

The case for a universal rating of a products climate impact - The Greener Choice

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technology placement dissertation

By Arnaud Gillard

B614809

“In the absence of a clear labelling system, consumers really are at the mercy of the marketing department.”

Richard Ayre, Former FSA board member

Abstract/Executive summary

This dissertation comes in the midst of a climate crisis acting as a proposal on how we might steer the global economy and consumer industry towards a more sustainable future. Using the liberal economic model of free trade, this proposal capitalises on using market demand to initiate change, shifting this demand through empowering consumers with information in order to make the best environmental choice in their purchases.

This report aims to provide the foundation for the development of a new eco-label. It would consider the current economic limitations, accuracy in data, and population engagement in order to provide a strong proposal for governments to consider.

The proposal is an eco-label built with the future in mind. Merging both our physical and digital worlds in order to empower consumers with the right information at the right time. The report concludes that a legally binding Type III eco-label based on the foundation of publicly available LCA data would amplify a global shift towards a more sustainable future.

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Literature review

There is an extensive source of information evaluating the impact of labels on consumer choices. As it is a practice adopted by both governments and private organisations, different perspectives have been translated into various papers, news articles, and books.

As a leader in energy efficiency labelling, the European Commission conducts yearly reviews on the effectiveness of its programmes. Insights from producers, psychologists, economists, and government representatives provide an extensive review on successful elements of eco-labelling and limitations.

This proposal also capitalises on well-known concepts such as “Life cycle analysis” whereby sources critically evaluating its effectiveness can also be found.

In an ever more globalised world

The world has become ever more interconnected. And with this globalisation, comes economics of scale. And with economics of scale, the impact of consumer choices has never been more evident. This report identifies the opportunity that consumer choice holds as a key to dealing with our single greatest challenge, climate change. I will be reviewing both successful and failed case studies in influencing consumer choices, whilst also evaluating its potential impact.

Our planet is experiencing unprecedented changes in its climate, biodiversity and land use. And in the midst of all this, humanity has also found itself at a crossroad whereby its economic system is increasingly at odds with ecologically and socially harmful priorities.

"The current economic system, capitalism, has been constructed to respond to only one signal: profit. It has not been designed to take other systems into account." (Boehnert, 2018)

Shifting focus is certainly no small feat, yet necessary if we intend to maintain the health of our planet. Therefore, if our current economic system solely responds to profits, let's make these profits directly respond to the ecological and social contexts. And to do so, we must pivot the minds of the source of these profits, consumers. In every purchasing decision we make, there is an impact on the environment, economy, and society with far-reaching implications right across the supply chain and the wider community (Naden, 2017). We need to empower consumers to shift these metrics of profits to reflect the views we desperately need in order to tackle this crisis.

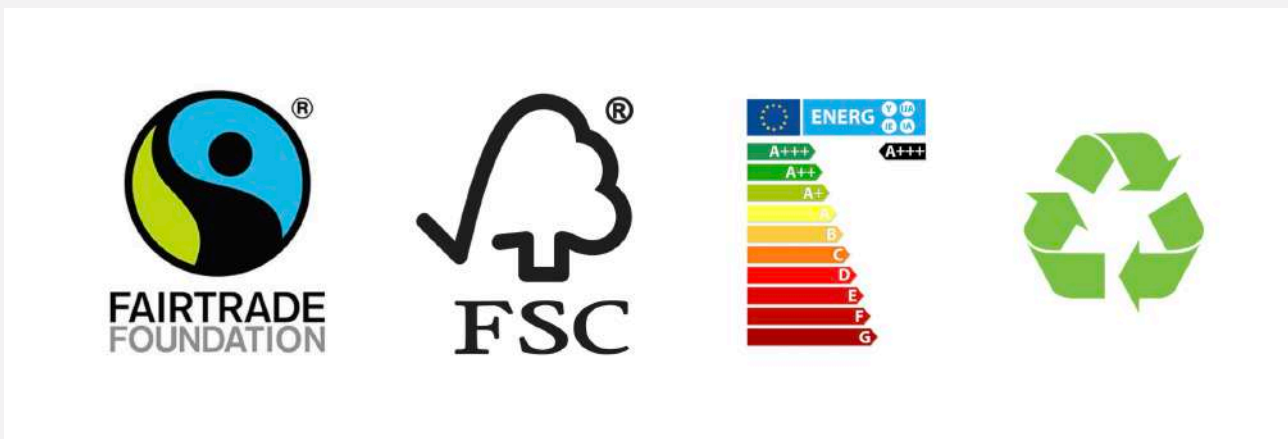
Many shortsighted environmental reports typically focus on critiquing the consumption of our civilisation rather than critiquing its production, and in particular, the production of consumption. In order to appear ethically orientated, corporations depend on the remoteness of socially and ecologically harmful industrial processes guarding them as secrets in the market. The world where corporations can hide from its destructive

environmental practices and decisions is outdated. Transparency is bound by law in areas of politics and finance in order to restrict exploitative activities aimed at profiting the main stakeholder. So it is therefore only a matter of time whereby producers are held to the same ethical standards of transparency, and it is only then where we are able to shift global demand towards a more sustainable and ethically sound future.

Product labelling and standards

The consumer industry can easily feel saturated by the proliferation of 400 different green labels currently used. Many of these labels failed to have any consumer recognition, due to increased ‘greenwashing’ of misleading claims by the companies hoping to falsely appear “eco” (Watanatada, 2011).

Yet in this abundance, there are a few commonly known labels positively changing consumer behaviours; ‘Fairtrade’, ‘Forest Stewardship Council’, ‘EU Energy Efficiency’ and the widespread recycling arrows.



Acting as voluntary labelling schemes ‘Fair-trade’ and ‘The Rainforest Alliance’ is aimed at improving ethical production, and the latter two (‘EU Energy Efficiency’ & ‘Recycling arrows’) acting as a legal requirement aimed at empowering consumers with comparable information of a certain product.

Voluntary labelling schemes

Voluntary labelling schemes are the most popular form of ‘eco identification’ in the consumer sector. They act as a “non-state authority” both nationally and internationally and bind agreements with various corporations attempting to hold each other accountable through “entrepreneurial democracy”. These labelling schemes have recently experienced rapid growth, reflecting the increased interest and demand from customers seeking eco-conscious products. This has led to a proliferation of different labels inundating the shelves of stores, all claiming to be “eco” whilst struggling to maintain authenticity.

Voluntary labelling schemes also tend to be less effective in shifting markets towards eco-conscious production. Labels such as the rainforest alliance and RSPO (sustainable

palm) have had limited environmental benefits and made little impact on consumer behaviour. The limitations with voluntary labelling schemes tend to be that “producers who are already low-impact certify whilst high-impact producers go label-free” (Poore, 2018). Consumers are also proven to be less likely to purchase from brands perceived as “unethical” than to start buying from those they perceive to be “ethical”. Therefore, voluntary labelling schemes fail to capture the real information needed to shift consumer minds, no matter how well intentioned they are.

