Drivers of Market Trasformation Towards Energy Efficiency: Analysis of a Case Study

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ABSTRACT

Over the past 5 years, Hungary has experienced one of the most remarkable market successes in a key energy-efficiency technology: compact fluorescent lighting. While market shares of compact fluorescent lamps (CFLs) were negligible half a decade ago, today residential CFL market penetration exceeds that in many industrialised economies, ranking Hungary among the eight countries in Europe with the highest penetration rates. Since substantial efforts have been invested internationally to promote the proliferation of CFLs often with limited results, the understanding of the Hungarian success can bring us closer to an effective planning of programs and policies designed to transform the markets of energy efficient technologies around the world. Therefore, the paper's goal is to provide an insight into the driving forces which contributed to this outstanding market success, and to investigate how the findings can apply in designing market transformation programs aimed at increasing the penetration of cost-effective energy efficient technologies internationally.

The paper presents the results of a nationally representative residential survey, and a large number of in-depth interviews with households, industry and other market participants. The market success is analysed in detail and differences in CFL penetration among the market segments provide an important clue for understanding which market barriers are the key in hampering market transformation, and which factors contributed to the overcoming of these barriers. Based on the findings on the drivers of the market success the authors draw lessons for the design of effective market transformation programs.

Introduction

For the design of effective market transformation (MT) programs, as emphasised by Blumstein et al (1998), beyond focusing on the end-user, it is crucial to understand the dynamics of the market the program aims to target. For market transformation programs addressed to influence penetrations of particular efficient end-use technologies, it is valuable to examine the driving forces of the transformation in particular success stories, when end-use markets have been transformed in a significant way, with or without the help of strategic MT or DSM programs. The identification of the key drivers behind major autonomous market transformations can show us which market forces or characteristics are the key to important changes in markets of energy-efficient technologies, and can help our understanding of how such transformations could be induced by programs. In addition, the authors believe that it is easiest to introduce new MT agenda items to markets which are already undergoing dynamic change. Thus, dynamic changes in end-use technology markets should be paid close attention to, and should be utilised as vehicles for reaching environmentally or economically motivated market-related public goals. When no such

dynamic development is taking place in the market in an autonomous way, MT programs can consider focusing on market characteristics and market forces which played a driving role in dynamic market transformations elsewhere.[1]

This paper seeks to analyse the driving forces behind a unique market success of a popular MT/DSM end-use technology target: the compact fluorescent lamp (CFL) in Hungary. Despite the fact that lighting usually represents only a fraction of national electricity consumption, the CFL is an ideal target for energy efficiency programs for several reasons (Vorsatz 1996). When a general service incandescent lamp (GSL) is replaced by a CFL, there is a very high potential of energy saving (up to 80%) for the (arguably) same energy service (illumination). Additionally important appeals of incandescent lighting as an energy efficiency program target include its low capital intensity, the short lifetime which provides ample opportunities for retirement-based retrofits, and the large number of lightpoints in all buildings. Since all over the world the majority of lightpoints in homes are still served by incandescent lamps, there is a massive potential for lamp replacements (Vorsatz, J.G.Koomey et al. 1997; Palmer and Boardman 1998). In summary, while there are several concerns with the CFL as an identical replacement of the incandescent lamp, it has rightfully been a very popular target of energy efficiency programs around the world for over a decade.

The effectiveness of these programs has been the subject of much discussion (Plexus Research 1995; Bergstrom 1997; Martinot and Borg 1999). Despite the large number of CFL oriented programs, the lighting marketplace has been transforming slowly, if at all, from the GSL to the CFL for years, sometimes even decades. For instance in the US, the home of one of the largest number of DSM programs targeting the CFL, less than 10% of households have owned a CFL in 1994 (Vorsatz 1996). The exceptions to low CFL market penetration rates in the mid-90s were a few Western European countries including Germany, the Netherlands, and Denmark, where CFL market penetration in 1995 reached values of 50%, 56% and 46% of homes, respectively, owning at least one CFL (Kofod, Naser et al. 1996; Palmer and Boardman 1998).

