

Going Digital! South Africa's Energy Labeling Program Adopting Digital Tools of Database, QR code and Smart Phone APP

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Abstract

Legislation to make energy labelling mandatory for 11 appliances, selected by South Africa under its Standards and Labelling (S&L) program, came into effect in 2015. As would be expected, the number of models requiring regulatory approval grew annually, and it became apparent to national Government and the Regulator that effective oversight would require a dedicated fit-for-purpose product registration and database system. Thus, technical specifications were developed, followed by the appointment of an ICT company to build the system towards the end of 2018. Simultaneously, the S&L project team evaluated the viability of introducing a QR code and smartphone APP to the program and were quickly convinced (based on the China experience) that incorporating them would realize sizable benefits to the consumer, the regulator, the ministry and the appliance industry. These include the fact that a database and online registration system would significantly reduce the processing time needed by the Regulator to issue manufacturers with an approval certificate (Letter of Authority – LoA) and would enable the efficient tracing of data for both public and private sectors; while assisting the Department of Energy to track penetration rates of energy classes, so as to reliably inform future policy decisions; and ultimately enhancing the Regulator's oversight capabilities. Moreover, by utilizing the energy label in the digital domain, the QR code and associated smartphone APP can combine to raise consumer awareness on energy conservation and can play an important role in consumer education and the promotion of energy efficiency related programs.

This paper now presents the process that could be considered in establishing a database, setting up a registration system, and developing QR code features and smartphone APPS. It also discusses the benefits that such digitalization brings to South Africa, while encouraging more energy efficiency labeling programs around the globe to adopt these digital methodologies, in leveraging the potential that energy labels provide.

Introduction of Regulatory Framework of South Africa's Standards and Labelling (S&L) Program

Aligned to global best practice, and in the interest of reducing energy and carbon intensity while enhancing consumer protection, South Africa has committed to pursue improved efficiency of household appliances – establishing this commitment in relevant legislation and frameworks.

Here, the National Energy Act, Act 34 of 2008 [1] empowers the Minister of Energy to regulate the sale of appliances that consume wasteful amounts of electricity¹. And the National Regulator for Compulsory Specifications Act, Act 5 of 2008 [2] then empowers the National Regulator for Compulsory Specifications (NRCS) - an agency of the Department of Trade and Industry (the DTI) - to

¹ ...by notice in the Gazette make regulations regarding—

- (a) the publication of energy statistics or information;
- (b) the type, manner and form of energy data and information that must be provided by any person;
- (c) the form and manner of the link between the energy database and information system to any other system within the public administration;
- (g) minimum levels of energy efficiency in each sector of the economy;
- (h) steps and procedures necessary for the application of energy efficiency technologies and procedures;
- (i) labelling for energy efficiency purposes of household appliances, devices and motor vehicles;
- (j) prohibition of the manufacture, or importation or sale of electrical and electronic products and fuel burning appliances for reasons of poor energy efficiency;

administer and maintain mandatory specifications in the interest of public safety and health, or for environmental protection. The NRCS thus issues compliant products a Letter of Authority (LoA) which is valid for a three-year period; without which, products may not be sold on the South African market.

The DTI is also the parent ministry of the South African Bureau of Standards (SABS) which develops national standards and operates the country's testing laboratories.

The Department of Energy (DoE), as policy owner of residential energy efficiency, is thus collaborating with the DTI and the above-mentioned agencies - NRCS & SABS - in implementing the project "*Market Transformation through the Introduction of Energy Efficiency Standards and the Labelling of Household Appliances in South Africa*". The project is supported by the Global Environment Fund (GEF) and the United National Development Program (UNDP), with the objectives of removing inefficient residential electronic appliances (refrigerators, laundry, AC, water heaters) from the South African market, while encouraging the adoption of efficient technologies. This includes implementing measures/interventions such as Minimum Energy Performance Standards (MEPS), as well as labeling and incentive programs; and it is regulated by compulsory specifications, VC9006 and 9008 for residential appliances, which include: refrigeration, ovens, laundry and tumble dryers, dishwashers, electric hot water systems, air conditioners, standby power (AV only).

