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# Energy efficient washing machines

## Country

South Africa

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# 1 Country-wide saving potential in South Africa

## *Washing machines*

About **3.9 million** automatic washing machines are in use in South Africa (reference year 2010). The average annual consumption of each of these washing machines amounts to about **431 kWh**. In total, this causes an annual electricity consumption of **1.7 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 washing machine 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 washing machines can be achieved. While the stock is expected to grow by 73 % between 2010 and 2020, in the efficiency scenario the energy consumption can be reduced by 12 %. Although the stock is expected to grow by another 53 % until 2030, in the efficiency scenario the energy consumption would only rise by 2 % (Figure 1). Thereby, higher living standards (e.g. increasing appliance ownership rates and household numbers) have been anticipated. In contrast, in the baseline scenario with moderate efficiency gains the energy consumption would increase by 38 % by 2020 and 20 % between 2020 and 2030.

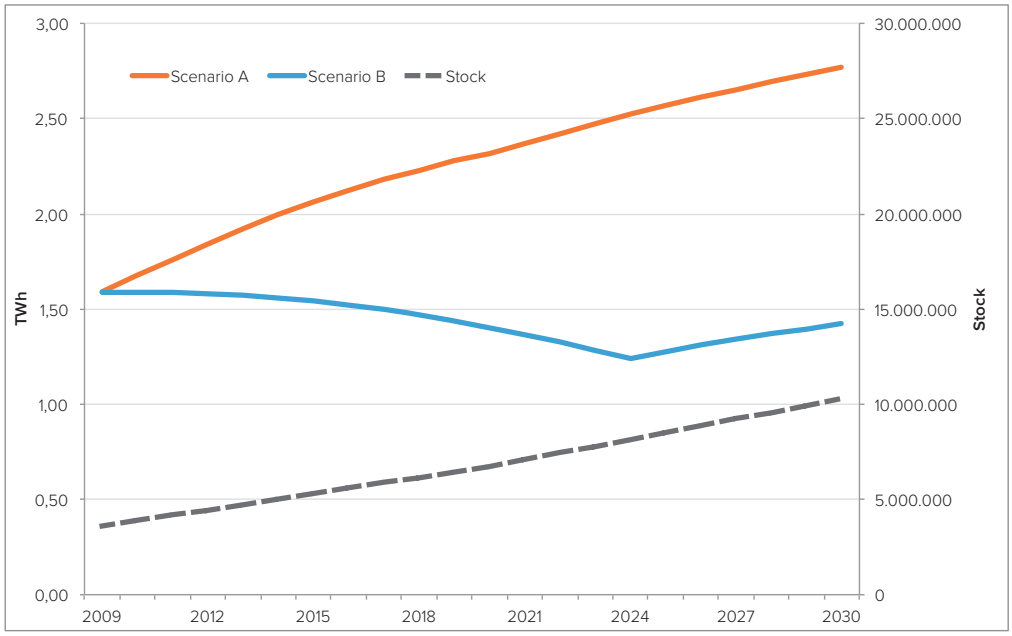


**Figure 1:** Electricity consumption washing machines, Baseline Scenario (A) vs. Efficiency Scenario (B)

Source: Wuppertal Institute (2014)

**Table 1:** Country-wide saving potential 2010 - 2030: Washing machines

| | | |
|---|---|---|
| **Base year 2010** | Total energy consumption of Washing machines per year [TWh/year] | 1.68 |
| | Stock number Washing machines | 3,880,000 |
| | Average annual energy consumption of Washing machines in the stock [kWh/year] | 432 |
| | Total annual $CO_2$eq emissions related with Washing machines [Mt/year] | 1.13 |
| **2020** | Energy savings potential in 2020 vs. baseline development [TWh/year] | 0.92 |
| | Resulting change in energy consumption 2020 vs. 2010 [TWh/year] | -0.28 |
| | $CO_2$eq emission reduction potential vs. baseline development [Mio.t/year] | 0.60 |
| | Stock number of Washing machines in 2020 | 6,730,000 |
| | Average annual energy consumption of new Washing machines (all BAT) in 2020 [kWh/year] | 150 |
| | Total incremental investment costs [not discounted] until 2020 (end-user perspective) [€] | 494,885,419 |
| | Total incremental investment costs [not discounted] until 2020 (societal perspective) [€] | 434,110,017 |
| | Total economic benefit until 2020 [not discounted] (end-user perspective) [€] scenario B vs. scenario A | 16,723,541 |
| | Total economic benefit until 2020 [not discounted] (societal perspective) [€] scenario B vs. scenario A | -205,548,952 |

| | | |
|---|---|---|
| 2030 | Energy savings potential in 2030 vs. baseline development [TWh/year] | 1.35 |
| | Resulting change in energy consumption 2030 vs. 2010 [TWh/year] | -0.25 |
| | $CO_2$eq emission reduction potential vs. baseline development [Mio.t/year] | 0.88 |
| | Stock number of Washing machines in 2030 | 10,300,000 |
| | Average annual energy consumption of new Washing machines (all BAT) in 2030 [kWh/year] | 120 |
| | Total incremental investment costs [not discounted] between 2021 and 2030 (end-user perspective) [€] | 705,165,054 |
| | Total incremental investment costs [not discounted] between 2021 and 2030 (societal perspective) [€] | 618,565,837 |
| | Total economic benefit until 2030 [not discounted] (end-user perspective) [€] scenario B vs. scenario A | 300,888,271 |
| | Total economic benefit until 2030 [not discounted] (societal perspective) [€] scenario B vs. scenario A | -298,437,422 |
| Lifetime data for Washing machines purchased in the analysed timeframe | Total electricity savings, scenario B compared to scenario A [TWh] | 28.02 |
| | Total GHG emission reductions scenario B compared to scenario A [Mt] | 18.16 |
| | Total incremental investment costs [not discounted] (end-user perspective) [€] scenario B vs. scenario A | 1,200,050,473 |
| | Total incremental investment costs [not discounted] (societal perspective) [€] scenario B vs. scenario A | 1,052,675,854 |
| | Total economic benefit [not discounted] (end-user perspective) [€] scenario B vs. scenario A | 979,912,438 |
| | Total economic benefit [not discounted] (societal perspective) [€] scenario B vs. scenario A | 46,950,477 |

