Appliances Guide
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Energy efficient clothes dryers and washer dryers

Country

South Africa

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Index

1 Country-wide saving potential

Dryers

About **1.3 million** dryers are in use in South Africa (reference year 2010). The average annual consumption of each of these dryers amounts to about **840 kWh**. In total, this causes an annual electricity consumption of **1.1 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 dryer 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 dryers can be achieved. While the stock is expected to grow by 45 % between 2010 and 2020, in the efficiency scenario the energy consumption can be reduced by 41 %. Although the stock is expected to grow by another 71 % until 2030, in the efficiency scenario the energy consumption would decrease by 14 % (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 16 % by 2020 and 19 % between 2020 and 2030.

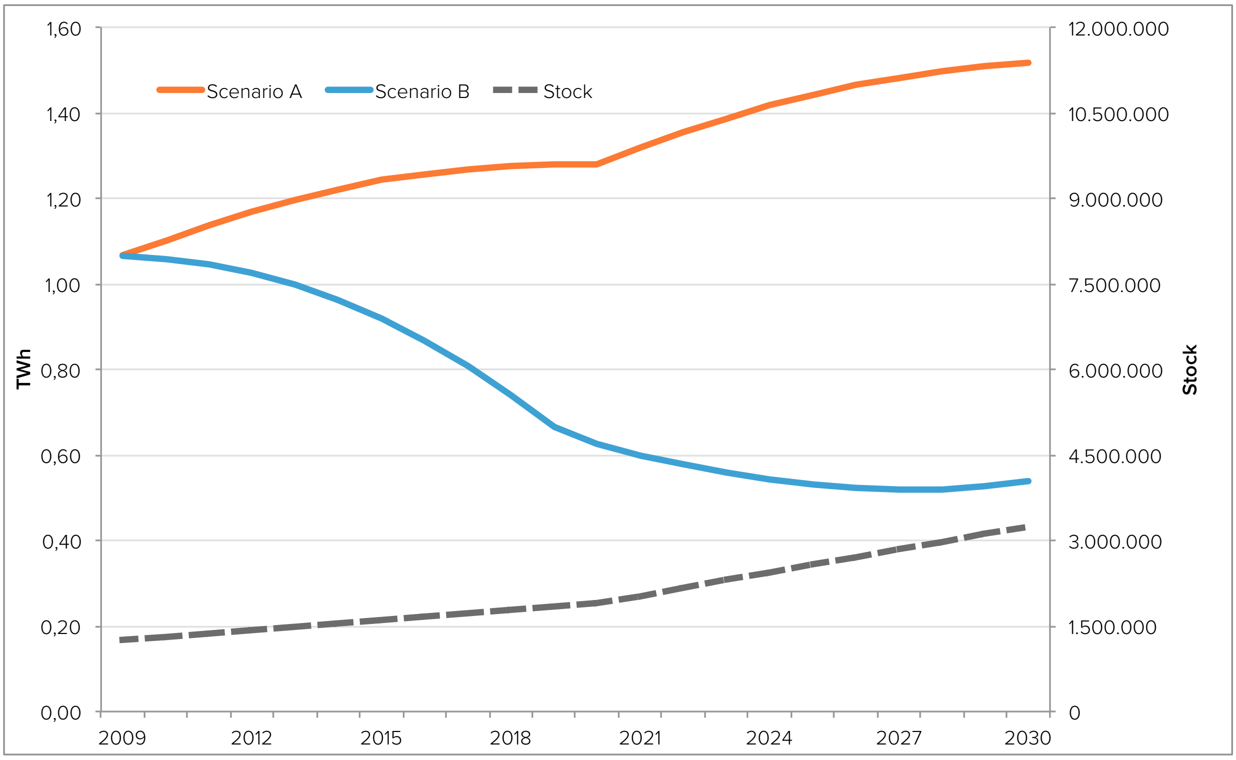

Figure 1: Electricity consumption dryers, Baseline Scenario (A) vs. Efficiency Scenario (B)

Source: Wuppertal Institute (2015)

Table 1: Country-wide saving potential 2010 - 2030: Dryers

Base year 2010	Total energy consumption of Dryers per year [TWh/year]	1.10
	Stock number Dryers	1,310,000
	Average annual energy consumption of Dryers in the stock [kWh/year]	841
	Total annual CO_2eq emissions related with Dryers [Mt/year]	0.74
2020	Energy savings potential in 2020 vs. baseline development [TWh/year]	0.65
	Resulting change in energy consumption 2020 vs. 2010 [TWh/year]	-0.48
	CO_2eq emission reduction potential vs. baseline development [Mio.t/year]	0.43
	Stock number of Dryers in 2020	1,900,000
	Average annual energy consumption of new Dryers (all BAT) in 2020 [kWh/year]	187
	Total incremental investment costs [not discounted] until 2020 (end-user perspective) [€]	189,882,417
	Total incremental investment costs [not discounted] until 2020 (societal perspective) [€]	166,563,524
	Total economic benefit until 2020 [not discounted] (end-user perspective) [€] scenario B vs. scenario A	189,750,059
	Total economic benefit until 2020 [not discounted] (societal perspective) [€] scenario B vs. scenario A	19,462,196

2030	Energy savings potential in 2030 vs. baseline development [TWh/year]	0.98
	Resulting change in energy consumption 2030 vs. 2010 [TWh/year]	-0.56
	CO_2eq emission reduction potential vs. baseline development [Mio.t/year]	0.64
	Stock number of Dryers in 2030	3,250,000
	Average annual energy consumption of new Dryers (all BAT) in 2030 [kWh/year]	149
	Total incremental investment costs [not discounted] between 2021 and 2030 (end-user perspective) [€]	300,105,000
	Total incremental investment costs [not discounted] between 2021 and 2030 (societal perspective) [€]	263,250,000
	Total economic benefit until 2030 [not discounted] (end-user perspective) [€] scenario B vs. scenario A	824,109,938
	Total economic benefit until 2030 [not discounted] (societal perspective) [€] scenario B vs. scenario A	280,733,249
Lifetime data for Dryers purchased in the analysed timeframe	Total electricity savings, scenario B compared to scenario A [TWh]	16.8
	Total GHG emission reductions scenario B compared to scenario A [Mt]	10.9
	Total incremental investment costs [not discounted] (end-user perspective) [€] scenario B vs. scenario A	489,987,417
	Total incremental investment costs [not discounted] (societal perspective) [€] scenario B vs. scenario A	429,813,524
	Total economic benefit [not discounted] (end-user perspective) [€] scenario B vs. scenario A	1,208,879,476
	Total economic benefit [not discounted] (societal perspective) [€] scenario B vs. scenario A	499,570,729

Source: Wuppertal Institute (2015)

Washer dryers

About **0.4 million** washer dryers are in use in South Africa (reference year 2010). The average annual consumption of each of these washer dryers amounts to about **1095 kWh**. In total, this causes an annual electricity consumption of **0.5 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 washer dryer 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 washer dryers can be achieved. While the stock is expected to grow by 59 % between 2010 and 2020, in the efficiency scenario the energy consumption can be reduced by 7 %. Although the stock is expected to grow by another 24% until 2030, in the efficiency scenario the energy consumption can be further reduced by 7 % (Figure 2). 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 26 % by 2020 and 10 % between 2020 and 2030.