Standardising Voluntary Labelling Schemes

The ‘International Standards Organisation’ (Commonly known as ‘ISO’) has identified this ‘GreenWash’ and set out standards to harmonise the process. The ISO 14000 series covers all environmental standards with specific requirements governing environmental labelling. Three types of labelling schemes have been produced under the ISO 14020 category:

Type I

An environmental label certified by a third-party complying to the ISO 14024 standard. It is assessed against a set criteria and compared to others within the same category. These certifications don’t assess the product’s impact through an LCA (Life cycle analysis) or ‘Cradle to grave’. The criteria are set by an independent body with its relevant stakeholders (Ecosmes.net, 2019).

Type II

A self-declared environmental claim complying to the ISO 14021 standard. These claims are not independently verified and do not use pre-determined / independently verified criteria. Although, a label claiming a product to be ‘biodegradable’, without defining the term, is not necessarily a compliant Type II label. The claims created by the corporations must be backed with readily available third-party information, including an explanatory statement. Due to the immense flexibility corporations hold with Type II labels, it is common for governments to regulate these claims independently under consumer protection legislation.










An example of this government regulation is Australia’s ACC. Self-declared claims must comply with the following requirements below:

- “Be honest and truthful”
- “Detail the specific part of the product or process it is referring to”
- “Use language which the average member of the public can understand”
- “Explain the significance of the benefit”
- “Be able to substantiate the claim”

(Australian Competition & Consumer Commission, 2011)

Type III

Probably the most extensive form of eco-certification. Known as Environmental Product Declarations “EPD”, this is based on a full life-cycle analysis. The analysis provides quantifiable environmental information enabling direct product comparisons which fulfil the same function. The data is independently verified in accordance with the ISO 14040 standard. The primary use of Type III certifications is for Business to business communication, supporting consistency within the industry. Although it can also be found to include business-consumer (Iisd.org, 2013). Unlike Type I & Type II, Type III is not designed to judge products. This is left for the consumers empowered with this information to judge for themselves (Ecospecifier.com.au, 2019).

		Certified eco-labels Type I	Self-declared Type II	EPD Type III
Characteristics	LCA Required?	✘	✘	✔
	3rd Party Certification	Required	Not required but enhances credibility	Not required but enhances credibility
	The eco label communicates...	Better environmental performance with same quality.	Improvement of one environmental aspect	Plain LCA data for comparison with other EPD
Useful for...	Communication with final consumer			
	Business to business			
	Green procurement			

Original table can be found: <http://www.ecosmes.net/cm/navContents?l=EN&navID=ecoLabels&subNavID=1 &pagID=1>

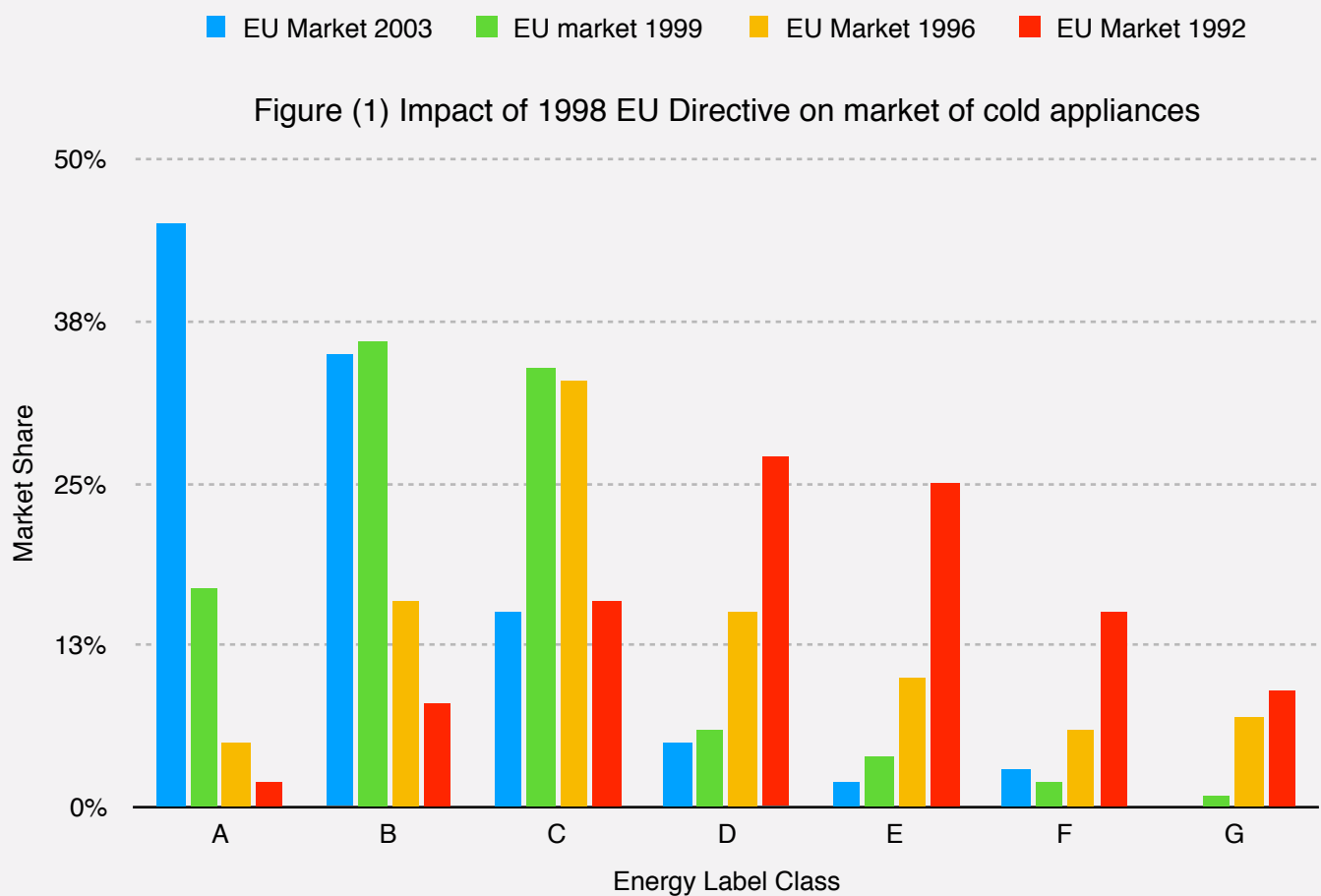
Mandatory Labelling Schemes

In order for corporations to trade in nation states, they must adhere to mandatory Labelling Schemes. These are usually imposed by governments and bind corporations by law to display in a transparent fashion their products production or functional detail. Mandatory labels would highlight both the high and low impact producers in the same way. And having all corporations adhere to this provides producers with the tools to monitor their impact, and having a nation-wide labelling scheme allows for a uniform measurement of impact and accountability for the results.

