A new digital switchover? Delivering a digital energy label for Europe

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Abstract

The EU energy label has been in the form of a static on-product label for 20 years. The 2014 evaluation prioritised the investigation of opportunities offered by ICT to provide more information through Quick Response (QR) codes (or similar) and/or to provide electronic displays in stores. Whilst the EU was a forerunner in the launch of energy labelling, it now risks being left behind by other regions. The Chinese energy label already has QR codes incorporated and Bosch Siemens have completed a proof of concept on the use of QR codes in energy labels. Will the EU get left behind in this next evolutionary phase or adapt and use the surrounding expertise to deliver an effective digital solution? The current information presented on the energy label is limited, lacking flexibility and adaptability. It cannot be modified once printed and does not support any future re-scaling. Digitised labelling could deliver a step change in the delivery of energy labelling and standard product information, by building on the existing energy label and delivering a range of digital solutions to enable consumers to take action with the full knowledge of the energy related aspects of the product. Digitised labelling would also deliver effective solutions to enable stakeholders (manufacturers, retailers and policy makers) to fulfil the full and intended aims of the energy label. QR codes could direct consumers to the often difficult to find product fiche, to the running costs for the appliance and to comparisons of category performance. Average EU5 (France, Germany, Italy, Spain, UK) smartphone penetration is now 60 %, with 1 in 5 consumers using their phones to engage with QR codes. Electronic displays could help eradicate the 20 % of products consistently not labelled in-store. They can adapt the display of energy label content according to cultural and national preferences. They could facilitate the re-scaling of energy labels; the opportunities to synchronise the digitisation of the energy label with the implementation of a revised energy label are considerable. The global best practice, and the benefits, risks and options for the EU will be presented here, but will the EU commit to this new digital switchover?

Introduction

The challenge remains that a lack of information is a barrier to consumers saving energy. The residential sector in the EU accounts for 28 % of total energy consumption. This barrier, whilst known for many years, is still present and preventing consumers from saving energy. Whilst the solution is not to overload the consumer with so much information as to switch them off entirely, the key is to form the right balance in how much information is too little and how much is too much, and to decide at what level to pitch the content, bearing in mind that this all differs according to the type of consumer. Undoubtedly there is a very important role that current methods of digital communication can play and this paper presents the latest developments in the areas of energy label communication. The Ecofys study on the review of the energy label acknowledged the role of ICT in supplying additional information – as a tool to overcoming the barrier to a lack of information. The study stated that ICT offers an interesting potential to convey additional information, and recommended that ICT would need to be further explored and tested. Providing an example of how ICT could be used to overcome the barrier of a lack of informa-

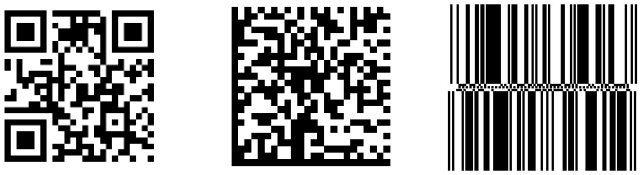

Figure 1. Advanced Data Carriers From left to right: QR code, DataMatrix and DataBar.

Figure 2. The SmartTag range of electronic shelf displays from Pricer: segment, and three graphic labels. Source http://www.pricer.com/en/Solutions/Electronic-Shelf-Labels/SmartTAG-labels1.

tion, the study highlighted the use of QR codes which could be added to the energy label to lead to online fiches providing extra information. We already know that the availability of product fiches in-store is poor[1] and that estimates for missing energy labels on products is on average >20 %[2]. This paper investigates possible solutions to address this barrier of a lack of information, at the point of sale (i.e. at the point of action) by evaluating such digital solutions as QR codes, its use in and outside of energy labelling, its take up by consumers, use by manufacturers and smartphone Apps, to supply further information.

Advanced Data Carriers

The retail industry is currently considering the implementation of the next generation of data carriers for product information. In particular the industry is considering what will supersede the traditional, linear barcode or the Global Trade Identification Number (GTIN). GTINs (previously referred to as EANs) come in 4 different formats, ranging from 8 to 14 digits long and can be seen below the barcode. The retail industry is being supported by GS1[3] – the neutral, not-for-profit, international organisation that develops and maintains standards for supply and demand chains across multiple sectors. Within the retail industry, the humble GTIN cannot for example incorporate such information as product variants, website URLs, expiry dates or serial numbers. That is why the industry as a whole is reviewing the next generation of data carriers – the so called advanced data carriers – such as two-dimensional (2D) barcodes like the QR code and the DataMatrix, or the DataBar.

2D BARCODES

There are two types of 2D barcodes: the DataMatrix and the QR code. Initially used to track parts in vehicle manufacturing, QR codes have since 2012 been used over a much wider range of applications, including commercial tracking, entertainment and transport ticketing, product/loyalty marketing and in-store product labelling. Typically, a smartphone camera is used as a QR code scanner, displaying the code and converting it to some useful form. The use of QR codes is free of any license, the patent rights were waved, and they are clearly defined and published within an ISO standard.

A DataMatrix carries approximately half the information that a QR carries, and has been used for a longer time in the retail environment than the QR code. The DataMatrix first launched in 2006, and the current version of the QR code was standardised by GS1 in 2012. 2D barcodes can carry more data than current linear barcodes, they require minimal space or "real-estate" on the product or label, they are easy to print – the quality of printing does not affect the scanning ability – and they are a proven technology and recognised by consumers.

