

What is the price of energy efficiency or which appliance efficiency class is the most suitable?

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Abstract

Electricity used for household appliances can represent an important part of the overall building energy balance and operational costs. Increasing electricity prices force our purchasing decisions to be more elaborated, and energy efficiency is their vital element. An important question is: can an average consumer get a comprehensive impression about long-term effects of the purchase based on data currently available at the point of sale?

An indicator showing average annual operational costs for a particular appliance can be a helpful tool, helping consumers to make reasonable decisions for the long-term framework. This type of information also fosters transition in consumer behaviour from the lowest cost orientation to economically most viable option, thus providing firm reasoning for green decisions in private and public procurement. It can also help in transforming the market towards a consumer-friendlier one. In this context Slovenia is taking part in two Intelligent Energy Europe projects entitled Yearly Appliance Energy Cost Indication (YAECI), and (green procurement-oriented) BuySmart+.

The relevance of elaborating energy cost indicators for the Slovenian appliances' market is underlined in the paper, the market itself is analysed and typical energy use data are presented. Aspects of energy cost indication are shown, among other the retailer point of view and reasons for cooperation (e.g. upgraded service for customers, market competition, improved company profile), and the consumer point of view received as feedback to two polls conducted by ZRMK (e.g. energy costs indication at point of sale, eventual influence upon change in purchasing practice and decisions).

1. Slovenian market of household appliances – past and current situation

Slovenian market of household appliances is well developed with regard to both variety of brands and models available as well as their technical and environmental quality. Also, as all the major international manufacturers are present in Slovenian shops it can be said that during the last two decades the situation has evolved to a level quite similar to other EU countries.

Households are a significant consumer of electricity, where the appliances play a very important role. Official statistical data for Slovenia [1] show that until the year 2007 electricity consumption was increasing fast. The global crisis hitting also many segments of Slovenian economy discontinued this trend. However, the household sector has some particular characteristics. In 2010 the share of electricity consumed in the household sector was 27%, nominally being the largest since 1991 and exceeding the figures from 2000 by almost one quarter.

This situation can be viewed at from different angles. On one hand it is related to the rising number of apartments, which brings along a higher number of household appliances. For example, comparison of inventories from 1991 and 2002 shows an increase in the number of apartments by almost 95000. The national statistics quotes that around 92% of residential buildings or apartments are owned privately. On the other hand, the number of building permits issued has been decreasing since 2007; in 2010 14.6% less permits than in 2009 were issued, and in 2011 6.8% less than in 2010. This means fewer purchased appliances for new apartments, with the sales reflecting a shift towards a larger share of appliances bought to replace old ones.

It can be reasoned that not only a higher number of appliances, but also their more frequent and intensified use related to changed living habits and patterns contribute to higher electricity consumption, although contemporary products have a significantly improved energy efficiency. According to estimations on an average around 1000 large household appliances are being sold annually in Slovenia [2], which has a population of slightly over 2 million.

The latest Energy Efficiency Status Report by JRC [3] states that final residential electricity consumption accounted for 29.71% of total final electricity consumption in the year 2010. Compared to this figure the final electricity consumption in the Slovenian residential sector is slightly below the EU-27 average.

It is interesting to observe the shares of some of the more significant appliances in the annual electricity consumption as included in the report. If we focus on the ones with a nearly 100% market saturation in Slovenia, namely refrigerators (usually as a refrigerator-freezer combination) and washing machines, we see that they fall into the “cold appliances” category with a 14,5% share, and “washing and drying” category with a 7,2% share on the EU-27 level, as illustrated in the figure below.

