institute for bigee.net South Africa

Contact:

South African National Energy Development Institute (SANEDI) – Barry Bredenkamp
Wuppertal Institute for Climate, Environment and Energy, Germany – Dr. Stefan Thomas

Index

1 Country-wide saving potential

Swimming Pool Pumps

About **700,000** Pool Pumps are in use in South Africa (reference year 2010). The average annual consumption of each of these Pool Pumps amounts to about **2,600 kWh**. In total, this causes an annual electricity consumption of **1.84 TWh**. As model calculations show, enormous efficiency improvements can be achieved, especially if old inefficient models are replaced by modern efficient ones. The calculations of the efficiency scenario are based on the assumption that every time a new Pool Pump is bought, the most efficient "Best Available Technology" (BAT) model is chosen and that the improvements of the most efficient models over the years are taken into account.

By this means, even an absolute decoupling of the annual energy consumption and the increasing stock of Pool Pumps can be achieved. While the stock is expected to grow by 23 % between 2010 and 2020, in the efficiency scenario the energy consumption can be reduced by 71 %. Although the stock is expected to grow by another 28 % until 2030, in the efficiency scenario (B) the energy consumption can be further reduced by 42 %. (Figure 1). Thereby, higher living standards (e.g. increasing appliance ownership rates and household numbers) have been anticipated. In contrast, in the baseline scenario (A) with moderate efficiency gains the energy consumption would increase by 3 % respectively 2010-2020 and between 2020 and 2030.

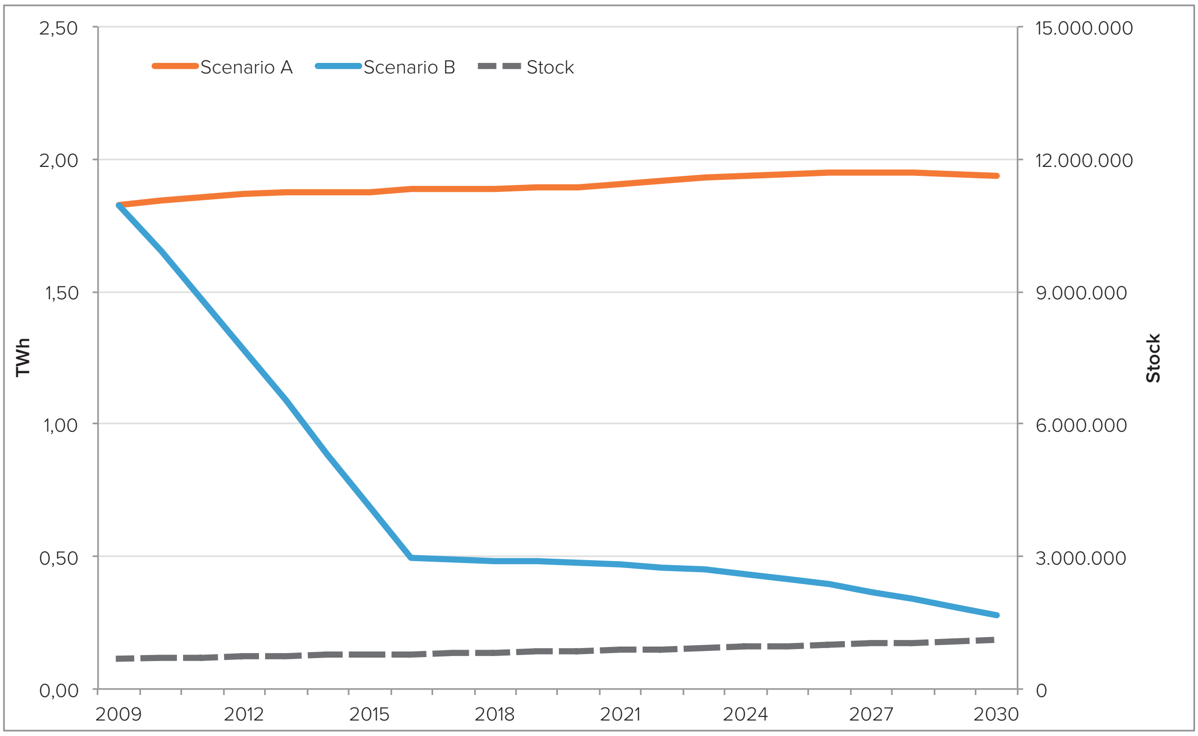

Figure 1: Electricity consumption Pool Pumps, Baseline Scenario (A) vs. Efficiency Scenario (B)
Source: Wuppertal Institute (2015)