An example of such a mandatory labelling scheme is the 1998 EU directive; requiring all electrical household appliances to provide information on its energy consumption. At its release, it outlined three objectives:

- 1) "Increasing energy efficiency and the level of protection of the environment."
 - 2) "Providing consumers with information that allows them to choose more efficient products."
 - 3) "Ensuring the free movement of energy-related products in the European Union."
- (https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_autre_document_travail_service_part1_v2.pdf, 2019)

Its success has resulted in the affected products (Fridges, freezers, etc...) to experience three times faster growth in efficiency compared to appliances without this mandatory labelling scheme (refer to Figure 1). Consumers also have a growing incentive to look for energy efficient appliances resulting in energy savings of their bills estimated to be around 100 billion euros per year.



The compulsory nature of the label meant that corporations willing to enter one of the largest markets had to adhere to this policy. EU member states hold these companies accountable through continuous market surveillance ensuring compliance. And with this, a high level of consumer trust was gained with many consumers and producers now considering energy efficiency as a top priority when manufacturing or purchasing a household appliance.

Key contributors to its success have resulted in a similar adoption of energy efficiency schemes in at least 59 different countries outside the European Union. The following Key principles have led to the success of the labelling scheme:

- “Universal application of a single label design”
- “Easy to understand at a glance through the effective use of mnemonics.”
- “Presents information that is salient to and trusted by consumers”
- “Information can be easily retained throughout the purchasing process actively affecting product purchase decisions”

(https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_autre_document_travail_service_part1_v2.pdf, 2019)

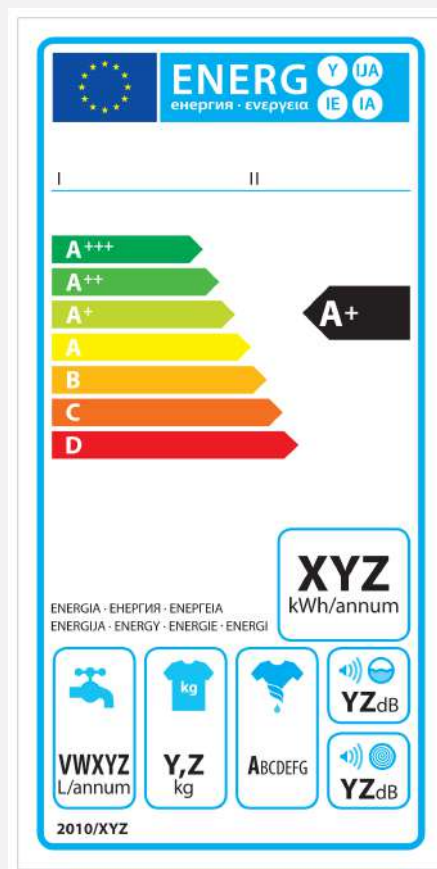


Figure (2)

With the EU directive now in effect for 20 years, it has built a strong brand in the consumer labelling sector. Its development process of including many industry stakeholders has maintained consistency in its expanding labelling programme. Although, there are several challenges it now faces due to its age and expansion, putting the effectiveness of the label at risk of diminishing.

Due to the success of the label and general improvement of efficiencies in electrical appliances, the alphabetical categories in the label have stuck to its 1998 thresholds and starting to realise its limits. There are now several categories of products, such as washing machines, fridges and dishwashers who's label has extended from A+++ to D

classes. But due to do minimum efficiency standards, only appliances scoring A+++, A++ and A+ can in fact still be sold in the EU market. Thus rendering the classes A-D as useless. This undermines the consumer relevance of the label, and loses its effectiveness of persuading consumers to buy more efficient products. Consumers have also shown to be less incentivised in comparing products between the A+ and A+++ classes, than within an A-C range. Limitations due to the printed nature of the label means that a complete review of the classes are deemed unlikely and too disruptive.

Adding new product categories to the directive is a long and arduous process. Extensive reviews with industry stakeholders and research institutes takes time, frequently resulting in outdated technical requirements and policy decisions.

Market surveillance is another challenge faced with this labelling scheme. As new appliance categories are added, traditional methods of monitoring complicity are finding its limits. A study conducted by the European Commission estimates that non-compliance results to a total of 10% loss in potential energy savings (https://ec.europa.eu/energy/sites/ener/files/documents1_EN_autre_document_travail_service_part1_v2.pdf, 2019). Enforcement of complicity requires economic and human resources. The EU's resources in this program are substantially less in comparison to similar sized economies. As an example, the US expenditure in their equivalent programme is around 10 times that of the EU. Additionally, as the EU is compiled of a group of nation-states, each member is required to do their own monitoring as there is no unified agency acting on behalf of the whole EU. This results in inconsistencies of enforcement as some members choose to be significantly less active or stringent than others. A lack of a common benchmark on what is also considered appropriate market surveillance is evident as well.

The Tesco carbon label:

In late 2006, humanity was faced by the reality of our climate crisis through several reports of the IPCC and the release of Al Gore's film "An Inconvenient Truth". With economic prosperity at a high, organisations took it upon themselves to create ambitious goals to tackle this crisis. The director of Tesco even claimed a "Green revolution" is on its way.

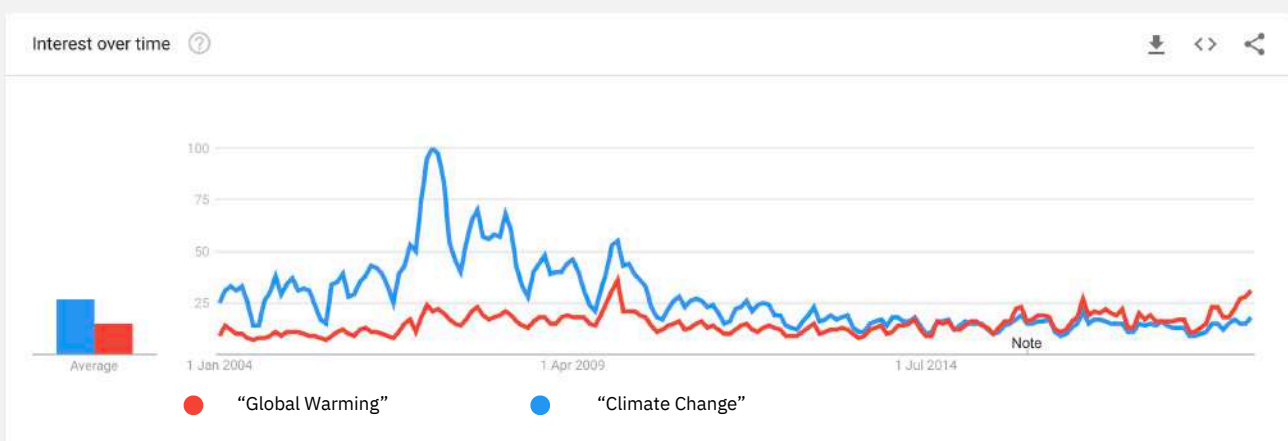


Figure (3): A graph sourced from Google trends showing the increased popularity in 2006-07 of the term "Global warming"

In fact, the very idea of this report has already been thought of then by Tesco. In 2007, Tesco's director Terry Leahy announced a radical vision to lead the industry towards a sustainable, carbon-neutral future. Ambitious targets were made declaring carbon neutrality by 2010 and a plethora of other initiatives. The most innovative and notable initiative was Tesco's objective to label every one of their 70,000 products with their individual carbon footprint (Vaughan, 2012). It was a radical move which spurred plenty of interest. Tesco invested £5 million pounds a year to fund the development of this project which it viewed would revolutionise the consumer industry.