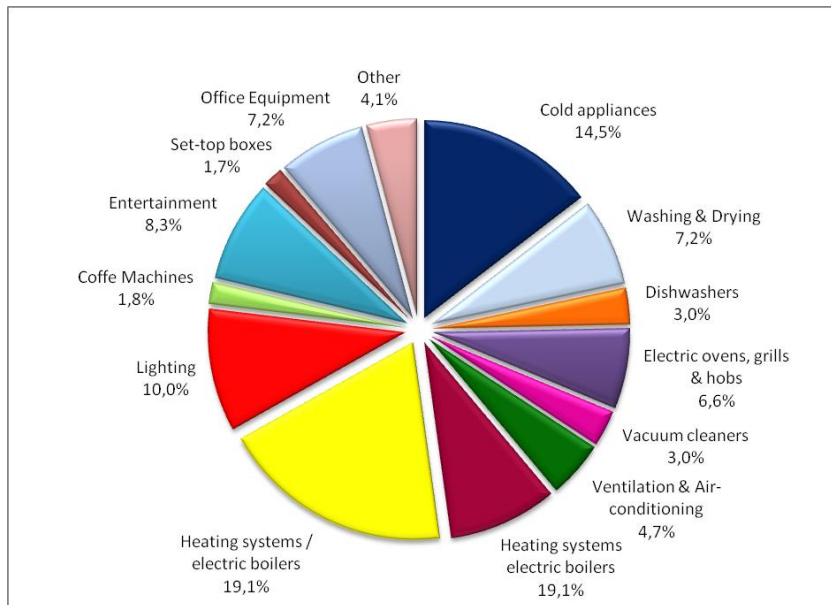


Figure 1: Residential electricity consumption breakdown in the EU-27; status 2009. (Source: [3])

The report brings an important conclusion, which confirms the above discussion about the situation in Slovenia; quote: “Residential electricity consumption is still rising. Although many appliances are becoming more efficient, the number of appliances is rising, appliances are used more often and for longer periods of time, and many appliances have more functions or special features that require more energy. The general trend in the residential sector is therefore an increase in electricity consumption.”

In the Slovenian non-residential sector trends related to appliances are similar, although not that dynamic. Since 2012 the public sector has to comply with specific rules for green public procurement, which will be presented in more detail below.

The most recent (2013) Energy Efficiency Watch report for Slovenia [4] states that the policy package for appliances is to a large extent based on the implementation of the EU Directives on ecodesign and energy labelling. Currently there are no public subsidies available for purchase of energy efficient household appliances, but some commercial banks offer favourable loans with lower interest rate for such purpose.

2. Energy efficient appliances in the Slovenian strategic framework

National short- and mid-term energy and environmental strategies and goals in Slovenia are in line with the EU framework and related targets, for instance with the Directive on Energy Efficiency 2012/27/EU requesting purchase of products, services and buildings with high energy efficiency performance. For the appliances’ sector labelling of products and gradual phasing out of inefficient models represent the starting point for improvements and progress. The public sector is supposed to play the leading role and represent a good example to the private one, based also on the requirements of the Decree on Green Public Procurement.

2.1 Decree on Green Public Procurement

Green (public) procurement has been identified as one of the crucial elements of national strategies oriented towards sustainable growth, low-carbon society and nearly zero energy buildings. Slovenian authorities have in the recent past taken more concrete steps for improvement of the usual procurement practice using solely the lowest price as a predominant selection criterion. In the year 2007 the lowest price as the only selection criterion was used in 79,81% of all procurement cases by value, and in 73,48% of all procurement cases by number. The national Action Plan on GPP 2009-2012, AP GPP [5], set targets in accordance with the EU ones, and it was followed by development of a specific decree bringing forward requirements and selection criteria for 11 product groups. The Decree on Green Public Procurement [6] prepared on the basis of AP GPP strategy has been in use since March 2012. It is a mandatory operational document and has the status of a regulation.

The decree sets basic (core) environmental requirements, which are the mandatory level, and additional environmental requirements in the primary sense of recommendations. Procurement bodies have of course a free choice of shaping further, more rigorous requirements. One of the product groups where consideration of these legal obligations is mandatory comprises refrigerators, freezers, combined refrigerators and freezers, washing machines, dishwashers, and air conditioners.