Source: Wuppertal Institute (2014)

# 2 Subtypes and markets

Washing machines are considered a non-essential appliance by the lower and middle-income groups in South Africa, and thus have a penetration rate of less than 50% amongst households. However, they are on top of the list of appliances to be purchased when living standards rise. Top load machines have and continue to be the preferred choice in South Africa due to their traditionally larger drum sizes and lower price point. Front load machines, the preferred choice of high-end consumers, are growing in popularity and gain market share with every year that passes. Semi-automatic machines, which do cold washes only, are popular with low-end consumers. After experiencing high growth rates from 1999, sales growth was negative from 2007 to 2010 due to weak economic conditions. As all automatic washing machines are imported nowadays, the market is sensitive to currency fluctuations. Due to the weak economic conditions and the depreciation of the South African currency in recent years it is most likely that sales will remain under pressure in the near future.

South Africa has a long history of appliance manufacturing and the first large appliances (electric stoves) were manufactured in 1932. Refrigeration came soon after and other domestic appliances such as gas stoves, washing machines, tumble dryers followed. Historically there was a limited number of locally manufactured mass produced models available to the middle to lower income groups while the high income groups were serviced by European imports. With the new democratic government and the onset of globalisation in the mid-1990s several South African appliance companies have shut down their manufacturing plants but still two remain in 2014. However there is no longer any local manufacturing of automatic washing machines in South Africa. This ceased in early 2000 despite an import duty of 30%, which was specifically introduced in order to protect the local manufacturers [1]. Today only low-end semi-automatic (twin tub) washing machines are manufactured locally.

As recently as the late 1980's the country's electrification rate for residential households was around 35%, whereby almost all white households had electricity and the electrification rate of non-white households was extremely low. An electrification programme was implemented in the early 1990's and by 2001 the electrification rate had increased to 61% [2] and by 2011 it was 83% [3]. By the late 1990's the country's electrification programme expanded the market for electrical appliances by an estimated 50% [4].

The country's significant income inequality means that the middle to lower end of the market chooses appliances almost exclusively based on price and brand. These appliances generally have less functionality and are higher consumers of electricity. Conversely, upper income households choose their appliances based on functionality, design, brand, guarantees and after sales service, aesthetics and to a lesser extent and only more recently on their energy consumption. South Africa has a two-tier consumer base, with each group supporting different brands and models. All washing machines sold in South Africa must comply with the South African National Standard (SANS) 60456:2007. This standard conforms to the International Electrotechnical Commission IEC 60456:2003.

**Market Characteristics**

The national standard does not categorise washing machines into specific sizes but tests are conducted using a 5 kg load. Up until 2010 automatic washing machines fell under two categories - < 5 kg and > 5 kg. With new innovation and product design there was a major transformation in the market with a wide range of capacities being offered by manufacturers. Accordingly, this report categorises washing machines based on the most popular capacity ranges in the market under "small", "medium" and "large":

- 5 - 7 kg: **Small**;
- > 7 kg but < 10 kg: **Medium**; and
- > 10 kg: **Large**.

Washing machines, although an essential appliance to the upper middle and high-income groups, is deemed less essential with the lower income groups who - when faced with financial constraints - are likely to categorise it as a non-essential appliance, as they can resort to hand washing. The two-tier market, which exists in the country means that consumers have very different requirements and manufacturers serving each segment must offer products which match their needs.

The market is dominated by freestanding machines (93%) with built-in units making up the balance. The market has always been led by top loading machines[1], but the gap between the two is being narrowed, as front-loading machines have become the preferred choice of high-end consumers. Middle-income and larger families tend to buy top loading machines, which have a larger capacity but with a lower price point and fewer features. The lower end of the market is made up of semi-automatic or automatic units with limited functionality. The semi-automatic machines, or so called twin-tub washers, are top loader machines with generally medium to large capacity (7 kg or more), have a wash and spin timer, but have no heating element (i.e: they only perform cold washes). Users are able to add hot water if they want a higher temperature wash. Conversely, at the top end of the market manufacturers offer innovation and new technology to entice consumers to buy their products. For example, Whirlpool offers its '6$^{th}$ sense' technology, while 'EcoBubble' from Samsung promises shorter wash times with en-

[1] In South Africa (2014) vertical axis impeller/pulsator-type top-loading machines are dominating. For more information, see also http://www.bigee.net, Appliances Guide, Washing machines, 'Technical background and design options'

[2] www.pricecheck.co.za and www.shopmania.co.za

hanced cleaning. Defy with its 'AquaFusion' and 'Smart Drive Motor' offers reduced water and energy consumption, as fewer moving mechanical parts mean greater efficiency. In the middle, where the bulk of the market sits, are the automatic washing machines where consumers tend to make their purchase decision around more traditional factors, such as price, guarantees, availability of parts and brand. Euromonitor (2013) [5] notes '*Many consumers are happy with a basic, functional machine which does the job and is reasonably priced. Furthermore, nearly all middle income and upper income consumers have domestic help, and get their laundry done for them. With this in mind, it is unlikely that people will worry about these features, as they are not going to be the ones using the machine, and also need the machines to be simpler rather than complicated for their staff*'. As the Government's water and electrification programme continues to develop coupled with increasing income it is expected that in particular home laundry will experience growth. But with electricity tariffs increasing by as much as 300% since 2007 and increasing national concern regarding water availability in a water scarce country, Euromonitor (2014) reports that increasingly manufacturers and consumers are moving towards more energy and water efficient appliances as the economy continues to remain subdued and the price of water and electricity continue to rise.