Unfortunately, 13 years later, only 500 of their products were labelled, and the program terminated. There are some stark similarities with what they envisioned and the proposal in this report. Although it is important to identify where they went wrong and how this proposal might resolve these issues.

Reasons for the failure of Tesco's initiative:

- The company wanted to conduct a full end-to-end lifecycle analysis of each individual product. This meant outsourcing an independent agency to spend several months investigating every single step of the products life. Although this provided a highly accurate picture of the impact of the product, it was costly and inefficient.
- The programme was built as a voluntary scheme in partnership with the Carbon Trust. This meant that in order for the label to obtain the needed traction, other retailers and grocers had to implement it themselves. Many could not afford the extensive investments stated above and therefore could not create the wide-reaching impact it initially had hoped.
- Little impact on consumer interest: This was due to several factors. The first being the inconsistency of some products having the label whilst others did not. Comparisons were difficult to do and the units used felt abstract as the majority could not perceive the relative environmental impact of several grams of CO₂.

Proposal

This 21st-century crisis requires a 21st-century solution. The proliferation of tech embedding in our daily lives enables us with access to information at light speed. It is therefore obvious that in this age we would leverage the powers of this connectivity to empower consumers to make an educated purchasing decision in order to maintain a healthy climate, society, and economy.

Digital solution:

Many product labels are designed for the physical world, excluding a rapidly growing digital world. Purchases on digital commerce platforms are expected to grow 15% each year, and with this, leaves a missed opportunity for educated and informed purchasing decisions.

QR codes have a successful ability to link the consumer's physical world with the digital world. The simple user experience of scanning the code enables consumers to access to a huge variety of online content. QR codes also remove the need to add detailed information onto the physical label, reducing the required surface area and simplifying the visual clarity.

The digital link would lead the consumer to the "Greener choice" website with the specific product loaded directly on their phone. Digital information has the ability to present itself at the most appropriate time.

One key differentiator with this, as opposed to physical labels is its ability to provide tailored and contextual information at specific stages of a products life. Information key to purchasing decisions could be provided when scanned in a store. When at home, tailored recycling information could be provided to help improve local recycling rates. Even beyond consumer disposal, these QR codes could provide valuable material information when scanned at a recycling facility.

In addition to providing information at the right time, digital data could even be adjusted towards personalised factors. If the scanned location could be accessed we could calculate the distance travelled of that product, and even provide information on how that purchase could impact your local community.

Many traditional labels suffer from the ability to easily update itself. As previously mentioned, the EU energy efficiency label has outdated categories and is unable to accommodate long term positive trends. This proposal enables a flexible and future proof solution.

The availability of direct access to digital information evokes a greater sense of trust and accountability between the stakeholders. A highly important factor proven to be a contributor to the success of the labels.

Updates to the LCA data of a product can be done whenever, which is an important factor in maintaining relevance and adoption. As an example; Companies who shift production plants are able to instantly submit new information and have the products digital rating directly reflect this. Naturally, the physical printed labels wouldn't "instantly" update but could easily be adjusted at the next production batch.

The resource demand for market surveillance is also greatly reduced. Regulators would have instant and direct access to details of the product, and artificial intelligence could be leveraged to identify inconsistencies in data submissions. The data could provide a confidence rating based on historical performances directing valuable resources towards product sectors failing to comply. In spite of these advantages, it is important to note that a unified compliance body across the whole of the EU is required. Trusting each member state to conduct their own compliance is inefficient and a waste of limited resources.

As well as maintaining transparency, digital data can also be made accessible through an API. This would enable third parties to capitalise on the available data and even provide

consumer-facing suggestions. An example of this could be Uber's ability to calculate the total environmental impact of a ride based on the model of car, the fuel, and its location.

Method of measurement

The largest concern when introducing a new eco-label are the metrics required to inform the rating. Many of these labels either focus on the usage or production of the rated products. Consequently leaving a large majority of a products environmental impact unaccounted for.

The most comprehensive form of analysing a products environmental impact is through conducting a life cycle analysis. Commonly known as 'LCA' this analysis enables a full trace of a product's impact from material extraction to disposal.



<https://www.innovationservices.philips.com/news/life-cycle-assessment-finding-best-approach-company/>

A significant advantage to using LCA's is the ability to compare the data against competing products. The standardised approach is key when considering a universal label across all products, and lends itself as an important contributor to this project.

One challenge faced with using LCA's is its resource-intensive approach to analysis. Currently, companies conduct an LCA for internal use with costs of \$50,000 USD and above. External consultants are hired to conduct the research and takes several months to complete.

There are many certified and freely available databases which are able to provide a good picture of a products Life Cycle analysis. These databases enable a cost and time reduction of up to 90% greatly reducing the burden of companies measuring the impact of their products (Business Energy, 2019).

The proposal aims to leverage the available information to achieve an analysis accurately enough in order to successfully differentiate between products. Our proposal would recommend making it legally obligatory that at a minimum each corporation or manufacturer completes such an 'online LCA'.

Once companies have provided the data required for a "minimum LCA" it is digitally submitted to our service. Then, with the access of open source databases, we would automatically process a tailored rating for that product.

As 'online LCA's' depend upon publicly available databases, companies who feel their products have been unfairly rated have the option to submit a full, independently conducted Life cycle analysis. Providing this can improve the rating of a product and encourage companies to continue investing in these analysis to better act on ways to reduce their impact.

Fighting against tampering

An approach to tackling the challenge of falsification of information lends itself towards a digital solution. Employees at each stage of a product's production are required to input their corresponding information. This "digital certificate" is then permanently stored with historical edits monitored. Government compliance officials are then able to instantly retrieve this information, demand proof of data, and even arrange an independent assessment. Information which has been falsely recorded with intended beneficial effects towards their rating should be heavily penalised. Government officials don't have the resources to monitor the integrity of all producers so a randomised approach towards investigations, coupled with a heavy fine should, in theory, should deter producers willing to falsely declare their products production details. Artificial intelligence could even be leveraged to identify inconsistencies in data input and report any unusual trends.