The technical specifications and selection criteria for the above mentioned appliance types all follow the same principle of using the energy label as the starting point. Technical specifications used as minimum requirements are: class A+ or higher for refrigerators, freezers, combined refrigerators and freezers, washing machines, and dishwashers, and class A or higher for air conditioners. Selection criteria are based on the bonus points principle, i.e. the offer is given additional points for A++ and A+ class (or higher) appliances, respectively. The procurer shall define the method for bonus calculation and the share of these criteria in the overall set. There are additional bonus points possibilities included in the decree regarding the selection criteria: class A or higher for the wringing cycle (washing machines), and class A or higher for the drying cycle (dishwashers).

The ZRMK institute representatives cooperated in the work of a special expert group appointed by the Government, with a task of preparing draft structure of the decree and its product appendices, and of defining the core and additional criteria and technical specifications. Here our experience from the Intelligent Energy Europe project Buy Smart+ (and its predecessors Buy Smart and GreenLabelsPurchase) proved to be very useful [7]. The project addresses both private companies and public authorities, and offers free consultation, guidelines and procurement tools, information about procurement directives and labels, good practice database and other materials of interest. The product groups considered are building components, green electricity, lighting, office equipment and vehicles, and also household appliances.

The decree will certainly go through changes and be upgraded in the future, especially concerning the product groups where technological development is fast or where the labelling scheme undergoes amendments. The national GPP legislation directly relates also to some other fields, one of the more important being EPBD-based regulation on energy efficiency of buildings. At first sight maybe not very obvious, but potentially important can be the range and type of input data for future building energy performance calculation method. Namely, a very important topic which all Member States need to deal with already at this moment is the national definition of a “nearly Zero Energy Building” (nZEB). To formulate the most appropriate nZEB criteria several questions need to be answered, one of them touching also the appliances’ sector: where will the system border be set and how detailed will the “energy” definition be, i.e. will the appliances be included in it. If yes, then the demand for most efficient products will grow faster, fostering also the development and manufacturing of new advanced products, and provision of additional information. Not only that, as the nZEB level will be mandatory for new public buildings already from 2018 on, the green public procurement criteria could need to be amended also considering this aspects. From this brief overview of a particular Slovenian regulatory segment it can be seen that many topics are interlinked and that in the future an instrument such as the YAECl indicator can play a noticeable direct or indirect role beyond the current one.

3. Energy efficiency versus investment and operational costs of appliances

Electricity used for various domestic appliances as reflected on monthly bills for operational costs can represent an important part of the overall building energy balance. The more efficient a building is the larger is the relative share of electricity consumption in the delivered energy score. It is somehow understandable that a highly energy efficient building is equipped with highly efficient products. But, as a consequence of increasing living costs related to electricity prices the purchasing decisions need to be more elaborated, and energy efficiency is becoming a logical yet sometimes not clear enough criterion. A very important question is: can an average consumer, be it private or public, get a comprehensive impression about long-term effects of the purchase based on data currently available at the point of sale?

For the appliances the same basic principle is to be followed as for the building energy efficiency itself. An analysis of long-term effects of individual choices and their impact on the overall performance is needed to gain the most profit out of the investment. At the same time another important fact has to be taken into account: electricity consumption and related operational costs depend also upon user behaviour, and patterns, frequency and duration of use.

It is fair to assume that data about average annual operational costs calculated according to a uniform method for a particular appliance can be one of the most helpful tools for the consumers, helping them to make reasonable decisions and bringing forward long-term advantages of buying a maybe somewhat more expensive yet much more efficient appliance in terms of energy use. This type of information also fosters transition in consumer behaviour from the lowest cost orientation to economically most viable option, and thus provides firm and clear reasoning for green procurement decision-making process in private as well in the public sector. Such an instrument can gradually bring further improvements and help in transforming the market towards a greener and consumer-friendlier one.