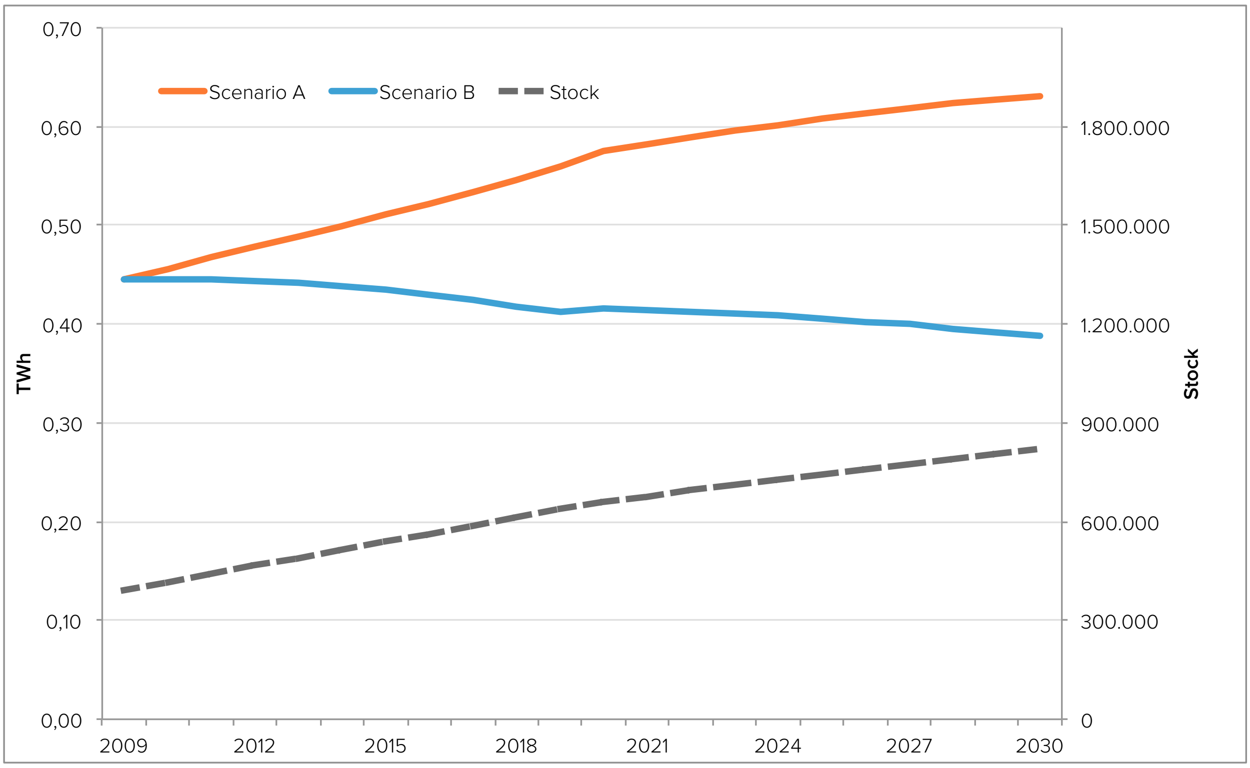

Figure 2: Electricity consumption washer dryers, Baseline Scenario (A) vs. Efficiency Scenario (B)

Source: Wuppertal Institute (2015)

Table 2: Country-wide saving potential 2010 - 2030: Washer dryers

Base year 2010	Total energy consumption of Washer dryers per year [TWh/year]	0.46
	Stock number Washer dryers	417,000
	Average annual energy consumption of Washer dryers in the stock [kWh/year]	1095
	Total annual CO_2eq emissions related with Washer dryers [Mt/year]	0.31
2020	Energy savings potential in 2020 vs. baseline development [TWh/year]	0.16
	Resulting change in energy consumption 2020 vs. 2010 [TWh/year]	-0.04
	CO_2eq emission reduction potential vs. baseline development [Mio.t/year]	0.11
	Stock number of Washer dryers in 2020	662,000
	Average annual energy consumption of new Washer dryers (all BAT) in 2020 [kWh/year]	550
	Total incremental investment costs [not discounted] until 2020 (end-user perspective) [€]	124,005,933
	Total incremental investment costs [not discounted] until 2020 (societal perspective) [€]	108,777,134
	Total economic benefit until 2020 [not discounted] (end-user perspective) [€] scenario B vs. scenario A	-49,591,086
	Total economic benefit until 2020 [not discounted] (societal perspective) [€] scenario B vs. scenario A	-81,370,266

2030	Energy savings potential in 2030 vs. baseline development [TWh/year]	0.24
	Resulting change in energy consumption 2030 vs. 2010 [TWh/year]	-0.07
	CO_2eq emission reduction potential vs. baseline development [Mio.t/year]	0.16
	Stock number of Washer dryers in 2030	823,000
	Average annual energy consumption of new Washer dryers (all BAT) in 2030 [kWh/year]	413
	Total incremental investment costs [not discounted] between 2021 and 2030 (end-user perspective) [€]	142,492,162
	Total incremental investment costs [not discounted] between 2021 and 2030 (societal perspective) [€]	124,993,125
	Total economic benefit until 2030 [not discounted] (end-user perspective) [€] scenario B vs. scenario A	-1,398,161
	Total economic benefit until 2030 [not discounted] (societal perspective) [€] scenario B vs. scenario A	-113,499,755
Lifetime data for Washer dryers purchased in the analysed timeframe	Total electricity savings, scenario B compared to scenario A [TWh]	4.14
	Total GHG emission reductions scenario B compared to scenario A [Mt]	2.70
	Total incremental investment costs [not discounted] (end-user perspective) [€] scenario B vs. scenario A	266,498,095
	Total incremental investment costs [not discounted] (societal perspective) [€] scenario B vs. scenario A	233,770,259
	Total economic benefit [not discounted] (end-user perspective) [€] scenario B vs. scenario A	103,347,866
	Total economic benefit [not discounted] (societal perspective) [€] scenario B vs. scenario A	-60,135,297

Source: Wuppertal Institute (2015)

2 Subtypes and markets

Dryers and washer dryers are commonly ranked even below washing machines in South Africa, which are themselves considered as non-essential appliances by the lower and middle-income groups. It is also not surprising that with a sub-tropical climate, dryers and washer dryers are literally 'nice to have' appliances and this is reflected in their low penetration rates of 10% and 3% respectively. Dryers in particular have still not managed to reclaim their former annual sales figures, which peaked in 2006. Sales of washer dryers continue to grow but off a small base.

