Should energy labels for washing machines be expanded to include a durability rating?

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Abstract: Washing machines are a key household appliance that can be found in the majority of UK homes. Over 2.5 million are sold in the UK every year and account for one of the highest material and production impacts of householder products in the UK (WRAP, 2011). Energy efficiency ratings are provided as a method for consumers to make an informed purchasing decision and were brought in by EU legislation to reduce energy use and enable users to reduce running costs, as it is known that the greater environmental impact of a washing machine is during use. From 2014, all washing machines sold must be at a minimum A rated, with ratings increasing to A+++. However, under this current labelling system the embodied impacts and durability of the machines are ignored.

Through semi-structured interviews with consumers, manufacturers and distributors, this paper explores different perceptions of longevity and expectations of performance and durability. The paper explores whether energy labels should be expanded to include durability information, as this could enable consumers to make a decision based not only on cost and energy efficiency but also on expected lifespan. Existing manufacturer's guarantees may give an indication of the expected durability of the product and this is investigated to explore if there is a positive correlation. The findings will further discuss the potential impacts of providing durability information and how this could enable manufacturers and consumers to shift towards a low material and energy future.

Introduction

Durable products, defined as those which have a longer lifespan (Baaker, 2014), have a positive impact on sustainable practices, through reduced waste and CO_2 emissions and are economically beneficial to the user (Stahel, 2010). WRAP(the Waste and Resources Action Programme) has identified washing machines as a priority product contributing significant resource impact on the UK market (WRAP, 2013). Estimates suggest 97% of UK households own a washing machine and the market is expected to grow by at least 18% between 2014 and 2019 (Mintel, 2014). With an expected lifetime of six years, many consumers replace washing machines because they have either failed or are unreliable (WRAP, 2013). This means that most individuals will own several machines over their lifetimes, increasing environmental impacts from materials. Implementing durability as a key characteristic of washing machines should increase both the functional performance and service life of these appliances (Stahel, 2010). Communication of durability by manufacturers and retailers and understanding by consumers is an integral part of ensuring lifespans are increased.

The meaning of durability is open to varying interpretations (Stahel, 2010). As a characteristic durability can be linked to products that have lifetime guarantees or that have parts that can be updated or modified (Van Hinte & Bonekamp, 1997). Durability is not limited to the materials and design of a product, but also a product's capability of maintenance and its satisfactory performance which implies its functionality over time (Stahel, 2010). Durability is also influenced by how the consumer uses the product. When selecting products consumers generally research particular features (Lancaster, 1966) and product information signalled through brand and labels (Sammer & Wustenhagen, 2006).

Brands and labels fulfil two main functions for consumers, they communicate the intangible product characteristics (information functions, e.g. quality) and provide a value in themselves (value function e.g. prestige). However durability may not always be consistent with the brand, price and perceived quality of the washing machine, which confuses the consumer's understanding and expectation of how long the product will last.

The significant resource impact of washing machines is acknowledged (WRAP, 2013), yet durability and embodied impacts are not included in the current labelling system, and as a product it hasn't been considered in current research addressing durability labelling (Cooper & Christer, 2010). This paper considers the feasibility of expanding labelling to include durability ratings for washing machines, acknowledging the potential impacts of durability labelling for consumers and manufacturers.

Effectiveness of existing energy efficiency labels

The European energy label is a compulsory label that is applied to all home appliances and light bulbs sold within the EU. The label was first commissioned because the most resource impacts were identified to be during the use phase (Truttman & Rechberger, 2006). Figure 1 shows an energy efficiency label for a household washing machine, highlighting the different information requirements

