

Waking up the dragon – Can energy efficiency induce new and more consuming lighting practices?

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Abstract

In the last four decades energy efficiency has become a central element of policy documents and public speeches. Success in promoting energy efficiency has been different across sectors. In households results are often more difficult to obtain and monitor.

A conjunction of factors related to agential powers and structural elements - lifestyles, information, education, social status, income, age, incentives, knowledge, technology, and infrastructure - seem to be shaping the way energy efficiency is being integrated in day-to-day practices.

Building on the theories of practice this communication aims to discuss the influence of factors like rules and knowledge, meanings, material structure and practical understanding in shaping lighting practices among Portuguese families and how energy efficiency has influenced the way people understand lighting as a practice.

Results show that, at the same time as energy efficiency became a central element in policies for the lighting area, diversification of solutions introduced new choice factors that made more complex the once simple act of acquiring a light bulb. Also partially due to the diversification of lighting solutions, changes have occurred on the cultural meanings and functions attached to lighting practices. This new context has resulted in the construction of new practices related to lighting, not necessarily more efficient or sustainable.

Combining data from a survey and interviews to families and to energy experts and technology manufacturers, different perspectives will be discussed aiming at a deeper understanding of the pros and cons of energy efficiency if the objective is to build a more sustainable society.

Introduction

Ever since the 70's energy efficiency became a central element of public policies for the energy area enacted by the European Union. From a context where member states maintained full control over energy policy, a clear evolution occurred that resulted in a progressively stronger EU role.

But at the same time as this evolution occurred, based on the increased awareness of the centrality of energy and its efficient use for EU to achieve a sustainable development, a quieter change was also occurring. Public policies aimed at influencing households and families to use energy more efficiently were developed and implemented over several decades. Such policies usually implied that if citizens or families were empowered to use energy more efficiently, using information and making technological solutions available, sooner or later results would appear. But such a direct effect, except in some specific contexts, has shown to be elusive. It is true that at present, in the EU, energy is used more efficiently, but results are far less significant than could be expected, if assumptions backing public policies, namely those referring to the main barriers to be overcome, were the only variables to take into account.

The not so interesting results have opened the door to disciplines like Sociology to try to contribute to a broader understanding of what, in fact, can induce social change and can influence practices involving energy use. And for that to be possible, we have to go beyond the usual suspects – agents and barriers – and integrate a broader context where public policies and technology development are scrutinized not only in their intrinsic capacity to promote a more efficient use of energy, but also, on how they can induce more energy consuming practices, for example, by standardizing and legitimizing certain energy consuming practices.

In this article, our aim is to illustrate this complexity using the example of lighting practices. For that we will use practice theory, which by integrating agential and structural factors, allows us to analyze the interplay between these two dimensions and how they contribute to more or less sustainable practices.

For this article we use data gathered for the author's PhD thesis. Due to the field work time frame, CFL was the only lighting technology available in a large scale for households. For this reason, Led Technology was not included.

The theory of practice and the analysis of lighting practices

Theory of practice emerged as a theoretical orientation that brings together a wide range of approaches that seek to overcome the classic division between agency or structure as the defining element of human conduct. The innovation of these approaches relates to the capacity to:

“(...) explaining and understanding actions by reconstructing the symbolic structures of knowledge which enable and constrain the agents to interpret the world according to certain forms, and to behave in corresponding ways. Social order then does not appear as a product of compliance of mutual normative expectations, but embedded in collective cognitive and symbolic structures, in a ‘shared knowledge’ which enables a socially shared way of ascribing meaning to the world.” (p.245-246[1])

Theories of practice began to emerge in the 70s stimulated by authors like Pierre Bourdieu and Anthony Giddens, although the list of authors is extensive, as well as the interpretations and explanations offered [2] [1]. Despite this context, some of the authors who have recently focused on this topic and that have applied it to the area of consumption and energy identified a set of common concerns that constitute a way to address the social reality, namely, by underlining the significance of symbolic structures of shared and collective knowledge as a key element to explain and understand agency and social order [2] [1]. In short, theory of practice puts practices at the heart of understanding the social, where other theoretical approaches put agency, structure or language (p. 46 [3]) and seeks to give emphasis to the realm of the symbolic and cognitive exploring how these structures give meaning to the world in a contingent way [1].