Compliance Procedures – Obtaining a Letter of Authority

Established in 2008, the NRCS' mandate is to promote public health and safety (H&S), environmental protection and fair trade. Thus, in seeking a mechanism for mandatory oversight of the S&L program, the DoE determined that the NRCS was the most appropriate entity to regulate the program, as it had the enabling legislation (NRCS Act 2008), and was familiar with all the appliances selected for the S&L program, because they were already required to apply for an H&S LoA. It was rationalized that henceforth a 'one-stop' service would be offered to applicants for both the H&S and EE LoA's.

In regulating the market, the NRCS applies two separate mechanisms: 1) Pre-certification - certifying a product prior to market entry through the issuance of a LoA, and 2) Monitoring, Verification and Enforcement (MVE) - Monitoring the market to identify and penalize non-compliant products. This compliance approach aligns with that of many countries, but it is the robustness of its implementation which ultimately determines the effectiveness of compliance. Indeed, international studies [3] [4] show that effective market regulation is only possible if both these components are present, and that without MVE, compliance levels average at around 40%, while increasing to 80% when both instruments are in place and operating effectively.

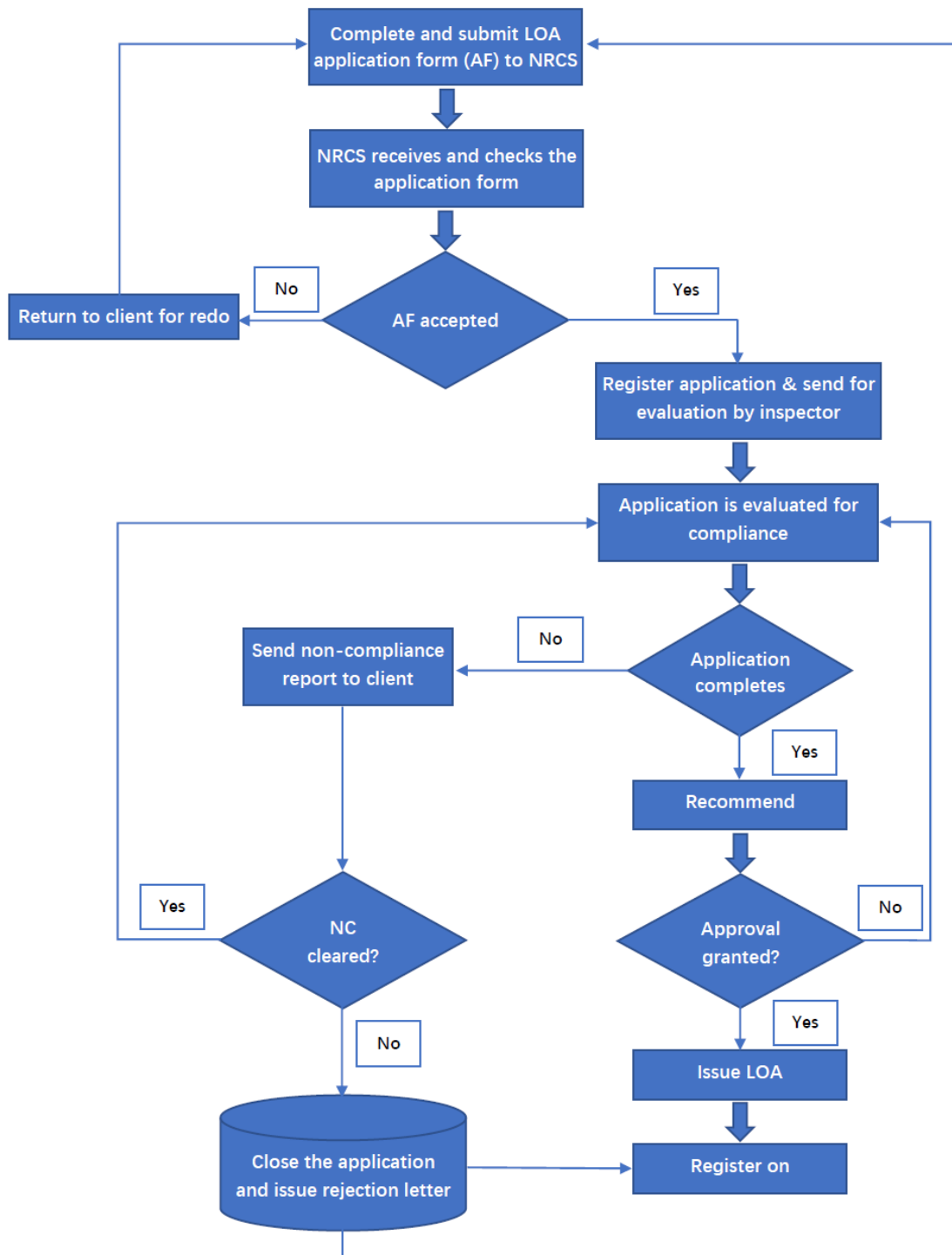
Currently, NRCS emphasis is on the pre-certification process, with limited focus on the MVE component; and a compulsory standard, or VC, requires NRCS approval for 'every type and model' before 'offered for sale' in the country [5], demonstrated by the NRCS' issuance of an LoA. Previously, the NRCS issued LoA's within a 30-day period. This time period has steadily increased over time though, with the procedural cap making allowance for a maximum of 120 days [5], but which can take longer. It is however possible to streamline this pre-certification component. By way of example, Australia issues registration certificates within a fortnight, while in China a successful application means that a system-generated certificate is issued within a two-week period. NRCS backlogs on the other hand, [6] [7] [8] (as reported in Annual Reports and identified for intervention by the Parliamentary Portfolio Committee on Trade and Industry) have led to extended turnaround times, with only 37% of applications processed within the prescribed 120 days in 2016/17. Turnaround times have however improved in 2018, due to intense pressure from industry. Indeed, at the South African Investment Conference in September 2018, an EU Delegation specifically raised the inefficiencies of the LoA process as one of three "*main constraints to potential FDI (and trade) that would benefit from the government's urgent attention*". The delegation emphasized the importance of certification procedures being "proportional to the risk at stake and efficient enough so as not to inhibit existing business operations, as well as new investment" [9]. This intense pressure has led to some improvement and in 2018 the turnaround times have dropped to around the 100-day mark, but are still higher than international norms.