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 and 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 remained in 2014, and one of them still manufactured dryers locally. The South African Government has for many decades had a policy of protecting local manufacturers and this extends to residential appliances. Luxury imported items are generally not spared and they are also taxed. A 20% duty is levied on all imported dryers not exceeding 7.5 kg, 30% for combination washer dryers not exceeding 13 kg and 10% for parts [1]. This tariff is not applied to products from the EU. Locally manufactured dryers are below 7.5 kg in size and washer dryers are taxed as a luxury item and not to protect local manufacturing as all models are imported. 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 dryers sold in South Africa must comply with the South African National Standard (SANS) 61121:2010 and washer dryers with SANS 50229:2010. These standards conform to the International Electrotechnical Commission IEC 61121:2010 and IEC 50229:2010 respectively.

Market Characteristics

The national standard does not categorise dryers into specific sizes but tests are conducted based on the rated capacity of the dryer, which is defined in the standard [5] as '*mass in kg of dry textiles of a particular defined type, which the manufacturer declares can be treated in a specific programme*'. A review of available tumble dryers in the market shows that the capacity ranges between 5-9 kg. What the standard does differentiate is between air-vented and condenser models. Accordingly, this report categorises dryers based primarily on the technology type and not capacity. The test for washer dryer combination units is conducted on the rated capacity of the appliance using a standard 60°C cotton and dry cotton cycle. For the wash cycle the standards constantly refers to SANS 60456 (see bigEE South Africa washing machine paper for more details). Due to the small sales volumes of washer dryers all models are categorised jointly.

If washing machines are deemed as a 'second tier' or non-essential appliances then dryers and washer dryers are even more so. South Africa's sub-tropical climate means that clothes can be dried relatively easy outdoors (washing line) or indoors (clothes horse). For households that do own dryers the preference is to use them only when weather conditions are not suitable for other drying methods. Figure 3 below shows the average percentage of sunshine over the year in Johannesburg and provides an indication of conditions for the entire province, which is by far the smallest but most affluent and populated in the country. Euromonitor (2014) [6] concludes, (the sub-tropical climate) '...*continues to pose a restriction to growth*' for dryers.

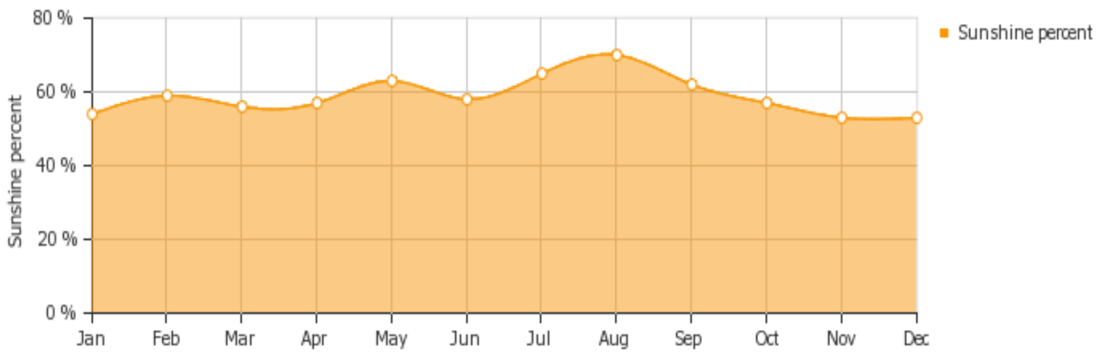

Figure 3: Average percentage of sunshine in Johannesburg, South Africa

Source: Weather-and-climate.com

The dryer market in South Africa is dominated by ventilator models (91%) even though condenser models continue to show growth, e.g. from 2% market share in 2003 up to 9% in 2013. Automatic washer dryers grew by 7% in 2013, which was the highest growth of a category in the home laundry market in the country. This can be attributed to high end, younger consumers opting for smaller residences which have limited outside areas for drying and indoor drying on clothes horses is deemed unsightly. These models gives them the ability to save space and be able to dry their clothes in a more convenient, albeit more expensive, manner. These users are typically less sensitive to cost and more focused on time saving and convenience. As with all appliances in South Africa there is a two-tier market for tumble dryers and manufacturers develop their products accordingly.

At the bottom end a 5 kg air-vented standard model is available which offers only two basic heat settings and not much more. At the top-end the models have as many as 14 programmes, dual direct drive, double the capacity, proprietary features such as 'smart diagnosis' and a multitude of other features. These machines can be up to four times more expensive.

Penetration Rates and Sales

Figure 4 shows the household penetration rate of dryers and washer-dryers in 2000. What is immediately evident from the graph is that sales are not keeping up with the increase in new households, so fewer households in effect have a dryer even though the annual sales of dryers may be increasing. After experiencing an average annual growth rate of 15% from 2003 to 2006 and peaking at 131,000 units in the same year, the dryer market slumped and sales dropped to their 2003 level just two years later (Figure 5). The economic recession has continued to affect the sector and although sales have stabilised they remain flat and with little prospect of significant growth up until 2018. Euromonitor (2014) only expects dryer sales to breach 100,000 units per annum again in 2018.

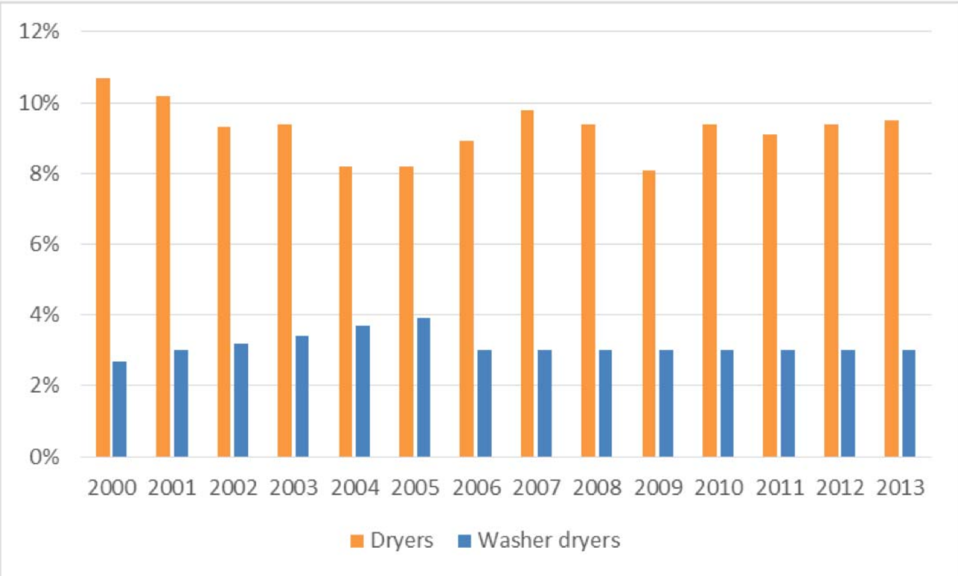

Figure 4: Penetration rate dryers and washer dryers in SA households (HH) 2000-2013 (%)
Source: Own illustration, based on AMPS (2000-2013) and Euromonitor (2014)

Figure 5 shows the annual sales and forecast sales of dryers and washer dryers for the period 1999 to 2018 and illustrates very clearly how hard the dryer market was hit during the recession and that it has still not recovered. Washer dryers, which are a niche product, have remained resilient and are growing.