Theories of practice aim to highlight that human subjectivity resulting from reflexive capacities and intentionality is closely related to how practices are structured and how they “co-constitute individuals and their values, knowledge and abilities” (p.815 [2]), underlining the importance of analyzing the direct relation between agential powers and social structure [4].

Schatzki defines practice as a nexus of actions and meanings that are connected by an understanding of what to say or do, by explicit rules, principles and instructions and teleoaffective structures, where purposes, projects, goals, beliefs and emotions come together [5]. This perspective implies the importance to analyze, not only the practical elements, but also social representations [6]. To Reckwitz a practice is “a routinized type of behavior which consists of several elements, interconnected to one another; forms of bodily activities, forms of mental activities, ‘things’ and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge (p.249 [1]). That is, “a practice is thus a routinized way in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood” and it is social because it is a way of behavior and understanding that “appears at different locales and at different points of time and is carried out by different body/minds” (p.250 [1]). In this context, agents are carriers of bodily behavior patterns and of certain routinized ways of understanding, knowing and wanting, but these are necessary elements and qualities of the practice in which agents participate and not a quality of the agents. Therefore, practices precede agents, since they are a collective and historic event, that is developed through time by all those who get involved in that

practice, and this reproduction is fundamental to keep the practice nexus and to guarantee its existence (p.134 [6]).

As for the identification of the key elements to understand practices there are different approaches. Alan Warde and Elisabeth Shove present their own interpretation resulting from the previous work of Schatzki and Reckwitz. For Warde practices present four key elements: understandings, procedures, engagement and items of consumption [6]. Shove and Pantzar [7] reduce to three elements, namely, competences, meanings and products. Kirsten Gram-Hanssen offers a slightly different perspective by highlighting the importance to distinguish between two types of competences: “know-how or nonverbal knowledge and explicit, rule-based or theoretical knowledge” (p.155 [3]), particularly when analyzing energy consumption. Since we agree with this perspective, lighting practices were analyzed using four key elements: practical understanding/embodied habits, institutionalized knowledge/rules, engagements/meanings and technologies/material-structures. Practical understanding or embodied habits refers to knowing what to do or how to react to a situation. In the present article we include in this element of practices the knowhow of families to choose lighting bulbs, to install them and embodied habits of use. Institutionalized knowledge or rules can be understood as the set of conditions to decide which are the best lighting solutions or to interpret labels on light bulbs, for example. Lighting practices fulfill certain objectives or ends that can be both objective (for example when light bulbs are used to provide conditions to proceed with a certain task – like reading in the evening) or subjective (aesthetic value or comfort), and the meanings people attach to these practices play a role in structuring them. Finally we have technologies or the material structure that provides an important element of the practice. In the lighting area in the last few years important changes occurred not only due to the ban of certain lighting solutions considered to be least efficient, but also due to the increased diversity of lighting solutions offered.

Therefore, by combining these four elements and analyzing them when it comes to lighting practices, we try to highlight the importance to consider each element to understand a practice. By doing that we provide a different theoretical approach where agency and structure interact to structure patterns and practices, shifting the focus on individual choice to a broader approach where public policies and technologies are analyzed also by their “side effects” on “configuring the fabric and the texture of daily life” (p.1281 [8]).