DATABAR

The DataBar is perceived by the retail industry as a smaller leap from the current linear barcode, compared with the 2D barcodes, and have actually been around since 2000. They can carry more information than the current linear barcodes (up to 4 pieces of information e.g. expiry date, batch number) and can be printed on a smaller scale. They carry considerably less information though than the 2D barcodes but unlike the 2D barcodes can be used with existing point of sale (POS) scanning technology. A barrier preventing the immediate roll out of 2D barcodes across the retail chain is the cost of funding the camera scanners. This barrier has resulted in some industry commentators saying the widespread adoption of 2D barcodes and the replacement of linear barcodes is still some 8–10 years away. Because of these timescales some in the industry are calling for the adoption of DataBars as an intermediate solution whilst others are pressing for an expedited move to 2D barcodes.

Electronic Shelf Displays

Electronic shelf displays, such as those pictured in Figure 2, display digitised product information at the point of sale. The segment label, featured on the far right of Figure 2 displays content via a LCD technology, whereas the graphic displays, featured in 3 sizes, use e-paper technology. The graphic displays can embed a QR code.

According to the equipment supplier Pricer, in 2012, their electronic shelf displays were installed in 8,500 stores across 51 countries. In 2006 and 2008, and as early as 2003[4], Tesco in the UK trialled electronic shelf labelling[5] with the main aim of

1. www.market-watch.eu/resources/rr1/

2. www.energylabelevaluation.eu/tmce/Literature_report_Energy_Labelling_Ecodesign_2013-12-18_Ecofys.pdf

3. https://www.gs1uk.org

4. http://www.thegrocer.co.uk/companies/tesco-brings-back-roll-out-of-electronic-shelf-edge-labels/110078.article

5. http://www.marketingmagazine.co.uk/article/1181195/real-time-pricing-coming-store-near

Figure 3. Example use of QR codes on product, environmental and system certification labels.

testing the environment for real time pricing i.e. linking online pricing to in-store pricing. The fact that it's not yet been implemented suggests there is no clear business rationale yet. This has progressed in 2015 with the announcement that Sainsburys in the UK is trailing electronic shelf labels in 1 store. The small LCD displays, (similar to the example in Figure 2 fat right), will be trialled to see if they reduce paper consumption, save store staff time and benefit automatic pricing updates[6]. To date, these developments have primarily served the retailers interest: not the consumer. As part of the research for this paper, retailers belonging to the trade associations in the UK and Europe – the British Retail Consortium and Eurocommerce, respectively – were contacted. Now one major retailer is planning to incorporate electronic shelf displays in stores in 2015 to help communicate energy efficiency product information. QR codes will not be included. No other retailers acknowledged the use of QR codes or electronic displays to communicate energy efficiency product information.

QR Code Use

QR codes are being used in energy related product labels, retailer price tags, transport labelling and product and system certification. Figure 3 shows this array of examples.

The German Window Technology Institute[7] uses a QR code to help the user verify the label by linking to a product database. Best Buy[8], the U.S. multiple channel retailer, uses QR codes within their "fact tag" to inform their customers about the product they are considering. They can read customer reviews, compare features with similar products and email details to friends. The US Environmental Protection Agency and Department of Transport fuel economy and environment label[9] uses QR codes to facilitate model comparison on fuel economy, environmental and energy factors. Keystone Certification uses QR codes[10] to link the user to a host of technical information about the product and its manufacturer. The U.S. Federal Trade Commission (FTC) has recently considered the mandated use of QR codes[11] on the EnergyGuide label[12]. The main concerns from industry was around the feasibility of adding QR codes especially where space is limited (e.g. TVs) and that the information already on the EnergyGuide label was adequate without inundating consumers with information. Support for the inclusion referenced the usefulness of QR codes in aiding purchasing decisions on the go. The FTC concluded that until the online content is developed, which would link to the QR code, that no QR codes should be added to the EnergyGuide yet.

How do consumers use and react to them?

Customer segmentation is the practice of dividing a customer base into groups of individuals that are similar in specific ways relevant to marketing, such as age, gender, interests, spending habits and so on. There is a proportion of the consumer segment that wants to use and does use their smartphones whilst shopping, in order to find out more information on the products and services they are purchasing. Research from 2010[13], referenced a Business Week survey that reported 61 % consumers want to be able to scan barcodes for information and 9 % (as of 2010) use their phone to get information before buying. As of 2010, 98 % of consumer electronics and appliances were researched online even if the products were bought in a retail outlet. The same research also reported that according to an IMRWorld Survey 79 % of respondents agreed efficiency & environmental information relating to products should be online and in store and 65 % respondents prefer the presenta-

6. http://www.j-sainsbury.co.uk/media/latest-stories/2015/0219-sainsburys-shelves-go-digital-in-new-trial/

7. http://www.msbeyond.com/guide/energy_labels_explained

8. http://retailgeek.com/best-buy-deploys-qr-codes-to-enhance-shopping-experience/

9. http://www.driveclean.ca.gov/Know_the_Rating/Look_for_the_Environmental_Performance_Label.php

10. http://www.keystonecerts.com/page/labels/qrcoded-labels

11. https://www.federalregister.gov/articles/2014/06/18/2014-14058/energy-labeling-rule#h-17

12. http://www.consumer.ftc.gov/articles/0072-shopping-home-appliances-use-energyguide-label

13. Consumer 2020: From Digital Agenda to Digital Action (Joyce, 2010).

tion of carbon labels to be a barcode plus a symbol/logo and the relevant data.

Best Buy has introduced QR codes in their retail stores. The article by Retail Geek in 2010 references a survey by Insight-Express which states 82 % of consumers already use mobile phones during their shopping trips. Best Buy also has its own scan App that to use with the in-store QR codes. By the end of 2011 Best Buy averaged 78,000 scans per week which in turn created 6,000 unique opportunities per store to connect with a customer and during Labor Day week alone they had 33,000 downloads of their custom App.