To get a better understanding of the LoA application approval process, the S&L project undertook an Appliance Registration Database Study [10] to ascertain the current constraints and determine what actions could be taken to improve the situation. As stated earlier, in terms of EE, the LoA verifies that the particular appliance conforms to the Minimum Energy Performance Standards (MEPS) specified

for that particular category of appliance. The applicant (entity) must be also registered with the NRCS' Electro-technical Division² Customer Relationship Management (CRM system), which is a hybrid of on-line and downloadable paper-based forms, before any LoA can be issued.

Once registered, the applicant can then proceed to complete an application form for each product; which as part of the application process requires the uploading of electronic copies of certain documentation, such as test reports and declarations. An NRCS evaluating officer then reviews the application and will either reject, approve or return it for amendment; with the overall process detailed in Figure 1 below.

² Foreign (international) entities must apply for registration through a South African agent



Source: NRCS

Figure 1: NRCS LoA Application Process

As the NRCS CRM system was originally designed to manage registration approvals for health and safety applications, which simply require a record of whether a product is compliant or not, it is as such not suited for the purposes of S&L regulation. Consequently, this *'not fit for purpose'* system has many shortcomings; most notably, the fact that it is not capable of modification to facilitate the requirements of the S&L program. Indeed, the NRCS was forced to add a paper-based form to the application process, in capturing the additional S&L specific data that could not be captured

electronically. These paper-based forms are, however, deficient in terms of the scope of data collected, include no internal checks as a means for reducing processing time, are administratively cumbersome and, most significantly, do not allow for the electronic capture of data into a central database.³ Furthermore, the paper-based energy efficiency form also duplicates much of the information already captured in the CRM system, such as the applicant's details and some product particulars, but captures no technical detail of the product being registered, such as its energy consumption, energy rating or capacity. These key data sets all need to be captured to facilitate crucial components of the S&L program [10].

The inefficiencies of the current pre-certification system have been acknowledged and the NRCS has identified the need for a streamlined system. Thus, to counter the uncertain delivery time period and expedite the S&L project objectives, the project has initiated the development of a product registration database that will automate the registration process for household appliances with respect to the MEPS component of compliance. Registration database development is already at an advanced stage, with user acceptance testing and a pilot project completed; and it is expected that it will be launched in Q3 of 2019. It is also planned that the database will be extended to include registration and certification of lighting products.