Hungary, similarly to the rest of Central and Eastern European (CEE) countries, was no exception to the general trend: CFLs were barely known in the early 1990s, and only few households owned a CFL even in the mid-90s. However, by 1997, every 5th household used a CFL, which ranked Hungary in the top 8 countries in Europe (and thus likely in the top dozen worldwide) in terms of CFL penetrations (Palmer and Boardman 1998).

This paper describes this rapid market transformation, examines the possibly key driving forces behind the swift success, and derives the implications for the design of market transformation programs worldwide.

Methodology

The findings in this paper rely on several years of research related to the lighting market in Hungary by the first author and a team of students of the Central European University. The first key component of the research was a representative market survey of 2400 Hungarian households evaluating CFL ownership, awareness, purchasing behaviour and barriers to CFL market success in 1997. It was conducted by Medián, a Hungarian

[1] The authors of this article consider efforts from the side of the CFL market participants towards market transformation, such as advertising campaigns, as part of the autonomous transformation of the market.

market research company, which repeated the survey in 1999, when it included only questions related to ownership.

The second component of the research consisted of in-depth consumer interviews. Within the 2400 households, two focus groups of eight consumers each were selected based on careful evaluations of the representative survey results. These households were questioned in detail on their consumption attitudes, behavioural patterns and awareness related to the CFL. In addition, a group of students has conducted over a hundred in-depth interviews on convenience samples in Budapest to reveal motivations for purchasing or for not purchasing CFLs.

Third, an industry survey was conducted by the first author and a group of students to understand the dynamics of the CFL marketplace in Hungary. The industry review included interviews with the key manufacturers and CFL suppliers, and distribution channels including small retail outlets, supermarkets, hypermarkets, do-it-yourself chains and furniture outlets. Parts of the survey were conducted under the framework of the Efficient Lighting Initiative (ELI) of the Global Environment Facility.

During the pre-appraisal and appraisal phases of the ELI program, the authors gained deeper insight to residential lighting market dynamics through meetings with further market participants, lighting experts, engineering companies, ESCOs, government agencies, energy efficiency related NGOs and consumer protection organisations.

Market Transformation in Hungarian Residential Lighting

As mentioned above, the average Hungarian, similarly to the average CEE citizen, did not know about CFLs at the beginning of the 90s (Kazakevicius, Gadgil et al. 1999). However, CFLs, or "energy saving lamps", as they are commonly referred to in Hungary, started to gain popularity during the mid-90s. In 1997, 8 out of 10 Hungarians knew what a CFL was, and one out of five households (19%) owned a CFL.

This relatively high market penetration was reached in only a few years. Figure 1 shows that there was a dramatic increase in CFL purchases in 1995. 83% of those who owned a CFL in 1997 bought their first CFL in or after 1995, only 5% of CFL owners, or less than 1% of all households, bought their first CFL before 1992.