A Pitney Bowes report in 2012[14] assessed current levels of consumer usage of QR codes in Europe and the U.S. and concluded QR codes were fast becoming an essential addition to today's marketing toolbox. As of 2012, on average 15 % of consumers across the U.S., UK, France and Germany have used a QR code. Of those countries, QR code usage is most prevalent in the US (19 %), followed by UK (15 %), Germany (14 %) and France (12 %). QR codes have been used by 27 % of 18–34 year-olds. The use of QR codes on packaging is the second most prominent position for QR code usage.

Also in 2012, Digital Strategy Consulting reported on a study performed by comScore on mobile commerce and QR code usage across the five leading European markets (France, Germany, Italy, Spain and the UK)[15]. The study showed that European smartphone users scanning QR codes via their devices grew by 96 % in the preceding 12 months to 17.4 million users for the three month average period ending July 2012. Germany ranked first for usage of QR codes with 18.6 % of smartphone users making use of the service, several percentage points higher than its European counterparts. Nearly 3 in every 4 QR code scans resulted in users receiving product information, making this the most popular type of result across Europe.

Mudgal completed a study in 2012 for the European Commission[16] on the different options for communicating environmental information for products. The study focused on what information to communicate, how to communicate it and where. In his own literature review, he concluded that the use of smartphone technology to communicate environmental information could allow consumers to access detailed product information when making their purchasing decision but that there was no research on the effectiveness of smartphone technology as a shopping tool for consumers. Information communicated over this medium can be updated more frequently, and at a lower cost than physical labels. Mudgal also concluded that information at the purchase point is necessary to impact behaviour. Mudgal found a tendency for consumers to express a desire for environmental information but only about half actually look for it. For consumer electronics products, Mudgal concluded consumers have a strong understanding of energy use. Specifically for consumer electronics, research shows that because of the prevalence of technical product information and the relatively small packaging space offered, communicating environmental information would be most effective through a combination of different channels, such as in store displays, coupled with smartphone applications that could provide more complete information. In their research, Mudgal consumer tested 4 different label designs and found that for the one featuring a QR code 83 % of respondents felt the label was clear, 84 % felt it was interesting, 77 % felt it was easy to understand, 79 % thought it encouraged people to look at it before purchase of the product, 78 % felt it encouraged a purchase decision and 75 % felt it gave good information on the environmental impact of the product.

A January 2014 feasibility study[17] by the UK Department of Business Innovation and Skills (BIS) considered the effectiveness of using QR codes on energy bills to inform consumers. The BIS report found that QR codes could be cost effective and technically highly feasible and that 1 in 5 consumers with smartphones would engage with them. Current research trends show strong increases in smartphone ownership. Average smartphone penetration in EU5 has now reached 57 %[18], with Spain and the UK having the highest levels of ownership at 66 % and 64 % respectively; Italy and France (both 53 %) and Germany (51 %) all exceed the 2012 European average of 49 %[19].

Whilst the penetration of smartphone users is set to continue to rise[20], commentators have poured doubt on the potential for the effectiveness of QR codes and whether or not they are indeed a marketing fad[21]. There are examples of poor choices in the positioning of the QR code testing a consumer's ability to feasibly scan it with their smartphone[22], or poor landing spots that either aren't mobile optimised or indeed have broken links. It is this misuse of this communication tactic that is the most likely turn off for the consumer. What this same commentary did concede is that of the marketers who responded to an Experian survey about the effectiveness of QR codes as a mobile marketing tactic, 29 % of them rated QR codes very effective, and another 66 % effective. The commentary concluded that for the small proportion of consumers who use them, they are working well. Mobile marketing alternatives to QR codes include augmented reality, which IKEA have implemented in the catalogues to bring images to life, and near field communications (NFC) which could potentially have a benefit to product labelling with information exchanged between two devices via a tap. But for a QR code to have a chance of being effective they should be easy to scan, i.e. somewhere where people can reach and have the time and internet connection. They should give people a reason to scan it; consumers should know what to expect when they scan. Finally, the scan should lead to a mobile optimised landing page.

Econsultancy reported on 6 QR code campaigns where the effectiveness had been quantified and published[23]. Examples included use of the codes directly on products and by Korea's largest electrical retailer Emart. The retailer used QR codes to

14. http://pressroom.pitneybowes.co.uk/download/1917/

15. http://www.digitalstrategyconsulting.com/intelligence/2012/10/qr_code_usage_doubles_in_europ.php

16. http://ec.europa.eu/environment/eussd/pdf/footprint/ProductsCommunication_Final%20Report.pdf

17. www.gov.uk/government/uploads/system/uploads/attachment_data/file/276198/bis-14-519-midata-programme-feasibility-study-on-use-of-qr-codes-in-energy-sector.pdf

18. www.comscoredatamine.com/2013/03/smartphones-reach-majority-in-all-eu5-countries/

19. http://gsmamobileeconomyeurope.com/GSMA_Mobile%20Economy%20Europe_v9_WEB.pdf

20. http://blogs.wsj.com/tech-europe/2013/05/29/europe-tops-global-smartphone-penetration/

21. http://blog.hubspot.com/marketing/qr-codes-dead

22. https://econsultancy.com/blog/10818-10-examples-of-qr-code-madness

23. https://econsultancy.com/blog/9777-six-qr-code-campaigns-that-actually-worked

link consumers to special offers and drive footfall in traditionally quieter periods of the day. From this campaign, Emart experienced a 25 % increase in sales during these previously quieter times (e.g. lunchtimes).