Public policies regarding lighting

Policy action on energy efficiency has looked at lighting as an area for intervention. Seen by some as a way to force consumers to see beyond the initial price of the more efficient light bulbs and, therefore, aiming at promoting energy efficiency [9] and by others as a way to force transition and overcoming a technological “lock-in” through direct regulatory action [10], the decision to ban inefficient light bulbs is one of the few times where public policies interfered with families' context of choice in a very direct way. For sure many initiatives taken at the EU level influence solutions that are available to families, but usually that happens upstream and the final consumer doesn't realize that, for example, the washing machine he is about to buy has to have an energy efficiency above a certain level or otherwise cannot be placed on the market. But it is still a washing machine that requires no especial adaptation of routines. The ban of some light bulbs has introduced a certain degree of complexity that did not exist before. Besides the end of life problem posed by compact fluorescent light bulbs – CFLs – (presented as the main alternative to the inefficient light bulbs that were banned), choosing a light bulb became increasingly difficult because new variables were introduced. Are we buying a lamp with ‘cold’ or ‘warm’ light, are they suitable for the fixtures and lighting appliances at home, are they compatible with dimmers, are they reliable and how long will they take to achieve full brightness?

During this transition period, several factors influence the acquisition and use of efficient lighting solutions, especially CFLs. The main barriers seem to be: waiting until there is a need to replace an existing light bulb and the light bulbs' technical features – color, response time, suitability regarding fixtures and lighting appliances and cost [11] [12] [13] [14].

The social practice of household lighting can be understood as involving three dimensions: “the acquisition, installation and the use of lighting technologies” (p.224 [15]). In each of these dimensions there is space for large discrepancies in energy use depending on the type and number of lamps, how

they are used and for what periods of time. Some of the differences that can be observed may be explained by cultural differences, as has been shown by Hal Wilhite in his comparison between the Norwegian and the Japanese lighting culture [16]. But within the same culture differences can be significant and despite the penetration of more efficient lighting solutions, some studies highlight that energy consumption for lighting continues to increase, at least in some cultural contexts [15]. When we analyze the EU as a whole, data points in a different direction, showing some improvement in energy consumption mainly due to the introduction of more efficient solutions (p.73 [17]) and the same trend can be found in countries where *per capita* energy consumption has been stable for many years [18].

Nevertheless, some of the trends highlighted in the Crosbie and Guy study can be found among the families interviewed for the present study, especially when asked to compare their present situation with the past. The increasing number of lamps that are used is a common trend and seems to result, not only of the tendency to live in larger houses, but also of the passage from the single ceiling lighting to a more diverse set of lighting solutions that, in some cases, go beyond functional use to respond to an aesthetic or comfort objective (although among the interviewed families the use of new lighting functions tends to be very carefully framed and justified, as we will see later on).

But at the same time as strong public policies are being implemented with the aim of increasing lighting energy efficiency, the image that is being conveyed by the media and particularly by some design and decoration experts or even by manufacturers doesn't always associate glamour, comfort and fashion to the most energy efficient lighting solutions. That is why some authors highlight the importance of working with different experts and at different scales in order to build an appealing image around solutions that represent sustainable forms of lighting [17] [18]. In short, this is a recognition of the need to act to prevent the institutionalization of practices that can induce increases in energy consumption.

Methodology

This article explores a specific set of data from a broader project – Ecofamilies¹ – using only the information related to social practices and the effects resulting from public policies on energy efficiency applied in the lighting area. The data was gathered using two different methods – a survey and interviews – addressing three different groups: families, energy experts and representatives from manufacturers of lighting solutions.

The survey was applied to 142 families involved in the project. Although an effort was made to build a sample that would express the distribution of some relevant social variables in the Portuguese population, in variables like age, education, profession and number of people in the household, the results are significantly different from the ones that can be found among the general population, according to the last Census initiative that was conducted in 2011. Since most families involved did so on a voluntary base, it became more difficult to guarantee the overlap of some social variables. In this sample the most common families are those with children (70%) and single person households are clearly under-represented (in Portugal 21% of households have only one person, whereas in our study not more than 6% of households are in that situation). Regarding age, the youngest and the oldest are under-represented while those between 30 to 44 and 45 to 65 years are on the opposite situation. As for education, those at the first level are under-represented and those with a university degree are clearly over-represented. According to Censos 2011, Portugal has 15% of its population with a university degree whereas in our sample that number is almost half (46,8%).