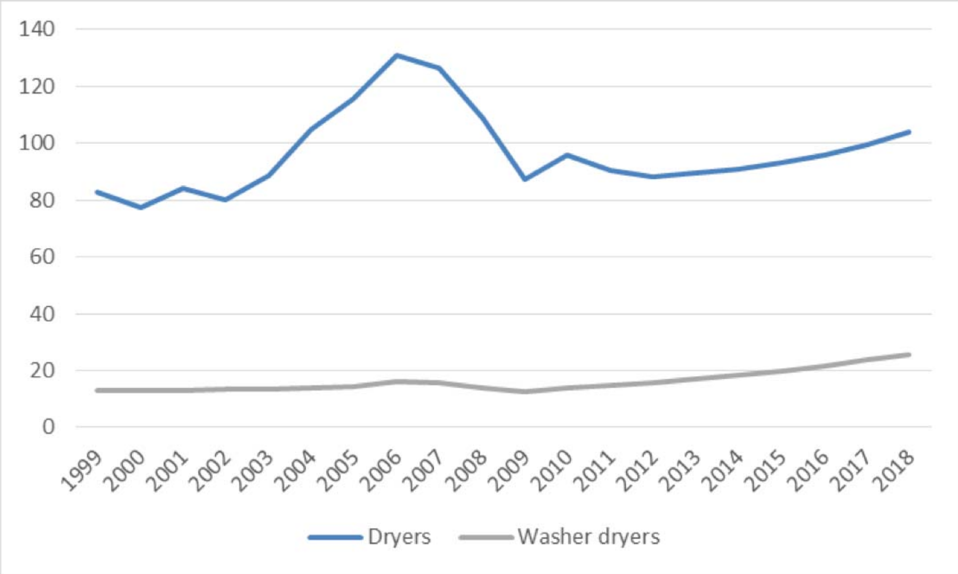

Figure 5: Annual sales of dryers and washer dryers (1999-2013) and forecast sales (2014-2018)
Source: Own illustration, based on Euromonitor (2014)

Figure 6 shows the total number of dryers in the market and again confirms the flat, even slightly decreasing, numbers. Slightly encouraging from a manufacturer's perspective is that it appears that upper middle-income households are beginning to buy dryers. In 2013 there were 14,977,633 households in South Africa. In 2010, 79% of dryers were found in the highest income households and dropped to 76% three years later. From an energy conservation perspective it is a positive outcome that the first choice to dry clothes in South Africa is by non-mechanical means. Dryers are notoriously large users of energy and if they can be avoided or replaced it is a large saving to the household (electricity usage), the country (reduced consumption) and the environment.

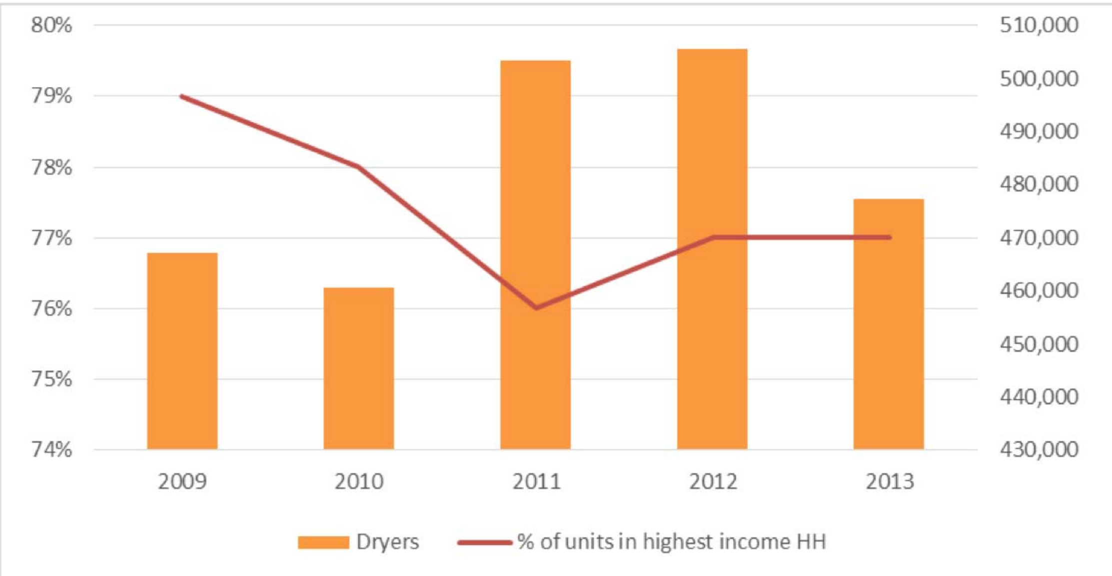

Figure 6: Total number of dryers in SA HH 2009-2013 and percentage of units in highest income HH
Source: Own illustration, based on AMPS (2009-2013)

Table 3 provides a breakdown of sales by sub-category type.

Table 3: Unit sales by sub-category (‘000 units)

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Dryers	Condenser	2	3	4	4	4	3	3.5	6	5.5	7	8
	Ventilator	87	102	112	127	123	106	84	90	85	81	81
	Total	89	105	116	131	127	109	87.5	96	90.5	88	89
Washer dryers	Total	13.3	14	14	16	16	13.7	12.5	13.8	15	16	17
Total Sales		**102.3**	**119**	**130**	**147**	**143**	**122.7**	**100**	**109.8**	**105.5**	**104**	**106**

Source: Euromonitor (2014)

Dryer Market – 1995

Electricity tariffs in South Africa were amongst the lowest in the world in 1995. Nevertheless, first interest in energy efficiency in the appliances sector dates back to this year, when a cost benefit analysis [7] was undertaken by the South African Department of Minerals and Energy. The study analysed the typical consumption figures of dryers using a standard cycle, which came to 876 kWh per annum. There were no washer-dryer units available in the market in 1995. Existing dryers would be replaced after a typical lifetime of 15 years [8].

(Washer) Dryer Market – 2010

A study undertaken by the Department of Trade and Industry [9] in 2011 surveyed the top 5 manufacturers and distributors of (washer) dryers in South Africa. Jointly, these companies accounted for more than 80% of annual sales in 2010 and 2011. The study found that there were 36 dryers and 16 washer dryer models available in the market. The lowest (EU) energy class for dryers was an E and the majority of models (15) had a C energy class. The two models with an E energy class were locally manufactured models and it is highly probable that the six models which were not specified were C or less. The washer dryer models had high energy class ratings with only two models being rated C or worse. This is probably due to them being high end imported models which serve the European market. All dryers and washer dryers had a drying capacity of < 7 kg, while approximately half the washer dryers had a maximum washing capacity of 10 kg.

Please note: The number of models and the energy class levels were provided voluntarily by the 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.