Funds generated from the fines could then be re-invested in the compliance agency. This would support the infrastructure of the programme and fund investigations in non-compliance.

Includes the entire chain of stakeholders

Due to the globalised nature of our production lines, many components are outsourced across various companies throughout the world. Companies purchasing components for assembly in their own products would find it unnecessarily difficult to have to register their outsourced components as well.

Products registered on the system are automatically assigned a unique identifier number. These unique product numbers can then act as component ID's enabling a digital assembly to take place for a complete picture of the impact of a product. With each product used as a component in an assembly, details on the methods of assembly would be required. We would also know the country of origin for these components and can, therefore, measure their individual distances travelled.

The Design:

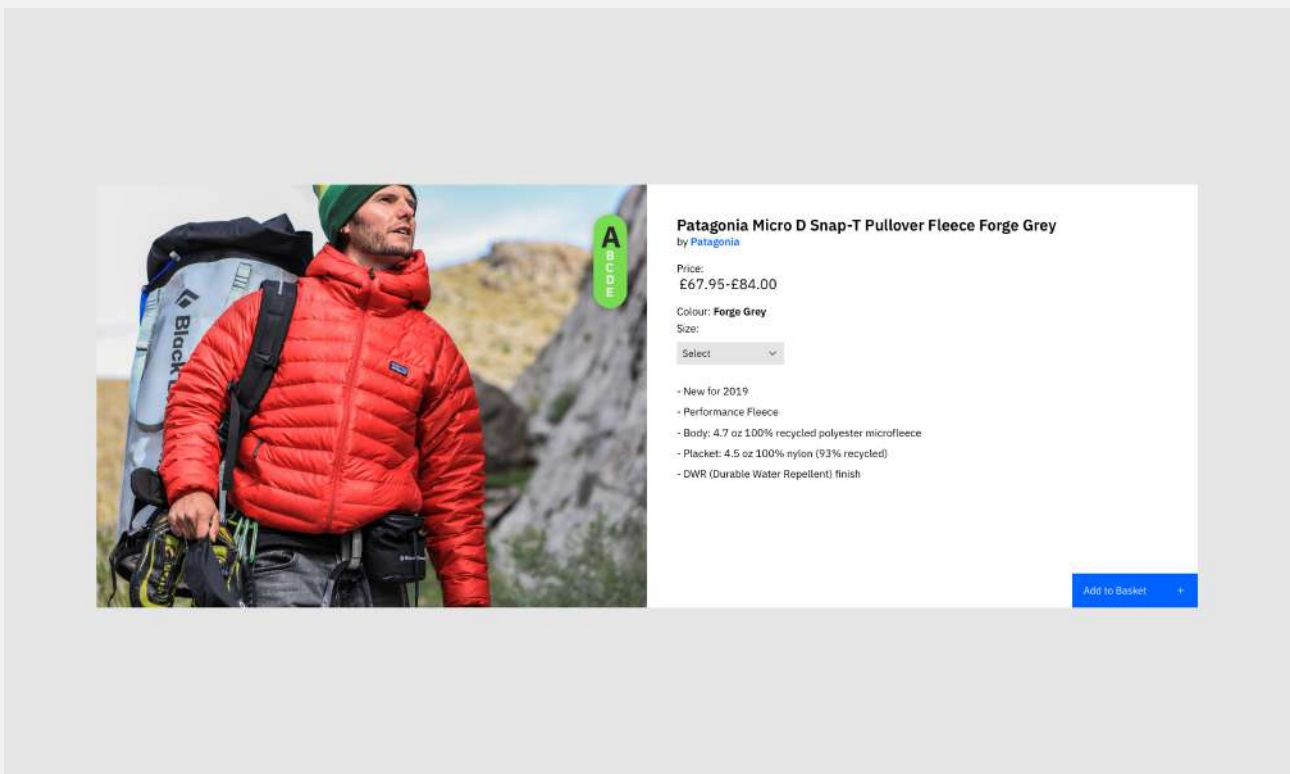
It takes about 15 seconds for a consumer to decide on a supermarket purchase (Peretti, 2019), and with labelling often acting as the deciding factor, it is important to maintain a clear and easily understandable design.

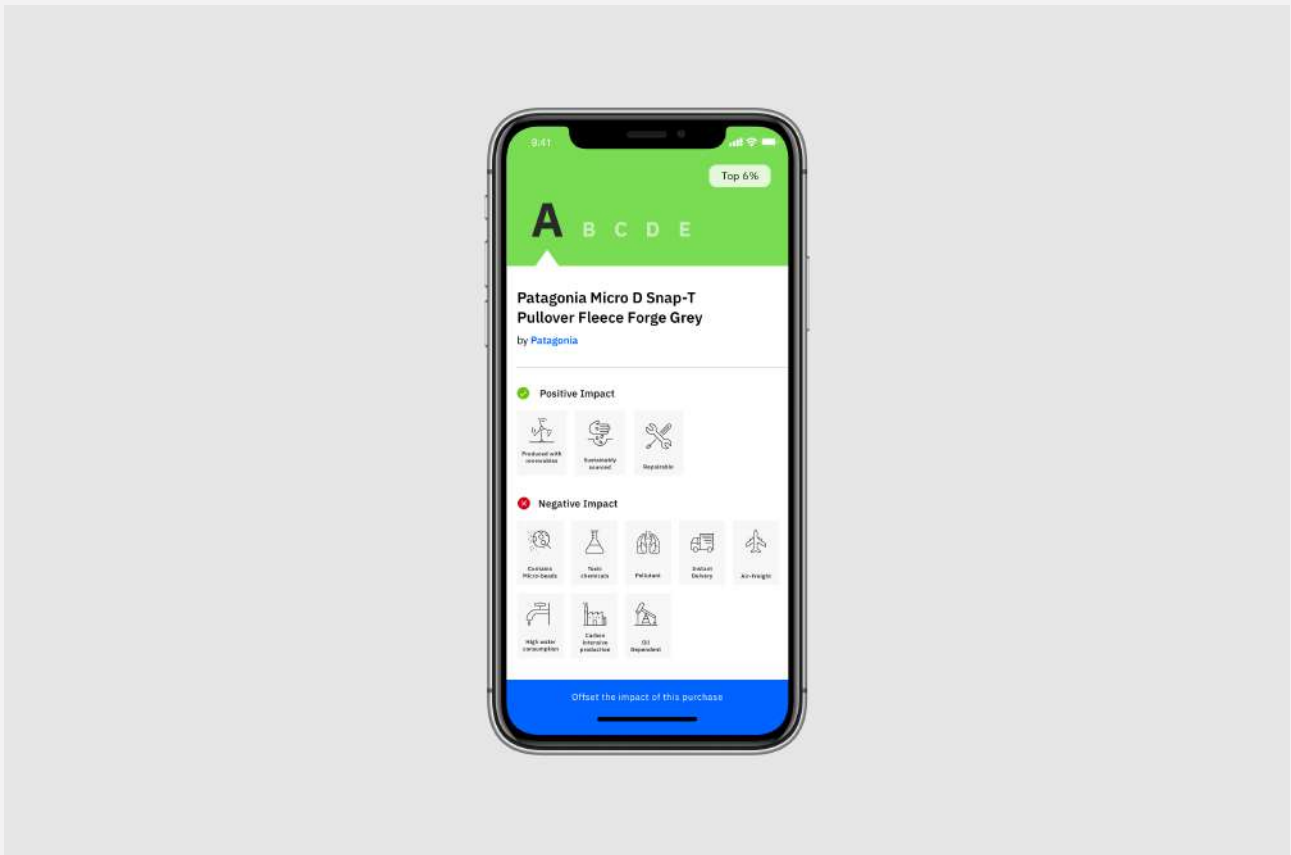
The proposed design consists of a label built for both the physical and digital world. It is compact in size yet maintains clarity of information and is easily understood. It borrows successful elements of the EU energy efficiency label such as the pointed arrow and the alphabetical rankings. The concept highlights the product's rating through a set of traffic lights. Research by the Food Standards Agency has shown that consumers prefer traffic light labelling because it offers key information "at a glance" (Triggle, 2013).