**Penetration Rates and Sales**

Figure 2 shows the household penetration rate of washing machines by category type since 2003. After experiencing an average growth rate of 6.5%, albeit from a smaller base, for the period 1999-2006 the sector was hit hard when the economy slowed and went into recession. For the period 2007-2009 the compound annual growth rate (CAGR) was -6.8% but has recovered in recent years and growing at a more modest rate of 3.7% for the period 2010-2014 [5]. The same report has forecasted a CAGR of 6.4% up until 2018, but this may be on the high side given that washing machines are a non-essential appliance, the economy remains sluggish and the currency continues to lose value. Thus, it is likely that consumers continue to buy but lower-end machines, which have fewer features and offer good value for money. Figure 2 also shows how the penetration rate has increased since 2003.

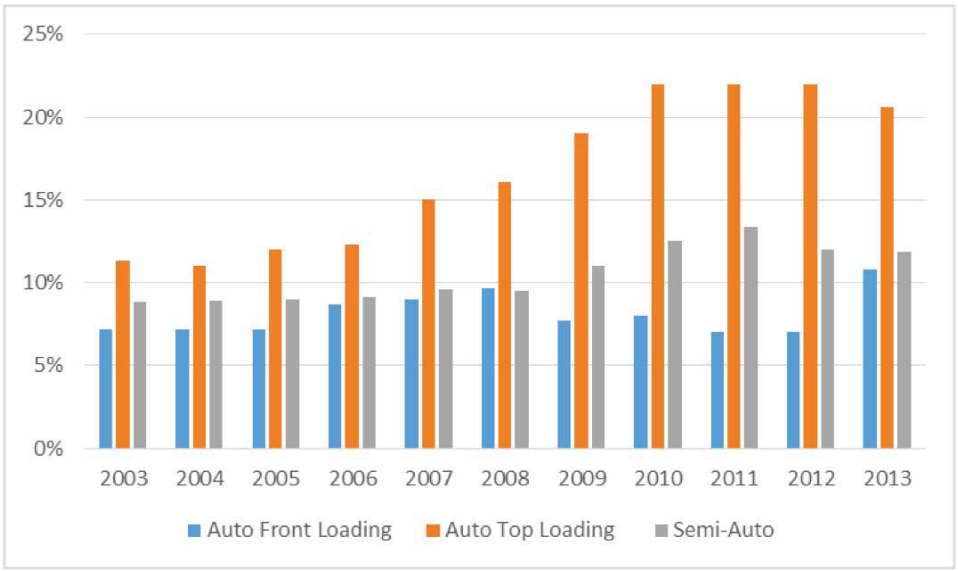


**Figure 2:** Penetration rate by washing machine type in SA HH 2003-2013 (%)

Source: Own illustration, based on AMPS (2003-2013)

Figure 3 shows the total number of units in South African households by category type. In 2011 there were 14,074,000 households in South Africa. Semi-automatic machines, which are mostly manufactured locally, continue to dominate the low-end of the market. Front-loading machines, which increasingly offer new innovations, are expected to continue to close the gap to top loader machines.

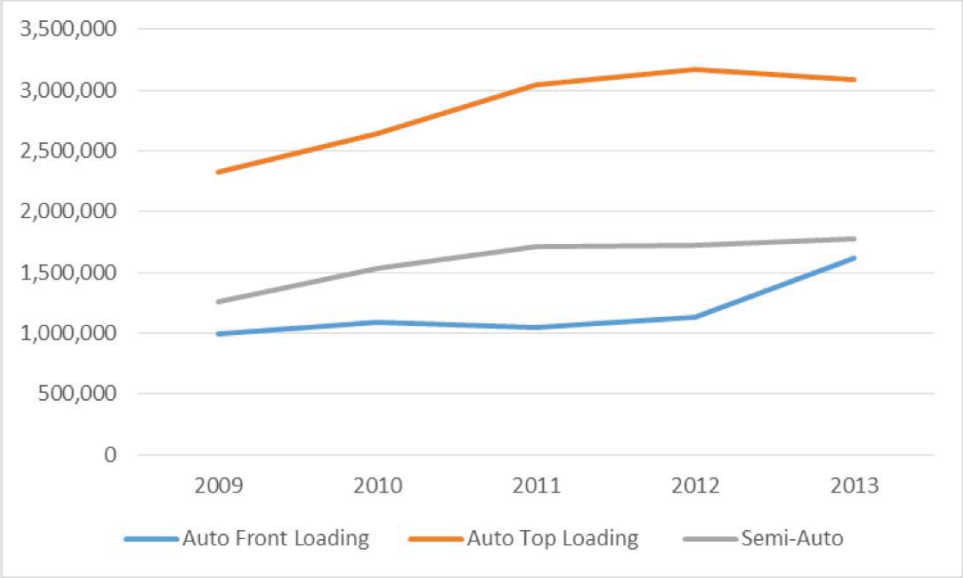


**Figure 3:** Total number of units in SA HH by sub-category 2009-2013

Source: Own illustration, based on AMPS (2009-2013)

Figure 4 shows the annual sales and forecast sales of automatic washing machines for the period 1999 to 2018 and illustrates very clearly how hard the sector was hit during the recession.