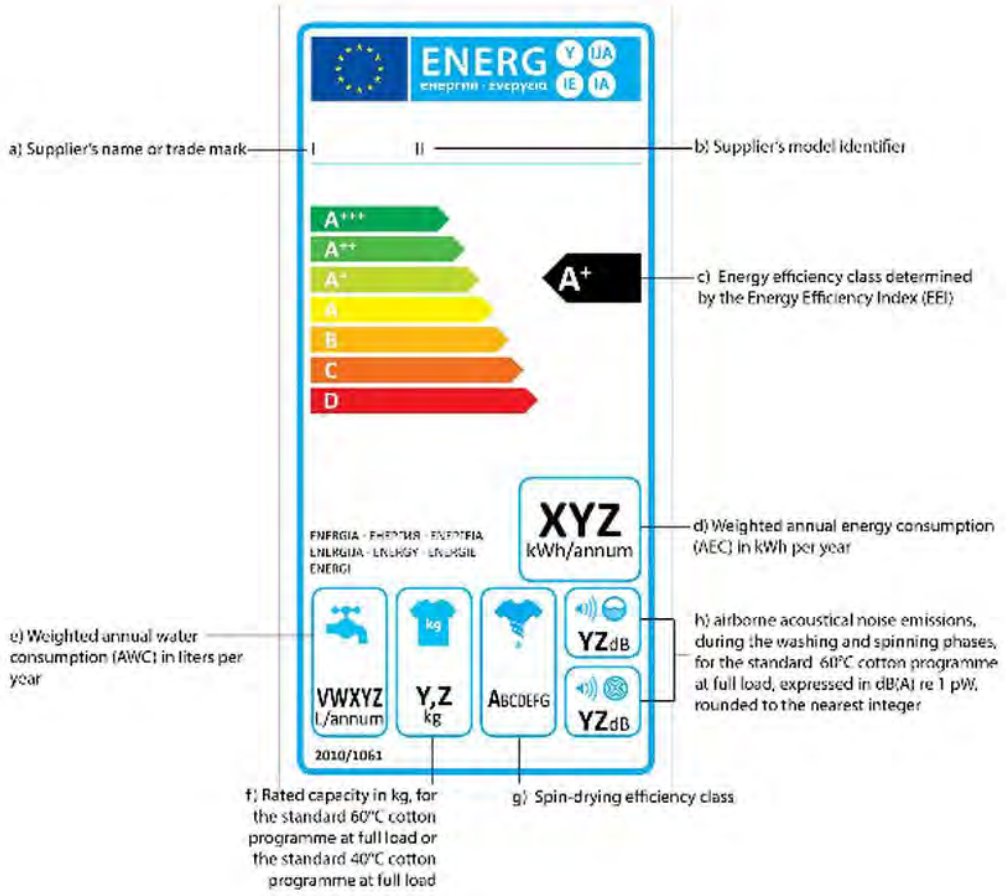

Figure 1. Energy Efficiency Label for household washing machines. © Source: European Commission, 2010.

Different energy efficiency classes of household washing machines exist according to the Energy Efficiency Index (EEI) in which A+++ is the most efficient and D is the least efficient (European Commission, 2010). The Energy Efficiency Index is determined by calculating the energy used in kWh per year at the standard 60°C full and partial loads and partial 40°C load, based on 220 standard washing cycles in a year, equating to 4.2 washing cycles per week. As of 2014, washing machines can only be rated in the UK as A+++, however other ratings do exist in the market (Which?, 2014).

Sammer and Wustenhagen (2006) found that energy labels are important in guiding consumers' buying decisions. Their research shows a willingness to pay more for A+ rating and above. However, Which? (2014) found that some A+ machines are cheaper to run than A+++; based on the 40°C cotton program (Mintel, 2013). Running costs vary according to peoples' preferences on washing temperatures and cycles. Mintel (2013) found a third of consumers mostly wash clothes at 30°C, and that 1% of the population washes at lower temperatures (20°C or less). This highlights the importance of laundering practices in relation to energy efficiency.

Consumer understanding on durability

Although the Ecodesign Directive (2009/ 125/ EC) has enabled the Commission to act in implementing measures on extension of lifetime, consumers feel that there is no reliable, information on durability for washers (DEFRA, 2011). In contrast, in 2013, the Commission drew on the Eco-design Directive to have an eco-label for vacuum cleaners that specified both energy consumption and minimum component lifetime requirements (European Commission, 2013). For washing machines, the Directive (2000/45/EC) addresses lifetime extension by implementing two year manufacturer warranties as standard. As such, consumers assess the durability of washing machines through the warranty offered, and their perception of brand to estimate how long the product will last (WRAP, 2013).