3.1 Indicator of operational costs as additional consumer information

Experienced partners from 11 European countries, including Slovenia with the ZRMK institute, have formed a consortium under coordination of the NL Agency and started developing a voluntary indicator as described above [8]. The project (Yearly Appliance Energy Costs Indication; YAECI) has been supported by the Intelligent Energy Europe programme. It is based on a successful Dutch practice EnergieWeter. The main objective of the project is to provide customers with information at the point of sale on the yearly energy cost of products with an energy label, in order to stimulate the uptake of affordable efficient products.

As discussed above, the EU energy label currently provides the consumer with information on the energy efficiency (energy class), energy consumption and several other energy-related aspects. However, it lacks the information about an aspect that many consumers find very important, i.e. the product's (yearly) running costs. The calculation of costs follows a common method based on data from the energy label and average national electricity and water prices. For products with the old energy label the method has been modified to allow for comparison with the new labelling.

There are at least two major yet slightly different aspects of presenting these data at the point of sale (shop, catalogue, Internet). Firstly, consumers are able to better comprehend the difference between more and less efficient products when it is illustrated by lower operational costs for the first group. In this way the usually higher price of a more efficient product ceases to be perceived as a disadvantage frequently posing as an obstacle for a purchasing decision in favour of such items. Secondly, there may be cases when some product would for one reason or another be only seldom used, i.e. with much lower frequency than in a "standard" pattern of use. In such a situation the cost indicator would show that purchasing a more expensive and more energy efficient appliance would not bring long-term advantages as the operational costs' savings would not cover the price difference. This can be done in a simple way by checking the ratio between price difference and annual energy costs difference.

An example: a customer compares a highly energy efficient but more expensive (price: 400 EUR) appliance with a less efficient but cheaper (price: 350 EUR) one. Let us say that with "average (standard, normal, ...) use" the energy costs are 30 EUR/a and 39 EUR/a, respectively. The price

difference would be covered by a reduction of energy costs in ca. 5 years (50 EUR/9 EUR), so the purchase of a more efficient appliance seems completely rational and beneficial. However, in a case when the intended use is only occasional, for instance only one third of the “average” one, the energy costs would be only 10 EUR/a and 13 EUR/a, respectively. In this case the price difference would be covered by reduction of energy costs only in ca. 16 years (50 EUR/3 EUR), which may even be past the technical lifetime of a particular appliance.

Of course, points of sale will be equipped with simple but clear information for customers about the considered average use patterns of appliances fitted with indicators. These data and the calculation methodology behind the YAECI indicator are for each appliance type presented in detail in a report publicly available at the YAECI website (<http://www.appliance-energy-costs.eu/eu/library/library>).

It may be argued that the second case does not represent green purchasing decisions, but only if we look at the subject in a very narrow way, not taking into account the principle of searching for an economically most viable offer and the fact that lower usage rate also means lower electricity consumption and related lower negative environmental effects.

Although the visual appearance of the indicator has not been defined within the YAECI consortium to allow for customisation for different use options such as on a price tag, as an individual label and similar, in Slovenia the decision has been made to prepare a unified design. This initiative came in fact from the side of the largest retailers, pointing out that such an instrument needs own graphical identity so that the buyers will recognize it and accept it more quickly. Therefore the indicator carries the project logo and the text “Yearly energy costs” followed by the value expressed in EUR as illustrated in the figure below.



Figure 2: An example of the YAECI indicator for the Slovenian market. (Source: ZRMK)

4. Selected statistical data for Slovenia

The Statistical Office of the Republic of Slovenia provides access to statistical data from various sources and about various categories on its web portal [9], also about electricity consumption in households including information about electrical appliances and the shares of labelled ones. If we take a look at washing machines, refrigerators (also combined with freezers) and dishwashers we can see that in the year 2010 there were about two thirds of these appliances equipped with an energy label: washing machines, 65,3%; refrigerators (+freezers), 64,7%; dishwashers, 72,2%. Having in mind that in Slovenia energy labelling started in practice about a decade ago we can estimate that over two thirds of the mentioned appliances in use in Slovenian households are not older than ten years. The above mentioned statistical source offers further interesting data, some of which are presented in the figures below.