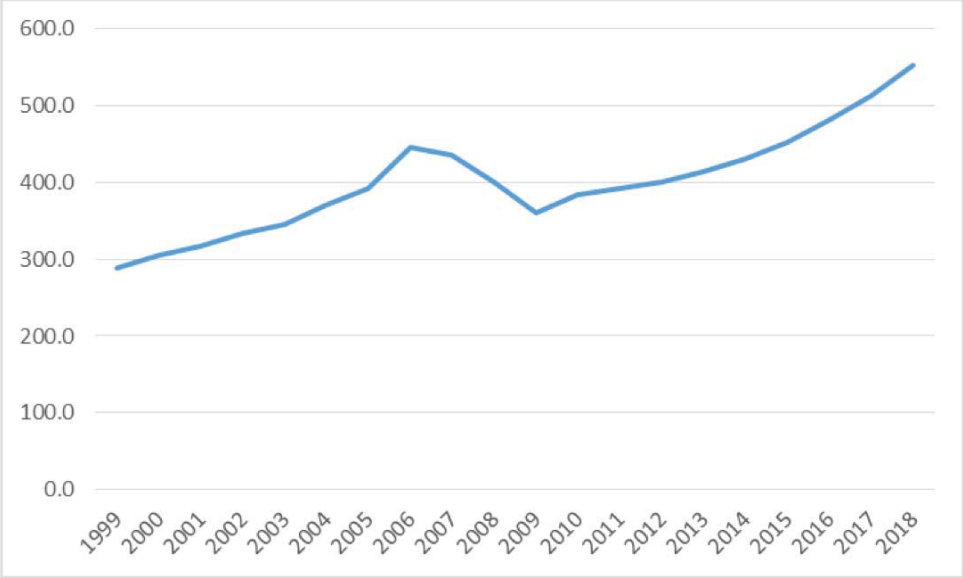


**Figure 4:** Annual sales of automatic washing machines until 2009 & forecast for 2014-2018 ('000 units)

Source: Own illustration, based on AMPS (2011)

Figure 5 also shows unit sales of automatic washing machines but in a line graph in order to show the market transformation from < 5kg to > 5kg machines, which occurred 2010. Unit sales of washing machines by sub-category are shown in Table 2.

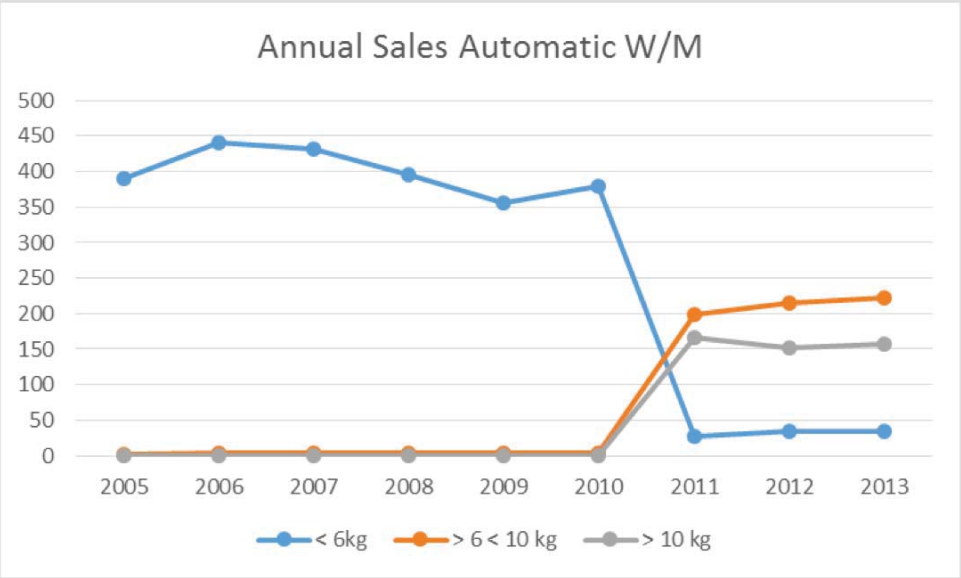


**Figure 5:** Annual sales of automatic washing machines 2005-2013 ('000 units)

Source: Own illustration, based on Euromonitor (2014)

**Table 2:** Unit sales by sub-category ('000 units)

| | | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Automatic** | Small | 391 | 441 | 432 | 396 | 357 | 379 | 27 | 35 | 35 |
| | Medium | 2 | 5 | 4 | 4 | 4 | 4 | 198 | 215 | 222 |
| | Large | 0 | 0 | 0 | 0 | 0 | 0 | 167 | 152 | 158 |
| | Total | 393 | 446 | 436 | 400 | 361 | 383 | 392 | 401 | 415 |
| **Semi-Automatic** | Total | N/A | N/A | N/A | 131 | 98 | 94 | 99 | 102 | 104 |
| **Total Sales** | | | | | **531** | **459** | **477** | **491** | **503** | **519** |

Source: Euromonitor (2014)

### Washing Machine Market – 1995

First interest in energy efficient appliances in South Africa dates back to 1995, when a cost benefit analysis [7] was undertaken by the Department of Minerals and Energy. The study analysed the typical consumption figures of front and top load washing machines using a standard cycle. The energy used per annum was taken as 276 kWh for front load washers and 192 kWh for top load washers. Existing washing machines would be replaced after a typical lifetime of 15 years [8].

### Washing Machine Market – 2010

A study undertaken by the Department of Trade and Industry [9] in 2011 surveyed the top 5 manufacturers and distributors of washing machines in South Africa. Jointly, these companies accounted for more than 80% of annual sales in 2010 and 2011. The study found that there were 64 front loader and 17 top loader models available in the market. Semi-automatic twin tubs without heating elements were excluded from the survey due to their very low energy consumption. The lowest energy class, and also the most dominant, for front load machines was found to be an A. Only one manufacturer supplied an energy class rating for top load machines. All top load machines had a capacity of > 10kg.