In absence of reliable information on durability, consumers use intrinsic and extrinsic cues (Schiffman and Kanuk, 2001) to judge how long a washing machine will last. Intrinsic cues reflect the physical characteristics of a product. Thus when buying a new washing machine, consumers would like to see evidence of product testings, see independent testings and reviews from external associations such as Which?, get information on-line and on the shop floor, and be able to check online product reviews to judge how long it will last (WRAP, 2013). Extrinsic cues are external to the product and include price, brand or store image. Brand could be considered as a proxy of quality and reliability, and indicator of durability (Cooper & Christer, 2010). Many premium washing machine brands use marketing tactics to advertise longevity. For example, Bosch uses the campaign 'Design for Life', or Miele, widely known for their advertisements promoting longevity (Figure 2). Consumers considered reliability and quality as significant attributes when purchasing a washing machine (Wrap, 2013). However, Which? product tests found that premium brands are not necessarily the most reliable. According to DEFRA (2011) proxies of brand and price were considered by consumers as unreliable indicators to assess product lifetimes as more expensive products do not always last longer than less expensive, lower quality ones. The next sections, explains a mix research methods approach, and presents quantitative and qualitative findings to understand if energy labels for washing machines should include a durability rating.

Figure 2. Miele print ad (released March 2003) © http://www.advertolog.com

Methodology

Firstly the energy consumption between an A+ rated machine to an A+++ machine of different brands were calculated, from this the associated price and carbon emission impacts were estimated. The embodied emissions were estimated to understand if a focus on durability and lifespan could save more carbon than a continued focus on in-use energy. To make these analyses, different models and brands of freestanding washing machines were chosen (Table 1). According to Mintel (2014), some of these brands are leaders in the market, others are premium brands, or new players. The models analysed were chosen according to their energy rating and price range: A+ washers with a price range between £200-£300 and A+++ washers with a price above £300.

Brands analysed to calculate the carbon and embodied emissions	Brands analysed to understand the type of information provided to UK shoppers
Hotpoint - Leader in the market	Hotpoint - Leader in the market
Indesit - Leader in the market	Indesit - Leader in the market
Becko - Leader in the market	Becko - Leader in the market
	Bosch-Siemens - Leader in the market
	Samsung - New player
Miele - Premium brand	Miele - Premium brand

Table 1. Brand and model considered.

An online search was undertaken to understand the information provided to UK shoppers and assess if these could be used to predict the lifespan of washers. The research was limited to an online search, as Mintel (2014) estimates that 40% of washers and dryers are bought online, major UK retail players have an online store, 57% of people will check prices online before buying , and 23% of consumers will use online product reviews to assess product lifespans (Mintel, 2014, WRAP, 2013). The brands and models analysed are shown in Table 1. The analysis compared fourteen different models of these brands of washers, according to their energy rating (e.g. 7 A+ and 7 A+++). The online search also considered where people shop for washing machines, as information displayed at the point of purchase is important (Cooper & Christer, 2010). These retailers are key players in online retailing (Mintel, 2014) and are shown in Table 2.

Type of retailer	Retailer(s)
Traditional Retailer	Curry's, John Lewis and Argos
Supermarket Online	Tesco Direct
Independent Group	Euronics Buying Group
Pure Online Retailer	Amazon, AO.com
Selling online via partnerships	Next Home with DRL

Table 2. Retailers considered.

The data from the online search was classified in six categories which will be described in the Findings and Discussion section. A comparison of these categories was made between brands and data collected from the seven retailers. These findings were then complemented with data from a small sample of semi-structured interviews with consumers and some traders that retail and maintain large household appliances.

Findings and discussion

This section presents preliminary findings to explore if a focus on durability and lifespan could benefit the environment and the consumer.

The impact of improving the energy efficiency of washing machines

As discussed in Section 2, legislation has pushed for improved energy efficiency of washing machines to reduce energy use and carbon emissions. However, as can be seen in Table 3, efficiency improvements become more incremental as the scope to improve energy efficiency decreases. This section explores the improvement in energy consumption and the associated price and carbon emission impacts of moving from an A+ rated machine to an A+++ machine.