There are no official cumulative statistical data available which would allow for an estimation of the share of household appliances in the electricity consumption in the non-residential sector. This sector is very specific and the figures can vary significantly, for example between schools and hospitals on one side and office buildings on the other side. However, in relative terms the status can be estimated as being similar to the residential sector: continuous uptake of more efficient appliances both as first buy and as a replacement of old ones, increasing number of appliances or at least of some of the types due to technological upgrade, intensified and more frequent use.

Municipalities in Slovenia have an obligation to prepare local energy concepts (LEC), where the baseline conditions are established and various technically and economically feasible strategies for improvement of energy efficiency on the local level are defined. Current practice touches the share of

electricity consumption as discussed in this paper only seldom, but with respect to the strategies for sustainable growth this aspect will probably have to find its place in the LECs as well.

A clear picture of electricity consumption range evolving from different sources can be established during energy audits, which are being carried out for example in Slovenian hospitals, schools and kindergartens as a precondition to apply for state funds for improvement of energy efficiency. Here again not only an estimation of improvements in technical terms is important, but also from the financial aspects. An indicator of operational costs for large appliances can offer valuable help as an input to mid- and long term financial flow projections and planning of necessary budget.

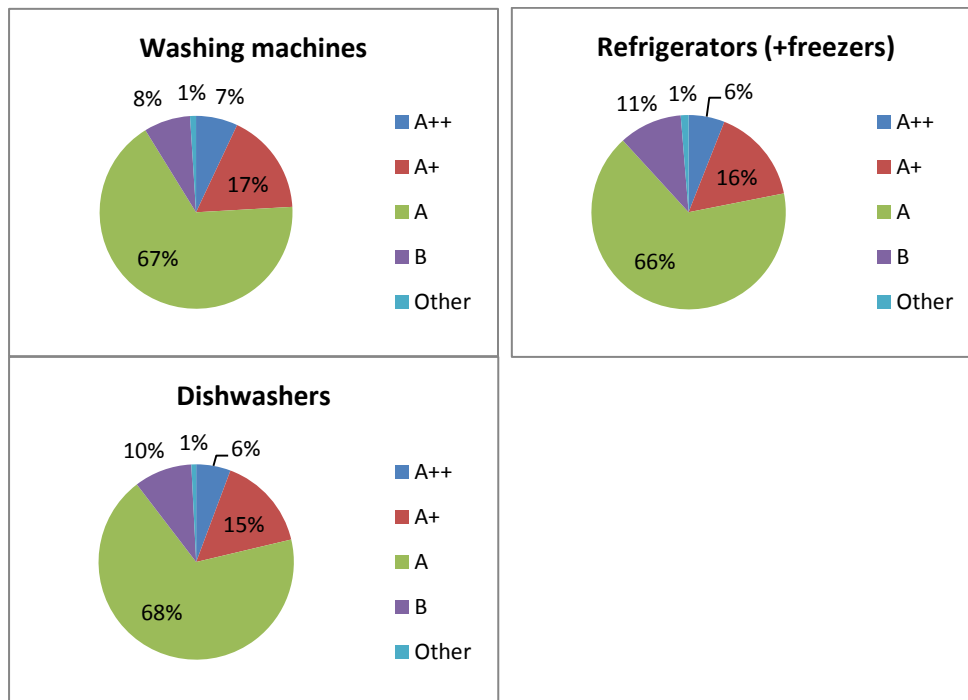


Figure 3: Energy label class shares, residential sector: washing machines, refrigerators (+freezers), dishwashers; status 2010. (Source: [9])

We can also observe (Fig. 4) that in the residential sector in the period between 2009 and 2011 the total electricity consumption for washing machines and refrigerators was slowly decreasing, which is probably due to uptake of more efficient products, not due to a reduced total number of these appliances. As opposed to this trend the consumption of dishwashers was slightly increasing, which can be related to a larger number of households, both old and new, equipped with this appliance.