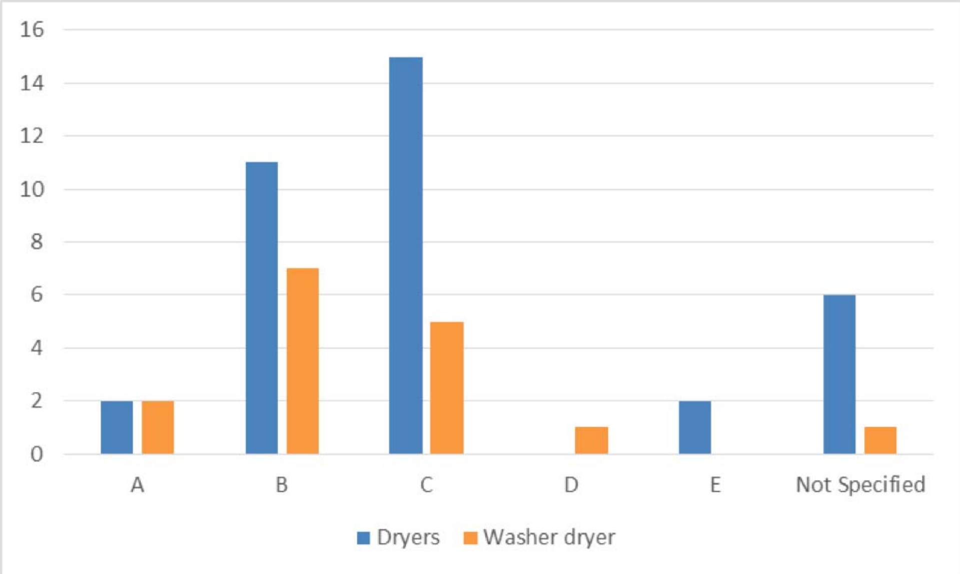

Figure 7: Energy class distribution of dryers and washer dryer models (2010)

Source: Own illustration

(Washer) Dryer Market – 2014

Table 4 gives the number models available in the South African market in 2014. The data was sourced from popular online shopping websites[1]; 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 same data is represented graphically in Figure 8. A comparison of Figure 7 and Figure 8 reveals that the number of models available in the market remains almost the same, which is understandable given the low annual sales compared to other large appliances. The number of 'not specified' models has increased significantly for dryers in 2014 compared to 2010 – having gone from 6 to 13. Desktop research was done to source the energy class of the models where an energy class was not provided but this yielded almost no results. This is somewhat surprising as it would have been expected that the access to information would have improved as the implementation of the South African S&L programme has progressed and is due to be implemented in August 2015. This may raise questions about the reliability of the 2010 data supplied by the manufacturers. It should be borne in mind that for locally manufactured dryers, because there has been no requirement to comply with any minimum energy standards, these units had never been tested and their performance may have been estimated (incorrectly).

The MEPS for washer dryers has been set at energy class A (see Chapter 4), however the data collected shows that only 3 out of 13 models in the market by end of 2014 meet this level. The MEPS comes into effect in August of 2015 and it will be a regulatory requirement for manufacturers to discontinue existing lines and introduce newer more efficient models, which may be more expensive. Because all washer dryers are imported it is not expected that this will be a major issue and it is likely that all the

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

manufacturers will be able to comply, but prices will probably increase. As washer dryers target high-end customers this may have a limited negative impact on sales.

Table 4: Numbers of models available in the South African market, per energy class (2014)

Category	Dryers	Washer dryers
A	3	3
B	12	4
C	13	4
Not specified	13	2
Total number of models	54	

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

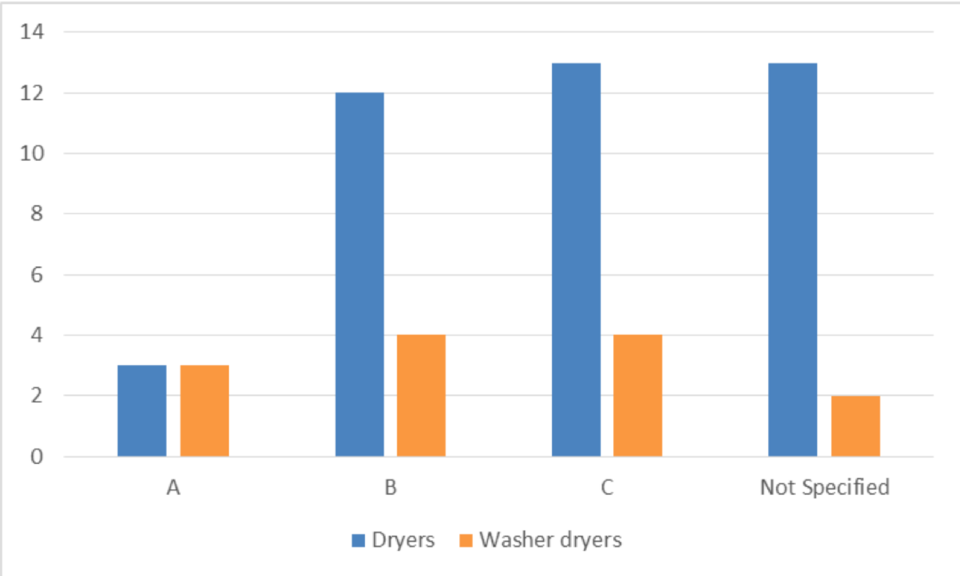

Figure 8: Energy class distribution of dryers and washer dryer models (2014)

Source: Own illustration

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 dryers especially, which are considered a lower priority and luxury appliance. Dryers remain well below their 2006 peak and are not expected to reach 2006 volumes until after 2018. Sales of washer dryers have remained flat, and actually increased by 7% in 2013. This is most likely due to washer dryers being a niche product, which serves a small but high income market. The consequence of the recession 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'[2]. 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 Figure 9 and Figure 10. This makes it difficult for consumers to interpret and compare them. A visit to one of the country's major appliance retailers found that out of a total number of 10 dryers and 4 washer dryers on the shop floor not a single one had an energy label. Other appliances such as refrigerators, washing machines, dishwashers did have some labels. For a high energy consuming appliance such as a dryer it is only a matter of time before consumers see the benefits of more efficient units and opt to use their machines less frequently or the model's energy class plays a bigger role in the decision making process.

The market will continue to serve two markets: 1) the entry level market for dryers which is served primarily by locally manufactured products which offer a basic heating functionality, shown in Figure 9; and 2) the dryer and washer dryer high-end models which provide extensive functionality, electronic panels and in the examples shown in Figure 10 – up to 16 different programs and a 10 year guarantee.

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

Figure 9: Entry to mid-level front load tumble dryers – Limited functionality and no energy labels
Source: Photos taken by Theo Covary (2014)

Figure 10: High end washer dryers – Extensive functionality but no energy labels
Source: Photos by Theo Covary

Summary of the dryer and washer dryer 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.

- Entry-level dryers are still manufactured in South Africa. These were poor performing machines (Energy class D or worse) but it is understood that the manufacturer has upgraded their facility and all the dryers on the market will comply with the MEPS when it comes into effect in 2015. The rest of the market is made up of imported products and it may be the case that there are several poor performing models still being imported and sold.