Benefits to Energy Labelling

The current barriers to the existing set up of an on-product energy label, coupled with essentially, placing that on-product label online, are known. The barriers all incorporate the traits that the information presented is limited and lacking. For example, the existing energy label is limited to the quantity of information it can provide in the physical area it occupies. Due to the necessary regulatory framework being set for the European single market, the energy label is inflexible. In terms of its use, the energy label cannot be modified once it is printed and affixed onto the product within a store. This triggers further barriers in not being able to incorporate changes to scales or bands during a revision process for the energy label. The energy label also lacks the ability to be personalised, for example, in terms of the language used.

There is a body of work on consumer understanding of energy labels which is relevant to digital solutions for energy labelling. This body of research includes studies on the understanding of the current energy label both by the European Commission (EC)[24] and by CLASP[25]. The latter concluded that for certain aspects of the energy label such as: some of the icons, the length of the arrows, certain text, (per/annum) and even the word energy spelt in different languages, the consumer comprehension was actually quite low. The use of digital solutions to the energy label could help address these issues, improve understanding and enhance action. Indeed the solutions can be tailored to provide information to consumer preferences – such as providing energy consumption per cycle, if that is preferred to the per annum figure on the label – or vice versa as suggested by the CLASP study.

QR codes can be used to enrich current, existing information on the energy label:

- Cost – they can be used to display annual, lifetime and total cost of ownership for the appliance.
- Energy consumption information – beyond the "kWh/annum" figure.
- Energy class information – depending on when it was placed on the market.
- Best practice benchmarks – comparison with other models currently on the market.
- Time benchmarks – how much more efficient is the product compared to an older model.

QR codes can also be used to support the label transition or rescaling process, during transition periods. This transition period is the time when the old version and new version of the label co-exist linked to the fact that a label is associated to a specific product and thus depends on the date of placing on the market of this product. Provision of such "cloud labels" could be a useful vehicle to help manufacturers, retailers and consumers overcome the issues during a transitional phase, such as: the simultaneous existence on the market of more than one label risking consumer confusion and the long lead times to deliver paper labels to the shop floor. This idea will be further explored in the section below on the Bosch Siemens Home Appliance (BSH) case study.

Case Study

PROOF OF CONCEPT BY BOSCH SIEMENS HOME APPLIANCES: ENABLING EFFECTIVE CONSUMER INFORMATION THROUGH QR CODES ON ENERGY LABELS

BSH were interviewed for this paper and agreed to be included. They stand out as the only European manufacturer of either large domestic appliances or consumer electronics products that has investigated and planned for the introduction of QR codes on energy labels. Alexander Eisenberg, Senior Expert for EU Technical Governmental Affairs responded to questions.

The Issue

BSH and their Development Team set out to solve the key dilemma in communicating energy using product information to consumers through energy labels: that is, the need to maintain simplicity in the message without losing key relevant information about the product.

Dating back to the mid-90s, the energy label quickly evolved to become a key economic instrument for large domestic appliance manufacturers, but in recent times this effect has been on the wane with the decreasing differentiation at the top end of the efficiency scale, according to BSH. The difficulties and limitations in trying to squeeze in both energy use and product performance information into one label are typified in the most recent iteration of the energy label – like the earlier pictograms depicting the hard off switch on TVs, or the wrung out t-shirt on washing machines, will the consumer understand all the icons in the new vacuum cleaner label? Can this information be delivered in a more effective way, utilizing more modern means of communication?

Apart from the fact that there is more information than you can reasonably fit onto one label, the BSH team saw an additional challenge: as a manufacturer they rely on a label scale that stays stable for as long as possible. On the other hand, markets can evolve quickly. For example, for washing machines the sales unit based market share in the EU28 of appliances in the class A+++ has been rising each year by about 6–8 percentage points between 2011 and 2014. This has been leading to the demand by some policy makers and others to update label classes more swiftly which could result in several consecutive rescalings. BSH define a "rescaling" as a reassignment of class identifiers (e.g. "B") with a different, usually higher energy efficiency, e.g. the former A++ becomes the new B. Manufacturers are reluctant to accept such rescalings for several reasons, one is the co-existence of the old and the updated label on the market which creates confusion. Another reason is the organisational overhead to change a printed label and the mere time lag to react: the supply chain can take 12 months to deliver a new printed energy label measured between the first test measurements and the availability to

24. www.endseurope.com/docs/91001b.pdf

25. www.clasponline.org/en/Resources/Resources/PublicationLibrary/2013/Assessing-Consumer-Comprehension-of-the-EU-Energy-Label.aspx

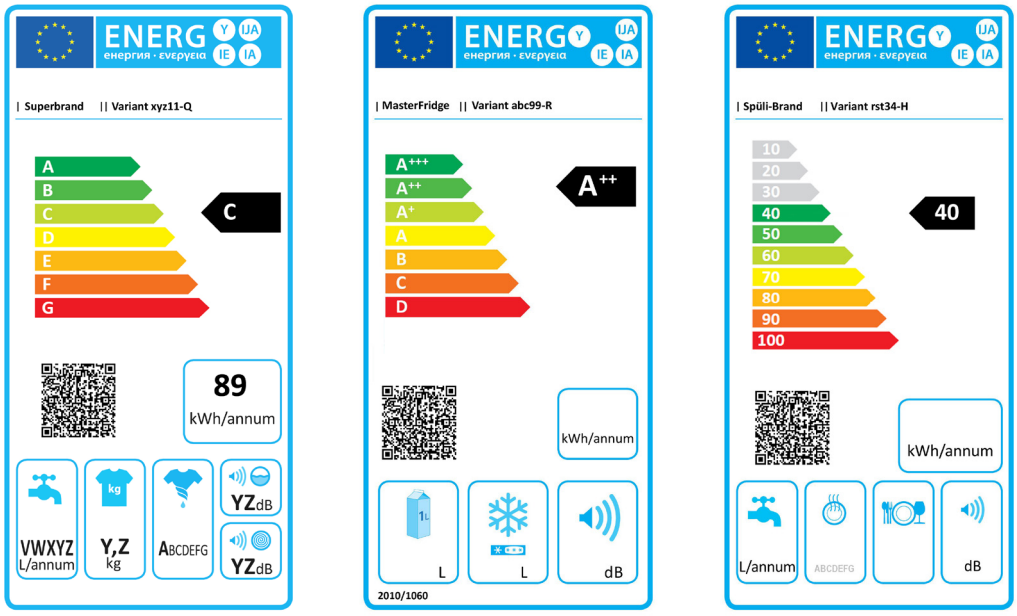

Figure 4. Mock EU Energy Labels featuring QR codes for use in BSH's proof of concept (supplied by BSH).