Table 3 shows a comparison of the different energy ratings and annual consumption for four different brands. The energy consumption has been calculated per kg of capacity so that energy consumption of washing machines of different loading capacities can be compared. It can be seen that in each of the examples there is an energy saving by upgrading to the higher energy rated machine. This energy saving in turn delivers a cost and carbon emissions saving (although these are minimal), which have been calculated based on the Energy Savings Trust, (2015) estimates of standard electricity cost at 14.05p/kWh and carbon dioxide emission factor for electricity of 0.490 kgCO2e/kWh. In particular, the difference in energy consumption between an A++ and A+++ machine is very small, 1.57KWh/kg capacity, compared to a 5.43kWh/kg capacity difference between the A+ Beko machine and the A++ Miele machine. It should be noted that these energy and associated savings are calculated based on the energy consumption disclosed as part of the energy rating, actual use in terms of cycle type, time and temperature will vary from household to household and thus so will the potential savings.

Brand	Indesit		Hotpoint		Beko		Miele	
Energy Rating	A+	A+++	A+	A+++	A+	A+++	A++	A+++
Energy Consumption (kWh/kg of capacity)	32.67	24.00	32.00	23.50	31.00	24.00	25.57	24.00
Energy Difference (kWh/kg of capacity)	8.67		8.50		7.00		1.57	
Price Impact (£)	1.22		1.19		0.98		0.22	
Emission Impact (kgCO2e)	4.25		4.17		3.43		0.77	

Table 3. Comparison of the different energy consumption of a range of washing machines, exploring the potential energy, cost and carbon savings when upgrading the energy efficiency of the machine.

It is not only the in-use energy consumption of a washing machine that should be considered, washing machines contain energy intensive materials such as steel, concrete and aluminium, which amount to its embodied carbon. Skelton & Allwood (2013) estimate the embodied emissions of a washing machine to be 270 kgCO2e. This becomes relevant when deciding where emphasis should be placed in the life cycle for emissions reduction. Are there greater carbon savings from continuing to improve energy efficiency, or from improved durability and maximising the life span of the already expended embodied carbon of the machine? Figure 3 explores the incremental, yearly energy savings from upgrading to a higher energy rated machine, showing where this falls in relation to the average embodied carbon of a washing machine. For the purposes of this graph, 270 kgCO2e is assumed to be an industry average, applicable across the range of washing machines in this study. It is also assumed that this does not significantly vary according to the durability and lifespan of the washing machine. An average capacity of the case study machines, of 7.6kg, is taken to ensure results are comparable.

From Figure 3 it can be seen that in the earliest case, for Indesit and Hotpoint examples, the carbon savings from upgrading an A+ machine to an A+++ machine reach the embodied carbon of the machine after approximately 8.5 years. For the Beko example this increases to just over 10 years. Considering the expected lifespan of a washing machine is six years (WRAP, 2013) this demonstrates that from an emissions perspective that there is an increase in whole life emissions if a A+ machine where upgraded to an A+++ machine. The carbon savings are even smaller from the upgrade from an A++ machine to an A+++ machine, with the total savings after 15 years not reaching even half of the embodied carbon of the machine. In this case, it would take approximately 46 years before the carbon savings from the improved in-use energy consumption reached those of the embodied carbon. This indicates that for washing machines of A+ standard (and above) there should be a much greater focus on durability and lifespan, to reduce machine replacement and thus minimize embodied carbon emissions, rather than continuing to focus on ever smaller, incremental improvements in-use energy.