- Imported models are susceptible to currency fluctuations. On 1 January 2011 the South African 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%. For a deemed non-essential appliance range (dryers), which has a low market penetration and is not expected to match its 2006 sales volumes until well after 2018, any further deterioration in the currency will impact the market negatively. Sales of washer dryers have remained flat and are less prone to currency weakness as they are purchased by affluent households with a focus on convenience, functionality as well as space and time saving.

- In its 2014 market analysis Euromonitor reported that the local market is aligning itself with the international trends and increasing its washing 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.

- Replacement cycles of drying appliances are almost identical to washing machines and have changed little over the last five years. In 2007 the expected replacement rate was 7 years dropping down to 6.5 years in 2013 [6]. It is similar for washer dryers but with manufacturers now offering 10-year guarantees (Figure 10), the replacement cycle could also go up rather than down. It is still less likely that these types of appliances will find themselves broadly in lower income households after being replaced by their first owners, but often there is someone who will be willing to take them. Thus, a life expectancy of 10 years is assumed for these appliances.

- Weak economic conditions and the depreciation of the South African currency mean that the dryer market will remain under pressure for the foreseeable future.

3 Efficiency range and user savings

The dryer market has until recently been characterized by inefficient but robust models which were locally manufactured. In the past, especially high-income households enjoyed low electricity tariffs, large homes with plenty of space for additional appliances, which were convenient to have during infrequent spells of wet weather. This dynamic has changed with electricity tariffs increasing significantly, average home sizes getting smaller (both physically and by number of occupants). Local manufacturing continues but the technology has been upgraded from an energy class E or worse to a C. This is due to the Government's intention to introduce MEPS and with increased competition from imported models, which offer greater functionality and higher efficiency levels. Washer dryers are even more targeted to high-income households who value convenience over cost. Sales of these appliances remained flat during the economic downturn and showed strong growth (7%) in 2013, which was the best performing sub-category in the laundry appliance category.

For the following Table 5 and Table 6 typical values of 220 washing cycles per annum (4.2 per week) [16] and 130 drying cycles per annum (2.5 per week) were assumed.

Table 5: Efficiency range and user savings of dryers, 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	5 kg				
Category	Venting	Venting	Venting	Condensing	Condensing

Type	Front Loader (5kg) with two heat settings	Front Loader (5kg) with two heat settings	Front Load (5 kg) Sensor drying, 15 programmes	Front Load (7 kg) Fully automatic, 15 programmes	Front Load (8 kg) Fully automatic, heat pump
Lifetime (years)	10	10	10	10	10
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)*	775	775	750	550	450
Yearly energy cost (ZAR)	1,300	1,300	1,125	825	675
Purchase cost in (ZAR)	2,500	2,500	3,600	7,000	7,500
Operation & Maintenance cost (ZAR)	1,000 (lifetime)	1,000 (lifetime)	1,000 (lifetime)	1,000 (lifetime)	1,000 (lifetime)

Table 6: Efficiency range and user savings of washer dryers, 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	7 kg wash and 4-5 kg dryer				
Category	Entry level	Entry level	Entry level		
Type	Front Loader (7 kg wash and 5 kg dry) with 5 cycles	Front Loader (7 kg wash and 5 kg dry) with 5 cycles	Front Loader (7 kg wash and 5 kg dry) with 5 cycles	Front Load (7 kg wash and 4 kg dry) non-stop wash dry, 5 loads	Front Load (7 kg wash and 4 kg dry) non-stop wash dry, 5 loads
Lifetime (years)	10	10	10	10	10
Qualitative perfor-mance classifica-tion 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)*	775	775	775	700	600
Yearly energy cost (ZAR)	1,200	1,200	1,200	1050	900

If applicable: yearly energy consumption for further energy carriers	N/A	N/A	N/A	N/A	N/A
If applicable: yearly water consumption	9,000 L	9,000 L	9,000 L	9,000 L	9,000 L
Yearly water cost (ZAR)	150	150	150	150	150
Purchase cost in (ZAR)	7,000	7,000	7,000	15,000	18,000
Operation & Mainte-nance cost (ZAR)	1,500 (lifetime)	1,500 (lifetime)	1,500 (lifetime)	1,500 (lifetime)	2,000 (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 dryers and washer dryers this is 28 August 2015 and the MEPS have been set at level C and level A respectively.

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.

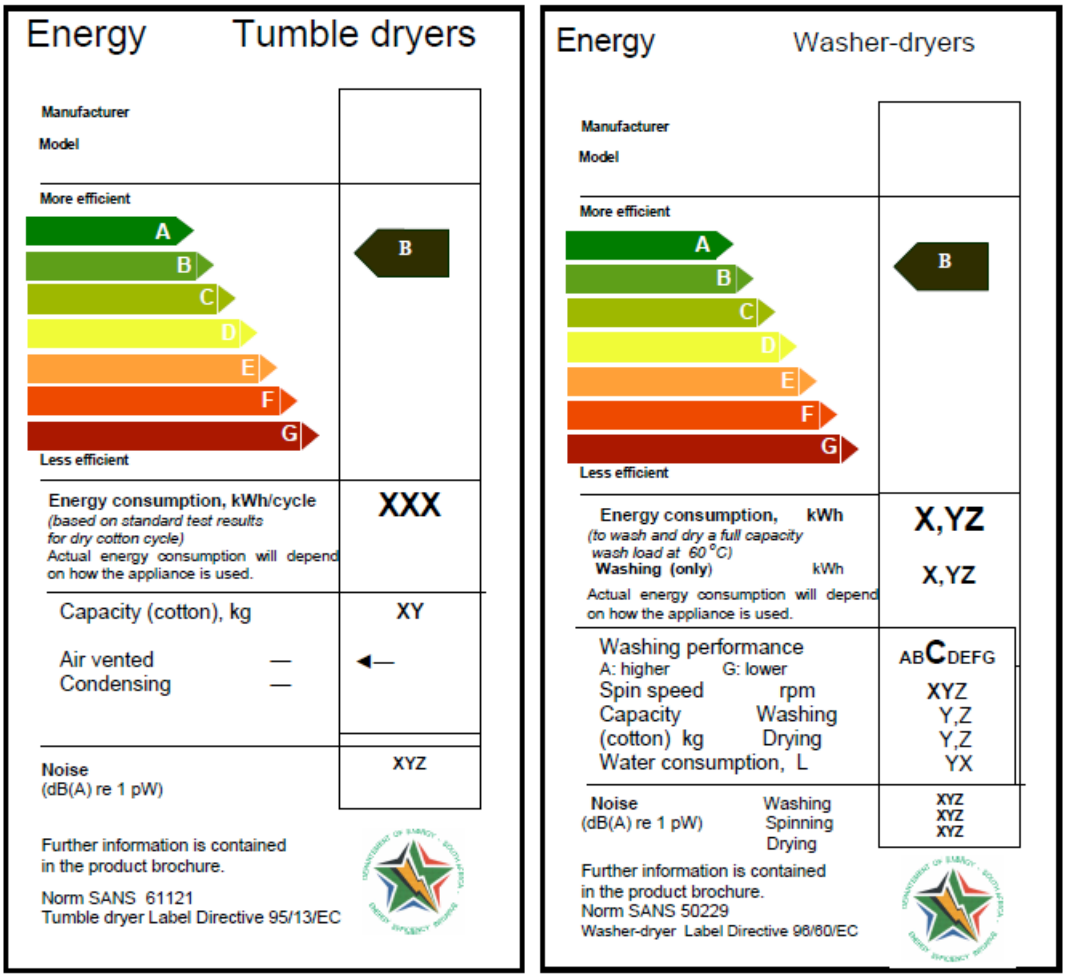

Figure 11: Energy Label for Dryers (SANS 61121:2010) and washer dryers (SANS 50229:2010)
Source: South Africa Bureau of Standards