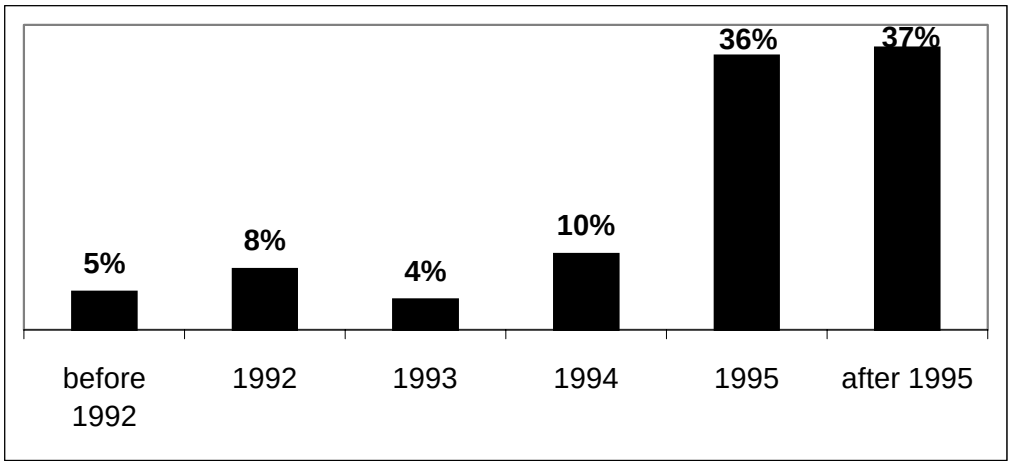

Figure 1. The Year of Purchasing the First CFL

This led to a dynamic transformation of the CFL market in Hungary: market penetration jumped from less than 5% in the beginning of 1995 to 19% in 1997. Awareness of the CFL has risen from less than half of the respondents in 1996 to 80% in 1997. While such rapid market transformations have been experienced in other cases, this was mostly due to large-scale programs. For instance, in the case of Poland, market penetrations increased from 11% to 33% in 4 years mainly as result of the Poland Efficient Lighting Project (PELP) (Navigant Consulting Inc 1999). Another example for a swift increase in market penetration of CFLs is the UK, where supplier subsidies and government sponsored give-aways of CFLs had a significant impact on the CFL penetration: the share of households which owned at least one CFL increased from 10% in 1993 to 23% in 1997. Awareness concerning CFLs in the UK increased from 50% of households to 75% during the same period (Martinot and Borg 1999).

These comparisons let the Hungarian case stand out as a rather uniquely fast change, so that it is worth looking into the reasons for and details of this rapid success.

The Current Hungarian CFL Landscape: Success Stories and Unresponding Market Segments

This section reviews the CFL market picture in more detail, to reveal the details of the transformation in various market segments. This analysis sheds light on the drivers of the dramatic changes.

The awareness concerning CFLs was found to be very high in almost all population groups: at least 75% of people from all population segments (by settlement type, geographic location, gender, and income level) were aware of CFLs. Two population groups differed significantly: only 62% of the elderly (those above 60), and less than half, 47% of the least educated (those who have not completed primary school) could say what a CFL was.

However, the picture is not so uniform from the perspective of ownership. As displayed by Figure 2, CFL ownership was significantly higher in some market segments than the average of 19% in 1997. The highest disparity was according to the level of education. While only 6% of those with no complete primary school education had a CFL, close to half, or 44% of all households with a college or university degree opted for the energy efficient alternative of the GSL. Already a high school degree implied that the CFL penetration was double of that among households with only a primary school degree.

While some may conclude that this is probably due to a higher income level among the better educated, the correlation between education level and income is not necessarily direct in Hungary. This is shown by the ownership distribution according to income group. Figure 2 shows that a higher income level did not mean higher CFL ownership, although there is some correlation in the extremes.

The strong correlation between the level of education and CFL ownership is confirmed by both the 1999 repeat survey and another representative market survey conducted by Szonda Ipsos for Philips Hungary Ltd (Szonda Ipsos 1999). The repeat survey executed by Medián has not found a significant difference in any of the categories, as compared to the 1997 research. Although the categories in the Philips survey were slightly different, the key findings were all consistent with our survey. In the Philips study, the level of difference between the most and the least educated in terms of CFL ownership is the same

as in the study conducted by the first author: five-fold. According to the Philips survey, more than half (51%) of respondents with a university degree owned a CFL in 1999[2].