Table 1: Country-wide saving potential 2010 - 2030: Pool Pumps

Base year 2010	Total energy consumption of Pool Pumps per year [TWh/year]	1.84
	Stock number Pool Pumps	700,000
	Average annual energy consumption of Pool Pumps in the stock [kWh/year]	2,632
	Total annual CO_2eq emissions related with Pool Pumps [Mt/year]	1.25
2020	Energy savings potential in 2020 vs. baseline development [TWh/year]	1.42
	Resulting change in energy consumption 2020 vs. 2010 [TWh/year]	-1.37
	CO_2eq emission reduction potential vs. baseline development [Mio.t/year]	0.93
	Stock number of Pool Pumps in 2020	860,000
	Average annual energy consumption of new Pool Pumps (all BAT) in 2020 [kWh/year]	500
	Total incremental investment costs [not discounted] until 2020 (end-user perspective) [€]	601,172,958
	Total incremental investment costs [not discounted] until 2020 (societal perspective) [€]	527,344,700
	Total economic benefit until 2020 [not discounted] (end-user perspective) [€] scenario B vs. scenario A	571,761,977
	Total economic benefit until 2020 [not discounted] (societal perspective) [€] scenario B vs. scenario A	36,830,947

2030	Energy savings potential in 2030 vs. baseline development [TWh/year]	1.66
	Resulting change in energy consumption 2030 vs. 2010 [TWh/year]	-1.57
	CO_2eq emission reduction potential vs. baseline development [Mio.t/year]	1.08
	Stock number of Pool Pumps in 2030	1,100,000
	Average annual energy consumption of new Pool Pumps (all BAT) in 2030 [kWh/year]	150
	Total incremental investment costs [not discounted] between 2021 and 2030 (end-user perspective) [€]	704,514,642
	Total incremental investment costs [not discounted] between 2021 and 2030 (societal perspective) [€]	617,995,300
	Total economic benefit until 2030 [not discounted] (end-user perspective) [€] scenario B vs. scenario A	1,595,999,459
	Total economic benefit until 2030 [not discounted] (societal perspective) [€] scenario B vs. scenario A	335,303,826
Lifetime data for Pool Pumps purchased in the analysed timeframe	Total electricity savings, scenario B compared to scenario A [TWh]	31.72
	Total GHG emission reductions scenario B compared to scenario A [Mt]	20.89
	Total incremental investment costs [not discounted] (end-user perspective) [€] scenario B vs. scenario A	1,305,687,600
	Total incremental investment costs [not discounted] (societal perspective) [€] scenario B vs. scenario A	1,145,340,000
	Total economic benefit [not discounted] (end-user perspective) [€] scenario B vs. scenario A	2,147,939,975
	Total economic benefit [not discounted] (societal perspective) [€] scenario B vs. scenario A	632,714,327

Source: Wuppertal Institute (2015)

2 Subtypes and markets

Swimming pools are popular in South Africa due to the warm climate, a large percentage of the population living inland and cold sea currents on the south western and western coasts. In recent years pumps for fish ponds and fountains have also grown in popularity. The country's increasing population, urbanization and densification in major cities is likely to result in fewer new swimming pools but the existing stock, which is sizable, will continue to require pool pumps.

Swimming pools have a long history in South Africa and have maintained their popularity over the years. South Africa is in a sub-tropical location moderated by ocean on three sides of the country and the altitude of the interior plateau, which accounts for the warm temperate conditions. It is also a dry country, with an annual rainfall of less than 500 mm per annum. Gauteng, the country's smallest province, situated in the interior is also the country's business centre and most densely populated area. Figure 2 below shows a map of South Africa and its provinces, Figure 3 the number of inhabitants per province and Figure 4 the average temperatures across the country. Table 2 shows the maximum and minimum temperatures for winter and summer for the five major cities.