the final customer. A compromise scenario could be a large rescaling with unpopulated top classes at the time of the introduction of the rescaled label. These would need time to be filled thus keeping the scale as it is for a longer period. This however would leave the consumer with the question, whether the appliance they are considering purchasing would be in the currently best available class or not.

The Solution

At this point BSH decided to test how employment of electronic means e.g. "digitizing the energy label" could overcome these problems: would it be possible to offer simple additional information, such as whether a product is in the best available energy class or not? They investigated how a future energy label concept (i.e. the total package of label layout, the supporting database and whether or not rescaling is envisioned for the label) could be designed in such a way that delivers customized information to Europe's varying customers. BSH was keen to serve its customers who just wanted simple, straight forward information about the product, but also the consumer segment that wanted that extra information, the extra detail. BSH assumed that for the short term, and at least until 2020, there will be customers who want or need a printed label, so in these intervening years there is a need for an energy label to serve multiple purposes and varying consumer segments.

BSH designed a mock-up App that identified a product via scanning a QR code embedded within an energy label, and offered the consumer relevant information. For this, BSH was assuming a scenario in which a future label would contain a QR code and that the QR code was relaying to a database that contained the relevant information. Even with recent developments in smartphone optical recognition software, BSH would still maintain a preference for QR codes as this still allows for more reliable product recognition and enables the use of less sophisticated Apps. Current recognition software now facilitates the scanning of information directly from the energy label, and it's thus already possible with the current label to identify the product by the brand and it's identifier given on the label. But the product codes usually need a higher resolution for the optics (as the letters are small), it needs more sophisticated pattern recognition, so it is still a more challenging detection technique.

BSH tested the functionality on three of the four energy label layouts as used by the European Commission during the Autumn of 2014 as part of their own consumer research study on the evaluation of the energy label: an A–G and an A+++–D scale with one or two of the top classes currently unpopulated, and the numbered system (classes 0–100 in steps of 10)[26].

The Outcomes

BSH succeeded in proving it was technically feasible and identified the necessary requirements to realize the concept in a final App. The assumed database for the App was actually an interface to information that is offered by the online platform Tradeplace.[27]

The App's concept was to:

1. Inform the user by a simple icon whether or not the product was in the best available class – a green smiley or a red sad smiley. Depending on the settings, availability would refer to either the user's vicinity using geographical locating capability or a given country in Europe. Information was given in a scan and see mode, or in an augmented reality (AR) visualisation.

2. Provide additional information on any part of the label such as pictograms like the wrung out t-shirt or the numbered classes. Information was given in a pdf-mode or, again, an AR-mode.

26. www.energylabelevaluation.eu/tmce/energy_labels_designs_for_testing_and_methodology.pdf

27. www.tradeplace.com

3. Provide the user with tailored running costs for energy and water according to their own user habits and economics.

From the exercise, BSH concluded that:

- Apps like these should not be proprietary in nature. A competition between App designers would lead to highly individual information channels to customers all over Europe.
- Legislators should set the legal regulatory requirements without defining the solutions.
- It is not envisaged that a new pan-European database is needed for such Apps; they can work already under existing database structures.

BSH stopped short of finalising and launching the App. BSH could not justify the investment in programming the complete functionality with Tradeplace without first knowing the outcomes from the review of the Energy Label. But BSH will be ready when asked/required.

DISCUSSION

BSH's motivations for this study were not entirely driven by academic motives. Clearly there is a commercial rationale to provide "value add" to their customers and be ready for any changes in the regulation. There are at least three prime considerations to bear in mind if the rollout of QR codes on energy labels occurred at the manufacturer level. Firstly, the normalisation of information and content that is presented to the consumer. What information is presented, how is it presented and what is omitted? How will consumers effectively compare the information that is provided to them? Secondly, would the consumer trust information that is not presented by an independent third party? Thirdly, how would the product registration database work that underpins the QR code scan? Will there be an all-encompassing mandatory database, as in the U.S. and Australia, or, will existing market databases be used. If it's the latter, how would the voluntary system work on issues of consistency and reproducibility for product searches?

International Examples of Energy Label Digitisation

CHINA LEADING THE WAY – INCORPORATING QR CODES ON ENERGY LABELS

Following support from CLASP and the Top10 Energy Conservation Center[28], China is now implementing options for more ways to communicate and promote energy efficiency through product labelling. Figure 5a shows a new voluntary product label which includes a QR code for use by partner retailers selling Top10 products in-store. The label links the consumer to the Chinese Top10 website of best available products. Other features of the new label include integration of the electricity running costs and cost savings compared to less efficient products.

This Top10 initiative has led to China including a QR code within its mandatory Chinese energy label (CEL). This new feature was included from 1 January 2015 on refrigeration and washing machines and will be rolled out to air-conditioners and televisions in March 2015. The announcement[29] of the QR code as a permanent feature within the CEL will be made by the Chinese National Institute for Standardisation (CNIS) in March 2015 as part of the 10 year anniversary celebrations of the CEL. CNIS noted that by scanning the QR code on the energy label, consumers can easily identify the energy efficiency metrics of a product, understand its benefits and make more informed choices. The consumer will be directed to state authorised online content, as opposed to manufacturer produced content. The content will also feature media and user reviews.