Taking this context under consideration, when selecting the families to be interviewed there was an effort to guarantee a higher proximity with the national population, something that was not attained only for the education variable. Fourteen interviews were conducted among families and seventeen

¹ Ecofamílias (eco-families) had as main goals: to analyze the energy consumption of 225 families spread throughout the country, taking climatic zones under consideration, and proposing alternatives to increase each family's energy efficiency. This project was developed by Quercus – Associação Nacional de Conservação da Natureza, an environmental NGO, promoted by EDP Distribuição, and had the financial support of the Portuguese "Plan for efficient consumption" (PPEC), administered by the Portuguese regulatory commission on energy (ERSE)

among experts and manufacturers, although some of the testimonies are not included in this article since they had other areas of expertise in the energy sector (other than lighting).

Lighting practices and energy efficiency

To carry out an analysis of energy consumption in the domestic sector in Portugal it is important to begin by considering its weight in the final energy consumption. According to 2011 data households² ranked third among the sectors that assume greater weight in final energy consumption, accounting for 17% of national energy consumption (the first is transport – 37,4% - and the second is industry – 30,1%). Portugal has one of the lowest final energy consumption in the EU27 and the same goes for the domestic sector. According to 2010 data, the Portuguese domestic sector uses around half the energy used in EU27 (0,28 toe/per capita vs 0,61 toe/per capita) and below the values used in Spain (0,36 toe/per capita), Greece (0,41 toe/per capita) or Italy (0,52 toe/per capita) (p.32 [20]). This difference in energy consumption across countries is normally associated with a combination of factors such as the different consumption patterns, climate, energy efficiency of buildings, types of heating systems and energy prices [20].

The lighting sector has been one of the most stimulated in order to build more energy efficient domestic lifestyles, given the fact that the implementation of measures, behavioral or technological, is considered to be relatively simple and easy to achieve due to rapid amortization of the initial investment (when needed) and the financial gain for the aggregate that results from reducing energy consumption.

The weight of lighting in the domestic sector in Europe is about 10% (p.73 [17]), whereas in Portugal, recent data indicate a value that is about half the one recorded at the European level. In fact, of the total amount of energy consumed in households, lighting refers only to 5% (p.40-43 [21]).

The difference in the proportion of energy used for lighting in Portugal and on average in EU countries can be explained by different lighting needs that result from the availability of daylight hours throughout the year, but also of cultural practices that value the use of artificial light as a building element of comfort [4] [14] [16], a trend that is far more common in northern countries [12].

Although it represents only a small fraction of the total energy consumption in households, national data point to the need to continue to encourage the use of efficient lighting, since there is yet a predominance of the incandescent light bulbs. In fact, approximately 81% of households possess light bulbs of this kind, whereas only 68% have efficient lamps (although tubular fluorescent lamps - those commonly used in kitchens – are used in 80% of Portuguese households). Considering mean values, it is important to note that the number of incandescent light bulbs in use (nine per household) is very close to the number of efficient lamps in use (eight per household).