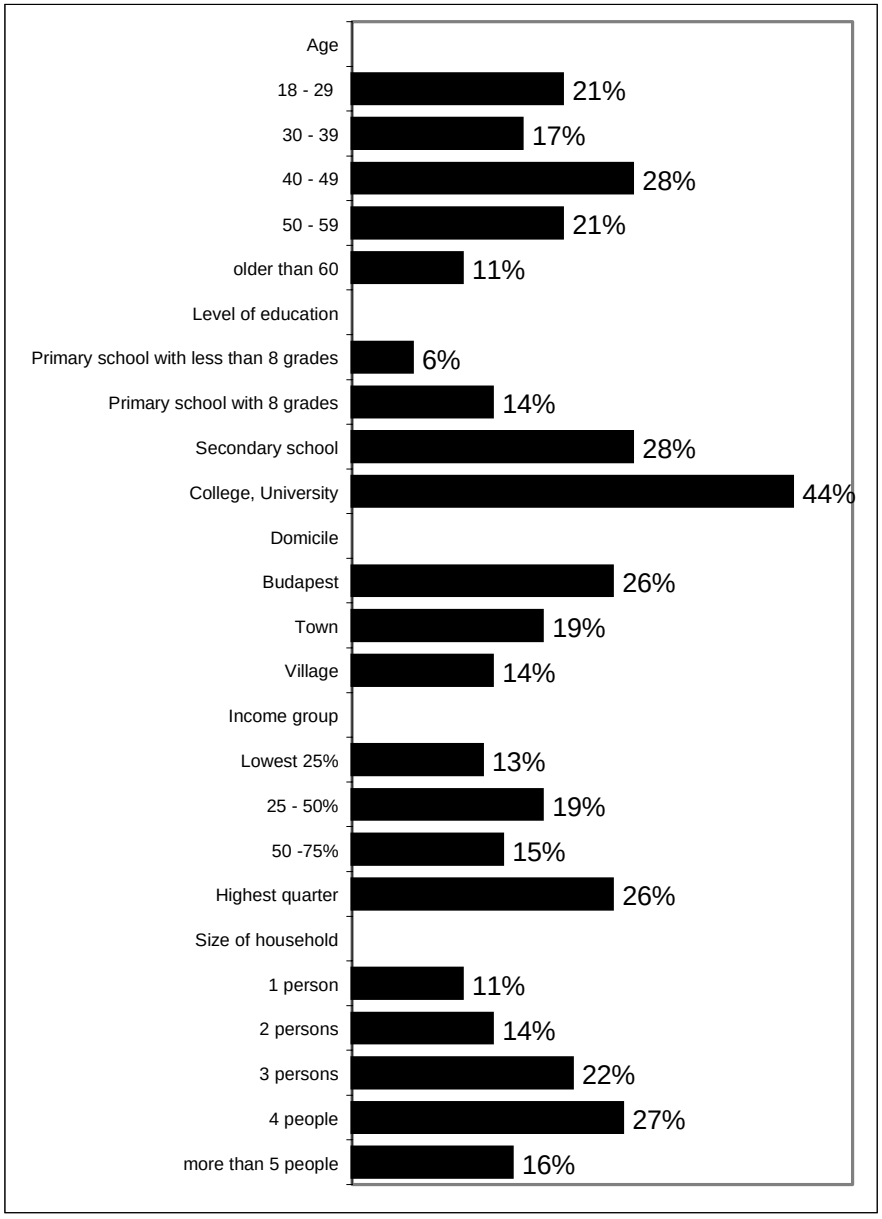

Figure 2. Ownership of CFLs According to Social-demographic Characteristics

The trend between income level and CFL ownership is also supported by the Philips survey: there is not a direct correlation between the level of wealth and the decision to use an efficient lighting technology. While the lowest percentage of CFL usage is recorded in the poorest households and the highest among the richest, the correlation, although slight, is in

[2] In fact this penetration maybe even higher in reality, if we consider the highest educational degree in the household versus that of the respondent: since the households were represented by the respondents, it is possible that some additional households with a college degree (through the spouse) own CFLs, which are currently classified in categories with lower educational levels.

fact reverse in the medium income groups: the more affluent the households are, the fewer of them installed a CFL[3].

Additional socio-demographic factors influencing CFL ownership include the size of household. Logically, the larger the household the longer hours lighting is needed, thus replacing incandescent lamps by CFLs is more economic. This is clearly supported by the survey results: almost three times as many households with 4 persons use CFLs as single households. However the trend of increasing CFL penetration with increasing household size is broken for households with more than 4 persons: about 40% less of them use this efficient lighting technology. This is probably due to the fact that large families are the most likely to have liquidity constraints, and therefore may not be able to afford the purchase of these lamps.