Figure 5. a) A new voluntary product label, incorporating a QR code, for use by partner retailers selling Top10 products in-store, and b) the mandatory Chinese Energy Label featuring a QR code, from 2015. Source Figure 5a: www.clasponline.org/en/Resources/Resources/Headlines/2014/Chinese-Press-Publicizes-CLASP-China-Energy-Label-Study.aspx.

Furthermore, in collaboration with CLASP, a specifically designed smartphone App for the CEL will allow users who scan the QR code to find further information and professional services, as well as to immediately provide their feedback and review to government agencies that administer the energy labels. This consumer feedback loop should lead to refinement of the consumer communications by better tailoring information according to user experiences.

Besides consumers, other audiences can benefit from the access to information that QR code scanning provides. These include retailers and market surveillance authorities. QR codes are recognised as being most valuable in retail settings where a sales assistant can use them to help demonstrate a product's credentials. The benefits of the QR code even stretch to being described by CNIS as a standalone "digital sales assistant". CNIS note that QR codes support the work of market surveillance authorities by easily facilitating product and manufacturer information, supporting the agencies having the most up-to-date and accurate information for their market assessment activities.

28. http://www.top10.cn/?page=English

29. Announcement provided by CNIS http://en.cnis.gov.cn/ via a transcript translated by CLASP.

ECOGATOR APP

Produced by the Intelligent Energy Europe (IEE) funded Efficiency 2.1 project[30], the Ecogator App works by scanning the energy label and providing the best available models as a benchmark – utilising the TopTen product lists as the database (see Figure 6). The App was launched in 2014 and so far can be used on TVs, LEDs, refrigerators, freezers, fridge freezers, dishwashers, washing machines and tumble dryers. The App is available in multiple languages: French, German, Spanish, Dutch, Polish, Czech, Greek and Slovenian, but currently not English, although this may change in 2015. Given the optical scanning technology employed in the App, there is no requirement for the energy label to have a QR code on it. Upon starting the optical scan function, the user points the built in camera of the smartphone at the energy label. The smartphone identifies the energy label and by taking one image of the energy label, the App first identifies the type of the label – for example, whether it is a washing machine label, a refrigerator label – and then subsequently initiates a text recognition process for the relevant data such as the energy class, the model and brand, and the text in the blue boxes. The user is also able to manually enter the energy label data. After the extraction, the data collated is benchmarked with data in the TopTen database. If the TopTen threshold(s) is/are met, a green traffic light shows a "go", but if the collated data is below the TopTen threshold(s) a "red" light is displayed. The user can also have the annual and lifetime electricity running costs for the appliance calculated, and, if the user enters the purchase price of the appliance, the app calculates the total lifetime costs i.e. purchase price plus running costs. The App also allows you to review the TopTen lists of the best performing products in a given category for the country you are in and provides information on the EU energy label: its content and why it's important, the underlying assumptions to the parameters, and how you can use the information to make a better purchasing decision.

Currently there is no independent published evaluation on the consumer usage of the App; however an evaluation is planned and should be published at the end of the year. In the short term, a proxy for this data can be seen from the user experience feedback, summarised in Table 1.

Anecdotal feedback suggests there can be issues with using the optical scanning recognition software. For instance, these reasons might be related to the external environment: the energy label is not printed clearly enough, the ambient light levels are not bright enough or there is a poor internet connection in the locality. Or the reasons could be hardware related: the smartphone does not have a sufficient camera or the screen resolution is poor.

ENERGYRATING APP (AUSTRALIA)

The App was launched in 2014, supporting the existing mandatory Energy Rating appliance label[31] in Australia. Its current primary aim is to allow users to compare running costs of appliances[32] they are planning to purchase and to support the 1 in 3 Australian citizens who use mobile internet when shopping and the 97 % of Australians who research appliances online before purchasing[33]. The App can be used on TVs, refrigerators, freezers, fridge freezers, dishwashers, washing machines, tumble dryers, air-conditioners and computer monitors. The user can search the App's built in model lists or search directly with their own model enquiry. As with the Ecogator App, users can customize the App by adding in their energy tariff data, the purchase price of the appliance, and make shortlists and notes of the appliances they are considering – the App then allows the user to compare the product options according to the appliance's running costs, purchase price and the total lifetime cost of ownership.

LAMPGUIDEN & PREMIUMLIGHT

The Swedish Energy Agency produced the Lampguiden App, which helps users to choose energy efficient lighting such as LEDs. The App takes the users through the different terminology and guides them into making an informed choice. The App has been available since at least 2012 and the code has been published on an open source platform. The Energy Saving Trust, as part of the IEE funded PremiumLight project (2012–2014), took the open source Lampguiden code and produced an English language version of the App.

INDIA'S BUREAU OF ENERGY EFFICIENCY (IN-DEVELOPMENT)

The Indian Bureau of Energy Efficiency (BEE) with support from CLASP[34] is developing an App for launch in March 2015. Similar to the Australian EnergyRating App, this App will allow users to compare models based on their full lifetime running costs. The App will support consumers' purchasing decisions through its connection to India's star labelling programme[35]. In a new feature, not otherwise included in the Apps reviewed in this paper, the App will allow consumers to verify the accuracy of the India star labels on products when they appear in store and allow a reporting function for when there appears to be a discrepancy – thus enabling consumers to support the Bureau's monitoring and verification process. This is in part enabled because of the mandatory product registration programme that exists in India and how, like the Australian EnergyRating App, it feeds through to the App.