Figure 2: Provincial map of South Africa

Source: https://commons.wikimedia.org

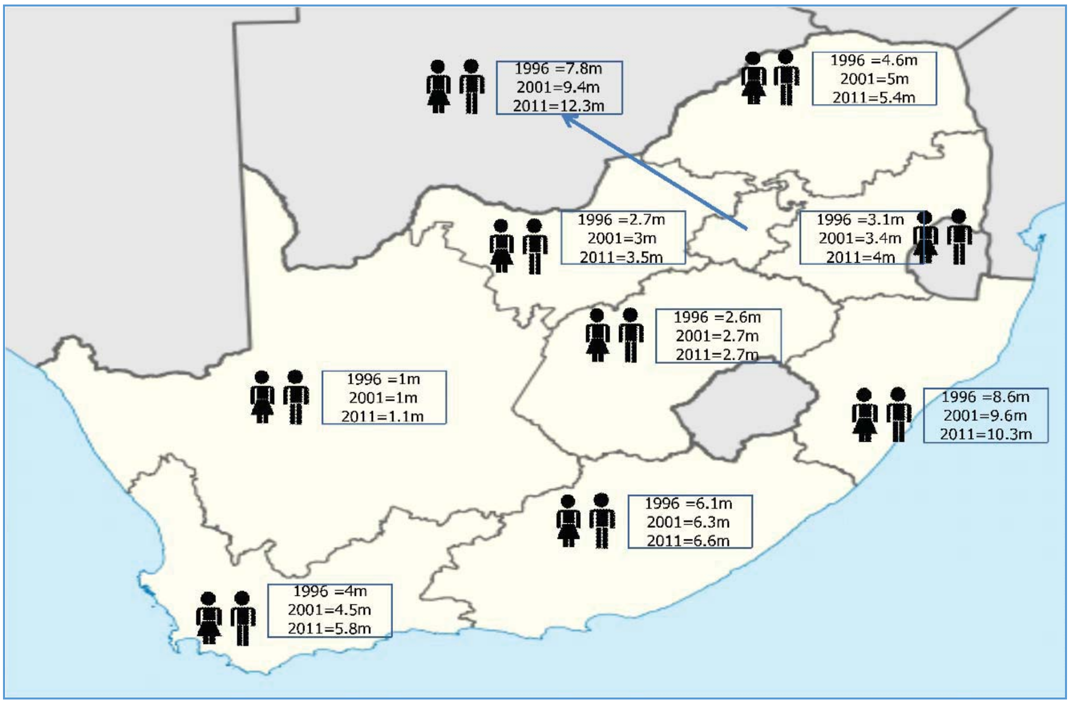

Figure 3: Total population by province

Source: Based on National Census 1996, 2001 and 2011. Statistics South Africa

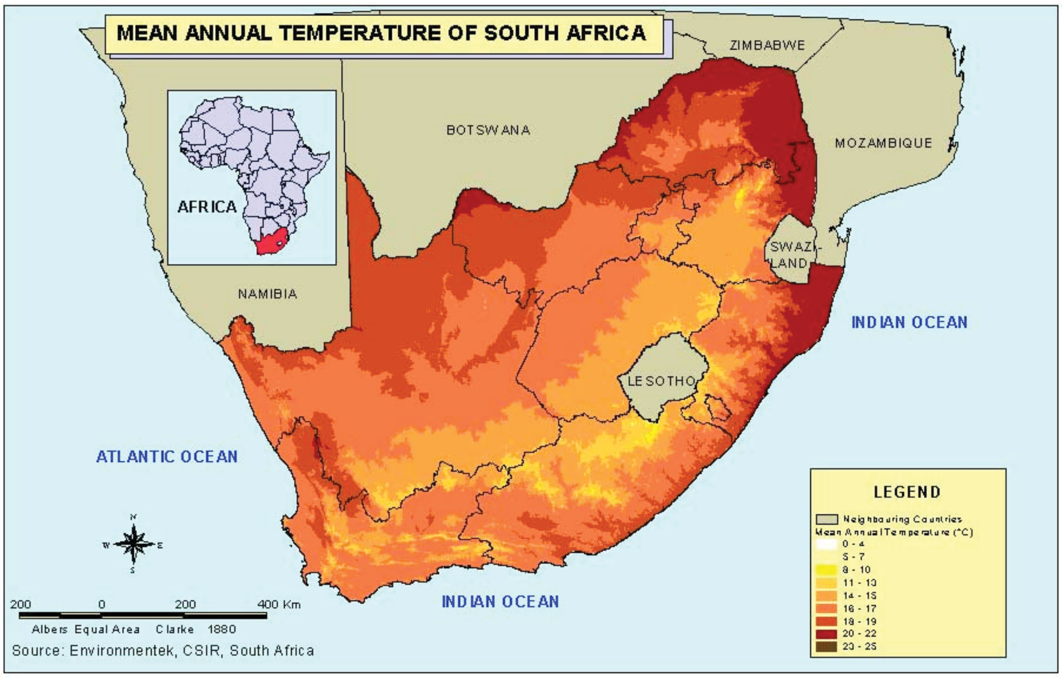

Figure 4: Mean annual temperature of South Africa

Source: Council for Scientific and Industrial Research (CSIR)

Table 2: Maximum and Minimum Temperatures of South African Cities

City	Province	Summer		Winter	
		Max	Min	Max	Min
Johannesburg	Gauteng	26	15	17	4
Cape Town	Western Cape	26	16	18	7
Pretoria	Gauteng	29	18	20	5
Durban	Natal	28	21	18	7
Bloemfontein	Free State	31	15	17	-2
Port Elizabeth	Eastern Cape	28	18	20	9
Kimberley	Northern Cape	33	18	19	3

Source: South African Weather Service

Market Characteristics

The total residential building stock in South Africa amounted to about 12.5 million units in 2008 [1]. In 2013 there were 15 million units [2], of which about 70 % were formal units and 4 million backyard properties, informal and squatter units. Residential housing in South Africa can be broken down into six categories:

1. Middle and upper income free standing single or double storey housing
2. Middle and upper income higher density single or double storey townhouses
3. Low and middle income multi-storey units (flats)
4. Low income single storey housing units (< $80m^2$)
5. Informal housing units (shacks)
6. Rural and traditional housing

Swimming pools are usually found in the first three categories, where category 1 houses typically have private swimming pools, category 2 townhouses have private or communal pools and flats (category 3) communal pools. Figure 5 shows a breakdown of the building stock by category, with the blue segments showing where swimming pools are potentially found.