As stated earlier though, another challenge is that the Regulator's MVE capacity can be described as little more than tame since MEPS were made mandatory by VC9008 and 9006 in 2016 and 2017 respectively. A "blitz" was undertaken in 2017 when approximately 20 retailers were visited nationwide, but the inspection was limited to the label being displayed prominently on the front of appliances. No appliances have as yet been withdrawn from the market by the Regulator and sent for performance testing however; and a primary reason for the lack of MVE surveillance taken by the regulator, (amongst other factors), is the lack of accessible and accurate data due to the deficient system used to process LoA applications. It is this that the registration database seeks to address.

Consumer Awareness

Given that public interest and awareness are crucial to the process of EE appliance market penetration, the S&L program has developed a marketing strategy to strategically stimulate these.

This ranges from traditional media advertising, such as newspaper advertisements, to store activation campaigns with key retail partners – beginning with the Minister of Energy publically launching the EE label amidst broad media coverage in a retail environment – as well as a dedicated website, targeted social media presence through Face Book and Twitter, and the development of a mobile device APP.

The smartphone APP, which is freely available on both Android and iOS platforms, was developed to support retail staff and consumers; and all that is required is the input of information provided on the compulsory energy label affixed on the appliance, as well as the price. The APP then provides data on the ten-year running cost (including upfront cost) and greenhouse gas emissions - allowing the consumer to compare appliances and make an informed buying decision (Figure 2).

³ In theory, the data captured in the paper-based forms could be manually keyed into an electronic database; however this does not appear to occur. Even if this was to occur, the dataset available from the paper-based forms is inadequate and would be subject to re-keying errors.

Fridge and Freezer

Please provide the following household details

What is the cost of electricity in your municipality?*

1.8

Please provide the following details of the fridge or freezer you are interested in purchasing

<p>Fridge or freezer #1</p> <p>Purchasing price (R)</p> <p>5000</p> <p>Annual energy consumption (kWh)*</p> <p>520</p>	<p>Fridge or freezer #2</p> <p>Purchasing price (R)</p> <p>5500</p> <p>Annual energy consumption (kWh)*</p> <p>375</p>
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<p>Fridge or freezer #1</p> <p>Annual Running Cost</p> <p>R936.00</p> <p>Annual GHG emissions in kgs of CO₂</p> <p>517.8</p> <p>10 Year Running Cost</p> <p>R9360.00</p> <p>10 year GHG emissions in kgs of CO₂</p> <p>5178.0</p> <p>Purchase Price + 10 Year Running Cost</p> <p>R14360.00</p>	<p>Fridge or freezer #2</p> <p>Annual Running Cost</p> <p>R675.00</p> <p>Annual GHG emissions in kgs of CO₂</p> <p>373.4</p> <p>10 Year Running Cost</p> <p>R6750.00</p> <p>10 year GHG emissions in kgs of CO₂</p> <p>3734.0</p> <p>Purchase Price + 10 Year Running Cost</p> <p>R12250.00</p>
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Figure 2: The South African Appliance Energy Calculator (APP)

Ultimately, having touched on the challenges of effectively applied EE regulation and ensured compliance through the South African S&L project experience - and given the global prevalence of digital technology - the next section now details how digital measures could assist MVE efforts, raise consumer awareness and improve information access among appliance manufacturer and consumer.

Digital measures to improve efficiency and effectiveness of Energy Labeling Programs

Overview of digital measures for energy labeling programs

Information and communication technologies have dramatically improved over the past decade; becoming ubiquitous due to their universal popularity – be they devices such as smart phones, or 4G (and soon 5G) mobile networks, and WIFI (Wireless Fidelity) amongst others – with rapid digitalization now allowing these to be applied to many fields, including energy labeling programs (ELPs).

At their core, energy labeling programs are established mainly to inform consumers of the energy performance of energy-using and -related products (EuP and ErP). Simultaneously, these programs also provide policymakers with improved market insight, allowing them to regulate the market more efficiently and effectively. In order to do so though, it can be argued that in light of contemporary technological developments, specific digital tools not only enhance the process, but have become crucial to it, in the form of a database, QR (quick response) code and smart phone APP. In this, key advantages of adopting digital measures include:

- A database enhances the efficiency and effectiveness of product registration;
- QR code labels can present additional helpful information to consumers, retailers and market regulators;

- A smartphone APP enables consumers to go through all available models of appliances and can provide them with a “scan” function to extract information stored in QR codes. It also allows the dissemination of the latest news and policies to consumers, which may include market surveillance results, incentive programs for efficient appliances, product maintenance reminders, etc. The APP can thus assist consumers throughout the lifecycle of the appliance - selection, use, maintenance and recycling;
- Database-based digital labels are easier to manage and regulate, because unlike information printed on physical labels, databases can be corrected and updated as frequently as needed, with updated information being reflected in real time through the QR code and smartphone APP.