Coupled with an enlarged letter. A white box sits on the left of this, acting as a "tooltip" both emphasising the product's rating, but also the ability to obtain further information through the QR code. The QR code is unique in its design as it contains an "earth" icon "circulating" around the barcode to emphasise the circular economy.



It is clear that in the digital world, this label would not require a QR code. Instead, an embedded widget accessible through an API call would provide direct information to the user when clicking on the label. The widget acts as a viewport to the web UI so all information can easily be accessible.





The web UI is built for mobile use. Once the QR code is scanned, the browser will bring up the relevant page. In addition to the rating, the page enables additional information to be conveyed, such as recyclability, measured impact, toxins, etc... (Refer to the appendix for further visualisations of the concept). For consumers who wish to understand the impact of a product beyond the simple “rating”, this is the ideal forum to do so.



Getting producers on board:

It is important to recognise that producers will be the most affected by our proposal. Yet, they are key to the success of it. It was mentioned that a leading factor to the failure of the Tesco initiative was the lack of adoption of other companies. It was also mentioned that if voluntary, only low impact producers adopt this as opposed to the high impact corporations. It is, therefore, my first recommendation that if we are to maintain a fair and balanced market, we should require the adoption of this label by law. At a European level.

An eco-label is useless if it fails to identify areas of improvement for producers. It is therefore paramount that the effort in developing this solution is balanced for both the consumer-facing end, but also the producers. It is important to provide clear information of the impacts of their products in order to enable them to identify and make effective changes to their products life cycle.

Getting consumers on-board:

When engaging consumers with our proposed label, there are a few clear factors which need addressing.

- The label needs to be easily understood and contains legible information.
- The label must clearly highlight the impacts and benefits.
- It must be highly accessible and a clutter-free experience.
- It must be able to work independently from a physical or digital solution.
- With the available third-party access, shops and supermarkets could further incentivise consumers by awarding them royalty points when purchasing a low impact product.

Getting governments on-board:

Governments (and in turn, the nation's population) would benefit quite significantly from the successful implementation of this proposal.

Generally, products produced locally are rated better for the environment, which encourages consumers to purchase products which stimulate the local economy. The ratings would encourage greater ethical manufacturing practices and in turn a fairer society.

Challenges in the implementation

Implementing such a project comes with significant challenges and it is important to consider these in order to best mitigate their risks. This proposal revolves around the legal obligation of rating a products environmental impact. In order to implement this obligation, the nation states and its industries must be all in agreement in order for successful implementation across the European Union. Due to the unanimity rule, getting this agreement passed is by far the largest hurdle.

If we are able to implement such a proposed label, another challenge would be to address the competing messages branded products have on their real estate. Clarity and transparency of the information are vital in gaining consumer trust.

Data fraud will undoubtedly occur with such a project. Producers and nations willing to present their product in the best light for economic gain will find loopholes to exploit. This is of particular concern with regards to foreign producers as ensuring data accuracy is much harder to enforce.

Conclusion:

If well executed, consumer demand has a proven ability to positively change the environmental impact of an industry. Empowering consumers with a compulsory, standardised label, fit for the 21st century is the most effective way forward. With the information provided from previous case studies and the ISO standard, this report has created the foundation to a proposal ready for adoption. The proposal aims to equip consumers with comparable LCA data by greatly reducing traditional labelling costs whilst managing to shift market demand towards a more sustainable future.

This proposal only lays the foundation for an effective eco-label. There are evident loopholes available and it is important to mitigate these to avoid fraud in order to maintain consumer trust. User testing will be required to further understand which information is most important to influencing a consumer's purchasing decision.

The "Greener choice" proposal is relatively simple but has the potential to be instrumental in halting and reversing the environmental degradation of our planet. Its aim is to encourage a society not built on exploitation but empowerment and the European Union is in a position where such a future can be decided upon.

References

Boehnert, J. (2018). Design, ecology, politics. 1st ed. New York: Bloomsbury Academic, p. 11.

Naden, C. (2017). Buying for a better world. [online] ISO. Available at: <https://www.iso.org/news/ref2241.html> [Accessed 17 Feb. 2019].

Watanatada, P. (2011). Questioning and evolving the eco-label. [online] the Guardian. Available at: <https://www.theguardian.com/sustainable-business/blog/questioning-evolving-the-ecolabel> [Accessed 24 Mar. 2019].

Poore, J. (2018). We label fridges to show their environmental impact – why not food? [online] the Guardian. Available at: <https://www.theguardian.com/environment/2018/oct/10/we-label-fridges-to-show-their-environmental-impact-why-not-food> [Accessed 4 Mar. 2019].

Ecosmes.net. (2019). Eco Smes - Certified eco-labels and eco-labelling framework. [online] Available at: <http://www.ecosmes.net/cm/navContents?l=EN&navID=ecoLabels&subNavID=1&pagID=1> [Accessed 13 Mar. 2019].

Australian Competition & Consumer Commission (2011). Your consumer rights: Environmental claims. Canberra: Commonwealth of Australia, pp.1,2.

Ecospecifier.com.au. (2019). EcoSpecifier: Technical Guide 9: Introduction to Ecolabels and Environmental Product Declarations. [online] Available at: <http://www.ecospecifier.com.au/knowledge-green/technical-guides/technical-guide-9-introduction-to-ecolabels-and-environmental-product-declarations/> [Accessed 16 Apr. 2019].

Iisd.org. (2013). The ISO 14020 series | Eco-labeling | Markets. [online] Available at: https://www.iisd.org/business/markets/eco_label_iso14020.aspx [Accessed 15 Mar. 2019].

https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_autre_document_travail_service_part1_v2.pdf (2019). Evaluation of the Energy Labelling and Ecodesign Directives. Brussels: European Commission, pp. 1,2,3,4,7,12,15,16,17,22,25,28,35,37.