*Please note: The number of models and the energy class levels were provided voluntarily by the five manufacturers with no additional research. It is thus not the full list of models available (per manufacturer) in 2011 as each manufacturer may have interpreted the request for data differently. For example, product ranges which were coming to an end or which had been discontinued may have been excluded even though they were still widely available.*

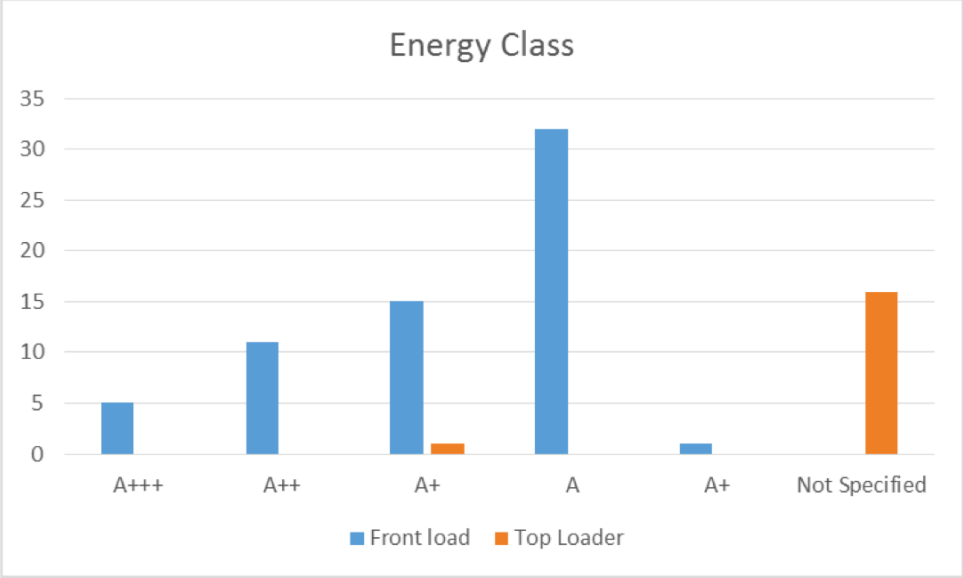


**Figure 6:** Energy Class Distribution of models for front and top loader (2010)

Source: Own illustration

### Washing Machine Market – 2014

Table 3 gives the number models available in the South African market in 2014. The data was sourced from popular online shopping websites[2]; manufacturer websites and data supplied by manufacturers themselves. Again, it is not a complete list, but it is believed to cover the majority of the market in South Africa. The most popular category is the medium sized front loader followed by the large top loaders. Interestingly even though top load machines dominate the market (see also Figure 3), the largest model variety is found in front load machines (Table 3), where the order is approximately 6:1.

[2] www.pricecheck.co.za and www.shopmania.co.za

**Table 3:** Numbers of models available in the South African market, per category (2014)

| Category | Top Loader | Front Loader |
|---|---|---|
| Small | 1 | 80 |
| Medium | 4 | 42 |
| Large | 15 | 6 |
| Total | 20 | 128 |
| Total number of models | 148 | |

Source: Own analysis, based on data from www.pricecheck.co.za and www.shopmania.co.za

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. These events have had a significant impact on the sales of washing machines, which are considered a lower priority appliance. It has taken five years for sales of automatic washing machines to match and exceeded their 2008 volumes. The consequence is that consumers of household appliances look for '*value offerings*' and it is unclear whether consumers have understood the '*value proposition made by energy efficient appliances'* [6]. The traditional decision making criteria: price; brand; guarantees; after sales service; design and aesthetics - still dominate. However, the combination of the Government's intention to introduce a mandatory Standards & Labelling (S&L) programme in 2015 and manufacturers realising that consumer awareness and understanding of energy efficiency is growing has elicited a response. Manufacturers surveyed have confirmed that for the appliances that are to be included in the Government's S&L programme their products meet the MEPS and would like to see the programme 'come into effect as soon as possible'[3]. It is with the retailers where the uncertainty continues as the delayed implementation of the mandatory S&L programme means that stores, where there is very limited understanding of how S&L programmes are applied, remain unclear on what labelling is required and where. This has resulted in a situation where it is left up to the individual store managers to decide as to whether appliances labels are displayed and how to best deal with appliances where the energy efficiency rating is not supplied by the manufacturer. The result is that some appliances have labels, others do not and labels are also not standardised – as shown in the following figures. This makes it difficult for consumers to interpret and compare them. Pictures taken in 2010 and 2014 show e.g. how different manufacturers developed their own labels or used EU labels to provide information. Entry to mid-level machines in one of the country's major appliance retail stores have no labels at all (Figure 8). However some of their high-end machines have the EU label (Figure 9). Not a single washing machine was found to have the South African designed energy label as defined in the National Standard 60456: 2007 (See also Figure 11).

[3] Discussion held with technical manager of Defy appliances September, 2014


**Figure 7:** Entry to mid-level front load automatic washing machines – Energy labels
Source: Photos taken by Theo Covary (2010/2010/2014)


**Figure 8:** Entry to mid-level front & top load automatic washing machines – no energy labels (2014)
Source: Photos by Theo Covary