CFLs are similarly accepted and used by all age groups, besides the group who is most in need of this technology due to its long lifetime and economic savings potentials - the elderly. While close to one-third (28%) of 40 – 49 year olds declared that they own a CFL, only 11% of those above 60 use them. In addition to potential liquidity constraints this can also be attributed to the fact that they are the least informed about the existence of this energy-efficient alternative to the incandescent lamp.

All three surveys show the significance of geographic location: a household in Budapest is almost twice as likely to use a CFL as one in rural areas (Figure 2). Although this is partially because the highly educated are more likely to live in Budapest, it can also be attributed to the fact that CFLs, or information on them, are less easily available in rural areas.

In summary, the Hungarian domestic lighting market has experienced a major transformation towards the CFL between 1995 and 1997. However, the success of the CFL was constrained to certain market segments. For instance, more than 7 times as many highly educated people own CFLs as those with the lowest level of education. A household in Budapest is twice as likely to use a CFL than a rural household. The elderly, who are probably most in need of expenditure saving and long-lifetime technology, has one of the lowest awareness and ownership levels in the society. Market penetration rates are half in the Southern and Eastern regions than those in economically most developed regions of Budapest and the West.

Analysis: Drivers of Market Transformation and Implications for Market Barrier Taxonomy

Programs Affecting the CFL Market in the Discussed Period

The first logical question is: were there any major market transformation or other programs which have affected the CFL market in such a profound way? It is important to note that there were no *major,* nationwide CFL programs taking place in Hungary during the discussed period, to which this success could be solely attributed. But there were a large number of small-scale energy-efficiency programs initiated by various organisations, the industry and the government that included the promotion of the CFL to various extents. The vast majority of these programs concentrated on awareness raising. Industry initiatives

[3] The Philips survey used 5 income groups, so mid-income groups here are represented by three-fifth of the society

ranged from information and advertising campaigns, professional and community education programs, articles and advertisements in newspapers and professional publications, trainings, to promotional sales at low prices. From the non-governmental (NGO) community, there were several domestic energy efficiency educational campaigns, some in cooperation with the government, many of which incorporated lighting and the CFL.

While the aggregated effect of these smaller-scale awareness raising activities are estimated to be considerable in raising awareness levels to 80%, the authors are not aware of any *significant* market transformation efforts which were targeted at overcoming other market barriers, such as the high first cost. Besides promotional sales initiated by manufacturers and distributors, the "Héra" foundation's activities deserve attention in this regard. The Héra Foundation's activities started after the drastic electricity tariff increases in Hungary. The Héra's mission is to assist those in need of support to cover their utility bills. Applications can be submitted to them for either a one-time support of a monthly electricity bill, or for a free CFL. Funding for the program comes from private donors, including GE Lighting TUNGSRAM. During its CFL give-away started in 1992, they supported app. 200,000 low-income households with a CFL. While this number is respectable especially from the perspective of social assistance, it cannot be considered to have a significant long-term transforming effect on the CFL market[4] (Bacso 1999).

In conclusion, there was no single, nationwide market transformation program to which the entire market success can be attributed, and no major programs were targeted to overcoming other barriers than the lack of information. Since a large majority of all programs affecting the CFL market in Hungary were initiated by CFL market participants, the transformation of the Hungarian residential CFL market can be classified as autonomous to a large extent.