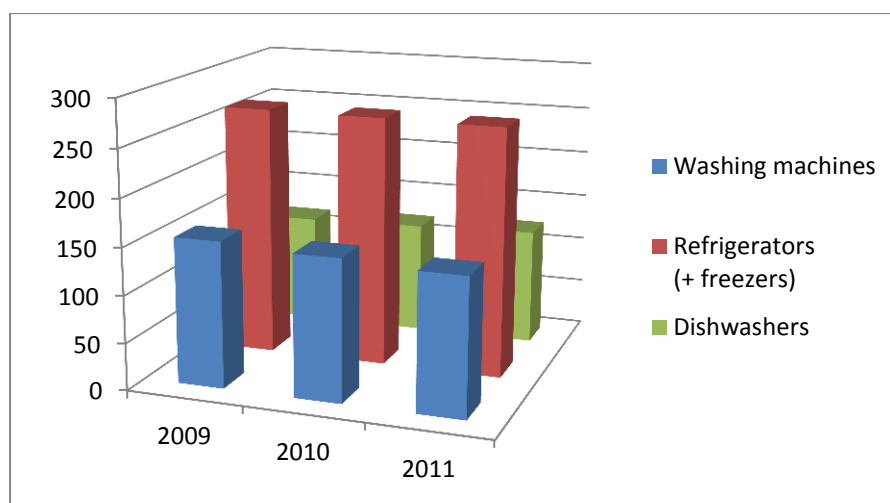


Figure 4: Annual electricity consumption for three selected products in GWh. (Source: [9])

5. Consumers' and retailers' point of view

Since the beginning of the IEE YAECI project in spring 2012 many promotional activities have been carried out in Slovenia by ZRMK, including presenting the indicator two times on the first programme of the national TV.

On the February 12, 2013 ZRMK presented YAECI project on the 1st programme of the Slovenian national TV in prime time just before the evening news. The additional information to consumers - appliances' operational costs was presented and explained at the interview. The second TV appearance was on March 5, 2013, when the Slovenian YAECI partner, ZRMK, went live into the national morning TV programme. The meaning and importance of energy labelling, and the idea of the yearly energy costs indicator for domestic appliances were presented in the Merkur retailer trade centre in Ljubljana.

To obtain the consumers point of view about the energy labels, understanding of the appliances' operational costs and about key aspects when purchasing a new appliance, two polls were conducted by ZRMK. The first one was distributed after the workshop about the energy efficiency of appliances at the DOM Fair, Ljubljana, from March 13 to 17, 2013. The second one was an electronic version sent randomly to different costumers who just recently made the purchase of an appliance or are planning to do so in the near future. Altogether 204 opinions were collected and are presented in the figures below.

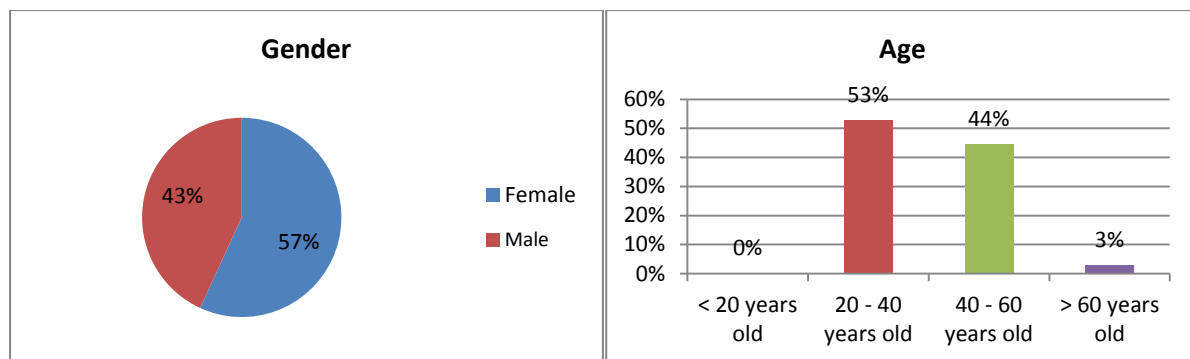


Figure 5: 114 female and 88 male persons mainly of the age from 20 to 60 years responded to the poll. (Source: ZRMK)