The voluntary 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 the existing International Electrotechnical Commission (IEC) standard. The derived testing standard for dryers is SANS 61121:2010 (IEC 61121:2005) and for washer dryers SANS 50229:2010 (IEC50229:2007). 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). At the end of 2014 the South African S&L project team was 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:

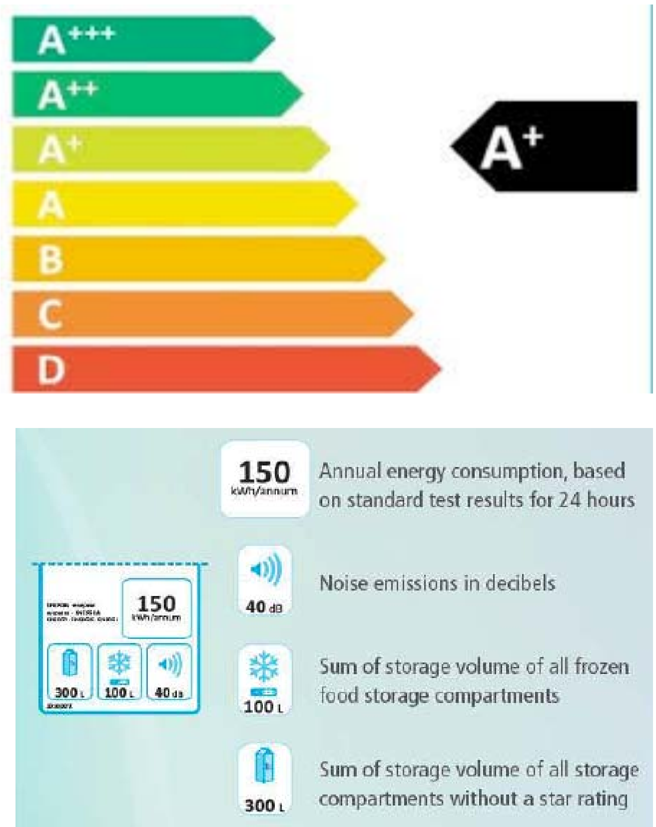

Figure 12: Draft for a new South African Energy Label (Example for refrigerators)

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:

- Dryers: C
- Washer dryers: A

The intention to introduce the above-mentioned regulation allowed for a mandatory two-month period for public comments. After this time had elapsed, on 28 November 2014 the Department of Trade and Industry published notification that the VC 9008 will come into effect for dryers and washer dryers 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

Dryers

According to the SANS 61121:2010 Edition 1.1 South African National Standard dryers for household use - Methods for measuring the performance [5], the Energy efficiency class for Tumble dryers will be determined based on the type of dryer.

The following definitions and descriptions are provided [5]:

Air-vented tumble dryer: Tumble dryer with a fresh-air intake, which is heated and passed over the textile material and where the resulting moist air is exhausted into the room or vented outside.

Condenser tumble dryer: Tumble dryer in which the air used for the drying process is dehumidified by cooling.

Rated capacity: Mass in kg of textiles of a particular defined type, which the manufacturer declares can be treated in a specific programme.

For air vented dryers, Table 7 applies, and for condensing dryers Table 8 applies [5]:

Table 7: Energy efficiency class: air vented dryers

Energy Efficiency Class	Energy Consumption for Standard dry cotton cycle C (kWh per kg load)
A	C ≤ 0.51
B	0.51 < C ≤ 0.59
C	0.59 < C ≤ 0.67
D	0.67 < C ≤ 0.75
E	0.75 < C ≤ 0.83
F	0.83 < C ≤ 0.91
G	0.91 < C

Table 8: Energy efficiency class: air condensing dryers

Energy Efficiency Class	**Energy Consumption for Standard dry cotton cycle C (kWh per kg load)**
A	C ≤ 0.55
B	0.55 < C ≤ 0.64
C	0.64 < C ≤ 0.73
D	0.73 < C ≤ 0.82
E	0.82 < C ≤ 0.91
F	0.91 < C ≤ 1.00
G	1.00 < C

The energy efficiency class is determined based on the energy consumption, *C*, for a standard *dry cotton cycle*. The value of *C* is determined as follows:

$$C = \text{kWh per cycle per kg load} = \frac{\text{Energy consumption per drying cycle}}{\text{kg load capacity}} \qquad (1)$$

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.

Assessing drying performance

In determining drying performance, initial moisture values for a test load are required [5] as shown in Table 9:

Table 9: Specifications for the initial moisture content of the test load

Textile	**Nominal initial moisture content**		**Allowable range for initial moisture content μ1**	
	A	**B**	**A**	**B**
Cotton textile	70%	60%	69% to 71%	59% to 61%
Easy-care textile	50%	40%	49% to 51%	39% to 41%

Final moisture values are associated with a particular drying programme [5] as indicated in Table 10.

Table 10: Specification of drying programme and final moisture content after drying

Programmes or user requirements	Nominal final moisture content μ_{i0}	Allowable range for final moisture content μ_i
Dry cotton	0%	-3% to +3%
Iron dry cotton	+12%	+8% to 16%
Easy-care textile	-2%	-1 to +5%

The initial and final moisture content values, as well as capacity, affect the corrected energy consumption, E in kWh:

$$E = E_m \frac{(\mu_{i0} - \mu_{f0})W}{(\mu_i - \mu_f)W_0} \quad (2)$$

Where,

E is the corrected energy consumption in kWh,
Em is the measured energy consumption in kWh,
µi is the percentage actual initial moisture content,
µio is the percentage nominal moisture content,
µf is the percentage actual final moisture content of a test load,
µfo is the percentage nominal final moisture content,
W is the rated capacity of the programme in g.
Wo is the conditioned mass of the test load in g.

Washer Dryers

According to the SANS 50229:2010 Edition 1 South African National Standard Electric clothes washer-dryers for household use — Methods of measuring the performance [17], a washer-dryer is defined as a washing machine which includes both a water extraction (spin) function and also a means for drying the textiles, usually by heating and tumbling.