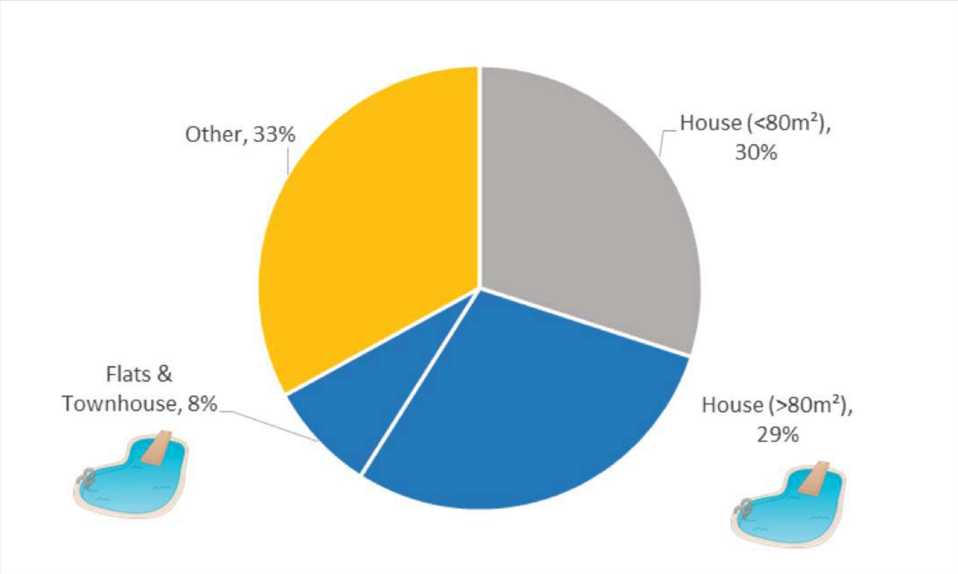

Figure 5: Residential building stock by category

Source: Construction Industry Development Board (2009)

Conventional residential pool pumps are typically available in three major performance categories: small (0.55 kW), medium (0.75 kW) and large (1.1 kW). Pumps are locally manufactured or imported. Depending on the size of the pool, the diameter of the pipes feeding the pump, the location of the pump in relation to the pool (distance and gradient) the installer will recommend the most appropriate size. There is a common view among experts that it was, and to a large extent still is, standard practise to install the 'next size up'. The reasons for this is the long operational hours and little concern given to the operating costs as electricity tariffs were historically cheap and typical pool owners were traditionally not looking to optimise energy costs. Thereby, household owners usually follow the recommendation of the pool company.

Energy consumption of pool pumps is dependent on: 1.) motor size; 2.) usage hours and 3.) efficiency level, whereby all these parameters can typically be found at sub-optimal levels for existing installations. Until recently a significant proportion of pool pumps operated 24 hours a day, which prompted the national utility Eskom to raise awareness through its demand side management campaign and to include pool timers in its residential mass rollout programme (see bigee.net South Africa policy section for more details). Where households have enquired as to how long the pool pump should be actually operating, the 'informal' guidelines were 8 hours per day in winter and 12 to 16 hours per day in summer.

The industry association, the National Spa and Pool Institute (NSPI) advocates a minimum of 12 hours per day in summer and half that in winter for a pool with a volume > 50.000 L. The view of NSPI is that, if the water is not processed adequately by the pump and thus by the pool filter, then more chlorine will be required, which is costlier. The NSPI believes that the water must circulate a minimum of four times through the filter over a 24 hour period during summer and half that in winter. This is contrast to advices provided on popular websites [3], which undertook studies on efficient pool pumps and claimed that '*...one hour's operation per day can be sufficient for a medium-sized domestic swimming pool with*

50,000 litres. If pool chemicals are manually administered, no extra pump time is required, and the monthly energy requirement to maintain the swimming pool, can be as low as 10 kWh'. The article goes on to note from the testing undertaken that a strong pump is very wasteful in energy usage, and even by just downsizing the conventional pool pump from a nominal 1,100 watt to a smaller nominal 450 watt the same volume of water will be moved through the filter at only 50 % of the previous energy consumption. Filtering will also be more effective because the water movement through the sand filter substrate is slower. The smaller motor can also drive an automatic pool cleaner as effectively as the big motor. The most important fact conveyed visually, however, is that there seems to be no generally accepted real lower limit to the minimum energy actually required to turn the pool water around adequately for filtering purposes. Thus, in the extreme a variable speed pump with digital control could be set to run continuously at very low speed/power, and to only speed up occasionally for a short period to operate an automatic pool cleaner, which need a pump capacity of at least 100 watt to function.

Appliance penetration rates and sales

Estimating the number of pools in the country is not easy, as the industry is not regulated. There are no mandatory reporting requirements and only about 25 % of the trade is registered with the industry body. A 2008 industry estimate [3] was that there were 800,000 pools in the country and approximately 30,000 new ones being built every year. However this estimate was at the height of the construction boom until 2008 and the NSPI believes that the number of new installations has dropped in meantime to approximately 5,000 to 7,000 new pools per annum due the following tight economic conditions. Other estimates put the figure for the existing stock at 'conservatively more than 500,000 [4][5] or at 700,000 as estimated by the NSPI. A 2011 publication of the national energy efficiency 'eta' awards for energy saving [6], stated that there were about 1,000,000 pools in the country, but this number is likely to incorporate also spas/Jacuzzis, fish ponds and fountains, which all need respective pumps. Thereby, especially pumps for (Koi) fish ponds in any case need to operate continuously 24 hours a day, 365 days a year.