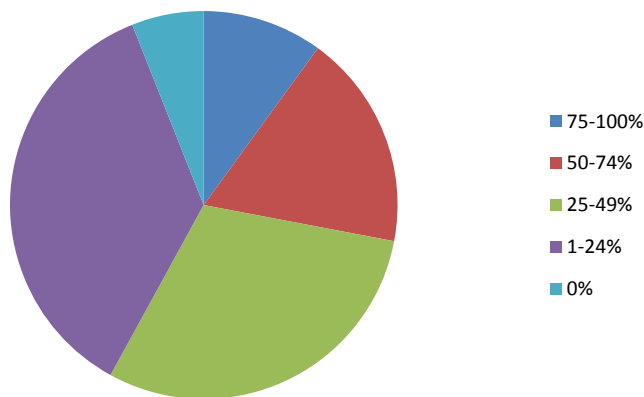
Another aspect to consider relates to the fact that efficient light bulbs tend to have a higher wattage than inefficient light bulbs. That is, among incandescent light bulbs 40W is the most common wattage, but among efficient light bulbs the most common wattages range from 11 and 14W (the equivalent of 60W or 75W) (p.92 [21]). This situation may result from a rebound effect associated with people choosing a slightly higher wattage when buying efficient light bulbs, since they will still be saving energy and money even though they are acquiring a slightly higher wattage than needed to replace the existent light bulb. But other explanations may be relevant. On the one hand, the replacement of inefficient light bulbs by efficient ones is likely to be directed, primarily, to contexts where lighting use is more frequent and requires higher lighting output, a trend that is corroborated by some studies [22]. On the other hand, due to the need to look for advice in order to identify the best lighting solution for each situation, we may be witnessing an adjustment in the lighting potencies used, assuming that, in some cases, the potency used before was not adjusted to the actual needs.

Among the families involved in the present study we found a very clear perception of the weight lighting has on the energy used in the household, since only 7% of the families refer to it as one of the

² The values for the household sector do not include the fuel consumption associated with households vehicles (p.13 [21]).

three most important areas for energy consumption. This perception may be one of the reasons why only 10% of the surveyed families have efficient light bulbs in 75% to 100% of the situations at home. The most common situation is to use efficient light bulbs in between 1 to 49% of the situations (figure 1).

Figure 1. Percentage of efficient lighting in the house



Source: Ecofamilies survey (N – 142)

Regarding the use of efficient lighting solutions and the reasons for their greater or lesser acceptance and use at the household level, there are two aspects to highlight. One is that most of the interviewed families already use efficient lighting at home, although, there are several cases where lack of practical understanding and technical knowledge has hindered a broader use. In any case, public campaigns where CFL were offered had almost no influence among these families. The other is that when asked to identify the main reasons why CFLs are not used more widely at home, the reasons identified by other studies on this matter come up [12] [13]. The main reason identified is the trend to change a light bulb only when it becomes necessary (when the lamp previously used has reached the end of its life). The difficult articulation between efficient light bulbs and existing fixtures and lighting appliances at home, the always present theme of the color of the light, the aesthetical aspect and the response time (how long it takes to achieve full brightness) are also highlighted by families. Costs are seen as having potential impacts in two ways. The more direct impact refers to the need to compare prices when buying a light bulb and the possible tendency to select lighting solutions (for example, improved incandescent bulbs) that are cheaper and, usually, less efficient. The indirect impact may result from the buying of cheaper CFLs whose performance may be disappointing in some of the technical aspects (color of the light – color temperature; lifetime; warm-up times; number of switches) what may prevent future acquisitions. In this context, the fact that some of the interviewees point to the information dimension as one of the most relevant to frame their relationship with lighting technologies is not a surprise. Having difficulties in selecting the best technological solutions for their specific situation is seen as a relevant constraint regarding their agential powers, even when the cost is not a barrier:

“I bought only one because I didn’t know if it fitted, because I don’t know the lamp sockets. Of the incandescent light bulbs I know. But I wanted to try and bought one and I would like to replace other light bulbs. But then I was disappointed because it didn’t fit in the living room lighting appliance I have. (...) I wanted to replace them all and that is way I bought one, but then I didn’t buy any other because I don’t know if they fit.”

Family 4

Despite recognizing the gaps of lighting technologies like CFLs and the difficulties in selecting the best lighting solutions, there seems to be an ability to look beyond them and to consider a wider spectrum of benefits, that include considerations regarding the contribution to society as a all, something that has been highlighted by studies conducted in other contexts [12].