Vaughan, A. (2012). Tesco drops carbon-label pledge. [online] the Guardian. Available at: <https://www.theguardian.com/environment/2012/jan/30/tesco-drops-carbon-labelling> [Accessed 18 May 2019].

Business Energy. (2019). LCA Tools - Business Energy. [online] Available at: <https://www.businessenergy.com/switching-services/lca-tools/> [Accessed 25 Apr. 2019].

Peretti, J. (2019). Why have food 'traffic-light' labels?. [online] BBC News. Available at: <https://www.bbc.co.uk/news/health-18767425> [Accessed 1 May 2019].

Triggle, N. (2013). Food labelling: Consistent system to be rolled out. [online] BBC News. Available at: <https://www.bbc.co.uk/news/health-22959239> [Accessed 14 May 2019].

Bibliography

https://www.researchgate.net/publication/254995098_Made_with_Renewable_Energy_How_and_Why_Companies_are_Labeling_Consumer_Products

https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_autre_document_travail_service_part1_v2.pdf

<http://www.ecolabelindex.com/ecolabels/?st=category,energy> Sunday 19th May 2019
<https://www.ungm.org/Public/ASRDataArchive> Sunday 19th May 2019

https://www.researchgate.net/publication/281236654_The_impacts_of_eco-labelling_schemes 19th May 2019

<https://www.businessenergy.com/switching-services/lca-tools/> 19th May 2019

https://www.bbc.co.uk/news/science-environment-48213808?fbclid=IwAR39eGtJcYywctShExmb_n8zf1yfo8c2IBfBSqhaMJV_juY54qTWlY-SOuI

<https://www.bbc.co.uk/news/health-22959239>

<http://news.bbc.co.uk/1/hi/magazine/7002450.stm>

<https://www.theguardian.com/business/2007/jan/18/supermarkets.retail>

<https://www.theguardian.com/environment/2012/jan/30/tesco-drops-carbon-labelling>

<https://www.carbontrust.com/client-services/certification/product-footprint/>

<https://www.bbc.co.uk/news/health-18767425>

https://wg1.ipcc.ch/publications/wg1-ar4/faq/docs/AR4WG1_FAQ-Brochure_LoRes.pdf

https://www.ipcc.ch/site/assets/uploads/2018/03/ar4_wg2_full_report.pdf

<https://www.ft.com/content/96fd9478-4b71-11e1-a325-00144feabdc0>

https://www.researchgate.net/publication/254995098_Made_with_Renewable_Energy_How_and_Why_Companies_are_Labeling_Consumer_Products

https://www.researchgate.net/publication/254995098_Made_with_Renewable_Energy_How_and_Why_Companies_are_Labeling_Consumer_Products

<http://news.bbc.co.uk/1/mobile/health/7217198.stm>

<https://www.bbc.co.uk/news/health-18034074>

<http://www.bbc.co.uk/news/mobile/world-europe-16856658>

<http://news.bbc.co.uk/1/hi/magazine/7002450.stm>

LCA available tools:

<http://www.eiolca.net>

<https://www.iersweb.com/life-cycle-assessment>

<https://www.vitalmetricsgroup.com/data-ceda/>

<http://economymap.org>

<http://www.openlca.org/download/>

<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1530-9290.2012.00463.x>

<https://eplca.jrc.ec.europa.eu/LCDN/>

<https://ghgprotocol.org/calculation-tools>

<https://perigordvacance.typepad.com/files/inventoryofcarbonandenergy.pdf>

https://www.lcacommons.gov/lca-collaboration/search/page=1&group=National_Renewable_Energy_Laboratory