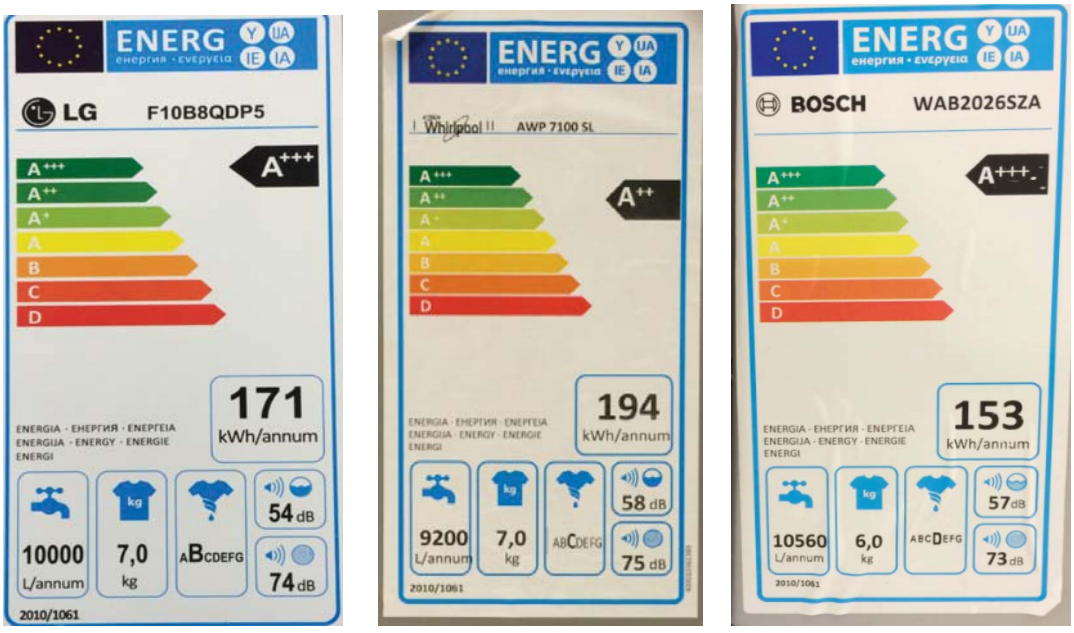


**Figure 9:** Energy labels found on high-end front load automatic washing machines in South Africa
Source: Photos by Theo Covary

Figure 10 shows the results of the market survey conducted in 2014 (referred to above) and the move towards energy efficient appliances by the manufacturers. Of course, it is not known to what extent the unspecified models are poor performing models, i.e. C class or worse, or whether these models have not been labelled, as there is no requirement to do so. In all likelihood it is a combination of the two reasons.

It becomes immediately evident when looking at Figure 10 that although for about 20% of front load machines an energy class is not available, all top load models (except for one) are not specified. An extensive desktop research to determine the energy class of top load machines of the five top brands in the country yielded no results. Although all manufacturers provided detailed information about the technical specifications and performance credentials of the front load machines, minimal information is provided on their top load units. This suggests that they might perform poorly with regards to energy and water consumption compared to the front load equivalents, but this assumption cannot be verified without further data and research.

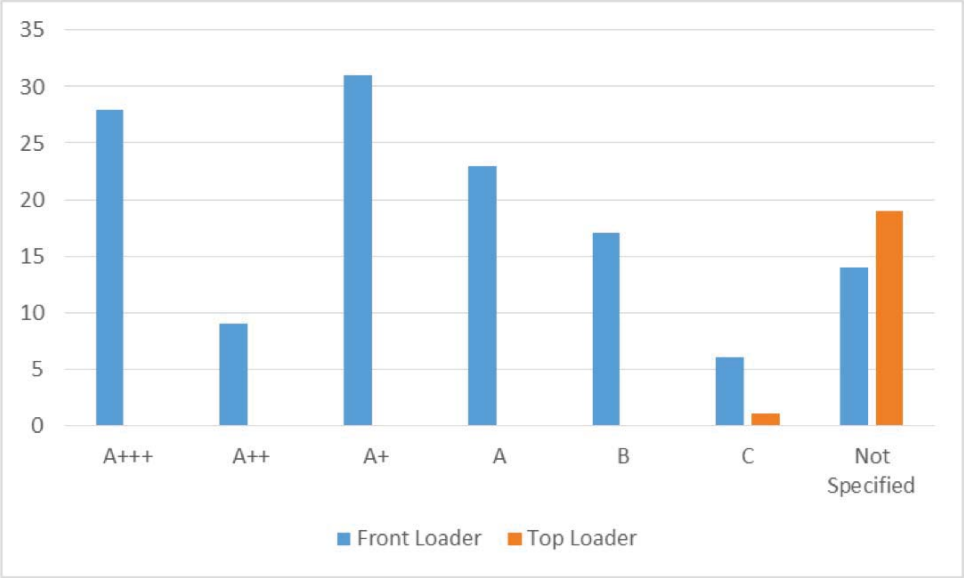


**Figure 10:** Distribution of models by energy rating, all categories (2014)

Source: Own illustration

**Summary of the washing machine 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. Tariffs have tripled over the four years period 2008-2012 and households are currently paying EUR 0.10/kWh (2014). 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. It is unlikely that these growth rates are sustainable for the period 2014-2030.

- The automatic washing machine market in South Africa is made up exclusively of imports. This theoretically should make compliance of the incoming mandatory S&L straightforward, as models not fulfilling MEPS can be banned from the market. This may pose some challenges for the larger top-loading machines, which appear to have a poor performance evidenced by the fact that none (except for 1) of them carry any label. A large percentage of semi-automatic washing machines are locally manufactured which makes them attractive to the lower end of the market and thus are expected to maintain their market share. Semi-automatic (twin-tub) machines do not fall under the S&L programme as they only perform cold washes.

- With all automatic washing machines being imported, they are susceptible to currency fluctuations. On 1 January 2011 the Rand was valued at 8.76 to the Euro and on 13 December 2014 it was valued at 14.47, which equals a drop of 65%.

- In its 2014 market analysis Euromonitor reported that the local market is aligning itself with the international trends and increasing its product ranges that are both energy and water efficient, which are marketed to the top end of the market. At the lower, mass end of the market price is the key-determining factor for purchases.

- In addition to innovation and new technologies mentioned above, the trend towards larger drum sizes and front load, which started in 2010, continues. At the lower end of the market washing machines are seen as non-essential but when they do buy automatic washing machines it is likely that they will buy smaller drum sizes or top load machines, which are cheaper.

- Replacement cycles of automatic and semi-automatic washing machines are almost identical and have changed little over the last five years. In 2007 the expected replacement rate was 7 years dropping down to 6.15 years in 2013. However, the replaced units generally find themselves in lower income households where they start a new life. Therefore an actual lifetime of 15 years is not unrealistic.

- Weak economic conditions and the depreciation of the currency mean that the appliances market in South Africa is likely to remain under general pressure for the near future.