From the “SANS 50229:2010 Edition 1 South African National Standard Electric clothes washer-dryers for household use — Methods of measuring the performance” [18], the following definitions are also noteworthy:

Complete operation cycle: Complete washing and drying process, as defined by the required programme(s), consisting of a washing cycle and a drying cycle.

<u>Washing cycle:</u> Complete washing process, as defined by the required programme, consisting of a series of different operations (wash, rinse and spin).

The energy efficiency class of a Washer-dryer is based on the energy consumption, *C*, for a complete operating (washing, spinning, drying) cycle using a standard 60 °C cotton cycle and dry cotton cycle. Based on the value of *C*, the energy efficiency class can be determined as set out in Table AA.1 of the standard [18] (see Table 11 below):

Table 11: Energy efficiency class – washer dryers

Energy Efficiency Class	**Energy Consumption for complete operating (washing, spinning, drying) cycle using standard 60°C cotton cycle and dry cotton cycle C (kWh per kg load)**
A	C ≤ 0.68
B	0.68 < C ≤ 0.81
C	0.81 < C ≤ 0.93
D	0.93 < C ≤ 1.05
E	1.05 < C ≤ 1.17
F	1.17 < C ≤ 1.29
G	1.29 < C

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

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

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

6 Application of the Standard

The SANS 61121 and 50229 formulas to derive the energy class are complicated and the practical application is difficult to understand for non-experts. To provide a reference point, for the most popular product ranges actual data was used to determine exemplarily the energy consumption for each of the energy classes.

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

Dryers

Actual dryer appliance data from South Africa reflect many European and Korean brands. Technical specifications for these appliances sometimes make a distinction between "cupboard dry" and "iron dry" and initial moisture content when listing energy consumption per cycle. According to a report published by CLASP and Navigant Consulting, "*Opportunities for Success and CO_2 Savings from Appliance Energy Efficiency Harmonization*" [14], the standard used primarily in Europe, "IEC61121 - Tumble dryers for household use - Methods for measuring the performance", specifies two initial moisture contents. These are Condition A (70% for cotton and 50% for easy care) and Condition B (60% for cotton and 40% for easy care). The standard specifies a range of allowable final moisture contents for various program types (e.g. iron dry cotton, dry cotton and easy care) [14].

To illustrate this, for an exemplary Air Vented tumble dryer with a capacity of 7 kg, the following energy consumption information is specified [15]:

Energy consumption cotton cupboard dry 50% moisture:	3.4 kWh
Energy consumption cotton iron dry 50% moisture:	2.7 kWh
Energy Consumption per Cycle:	3.9 kWh
EU Energy efficiency rating:	C

In applying the South African standard, the Energy efficiency class is determined based on the Energy consumption, *C*, for a standard *dry cotton cycle*.

For the above example, for an air vented tumble dryer with a 7 kg capacity and 3.9 kWh consumption per cycle, the value of C is calculated as follows using equation (1):

$$C = \text{kWh per cycle } \textbf{per kg load} = \frac{3.9\text{ kWh}}{7\text{ kg}} = 0.56$$

This value of *C* translates to an Energy efficiency class B although the appliance is specified as having a C energy efficiency rating. This discrepancy may be ascribed to the fact that the exact kWh for a *standard dry cotton cycle* is not specified.

Based on an actual data set for air vented tumble dryers, the most common capacity value (mode) was 7 kg. For condensing dryers, the most common capacity value (mode) was 8 kg. For these two capacities, the range of values for energy consumption for a *standard dry cotton cycle*, were determined for respectively air vented and condensing dryers. The values are given in Table 12 and Table 13:

Table 12: Reference table - energy consumption for air-vented dryers

Air vented dryers		
		For capacity = 7 kg
Energy efficiency class	Energy consumption C, per class	Energy consumption, *E* (in kWh), for a *standard dry cotton cycle*
A	C ≤ 0.51	*E* ≤ 3.56
B	0.51 < C ≤ 0.59	3.56 < *E* ≤ 4.12
C	0.59 < C ≤ 0.67	4.12 < *E* ≤ 4.68
D	0.67 < C ≤ 0.75	4.68 < *E* ≤ 5.24
E	0.75 < C ≤ 0.83	5.24 < *E* ≤ 5.80
F	0.83 < C ≤ 0.91	5.80 < *E* ≤ 6.36
G	0.91 < C	6.36 < *E*

Table 13: Reference table - energy consumption for condensing dryers

Condensing dryers		
		For capacity = 8 kg
Energy efficiency class	Energy consumption C, per class	Energy consumption, *E* (in kWh), for a *standard dry cotton cycle*
A	C ≤ 0.55	*E* ≤ 4.39
B	0.55 < C ≤ 0.64	4.39 < *E* ≤ 5.11
C	0.64 < C ≤ 0.73	5.11 < *E* ≤ 5.83
D	0.73 < C ≤ 0.82	5.83 < *E* ≤ 6.55
E	0.82 < C ≤ 0.91	6.55 < *E* ≤ 7.27
F	0.91 < C ≤ 1.00	7.27 < *E* ≤ 7.99
G	1.00 < C	7.99 < *E*

Washer Dryers

A small set of actual data for washer-dryers, limited to class B, was available [19]. For two washer-dryers, each with capacity of 6 kg, the following data, set out in Table 14, is used as a comparative benchmark. As also shown in the following table, the values of 4.81 kWh and 4.85 kWh are in agreement with the range of calculated values for a Class B washer-dryer with a capacity of 6 kg.

Table 14: Actual data for exemplary class B washer dryers

Example Product No.	Capacity (in kg)	Energy (in kWh/yr)	Energy Consumption (in kWh)	Energy Class
1	6	962	washing // washing + drying: 1.02 // 4.81 kWh	B
2	6	970	washing // washing + drying: 1.02 // 4.85 kWh	B

Two capacities, respectively 6 kg and 10 kg, were selected to determine a range of values for energy consumption for a complete operating cycle (washing, spinning and drying) using a standard 60°C cotton wash cycle and dry cotton cycle. The calculated values are given in Table 15.

Table 15: Reference table - energy consumption for washer dryer category

		Smaller Capacity: 6 kg	Larger Capacity: 10 kg
Energy Efficiency Class	**Energy consumption, C, per class**	**Energy Consumption, E (in kWh), for complete operating cycle**	**Energy Consumption, E (in kWh), for complete operating cycle**
A	C ≤ 0.68	E ≤ 4.07	E ≤ 6.80
B	0.68 < C ≤ 0.81	4.07 < E ≤ 4.85	6.80 < E ≤ 8.10
C	0.81 < C ≤ 0.93	4.85 < E ≤ 5.57	8.10 < E ≤ 9.29
D	0.93 < C ≤ 1.05	5.57 < E ≤ 6.29	9.29 < E ≤ 10.49
E	1.05 < C ≤ 1.17	6.29 < E ≤ 7.01	10.49 < E ≤ 11.69
F	1.17 < C ≤ 1.29	7.01 < E ≤ 7.73	11.69 < E ≤ 12.89
G	1.29 < C	7.73 < E	12.89 < E

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