The existence of a broad recognition of the limitations of some of the most efficient lighting solutions stimulated in recent years, allows us to move forward to a central question in this article: the complexity introduced by these new solutions in the decision context of households regarding lighting.

Diversity and complexity

As we have seen, families recognize having difficulties in identifying the best lighting solutions for their needs and even simple features as lamp sockets can be a barrier to acquiring more efficient light bulbs. That can be easily understood if we take under consideration the fact that most families have no technical knowledge about lighting, only practical knowledge that results for everyday practices throughout their lives. Since they now have to integrate different technical features in their choices and uses, some degree of difficulty is easily understandable.

Considering families testimonies and the experts' perspective on complexity and diversity resulting from the changes occurred in recent years in the lighting area, it is possible to identify common trends.

For some of the experts complexity associated with choosing and using light bulbs is understood as a natural reflection of the increasing complexity of modern society and a direct result of the constant technological evolution. For them, information campaigns and the free delivery of CFLs addressed any difficulties that might exist.

But for others, important gaps remain at the time of purchase, installation and use of different lighting solutions with clear disadvantages for families but also for energy policy goals defined at European and at the national level.

The suitability of the most supported technology by public policies (CFLs) to stimulate efficient lighting in different household contexts is challenged by some of the experts interviewed. They claim that in many circumstances CFLs are not the best technical solution and may induce unnecessary energy consumption while eluding families about the energy efficiency of their practices. At the same time, information provided to families on emerging lighting technologies (like LEDs), experts highlight, are not always accurate, since different performing light bulbs coexist and are marketed as equivalent to families that lack the expertise to identify the most relevant features to take into account to distinguish them. This context increases the risk of a bad experience and the possible backlash in the future preventing a wider and faster spread of promising technologies.

But for those experts that recognize complexity and diversity as a potential barrier to families faster and wiser adoption of the best lighting technologies, it's the moment of choice/buying that it is seen as the most relevant. Therefore, empowering families to select the best lighting technologies for the functions they want to see carried out is seen as the most relevant measure that can be taken. Among experts there is a relative consensus on the challenges faced by families in the area of lighting, not only through the generalization of different lighting solutions (CFLs; LEDs; improved incandescent and halogen light bulbs), but also due to the wider number of parameters that have to be taken into account while selecting the most suitable light bulb for each situation.

"We have many variables that influence lighting, lumens, the return of light, the colder or warmer light, etc... This was not addressed and we considered only the lower consumption. The only technical feature that was addressed by producers was the wattage correspondence in comparison with the incandescent light bulbs. But there are complicated things because some type of lights cannot be replaced by CFL or tubular fluorescent lamps. In the meantime, the improved halogen lamps appeared. And now LEDs are a different kind of light. Until people get used to it..."

Interviewee 5 – Researcher in the energy area

Even at the EU level, the website prepared to "inform consumers, professionals and the media about the wide range of energy efficient lamps currently available, the phase-out of inefficient lamp types and what European legislation is already in place"³, clearly reflects the increased complexity in comparison to the previous selection criteria that needed to be taken into account when acquiring a new light bulb. In the past, choosing a light bulb implied knowing the desired wattage, the socket and the shape of the light bulb. Nowadays, an informed choice will require paying attention to: light output (lumens), energy efficiency, lifetime, color of the light, number of switches before failure, warm-up time, dimming, operating temperature, lamp dimension and how to dispose of lamps at the end of the lifecycle. Even if some of the technical features do not relate to all the lighting technologies available, knowing what they mean is important if the right choice is to be made according to the different lighting needs in a household.