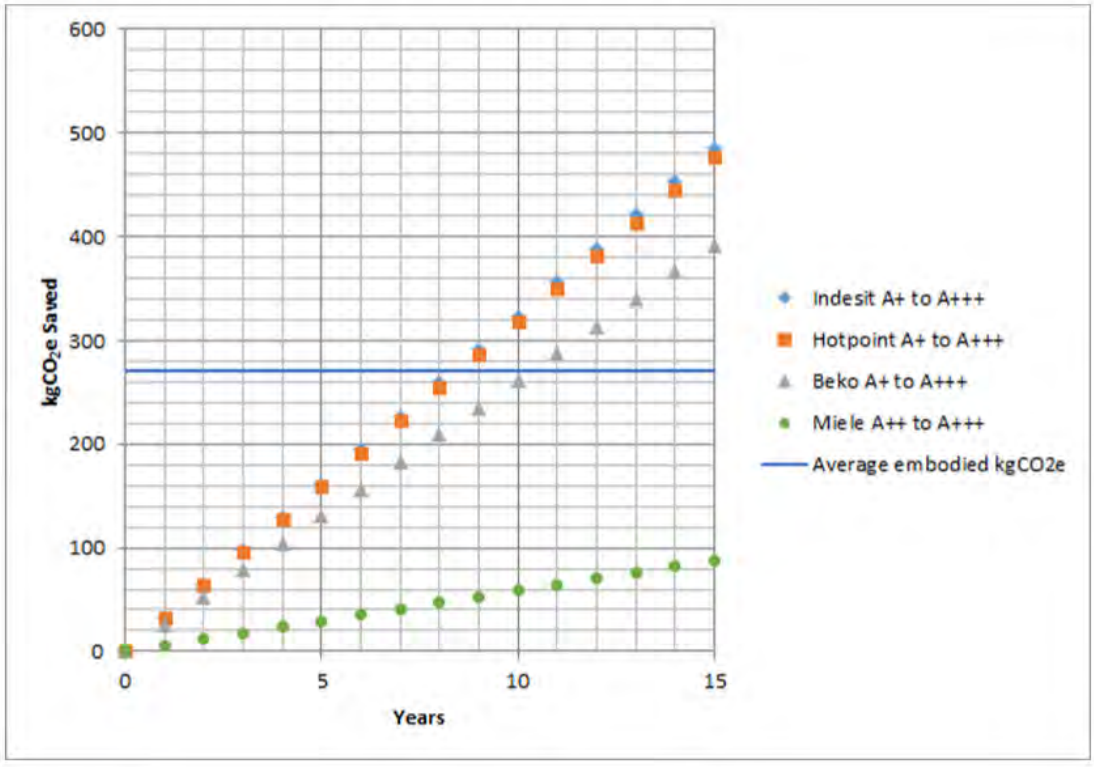

Figure 3. Incremental CO2e savings between different energy rated washing machines.

Current durability information provided to consumers

The analysis above calls to shift the focus from incremental improvement in-use energy to a greater focus on durability and life spans. However to make this change effective, durability features should be clearly communicated to consumers. This section presents the six categories on current information provided to consumers by manufacturers and retailers.

a) Types of information provided

Manufacturers' and retailers' display information about main technical specifications, functions, structural characteristics, washing programmes and options, as well as performances including spin speed, capacity, water usage and noise levels. Only Miele, indicates durability by stating the expected years of use, and just Amazon makes this clear for this specific brand.

b) Guarantees/warranties

As a minimum, manufacturers are obliged to offer a two year warranty. However, the law does not specify if this should include both labour and parts. Some manufacturers just offer 1 year warranty including labour and parts, plus one to ten years warranty for parts. The length of the warranty depends on washing machine model, specific embedded technologies and on specific deals with selected retailers. In addition, some manufacturers offer extended warranties through independent providers with an extra cost. These cover labour and parts. Table 4 shows a comparison of warranties offered by the six brands analysed. All retailers will offer the warranty provided by the manufacturer. However, some of them will offer certain deals that the manufacturer does not. For example John Lewis would offer a second year guarantee that includes labour for all washers without an extra cost.

Brand	Warranty offered
Indesit	1 year warranty labour + parts, and 5 years warranty for parts.
Hotpoint	1 year warranty labour + parts, and 10 year warranty for parts upon online registration of their product.
Beko	1 year warranty labour + parts. Offers an extended warranty up to 4 extra years through an external provider.
Bosch-Siemens	2 years warranty labour + parts, and 10 years warranty in parts if the washer has EcoSilence Drive™ (a specific motor that claims to be more efficient). Some Siemens washers have 5 year warranty (labour + parts) in specific models purchased from specific retailers.
Samsung	2 years warranty labour + parts, 5 years warranty (labour + parts) for specific models purchased from selected retailers, and 10 year warranty in parts if the washer has a Digital Inverter Motor.
Miele	2 and 5 years warranty labour + parts, depending on the model and 10 year warranty for an extra cost.