Globally, a few ELPs for appliance and lighting products have adopted, or are on their way to adopting, digital tools and measures, such as the China Energy Label, EU Eco-design, Australia Energy Rating program and South Africa’s Energy Labeling Program.

The particular digital measures involved, will now be discussed in greater individual detail.

Database

A database hosts data and information electronically; significantly reducing the use of hard copy (paper-based) materials for registration and tracing of data - thus greatly enhancing efficiency and effectiveness of processing applications. It is therefore a preferable solution for handling large and continuously increasing volumes of product registrations. It is also the fundamental prerequisite for further digitalization, as all digital measures are based on extracting data from the database.

A key advantage is that a database system can incorporate an automated validation function, which for example, can automatically compare product data against standard requirements set up in the system and thus verify compliance. The automated validation function therefore greatly reduces the need for physical compliance checks - further increasing the efficiency and speed of processing applications. Furthermore, a database also hosts all communication correspondence, market surveillance results and product advertisement material; again reducing ELP management time and effort when compared to a manual and hard-copy-based system.

Finally, stored information and data can be made easily accessible to all stakeholders, such as consumers, market regulators and ELP managers, through other digitalization tools. These tools include, but are not limited to, QR codes and smart phone APPS, which interact directly with stakeholders and present them with information they request and/or may be interested in viewing.

QR code

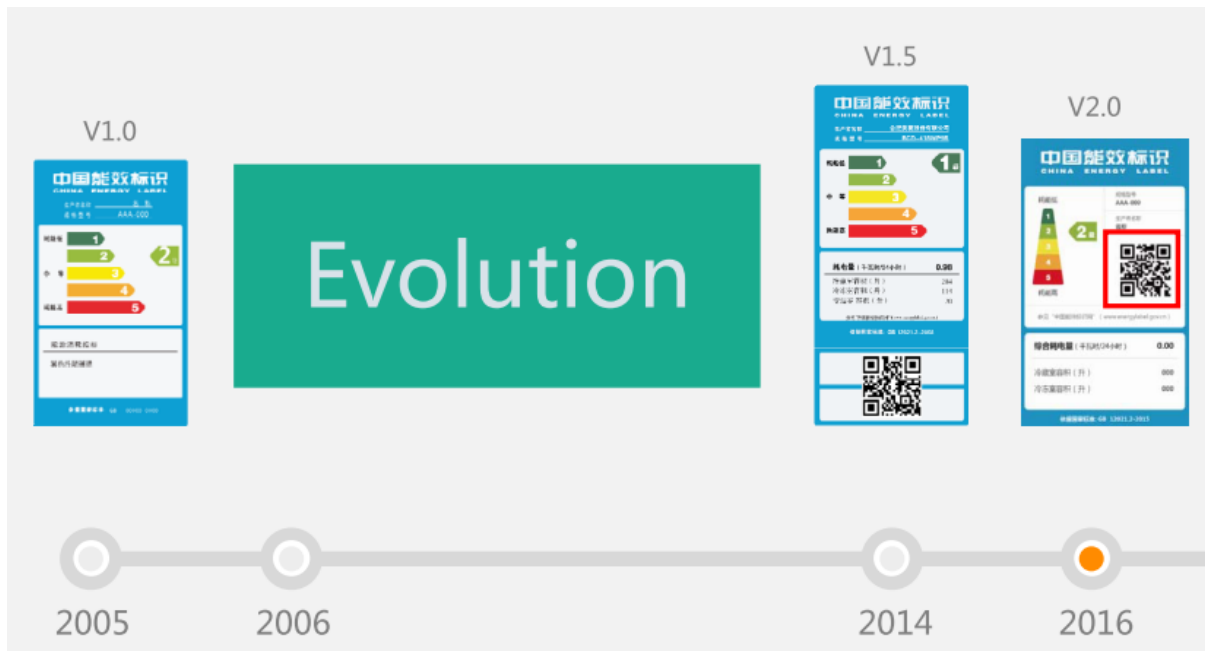
A Quick Response (QR) code is a technology that provides scanners with information stored in a particular space, such as a cloud server. Users request information by scanning the code via their smartphone, which then transports them to the specific webpage, based on the scanned code. Here, the primary benefit of QR code technology is that it is a gateway to vast amounts of information – far more than can be communicated in conventional physical forms of hard copy print and media.