# 3 Efficiency range and user savings

The washing machine market in South Africa had a transformation in 2009/10 when consumers were offered, and opted for, machines with much larger washing capacities. Up until this time units were commonly < 5kg but have now moved to an average size of 7kg. In addition there have been significant advances in technology with all major brands offering some kind of innovation, which claims to be more efficient and effective. There is little doubt that these new generation machines use less energy and water than machines from 10 years ago. However, the increased drum size of 20-60% means that some of this efficiency might be lost, if the machines are operated inadequately. As all automatic washing machines are now imported, consumers have access to the latest technologies and almost all front load machines are energy class B or better. It is unclear how top load machines perform.

**Table 4:** Efficiency range and user savings of Front Load Washing Machines, based on 2012 data

| **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** | 5 kg pre 2010 and 7 kg post 2010 | | | | |
| **Category** | | | | | |
| **Type** | Front Loader with four temperature settings | Front Loader (with four temperature settings | Front Load (6kg) 8 programmes, 800 RPM spin speed | Front Load (8kg)<br><br>15 programmes, 1,200 RPM spin speed | Front Load (10kg+) |

| | | | | | |
|---|---|---|---|---|---|
| **Lifetime (years)** | 15 | 15 | 15 | 15 | 15 |
| **Qualitative performance classification of the provided service:** | ☐ Poor<br>☐ Low<br>☐ Average<br>☒ Good<br>☐ Excellent<br>☐ No information | ☐ Poor<br>☐ Low<br>☐ Average<br>☒ Good<br>☐ Excellent<br>☐ No information | ☐ Poor<br>☐ Low<br>☐ Average<br>☒ Good<br>☐ Excellent<br>☐ No information | ☐ Poor<br>☐ Low<br>☐ Average<br>☐ Good<br>☒ Excellent<br>☐ No information | ☐ Poor<br>☐ Low<br>☐ Average<br>☐ Good<br>☒ Excellent<br>☐ No information |
| **Yearly energy consumption: *electricity (kWh)*** | 283 | 400 | 300 | 179 | 150 |
| **Yearly energy cost (ZAR)** | 425 | 600 | 450 | 270 | 225 |
| **If applicable: yearly energy consumption for further energy carriers** | N/A | N/A | N/A | N/A | N/A |
| **If applicable: yearly water consumption** | 12,000 L | 12,000 L | 9,500 L | 8,700 L | 8,000 L |
| **Yearly water cost (ZAR)** | 225 | 225 | 150 | 130 | N/A |
| **Purchase cost in (ZAR)** | 2,000 | 2,500 | 3,000 | 8,000 | 12,000 + |
| **Operation & Maintenance cost (ZAR)** | 1,000 (lifetime) | 1,000 (lifetime) | 1,000 (lifetime) | 1,000 (lifetime) | 1,000 (lifetime) |

# 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 the 28 November 2014 sets a date for the start of S&L programme. For automatic washing machines this is the 28th of August 2015 and the MEPS has been set at level A.

**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 were imported from Europe. A South African label was designed (Figure 11), 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. The label was registered with all the relevant national and international authorities.

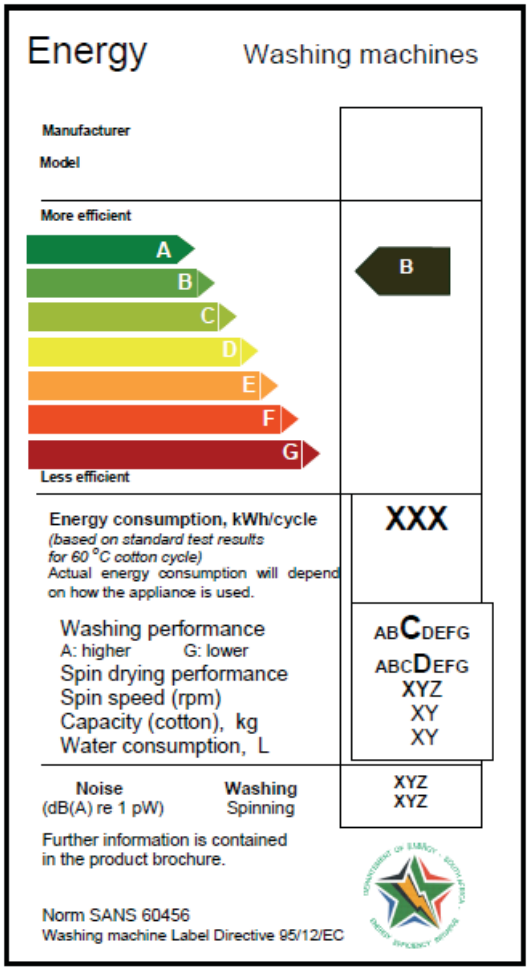


**Figure 11:** Energy Label for Washing Machines (SANS 60456:2007)

Source: South Africa Bureau of Standards

The voluntary programme had limited impact. With no support or signals from the 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 the existing International Electrotechnical Commission (IEC) standard. The derived testing standard for washing machines is SANS 60456:2007 (IEC 60456:2003). The proposal for the GEF funded S&L programme (submitted in 2010 and approved in 2011) selected the appliances based on SANS 941, but does not cover all the appliances listed in SANS 941.