Currently there is no independent data assessing the effectiveness of the Apps identified above in supporting consumers purchase more energy efficient product. Currently the only independent data available that can be used as a proxy for consumer usage is the user experience data from the Apps such as the number of downloads and the consumer scores and reviews. Table 1 presents this information for the 3 Apps that are currently on the market.

Scores and reviews were sourced from the Google Play Store: data collected 14/1/15. In the absence of independent published consumer evaluations this user experience data serves as the closest proxy.

The types of product categories featured within the 3 Apps are the common domestic high energy consuming products

30. http://www.myeconavigator.eu/

31. http://www.energyrating.gov.au/

32. https://www.youtube.com/watch?v=HS3BCKl9Pbk

33. http://www.superefficient.org/Activities/Standards%20and%20Labels/SEAD%20Policy%20Exchange%20Forum.aspx

34. http://clasponline.org/en/RFPsPartnerships/RFPs/ClosedRFPs/2014/RFP7-14.aspx

35. http://beestarlabel.com/

Figure 6. Screen shots of the Ecogator App. Source: Ecogator.

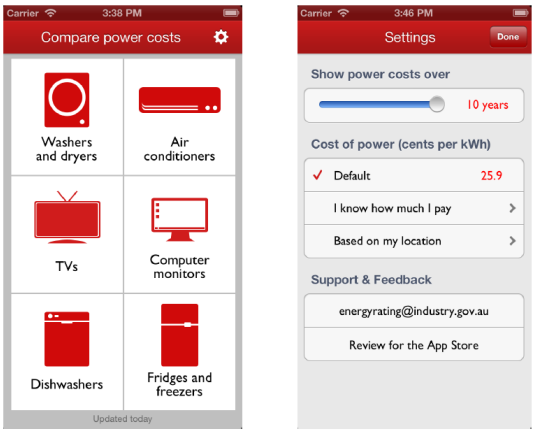

Figure 7. Screen shots of the EnergyRating App.

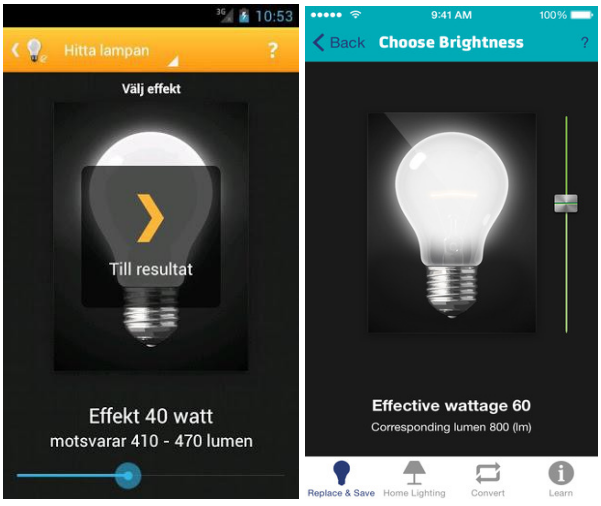

Figure 8. Equivalent Screenshots between the Lampguiden and the PremiumLight Apps.

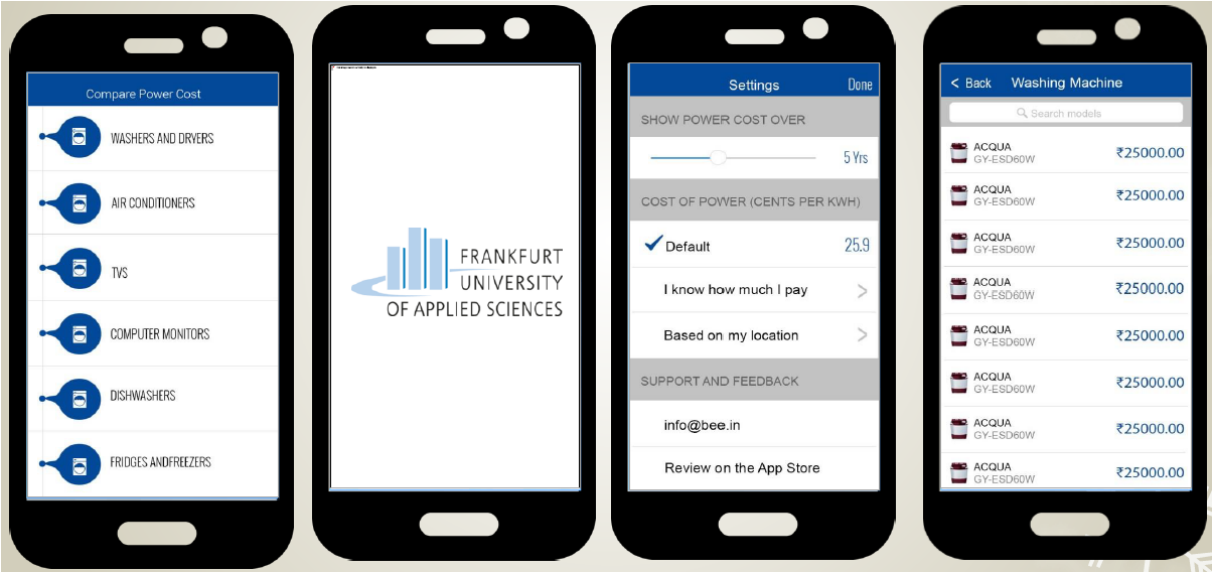

Figure 9. Snapshots from the Indian BEE App currently in development (and thus liable to change). Source: http://www.superefficient.org/Activities/Standards%20and%20Labels/SEAD%20Policy%20Exchange%20Forum.aspx. The images and product scope bear a similarity to the Australian EnergyRating App.

Table 1. App usage by consumers.