<https://www.amee.com>

<https://www.epa.gov/warm>

<https://sourceforge.net/projects/easylcacalc/>

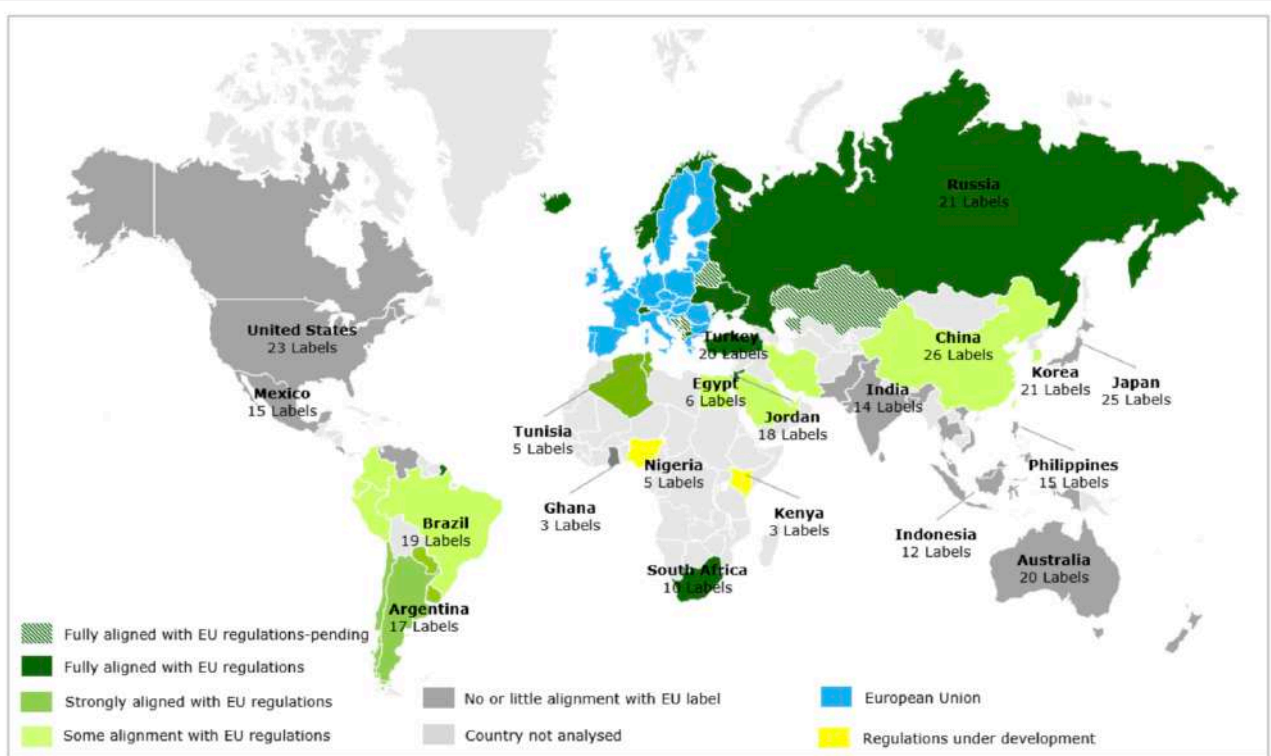
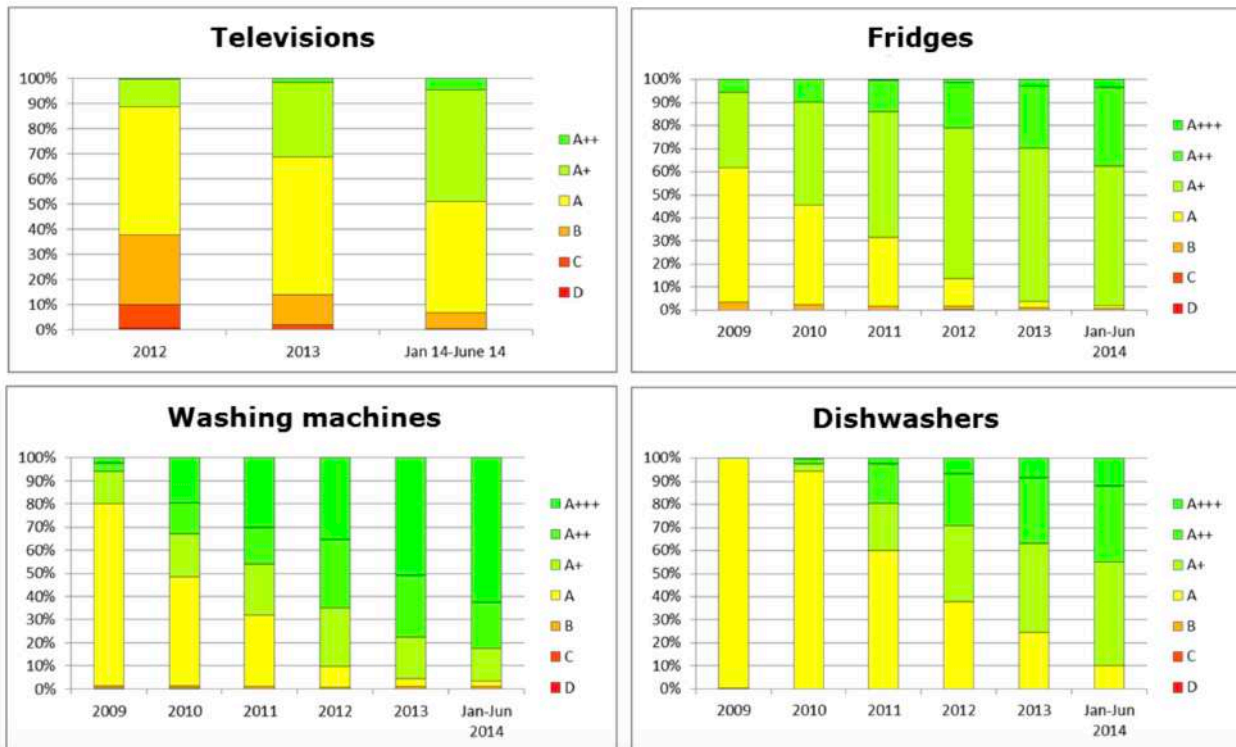
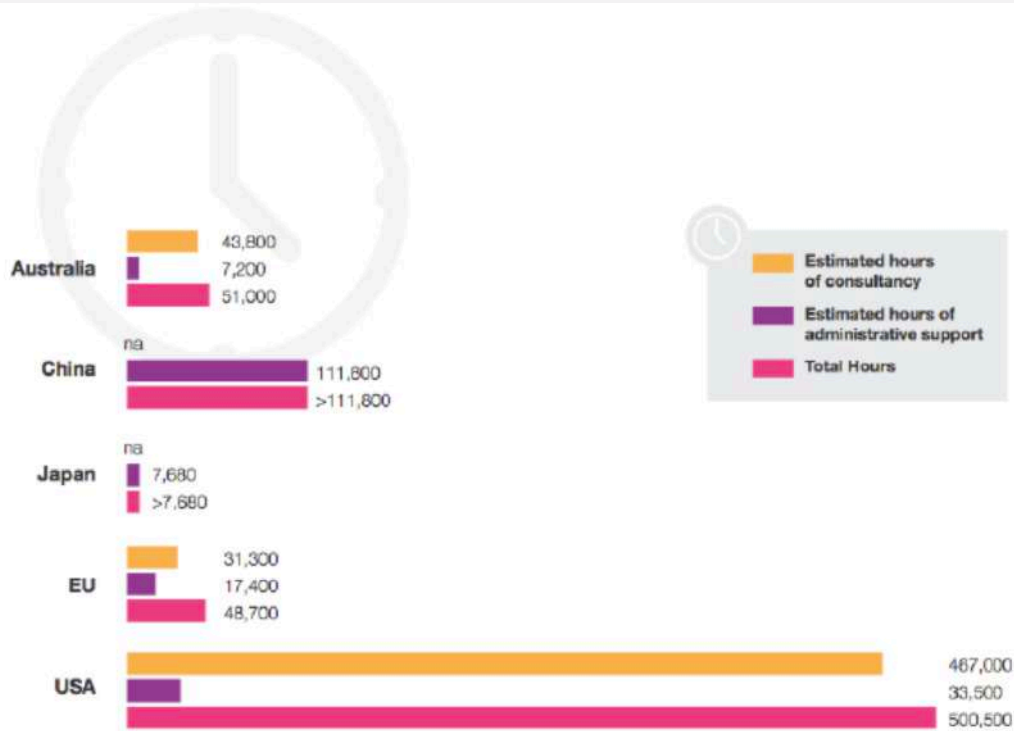


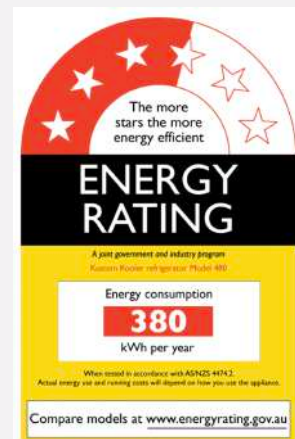
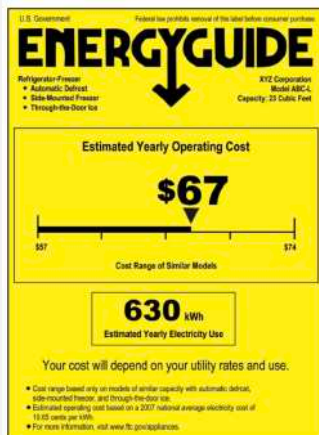
Figure 6: Countries with energy labels and degree of alignment with the EU label⁷³

Figure 2: Transformation of the EU Market for refrigerators and freezers 1992-2003²³





Note, the Australian, Chinese and European values include estimates of all time spent at the economy-wide level for the development of all equipment energy efficiency regulations, including MEPS and labelling. By contrast the US figures are just the estimated time spent on the development of MEPS.



Appendix