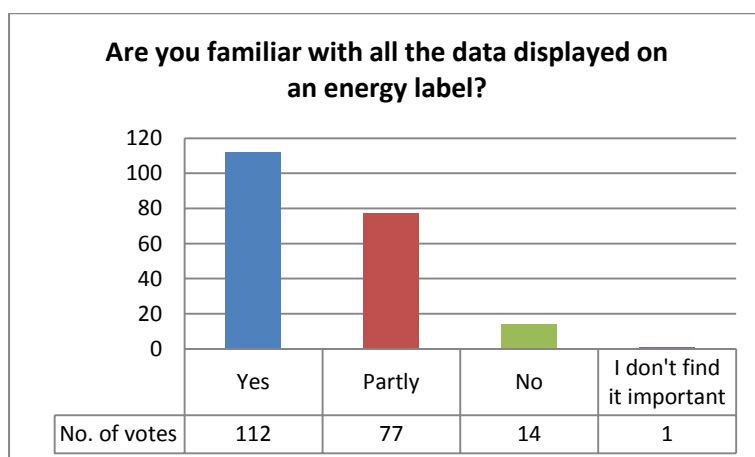


Figure 6: As seen from the chart the awareness about energy labels is quite high in Slovenia. (Source: ZRMK)

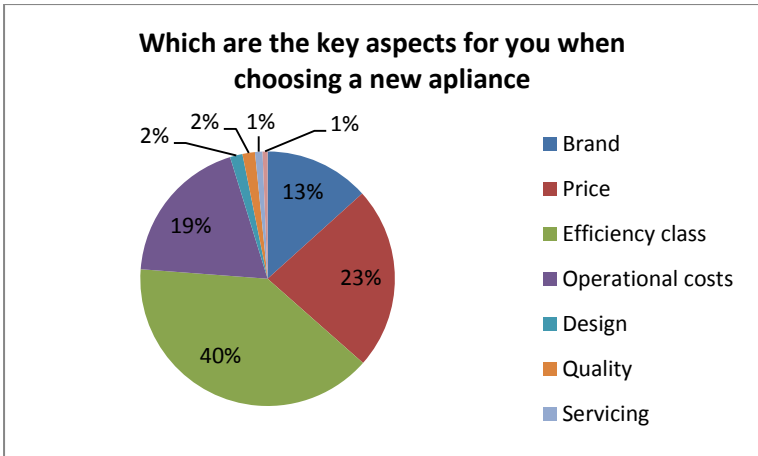


Figure 7: According to received answers the efficiency class followed by the price and operational costs are key elements when purchasing a new domestic appliance. (Source: ZRMK)