Each QR code is uniquely created and directs scanners to its own URL (Uniform Resource Locator) link, which allows all scanners of a specific QR code see the same information. Of course, because a QR code directs scanners to an online link, internet access is needed to acquire information. This truly makes QR coding a perfect tool for its time, given the increasing global prevalence of internet access, which allows it to present much more information to consumers – creating huge potential to extend the capacity of physical energy labels.

(Figures 3 & 4 respectively show a generic example of a QR code and the evolution of the energy label used in China).



Figure 3: Example of a QR Code



Source: Xia (2017) [12]

Figure 4: Evolution of China Energy Label with QR code

When consumers in China scan the QR code above, they are directed to a webpage, which contains various types of content; and Table 1 below, showcases some of the sections of information available.

Table 1. Contents in QR code landing page of China Energy Label [11]



Basic product information, such as the particular registration number and manufacturer, and energy efficiency level (this is a Level 1 product⁴).

Information about a project that aims to expose products that over-declare their energy performance.



Details about a basic consumer survey, designed to draw dynamic consumer attention to energy saving.

The latest news on appliance recycling – highlighting the serious environmental problems illegal recycling would cause.

It must be reiterated that each of the pictures above is a link to further data and discourse. Therefore, when consumers select one of these images, they will be directed to the webpages available on that specific issue or focus area - containing more detailed information and particulars.

To illustrate this further, Figure 5 below, provides an example of the “next level” of information that can be accessed by clicking on the Basic Information image in Picture 1 of Table 1 – showing the escalation possible once a particular selection is made.

⁴ China’s energy efficiency standard and labeling program categorizes appliances’ energy efficiency using numbers rather than letters or star symbols. Some types of products have five levels of energy efficiency and some have three. Level 1 means the most efficient and Level 3 or 5 signifies entry level efficiency i.e. the least efficient products permitted on the market.

Information box shown on the landing page after scanning the QR code, (as seen in Table 1 above).



[备案公示] KFR-26GW/(26592)FNhAa-A1 能效相关

能效标识管理中心



< 返回 能效备案信息

中国标准化研究院能效标识管理中心

兹证明

珠海格力电器股份有限公司

KFR-26GW/(26592)FNhAa-A1型号

转速可控型房间空气调节器 修订 产品

已完成能效标识备案, 特此证明。

备案号: 2015-33-324-1231287

公告时间: 2015-08-13

2015年08月13日

备案信息

额定制冷量 2600(W) 收起

表示空调的制冷能力, 制冷量约等于1匹

额定制热量 3600(W) 解读

制冷季节耗电量 318(kW-h) 解读

制热季节耗电量 229(kW-h) 解读

全年能源消耗效率 4.53[W-h/(W-h)] 解读

When going to the next level of information, an electronic certificate issued by the China National Institute of Standardization (CNIS) is shown.

CNIS manages the China Energy Label, with the authority to approve manufacturers' registration; and this certificate indeed certifies that the product has been duly registered.

This section then shows the registered product's performance parameters.

When clicking on the arrows to the right, one can access a brief explanation of what specific parameters mean, explained in simple and understandable terms, so as to paint a clear and detailed picture of expected performance.

Figure 5: Example of Deeper Level of Information provided by the QR Code.

As can be seen, the access to vital information is significant; and the energy label QR code system in China continues to update. [11]

Smart phone APP

While the current South African smartphone APP enables consumers to compare usage costs of appliances with their counterparts - providing a powerful tool in purchasing decision-making by showing the long-term financial advantages of products with higher energy efficiency levels - it lacks an intuitive user interface (UI), as well as better and more useful features that may attract users. Nonetheless, it already has revealed its potential for more market impact, especially in raising consumer awareness of the South Africa Energy Labeling Program and the need for energy conservation. Indeed, – the APP has been downloaded / installed to 1 492 devices since its release

and received an average rating of 4.43 (out of 5) from users⁵. This can then be further expanded, by developing a more functional and powerful APP, that works closely with QR codes when in place; and an upgraded smartphone APP may be needed for consumers and other potential scanners, such as market regulators, to scan and receive feedback information from QR codes.