Analysis of Potential Drivers of the Market Success

It is clear from the discussion above that the educational efforts of a wide range of market players has resulted in a major increase of the awareness of the CFL in the mid 90s in Hungary. What was the reason behind this active promotion of the CFL by suppliers in Hungary? If we compare Hungary to other CEE countries, we think that few of them experienced the same activity in advertising campaigns. As a result, CFL awareness in Hungary appears to be higher than in other countries of CEE, such as Lithuania (Kazakevicius, Gadgil & Urge-Vorsatz 1999). Beyond the environmental motivations, an important driving factor was the presence of GE Lighting Tungsram, traditionally a key player in lighting innovation and product manufacturing in Hungary and around the world. Tungsram dominated the Hungarian residential lighting market in the early 1990s. However, with the liberalisation of markets, other lighting manufacturers have entered the marketplace. As it may have been more difficult to attract consumers in the well established incandescent market, the competitors may have considered it less difficult to obtain higher market shares in a newly emerging market: that of the CFL. Therefore, a strong competition started between three CFL suppliers in Hungary in the mid 1990s: Philips, Osram and Tungsram. The competition has resulted in aggressive advertising campaigns, trying to preserve its leading market role in Hungarian domestic lighting. In the authors' opinion, the high level of

[4] Currently there are approximately 3.5 million CFLs installed in Hungarian households.

awareness of the CFL, therefore, can largely be attributed to the fierce competition of the three manufacturers.

However, a high level of awareness does not necessarily guarantee a market success. For instance, in the US 69% of the population in a survey recognised the CFL in 1991 (Macro Consulting 1992), but less than 10% owned them. In addition to our general understanding of market mechanisms, this is also supported by the fact that while the educational/promotional activities were more or less continuous since 1992, the major success in market penetrations was experienced in the period of 1995 to 1997. What happened during this period?

Aside from advertisement campaign, the competition among the three main CFL suppliers in the Hungarian market also triggered decreases in CFL prices. The average market price[5] for a CFL decreased from around HUF 1350 in 1997 to HUF 1125 in 1999, accounting for a nominal price decrease of roughly 17%. This decrease in prices can safely be assumed to have started already in 1995, although reliable data is not available.

At the same time, however, there was a significant decrease in incandescent lamp prices, so that the ratio of CFL vs. incandescent lamp price remained relatively high: Still in 1997 CFLs where about a factor of 20 more expensive than a 60 W incandescent lamp. This exceeds the factor of 10 - 16 found in West European countries with high CFL penetration (Palmer and Boardman 1998, p.21), but is significantly lower than the factor of 50 cited by the same source for East European countries. This shows that despite the absence of large scale market transformation programs, the Hungarian price ratio of CFLs to incandescent lamps was relatively close to a level found favorable to the market success of CFLs other countries. Nevertheless, the still high factor of 20 makes it clear that the decreasing price of CFLs can not be the sole explanation for their success in Hungary.

As cost savings through reduced use of electricity is one of the frequent reasons for the decision to buy a CFL mentioned in consumer interviews, a look at the electricity price development in Hungary over the past years might help to understand the market success of CFLs.

As is evident from Figure 3 below, nominal electricity prices increased more than tenfold during 1990 and 1998, the price increase in real terms amounted to roughly 140%. The sharp jump of nominal prices in 1995 led to a 35.5% increase of electricity prices in real terms. This marked the end of a period of a decrease in real term prices since 1992, and is certainly an explanation for the sudden increase in CFL use in that year. This jump in electricity prices coincided with the privatisation of the Hungarian electricity sector, described in more detail in an accompanying paper (Pesic and Ürge-Vorsatz 2000). Since then, real term electricity prices continued to increase, be it at lower rates.

Nominal and real price development can be interpreted as conducive to increased household interest in CFLs. Nominal price jumps are likely to trigger psychological effects, where people strive to protect themselves from rapidly rising energy bills. In an inflationary surrounding, however, one can argue that people learn to live with seemingly high prices and do look at the relation of electricity cost to the general price increases before making a rational decision where to save first. The data presented allows for both explanations: Hungarian households were facing steep nominal *and* real term price increases for electricity

[5] The data reflect nominal average prices to consumers (including 25% VAT) across all CFL producers and lamp types and result from market surveys (Juhász, Personal communication).

in 1995. Combined with a stagnant average wage, expenditure for energy including electricity placed an increasingly tangible burden on the average Hungarian household since 1995. Hence they had good reasons to consider the purchase of electricity saving technology such as CFLs.