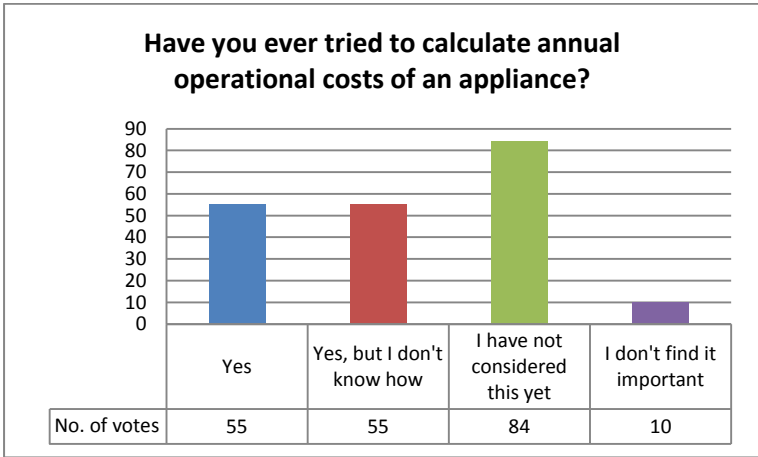


Figure 8: The calculation of annual operational cost of an appliance has proven to be a problem. The consumers are either not familiar with the calculation process or haven't considered it yet, basically for the reason of not knowing the methodology of calculation. (Source: ZRMK)

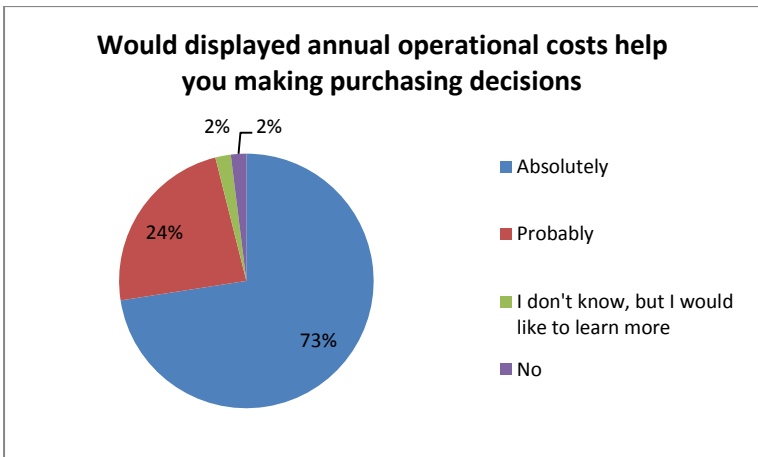


Figure 9: The final part of the poll shows that Slovenian consumers would highly appreciate additional information about the operational costs of an appliance. (Source: ZRMK)

The major Slovenian retailers contacted by ZRMK about YAECI so far underlined that one of the key elements of their approach to consumers is providing relevant and adequate information, be it in

shops, catalogues or on their web pages. They confirmed great care of proper display of energy labels and showed interest in the cost indicator idea as an additional information for the buyers. The prevailing positive aspects seen from their side can be summarised as building up the company image of being environmentally aware and consumer friendly, keeping up with current EU and national standpoints, and using the indicator as a marketing tool to strengthen their position on the national market.

6. Conclusion

Electricity consumption and related costs used to be somehow in the shadow of consumption and costs for heating. With the rising thermal standard of buildings (new construction and renovation) and with increasing energy costs in general this segment is quickly gaining importance. Building owners and users are more attentive to the possibilities of reducing related operational costs. Household appliances can contribute a significant share to the overall expenditure of energy and financial resources.

Based on these facts it would be logical that the fundamental decision making process when purchasing a new appliance is similar to the one when selecting for example a new boiler: defining the actual need in technical terms, choosing an appropriately high level of energy efficiency, comparing prices, and estimating long-term effects and payback time. We are talking about green procurement here, irrespective of the fact that especially in the private sector many buyers don't actually think about such a definition, but do it in a self-evident way simply because they are looking for the most rational solutions according to their available budget.

As shown in the paper the general awareness about the energy label for domestic appliances is high, meaning that buyers know how to differentiate between more and less energy efficient products. Knowing how to use data from the label to calculate long-term costs related to operation of appliances is another question. According to our survey an indicator presenting these facts at the point of sale as developed within the IEE YAECl project will be warmly appreciated not only by buyers, but also by retailers. The advantages are obvious and manifold: additional information for the consumer, a transparent picture of the relation between product price and its operational costs, clearer advantages of selecting more efficient products and better basis for planning of future budget expenditure. These facts are important both for private and for public purchasers and contribute to meeting individual as well as local and national environmental targets combined with cost savings.

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