Following discussions with three different pool pump suppliers, which individually estimated annual sales of pool pumps for residential purposes, lead to estimated overall sales in the order of 100,000 units per year. The assumed penetration rate of swimming pools in South Africa is approximately 5 % of the households.

Pool Pump Market – 1995

First interest in energy efficient appliances in South Africa dates back to 1995, when a cost benefit analysis was undertaken by the Department of Minerals and Energy [7]. The study analysed the typical consumption figures of major household appliances, but pool pumps were not considered at that time.

Pool Pump Market – 2010

A study undertaken by the Department of Trade and Industry in 2011 [8] aimed to quantify the impact that a mandatory standards and labelling programme would have on the local manufacturing industry. The study surveyed the market and identified the number of models and, where possible, each models energy class for 12 appliance groups that were selected for the upcoming S&L programme. The appliances chosen for the study corresponded with the ones selected for the country's residential standards and labelling (S&L) programme, as listed in SANS 941 "Energy Efficiency for Electrical and Electronic Apparatus". However, SANS 941 did not consider pool pumps and as a result, once again no data is available from this time period.

A separate study, undertaken by Eskom around this time and used in a national programme to promote energy efficiency, found that a 750 W pump uses typically at least 232 kWh of electricity per month. The campaign recommended reducing the running time of the pump by four hours per day to achieve a 40 % saving. The study did not state any assumptions about the baseline operating hours, but a figure of 10 hours / day can be derived. The report stated that pool pump electricity consumption makes up approximately 11 % of the average middle-income households overall consumption [9].

Pool pump Market – 2014

Since 2010 the market has seen increasingly the introduction and marketing of more energy efficient swimming pool pumps and additional technology to further reduce electricity consumption, such as solar powered pumps and pool covers. Pool pumps tend to be a homogenous product and are generally selected by the installer based on price and known reliability / performance. These pumps are growing in popularity, but off a very small base and efficient motors are estimated to make up still less than 10 % of sales. A major distributor of efficient pool pumps believes that floor sales staffs are not able to properly explain life cycle costing resulting in consumers opting for the initially (much) cheaper standard pumps. This has prompted the distributor to change the marketing strategy by targeting the consumers more directly.

Market Forecast

South Africa has been in an economic downturn since 2008 and continues to experience sluggish growth. In October 2014 the Minister of Finance revised annual economic growth down to 1.4 % from a forecast of 2.7 % in February 2014 [10]. The duration of these tight economic conditions and the steep rise in electricity tariffs over the same period has had a significant impact on household disposable income. Electricity tariffs more than tripled over the four-year period 2008 - 2012 and will continue to rise at an average of 12 % per year from 2014 to 2018.

With new builds of swimming pools having decreased significantly since the end of the construction boom in 2008 and totalling as few as 5,000 units per annum, the major opportunity is to introduce efficient pool pumps when the old products fail. This is still difficult given the structure of the market, where the pool installer is most likely to decide the motor size and specifications, but increasing awareness around the need to reduce electricity consumption and the electricity tariff increases may prompt consumers to request more efficient pool pumps, especially if they are doing the installation on their own.

Summary of the pool pump market in South Africa:

- Electricity tariffs in South Africa were amongst the lowest in the world in 1995, thus there was little demand for energy efficient appliances. However, tariffs have tripled over the four years period 2008 - 2012 and households are paid EUR 0.10/kWh in 2014. Additionally, the South African electricity regulator has agreed to a further annual 12 % tariff increase for the period 2014 - 2018.

- During the 1990's South Africa had low electrification rates. A priority of the new Government was to electrify all households, which it has largely achieved. The percentage of households that used electricity for lighting went from 58 % (1996) to 80 % (2007). This programme created a new market for manufacturers of electric appliances and the growth rates were high for the period 1995 - 2005.

  The impact on the pool market was less marked compared to other appliances, but nevertheless relevant as previously excluded people were now economically active and entered the middle and high income households in large categories creating new demand, especially during the construction led economic boom which took place from early 2000 until 2009 with about 30,000 new pools being built annually.

- Similar to electric hot water heaters, the distribution channels of pool pumps is such that the household is almost never directly involved in the purchase decision of a specific product and as such is often also unable to influence it. The decision is typically made by contractors, who have no incentive to buy a more efficient model, especially if it is (much) more expensive. Replacement cycles of pool pumps are around 30,000 operation cycles, which corresponds (depending on daily usage) with a product lifetime of 7 - 11 years.

3 Efficiency range and user savings

After electric water heating, pool pumps are becoming the next target for upper income households looking to reduce their electricity consumption. Since 2010 efficient pool pumps have entered the South African market but the penetration is still very low even though the financial benefits of reduced operation costs are very attractive.