Taking one step back however, a powerful smartphone APP would also be helpful even without the QR code. Indeed, it shares common functionalities with the QR code, such as providing more information about the appliance than the physical labels do. In this, the APP could also assist with tackling some of the disadvantages of the QR code, namely that it is a reactive tool, i.e. data is only available on scanning. A smartphone APP on the other hand, can be proactive, as it allows policymakers to push notifications to millions of consumers, such as updates on market surveillance activities and promotional programs of efficient appliances. Smartphone APPs also enable consumers to have an overview of all products in the database and to conveniently select products for comparison; while QR codes are more focused on showing detailed information of specific products that are scanned.

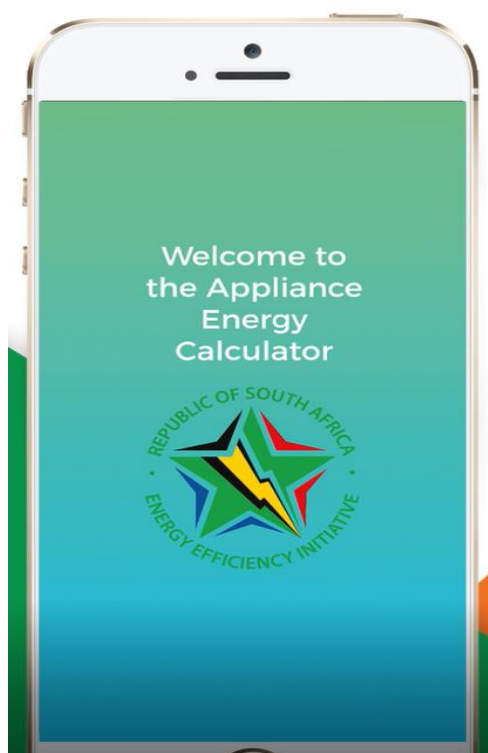


Figure 6: South Africa Smartphone APP (Appliance Energy Calculator)

Conclusion

Ultimately, the triangulation of database, QR Code and smartphone APP, appears to offer the optimal combination of digital measures; with significant potential to provide ELPs with multifaceted tools that impact the entire value chain - from seamless product registration and manufacturer liaison, to improved MVE capacity and enhanced consumer decision-making, which all translate to a lot more energy savings.

Indeed, the Department of Energy, with the support from GEF and UNDP, strongly supports this viewpoint; and is taking action via the EE S&L initiative, by developing an online database which will integrate a QR code system and a smart phone APP, based on global best practice and experiences.

By way of explanation, **Error! Reference source not found.** below, lists the benefits of a digital ELP – particularly given South Africa's combined circumstances of the appliance market expected to grow

⁵ Information received from APP developer and hosting company Urban Earth – 10 July 2019

as income levels increase **[13]**, a regulator already struggling to manage current volumes of LoA applications and government's recognition of the need to modernize its operations. **[14]**

More than anything, given the clear advantages of digital tools when utilized for ELPs, the authors of this paper would encourage more ELPs to explore digital solutions such as those outlined here, in order to further leverage and enhance the potential of energy labels; achieving more energy savings.

Table 2: Summary of benefits when going digital for energy labeling programs

Aspects that can be improved	Owner	Process With Traditional Hard Copy Materials	Process With Digital Measures (database, QR code and smart phone APP)	Improvements
Application for LoA	Manufacturer	Mailing of hard copies and filling out of forms online.	Only need to fill out the forms online	Saves time Provides certainty
Check application material against standard requirements	Authorities	Review hard copies and online material against standard requirements	The database can automatically complete most of the review and verification.	Saves time and improves accuracy of review and verification
Communication	Both Manufacturers and Authorities	Mostly through mails	Mostly online	Saves time Ensures far-reaching dissemination
Amount of useful information that should/can be presented to consumers	Authorities	Limited due to restriction of the size of physical labels	<ul style="list-style-type: none"> • As much information as consumers need; • Detailed (targeted) information that can guide consumers towards energy saving and creates a circular economy; • Promotional information to millions of consumers at very low cos, which “spreads the word” for policymakers about their energy efficiency policies and activities; 	Raises crucial consumer awareness and encourages engagement in ELPs
Support to market regulators	Market regulators	Very hard for market regulators to verify data on the label against registration data.	Market regulators only need scan a QR code or input product model numbers into a smartphone APP, and they will be able to verify product registration and if labeled information is aligned to that of registration.	Enables rapid and convenient market surveillance and MVE, regardless of location.

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