³ <http://ec.europa.eu/energy/lumen>

Therefore, independent advising and information are seen as fundamental strategies to empower families. In a context where families tend to buy light bulbs in supermarkets, and not so much in neighborhood stores where some form of counseling is usually available. Providing standard information about the different technical features of the different types of light bulbs and even allowing some experimentation by consumers is being recognized as an important step, but mostly regarding LED lamps. Regarding CFLs, the main strategy was to facilitate access to the technologies and not so much empowering families to make informed choices in the future.

Lighting functions

Different studies highlight that changes in the way lighting functions are perceived and defined have a significant influence on consumption associated with this area [15] [16]. A transition from central lighting to a more widespread use of fixtures and lighting appliances (for example, going from a central lamp in the ceiling to lighting a space using decentralized lamps) may lead to an increase in the number of light bulbs per room and the use of lighting beyond functional needs (to include aesthetical, comfort and safety functions) may induce increased energy consumption.

Among the interviewed families there is a clear recognition that the number of lamps and chandeliers that they have today is significantly higher than during their childhood, even if this increase is often framed in a context of efficient lighting integration.

As for the functions associated with lighting it is clear that interviewees feel compelled to contextualize and frame their use of lighting as being the strictly necessary. Even in cases where, in addition to the functional component, lighting is used to provide a safer environment (in cases of detached houses), there is a special care to avoid using energy beyond what interviewees consider necessary.

"We don't use lighting to set the mood or to provide an environment, but to show that we're at home. That is, when we go out, there are certain light bulbs which are lit just to show that we are home. When we travel, we leave the clocks that turn lights on and off. But I only use lighting for this."

Family 1

"Maybe it is wrong, but one thing I do now and didn't do before is leaving the outside lights turned on all night. Although we have a dog, the fact is that we have several empty houses around us and there are robberies. So I turn some lights off earlier and others later...but outside I leave them turned on. Not all simultaneously, but either the ones from the top or from the ground floor. One of these sets is turned on."

Family 10

When it comes to the use of lighting to increase comfort or for aesthetical reasons families tend to assume a very defensive approach and seem to show a sense that such uses are not socially acceptable or can only be triggered in very specific contexts, like when receiving friends or family, contrarily to what happens in other cultural contexts [15] [16]. In most cases where other lighting functions, besides functional and safety, are valued we are dealing with situations that involve moments of social interaction, including receiving guests at home, where the way to light the house or the rooms is seen as an important element the "welcoming".

"If I get some friends for dinner is obvious that I turn on the lights for the house to become more beautiful. But when they come in I turn some external lights off. There is also the issue of aesthetics. There are lamps that I turn on when I have a dinner, to give a more welcoming environment. In ordinary days it is just what I need. I just create an environment when someone comes"

Family 10

For experts, the broadening of lighting functions is not regarded as a worrying situation, since they believe it is possible to create a comfortable and visually attractive environment in a house using lighting but without a significant increase in energy consumption. Nevertheless, as we have seen before, in some cultural contexts such a change can lead to an increase in energy consumption even if the discussion around efficient lighting was already settled in the public domain.

Discussion

Considering theory of practice and applying it to this study it is possible to identify the role each component plays in defining families' practices regarding lighting. We start by highlighting the role of **technology or the material structure**. The adjustment recorded since the appearance of efficient lamps, with a clear evolution in the diversity of technologies available on the market, particularly from the moment when less efficient light bulbs were progressively withdrawn from the market, was an important step to consolidate practices of energy efficiency in the lighting sector, but also influenced and encouraged the development of different lighting functions. Difficulties in combining some of the efficient solutions with pre-existent fixtures and lighting appliances and gaps in some of the technical features of technologies like CFLs seem to have played a role as barriers to a wider use of more efficient lighting solutions. Even if in the studied group we have detected a tendency to overcome such difficulties and an ability to look beyond the problems associated with some of the technological solutions, it is reasonable to assume that among the general Portuguese population (that on average is less educated and less mobilized by environmental values than this group) such a trend won't be as expressive.