Table 3: Efficiency range and user savings of pool pumps

Level	**Typical appliance in the stock (over all appliances in use)**	**Typical inefficient appliance on the market.**	**Typical appliance purchased (BAU – Business As Usual)**	**Best Available Technology (BAT)**	**Expected future BAT (Best not yet Available Technology)**
Typical Capacity / Size	To service a 50,000 L swimming pool				
Category	Standard (0.75 kW)	Standard (0.75 kW)	Standard (0.75 kW)	Efficient Motor (0.3 kW)	Efficient Motor + PV
Type	Electric	Electric	Electric + reduced op. hours	Efficient electric motor + reduced op. hours	Efficient electric motor + PV electricity supply
Lifetime (years)	7	7	7	7	7

Qualitative performance classification of the provided service:	☐ Poor ☐ Low ☐ Average ☒ Good ☐ Excellent ☐ No information	☐ Poor ☐ Low ☐ Average ☒ Good ☐ Excellent ☐ No information	☐ Poor ☐ Low ☐ Average ☒ Good ☐ Excellent ☐ No information	☐ Poor ☐ Low ☐ Average ☐ Good ☒ Excellent ☐ No information	☐ Poor ☐ Low ☐ Average ☐ Good ☒ Excellent ☐ No information
Yearly energy consumption: *electricity (kWh)*	2,700	2,700	1,400	675	0
Yearly energy cost (ZAR)	4,000	4,000	2,100	1,000	0
If applicable: yearly energy consumption for further energy carriers	N/A	N/A	N/A	N/A	N/A
If applicable: yearly water consumption	N/A	N/A	N/A	N/A	N/A
Yearly water cost (national currency)	N/A	N/A	N/A	N/A	N/A
Purchase cost in (ZAR)	1,500	2,000	2,000	8,000	20,000
Operation & Maintenance cost (ZAR)	1,000 (lifetime)	1,000 (lifetime)	1,000 (lifetime)	1,000 (lifetime)	2,000 (lifetime)
Labelling class	*None*	*None*	*None*	*None*	*None*

4 Performance and information requirements

South Africa introduced a voluntary energy label for refrigerators and freezers in 2005. The label was based on the EU design and the objective was to extend this to other large appliances, such as washing machines, dishwashers and dryers but this did not materialise. National Standards for appliances were issued in 2009. VC 9008 published by the Minister of Trade and Industry on 28 November 2014 sets a date for the start of S&L programme. However, South Africa does not have any specific national standards relating to electricity consumption for swimming pool pumps.

Energy Label

The South African Energy Strategy of 1998 identified residential appliances as an effective means to achieve energy savings in the residential sector in South Africa. In 2005 the country's first National Energy Efficiency Strategy (NEES) was developed and in the same year the Department of Minerals and Energy (now Department of Energy) introduced a voluntary labelling scheme, which was a precursor to a mandatory Standards and Labelling (S&L) Programme.

The voluntary scheme targeted refrigerators but encouraged manufacturers to extend it to all their appliances. It was decided to use the EU designed label, largely because historically the majority of South Africa's appliances was imported from Europe. A general South African label was designed, which included some minor changes to the EU label being used at the time, most notably a star with the colours of the South African national flag (for an exemplary Energy Label, please see Figure 6. The label was registered with all the relevant national and international authorities. However, there is no South African label for pool pumps so far.

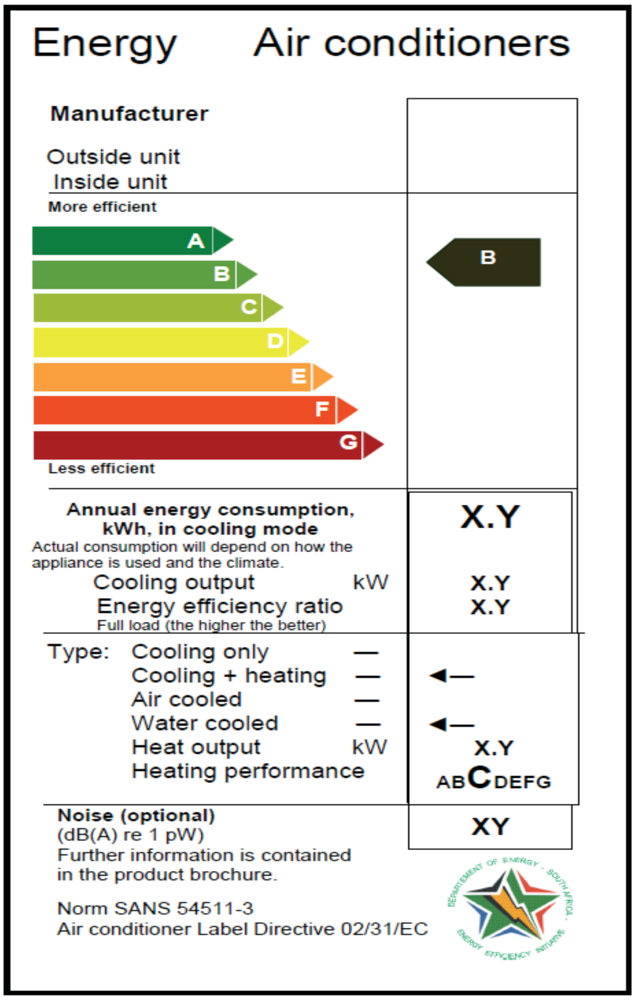

Figure 6: Exemplary Energy Label (for Air Conditioners, SANS 54511-3:2011)