The South African energy label in its current format has certain shortcomings. These include:

- The label designed in 2005 is obsolete, as 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 (2014) 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. Exemplarily, the proposed changes to the label for refrigerators are shown in Figure 12 below:

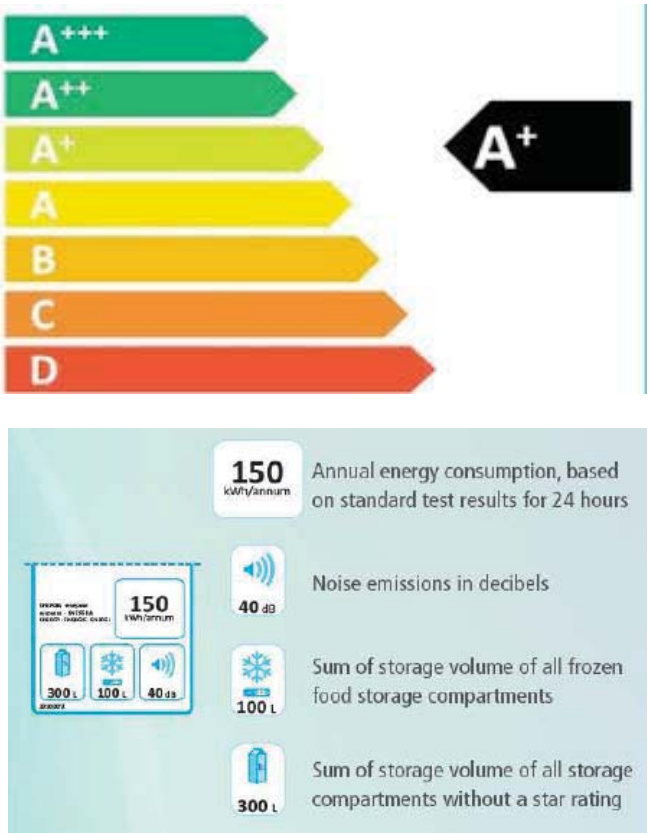


**Figure 12:** Draft for a new South African Energy Label

Source: South Africa Bureau of Standards

### Minimum Energy Performance Standards (MEPS)

On 7 February 2014, the "Compulsory specification for energy efficiency and labelling of electrical and electronic apparatus, VC9008" [12] was published by the South African government, which confirmed the MEPS (label class) as:

- Washing Machines: A

The intention to introduce the above energy class allow for a mandatory two-month period for public comments. Once this time has elapsed and comments are dealt with, the Minister may introduce the regulations at his / her discretion. It is expected that the MEPS will come into force during the 2015 calendar year. On the 28th of November, 2014 the Department of Trade and Industry finally published notification that the VC 9008 will come into effect for washing machines nine months after publication of the notice i.e: 28 August, 2015. [13]

The MEPS levels were based on the findings of preceding impact assessment studies as well as consultations with manufacturers, retailers and consumer groups.

# 5 Test procedures and standards

According to the SANS 60456:2007 Edition 2 South African National Standard "Clothes washing machines for household use - Methods for measuring the performance standard" [14], a washing machine is defined as follows: "An appliance for cleaning and rinsing of textiles using water which may also have a means of extracting excess water from the textiles".

The Energy efficiency class for washing machines can be determined based on the energy consumption, C, for a standard 60 °C cotton cycle as shown below in Table 5:

**Table 5:** Energy Efficiency Class

| Energy Efficiency Class | Energy Consumption for Standard 60°C cotton cycle C (kWh per kg washed) |
|---|---|
| A | C ≤ 0.19 |
| B | 0.19 < C ≤ 0.23 |
| C | 0.23 < C ≤ 0.27 |
| D | 0.27 < C ≤ 0.31 |
| E | 0.31 < C ≤ 0.35 |
| F | 0.35 < C ≤ 0.39 |
| G | 0.39 < C |

The equation to calculate the value of *C* is given as follows:

$$C = \text{kWh per cycle per kg load} = \frac{\text{Energy consumption per washing cycle}}{\text{kg load capacity}}$$

As input to calculate the value of *C*, the kWh per cycle per kg can be used or alternatively the energy consumption per cycle divided by the kg load capacity.

# 6 Application of the Standard

The SANS 60456 formulas to derive the energy class are complicated and the practical application is difficult to understand for the average consumer. To provide a reference point, the most popular ranges of automatic washing machines were chosen and actual data was used to determine annual energy consumption for each of the energy classes.

The calculations were done by the electrical engineering department of the University of Stellenbosch.

The final results contained in Table 7 were based on actual data values of:

- Capacity (in kg); and
- Energy consumption per kg load washed.

Data was only available for classes A to C with the following capacity ranges per class as set out in Table 6:

**Table 6:** Actual capacity range data for classes A to C

| | **Class A** | **Class B** | **Class C** |
|---|---|---|---|
| **Capacity range (in kg):** | 5 - 9 kg | 6 - 8 kg | 6 - 10.5 kg |

Based on these capacity ranges, two major capacity categories were identified, namely 5 to 7 kg and 7 to 9 kg. Capacities of 6 kg and 8 kg, respectively, were used to determine the range of values for energy consumption per 60 °C cotton cycle wash.

**Table 7:** Reference Table Energy consumption for Washing Machine Category

| | | **Smaller Capacity (in kg):** (Between 5 and 7 kg) | **Larger Capacity (in kg):** (Between 7 and 9 kg) |
|---|---|---|---|
| **Energy Efficiency Class** | **Energy consumption, *C*, per class** | **Energy Consumption, *E*, per wash (in kWh)** for 60 °C cotton cycle for capacity = 6 kg | **Energy Consumption, *E*, per wash (in kWh)** for 60 °C cotton cycle for capacity = 8 kg |
| **A** | $C \leq 0.19$ | $E \leq 1.14$ | $E \leq 1.51$ |
| **B** | $0.19 < C \leq 0.23$ | $1.14 < E \leq 1.38$ | $1.51 < E \leq 1.83$ |
| **C** | $0.23 < C \leq 0.27$ | $1.38 < E \leq 1.61$ | $1.83 < E \leq 2.15$ |
| **D** | $0.27 < C \leq 0.31$ | $1.61 < E \leq 1.85$ | $2.15 < E \leq 2.47$ |
| **E** | $0.31 < C \leq 0.35$ | $1.85 < E \leq 2.09$ | $2.47 < E \leq 2.79$ |
| **F** | $0.35 < C \leq 0.39$ | $2.09 < E \leq 2.34$ | $2.79 < E \leq 3.11$ |
| **G** | $0.39 < C$ | $2.34 < E$ | $3.11 < E$ |

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