App	Type	Platform	Total Installs	Score (out of 5)	Reviews
Ecogator	Optical scanner; benchmarking against national TopTen most efficient products	iOS & Android	10,000	4.4	90
EnergyRating	Informative; calculates and compares running costs	iOS, Android, Windows and Blackberry	5,000	3.4	19
Lampguiden	Informative; guide for choosing lamps	iOS & Android	50,000	4	83

Table 2. Product category comparison across the smartphone applications.

App	Refrigerators	Freezers	Fridge-Freezers	Washing Machines	Tumble Dryers	Dishwashers	Air Conditioners	Computer Monitors	TVs	LEDs
Ecogator	☑	☑	☑	☑	☑	☑			☑	☑
EnergyRating	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Lampguiden/PremiumLight										☑

and appliances. The EnergyRating App has the largest breadth of product categories of the Apps available on the market (see Table 2).

An interesting evolution since 2012 of the features within this suite of energy efficiency product smartphone Apps can be seen in Table 3. As well as the 3 Apps on the market, the 2 further Apps from China and India are included.

Table 3 shows that all identified initiatives target the purchasing decision, but the level of details and functionalities vary between the different initiatives. This illustrates the potentials of going digital and raises the question about what can be expected and fulfilled from a digitised label.

Conclusions

This paper raises the issue of going digital to enhance the information provided by the current energy label. The growth of online sales, the use of smartphones and the consultation of websites before finalising purchasing decisions in physical shops are all signs that a digitised label in the future could make sense.

Table 3. Comparison of features in smartphone Apps.

Features	App				
	Lamp Guiden	Australian Energy Rating	EcoGator	Indian BEE	Chinese Energy Label
Provision of consumer help guides to aid the purchasing decision	●	●	●	●	●
Provision of annual and lifetime running costs, plus total cost of ownership		●	●	●	O
Optically scans the energy label and compares with the most efficient products		O	●		
Provision of a feedback loop to allow the consumer to report on inaccurate energy label claims				●	
Built in optical scanner for QR codes					●
Year of Release	2012	2014	2014	2015	2015

A review of existing initiatives at international level reveal that different technologies, different scopes and different functionalities are available today on the market – each potentially helping consumers to make a more informed choice when purchasing a new appliance.

DO CONSUMERS USE QR CODES?

Regarding the use of QR codes by consumers, the BIS report concluded that 20 % of smartphone users would use them. This number was supported by the Pitney Bowes report in 2012 which also concluded in the range of 15–20 % and the Digital Marketing Strategy research from the same year also found a 20 % usage by consumers. Clearly, the research agenda in general for such use and effectiveness is lacking, as was concluded by Mugdal, but these early figures suggest a broad consensus. We know from experience that the use and placement of QR codes in marketing campaigns is subject to misuse by practioners. But conversely the benefits of using and trialling QR codes within marketing campaigns over the last 2–3 years has built consensus around a set of best practice principles to abide by for an effective campaign.

ARE WE BETWEEN TECHNOLOGIES?

Could QR codes soon be superseded? The EcoGator App is clearly a step forward and represents the most sophisticated technique yet in terms of user experience for energy labels and energy using products. Other Apps are now known to be considering such techniques. But in the retail sector, industry commentators say the widespread adoption of QR codes is still some 8–10 years away. BSH espouse the many benefits of QR code use. The proponents of the optical scanning techniques would site the benefits to policy makers and industry for not having to make space for QR codes on energy labels. But BSH reminded us of the possible proprietary issues involved with such techniques, and the difficulties of including such requirements in regulations and the potential for such a solution to be open only to users of higher end smartphones (and thus potentially discriminatory). QR codes are cheaper for industry and consumers and are effectively "open source".

Right now there is no one solution to jump onto. At the moment different options are available to the consumer – whether that is QR codes or the optical scanning route. But the market certainly isn't saturated and there are solutions that work better in different consumer segments. Certainly, if we're to achieve anything close to the impacts required we need to appeal to a broader range of consumer segments as possible. The solutions on the market have a place and are being implemented. On QR codes, China is rolling them out on their mandatory label and closer to home a major European appliance manufacturer is ready to "press the button" on rolling this out on their labels (should they need or be encouraged to). We've found research on product labelling (outside of energy labelling) where QR code use has been effective with consumers. On the optical scanning software, there is the Ecogator App which is a great step forward. Is the optical scanning route available now to all, or is there a place for an intermediate solution as well or better still a combination and choice?

ARE THE CURRENT EXAMPLES OF ENERGY LABEL DIGITISATION EFFECTIVE?

In short, we don't know. But that's not stopped major economies launching solutions to the market – for example China, India, Australia. As yet, there are no published independent evaluation studies and the only data available at the moment is user experience data like reviews and downloads. But there is a widely accepted assumption that given the prevalence of smartphones and the transformative nature they've had across markets and society that there is significant potential that these digital solutions can provide a major benefit to consumers in appliance purchasing. Off the back of this principle, funds have been invested and products have been launched across the world.

WHAT ARE THE OPPORTUNITIES WITHIN THE EU?

It's clear that a digitised energy label would benefit the EU in a number of ways:

- Guiding consumers.
- Providing tailored information on cost or the best product based on user habits.
- Enhancing comparison with benchmarks.
- Mitigating confusion at transition times.
- Supporting market surveillance.
- Providing tips on sustainable use.

It's imperative that the digitisation route remains in discussion as part of the solution for the reform of the energy labelling scheme in the EU. With the EU taking a lead, it would avoid proliferation of initiatives based on different measurement and verification systems and support the normalisation of the information and content. A joint and coordinated effort would help make the solution work for all – including retailers and all consumer segments – and supported by an EU wide product registration database.

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