Source: South Africa Bureau of Standards

The voluntary labelling programme had limited impact. With no support or signals from Government on the implementation of a mandatory programme it was soon forgotten and abandoned by manufacturers and retailers. In 2007 the South African Department of Energy (DOE) and the United Nations Development Programme (UNDP) country office agreed to submit a joint application to the Global Environment Facility (GEF) for financial support in order to implement a mandatory S&L programme [11]. In 2008, the South African Bureau of Standards (SABS) formed the Working Group 941 (WG941) who was mandated to develop the South African National Standard “SANS 941 - Energy Efficiency for Electrical and Electronic Apparatus”. SANS 941 identified energy efficiency requirements, energy efficiency labelling, measurement methods and the maximum allowable standby power for a set of appliances. SANS 941 created the basis for the development of national testing standards in South Africa, which adopted existing International Electrotechnical Commission (IEC) standards.

Pool pumps were not included in SANS 941 and consequently in 2015 there is also no national standard for the electricity consumption of pool pumps. Therefore, it is recommended to consider pool pumps in the next selection round of appliances to be included in the country’s S&L programme.

Furthermore, the existing South African energy label in its current format (2015) has certain shortcomings. These include:

- The label designed in 2005 is obsolete, and it does not go beyond A. The standard states 'the indicators for A+ / A+++ shall be placed at the same level as for class A';
- Focus Groups undertaken 2012 found that all consumers viewed the programme would benefit them and supported its implementation. However, reported issues concerning the label included confusion regarding the words used for descriptions on the label. For example, why does it say energy and not electricity? As South Africa has many languages (11 official) so this also means that certain words may be misunderstood; and
- Including extra information was also questioned. For example, why were noise levels included if it is an energy label?

Based on the above listed findings, a review and re-design of the South African label is recommended to incorporate the issues identified locally and in the EU (which has almost eliminated all text in favour of pictograms). The South African S&L project team is currently (2015) deliberating whether to make changes to the existing label in line with the upgrades made to the EU label, which makes greater use of symbols (pictograms) rather than text. The proposed changes to the label (as discussed in meanwhile) are shown exemplarily for refrigerators in Figure 7 below:

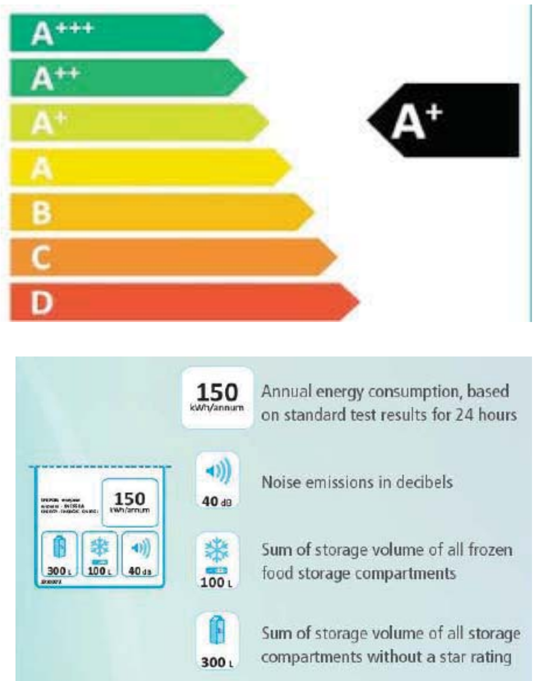

Figure 7: Exemplary draft for a new South African Energy Label

Source: South Africa Bureau of Standards

5 Test procedures and standards

SANS 941 - 'Energy Efficiency for Electrical and Electronic Apparatus' identified energy efficiency requirements, energy efficiency labelling, measurement methods and the maximum allowable standby power for a set of appliances. SANS 941 created also the basis for the development of national testing standards in South Africa, which adopted existing International Electrotechnical Commission (IEC) standards. However, pool pumps were not included and consequently in 2015 South Africa does not have any specific national standards relating to electricity consumption of this product group. Therefore, it is recommended to consider pool pumps in the next selection round of appliances, based on existing international approaches.

On international level, there have been significant efforts by the IEC to harmonize global motor test methods, culminating in the revision of the key standard IEC 60034-2-1 'Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)'. This was long overdue, as in the past different global regions have used significantly deviating test methods, not allowing a comparison between motors tested according to the different standards.

The current situation is that North America is still not ready to align with the IEC preferred methods. The practical implications of this are that manufacturers can use whatever method they like, but the regulator will specify what they will assess the motor by, and so it makes sense for the manufacturers to follow this specification. Meanwhile, Australia (alone) has MEPS listed for both standards.