Table 4. Warranties offered by 6 different brands of washing machines.

c) After sales services including repair
For manufacturers and retailers, after sale services are linked to those offered by the warranty and extended warranty. Just Curry's offers a repair service for those washers that are out of a warranty, except for Miele products.

d) Marketing and sales specifying durability or life spans features
Some manufacturers advertise specific features of their brand that resemble durability features. For example, Samsung's promotional material refers to the design of their motor as a proxy for durability. However, not all brands use the same strategy. In addition, retailers advertise durability features for certain brands. For example, Euronics refers to a Siemens washer by saying:

> *'With a washing machine from Siemens, you know you're getting a quality product from a leading household name. We stock only the best brands, and we understand the importance of a reliable washer that will last you for years.'*

e) Buying guides by retailers
Most retailers offer a buying guide except Amazon and Ao.com. The guides offer information informing which washing machine is best, including, type of washing machine, capacity, washing programmes, performances, energy efficiency and the environment, installation, recycling and disposal services, latest technologies and reliability. The latter, is the only attribute that relates to durability.

f) Rated attributes in online reviews
All the brands studied, except Indesit and Miele, have an option to review their machines online. The reviews include attributes such as ease of use, noise, value for money, range of functions, washing results and build quality. Build quality, is assessed by Hotpoint and Beko and is the only attribute that is a proxy of durability. All retailers, have an option to review the washers they sell online, build quality is considered by most retailers except John Lewis, Argos and Amazon.

The feasibility of durability labelling
The sections above demonstrates the need to provide consumers with clear durability information. This is supported by interview findings which emphasize the complexity of interpreting durability at user level. For consumers, expectations of lifetimes could be subjective and influenced by brand and perceived quality, past experience, needs and on occasion time expected to live in a property. WRAP quotes the expected lifetimes of washing machines is six years (2013), however, Which? quotes 12 years (2014). The consumers interviewed gave a varied range of years which reflected the disparity between expectations. Defra found that perceptions of durability can be fluid between individuals making it difficult to generalise its meaning (2011). The interviews demonstrated that durability was not a characteristic that these consumers consciously considered at the time of purchase and instead they used terms like quality as an indicator of expected lifespan. Having a clear indication through a labelling system should therefore encourage a more standardised expectation of washing machine lifetimes, and in turn this could motivate manufacturers to ensure that their machines are designed and made to last longer. More provision should be made for repair and maintenance and availability of spare parts which could see manufacturers developing business and thus profit through the offer of localised services.

Interviews confirmed that the manufacturers' standard guarantees are important as a mark of reliability which may link to durability (WRAP, 2013). However, there was little interest in extending guarantees or investing in repair and service options from these particular consumers. This may indicate that consumers do not always see value in maintaining and repairing products as they are expected to only last a short amount of time and repair can be expensive (McCollough, 2009). According to the interview findings, consumers stated that expected years of use would be a clear indicator of durability. Therefore communicating how many years the appliance will last, could create shifts in consumer behaviour and attitudes towards the care and maintenance of washing machines as the consumer sees it as having a longer service life. However, discussions with traders demonstrated that although in principle this is a good idea for consumers, it may not be embraced by manufacturers who would see labelling lifespan as a threat to existing business models. For labelling to happen manufacturers need to see

durability as a competitive advantage and commercially viable.

Mintel have seen a significant change in consumers' energy saving laundry habits which has led to increased sales in energy efficient appliances (2014). In support of this, interview findings evidence the significance of energy-efficiency as a cost saving measure. Although they considered the importance of efficiency rating at the time of purchase there was not an obvious correlation between the machine's efficiency and its durability from either the technical specification of the labelling or the consumers' perspectives. If consumers were to see that having a durable, longer lasting machine could be economically beneficial they may be willing to invest in such appliances.

Conclusions

Although further research is needed, it is evident that durability labelling would benefit both the consumer and the environment by ensuring washing machines are kept in use longer thus reducing resource impacts. Durability labelling would be closely bound to the design, manufacture, maintenance and reparability of washing machines, yet encouraging manufacturers to endorse such a model needs further work. Just as legislation supported the implementation of energy efficiency labelling, it could also encourage durability labelling.

As washing machines contain energy intensive materials and have significant embodied carbon impacts ensuring durability through longer lifespans would be an effective carbon reduction strategy. Although it has been assumed that embodied carbon does not significantly vary according to the durability and lifespan of the washing machine, further research intends to explore this relationship in more detail. The paper has argued that despite the impacts durability labelling might have on manufacturers and retailers it is a feasible method of moving towards a low material future. The authors intend to develop this research further to strengthen the case for durability labelling by demonstrating its potential benefits to manufacturers and retailers. By communicating durability these labels should ensure that washing machines are able to have a longer service life.

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