In fact, even among the interviewed families, a set of technical features created doubts and worked as obstacles to a wider adoption of CFLs. The lack of **technical and practical knowledge** to identify the best lighting solutions for each case, continue to hamper the process of acquisition and adoption of more efficient lighting solutions, by contributing to a sense of insecurity in terms of investment. Fears about its functionality regarding the existing material infrastructure at home, lack of knowledge of some of the parameters that must be taken into account while selecting light bulbs and even the comfort provided by this type of lighting emerge as important elements. In terms of **meaning / involvement** to the interviewees, comfort provided by lighting, either by their color or by lamps disposition around the house, emerges as an increasingly important factor in structuring practices. It is interesting to note that in terms of lighting functions, comfort and aesthetical components emerge related to restricted contexts, not being admitted as a regular element in lighting practices. Moreover, despite the role lighting plays in constructing a sense of comfort and of well receiving (most of the references to the use of this lighting functionality are framed in the context of receiving guests at home), their adoption tends to be very contextualized in order to avoid falling into the category of wastage.

As for the energy experts, some point to the inadequacy of some of the solutions advocated by public policies in the area of efficient lighting, at least when adopted widely. In this context, the legislative and regulatory framework related to efficient lighting may contribute to their partial failure, mainly due to the stimulus to the generalization of a technology (CFLs) that presents limitations in some situations, particularly in the households' context (CFLs perform better in prolonged use, a situation that is not very common in many household situations). At the same time, the withdrawal of incandescent bulbs emerged as an incentive for the market to come up with new solutions, stimulating a diversification of technical solutions. Such a diversification presents two main consequences. On the one hand, the complexification of choice which could lead to inappropriate and possibly less efficient uses, due to lack of information and training. On the other hand, it opened up possibilities for the development of new lighting functions, broadening the range of parameters that structure the notion of lighting and its link to dimensions that go beyond the functional dimension.

Therefore, this study highlights the different effects that may result from public policies to promote energy efficiency, and that frequently tend to be ignored or disregarded by politicians and energy experts. By disregarding the collateral effects that may result from public policies, we lose the opportunity to understand how they can transform and redefine cultural contexts, concepts, perceptions and social practices and can result in new forms of energy consumption that might counteract the initial objectives of promoting energy efficiency.

Although in the case of lighting some of the interviewed experts consider that the development of new lighting functions does not necessarily imply an increase in energy consumption, because we may be facing contexts of optimal adaptation between technology and functions, when analyzing studies done on this issue we can see that an increase may occur, even if only to occupy the space created by the adoption of more efficient technologies.

Conclusion

In this article we tried to demonstrate the relevance of looking into specific practices in order to better understand energy use. At the same time as we explained how the different components highlighted by theory of practice - technology or material structure; meanings/involvement; practical knowledge; technical knowledge - as the central elements of practices have evolved as a reflection of public policies that aim at improving families energy use, we tried to underline some aspects that point to collateral effects that such policies may have.

In Portugal, certainly due to the geographical location of the country (warm climate and many hours of daylight) and to the prevailing culture who doesn't value, in the same way as we see in the northern European countries, the use of lighting for aesthetical functions and to build comfort, most lighting uses tend to be restricted to functional aspects. Nevertheless, the changes occurred in countries like the UK and the effects, even if not very evident, some public policies seem to be already having (the difficulties felt by families to identify the best technical solutions, something that can result in wrong choices; or the diversification of alternatives with the inherent diversification of uses) should be read as evidences that if the objective is to reduce energy consumption, than, a different approach must be followed.

Particularly in countries, like Portugal, where lighting practices seem to be framed in a dominant functional approach, a particular attention should be given to the effects of public policies and of the interventions of some stakeholders or professionals that play a relevant role in shaping trends regarding household lighting.

As in almost every situation, prevention is the best option. Therefore, acting in a way to prevent more energy consuming lighting practices to be established appears to be the most reasonable approach to be followed if the objective is to build a more sustainable society.

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