There are consequently also two labelling schemes in existence, with the IE scheme created by IEC, and the other scheme a US only NEMA scheme (National Electrical Manufacturers Association, US Association of Electrical Equipment and Medical Imaging Manufacturers). However, these two schemes are now harmonized (see Table 4) to indicate the same levels of efficiency [12]. It is also concluded that there is a clear opportunity to unify EU and Australian swimming pool pump standards [12].

Table 4: Harmonized IEC and NEMA efficiency classes

IEC Designation	Similar to NEMA Class Province
IE1	Standard Efficient
IE2	Energy Efficient
IE3	Premium
IE4	Above Premium

In Europe, the European Commission is funding an Energy Using Product Preparatory Study on various types of pumps, including domestic swimming pool pumps. The study 'Work on Preparatory studies for implementing measures of the Ecodesign Directive 2009/125/EC, ENER Lot 29 – Pumps for Private and Public Swimming Pools, Ponds, Fountains, and Aquariums (and clean water pumps larger than those regulated under ENER Lot 11)' is being conducted by Bio Intelligence Service (France) and Atkins Ltd (UK). The objective of this work is to provide robust techno-economic analysis of the technical and economic energy saving potential of improved swimming pool pumps, from which policies for the EU-27 countries can be developed [13].

In Australia, which has approximately 1.32 million pools and a penetration rate of 12 % in residential households, a voluntary labelling system was introduced in 2010. The 10 largest pool pump manufacturers signed up to the programme and 35 different pumps were registered, but it has been found that the participants tend to register only their best performing models. A study in 2012 found that pumps labelled with the Energy Rating label sold clearly better than the ones that did not.

Thereby, the Australian swimming pool market appears to have striking similarities to the South African market. It may be worthwhile to undertake a review of how events have unfolded and the success achieved as well as lessons learned, in terms of electricity savings, which may be useful in the design and rollout of a South African S&L for swimming pool pumps.

Figure 8: Voluntary Energy Rating Labelling Program for Pool Pump-units (Australia)

Source: energyrating.gov.au

6 References

[1] AWO Branch Report South Africa (2012). The Building and Construction Industry – Market Overview

[2] LSM - Living Standards Measure South Africa, South African Advertising Research Foundation (SAARF)

[3] http://www.wattnow.co.za/article.php?id=721

[4] DUE 2015, Domestic Use of Energy conference, Cape Town, 30 March - 1 April 2015.

[5] Energy efficiency for residential swimming pools (2008). Domestic Use of Electricity Conference http://active.cput.ac.za/energy/past_papers/DUE/2008/PPT/DUE%20Conference%20-%20Workshops/Swimming%20Pools/G%20van%20Aswegen.pdf

[6] http://www.utillabs.com/sites/default/files/news-events-down-loads/2011_november_wattnow_a_smart_device_that_can_help_sa_achieve_its_energy_saving_targets.pdf

[7] Marbek Resources (1997): Appliance energy labelling program: Activity report: results of the benefit-cost analysis; Department of Minerals and Energy, South Africa.

[8] FRIDGE (2012): Energy Performance and Labelling Requirements for Specific Electrical Appliances and Equipment, 2012. Fund for Research into Industrial Development, Growth and Equity (FRIDGE).

[9] Eskom (2011): Trimming 10% is easier than you think. http://www.eskom.co.za/sites/idm/Documents/2011_12_20_ESKD_Trimming_10percent_Brochure.pdf

[10] www.biznews.com/budget/2014/10/south-african-economic-growth-plummet-1-4-nene-warns-country-turning-point-mtbps/

[11] http://undp-ccmap.org/projects/market-transformation-through-energy-efficiency-standards-labelling-appliances-south-africa

[12] Improving Global Compatibility: CLASP Fact Sheet IGC_Annex2_Product-Fact-Sheets_Motors-Pumps-Fans.pdf

[13] Wheeler, T. Falkner, H. and Refshauge, S. Addressing swimming pool and spa pump energy efficiency in Australia. https://www.motorsystems.org/files/otherfiles/0000/0163/035_paper_falkner.pdf

bigEE

Your guide to energy efficiency in buildings.

bigee.net

bigEE is an international initiative of research institutes for technical and policy advice and public agencies in the field of energy and climate, co-ordinated by the Wuppertal Institute (Germany). It is developing the international web-based knowledge platform bigee.net for energy efficiency in buildings, building-related technologies, and appliances in the world's main climatic zones.

The bigee.net platform informs users about energy efficiency options and savings potentials, net benefits and how policy can support achieving those savings. Targeted information is paired with recommendations and examples of good practice.

Co-ordinated by

Wuppertal Institute for Climate, Environment and Energy

Partners to date

中城深科 CSUSIBR · top10.cn · teri · BEE · sonedi · cscp

Supported by:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

based on a decision of the German Bundestag

Dr. Stefan Thomas • bigee@wupperinst.org

Wuppertal Institute for Climate, Environment and Energy • Doeppersberg 19 • 42103 Wuppertal • Germany • Phone: +49 (0)202 2492-129