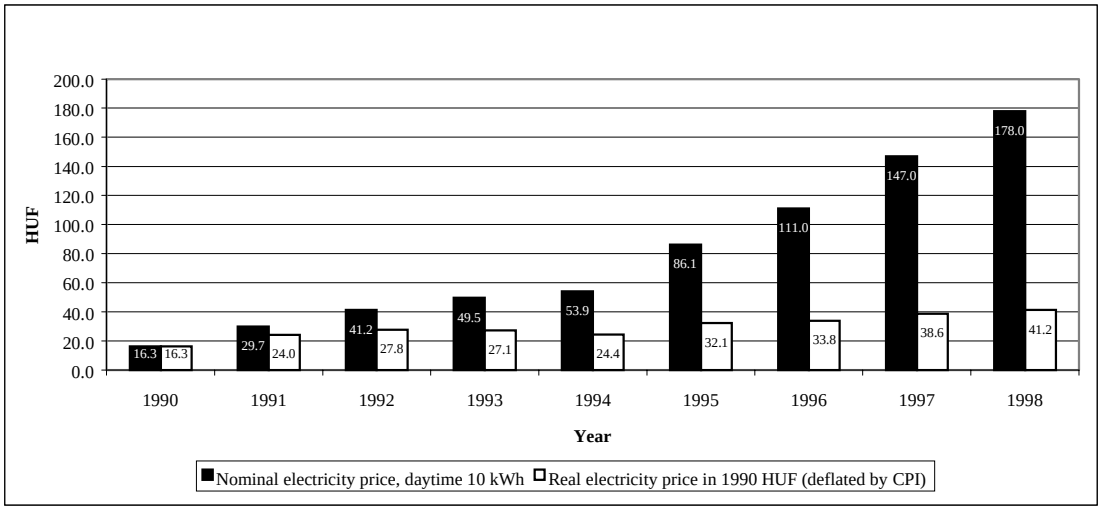

Figure 3. Nominal and Real Term Electricity Prices to Households in Hungary.[6] Source: KSH 1995, 1997 and 1999

Since most people did (and still do) not possess sufficient knowledge on how to conserve energy, with the exception of the CFL, the "energy savings lamp" has therefore become the symbol of energy conservation, and the only widely known and available technology for those eager to cut their energy bills.

There are other factors that are worth given consideration to when analysing driving forces, including technological “sexiness”. Although only 6% of users admitted in the survey that they purchased the CFL because it was “modern”, and 6% because it was “appealing, fashionable”, our in-depth interviews reveal that the real motivation is often not the financial savings. 36% of respondents named aesthetics as one of the factors for using the CFL. There were several households that replaced GSLs in location where this substitution was clearly not economically justified. Many respondents mentioned arguments in in-depth interviews of focus groups such as “That is the modern lighting technology. No-one buys a black-and-white TV either…”, or “My neighbours had them” and “They have a good quality of light”. The non-economic motivations probably dominate in the highest income group, where CFL penetrations are the highest, while economic incentives are the weakest. The technological appeal as a driving factor maybe supported by the gender distribution of CFL owners: almost 50% more men claimed to own a CFL than women.

A factor that is unlikely to play a significant role in the lighting decisions of Hungarians is environmental considerations. Although 4 % of respondents have identified the environmental benefits of CFLs in a multiple choice question with the option to choose

[6] Since the overall share of electricity in household expenditure is rather low, only a small error is included in the real price figure due to the fact that the development of electricity prices is part of the consumer price index by which the nominal price is deflated.

several answers, environmental motivations have not been revealed in any of the in-depth interviews.

Implications for Market Barrier Taxonomy

The understanding of the driving forces of this market success combined with the identification of non-responding market segments can reveal important lessons for our understanding on market barriers to the wider proliferation of the CFL, and perhaps of other energy-efficient technologies. Market barriers to energy efficiency are commonly defined as those reasons, which prevent investment in energy efficiency improvements even though such an investment would be technically feasible and economically profitable (Weber 1997, Eyre 1998). Taxonomies of such market barriers, as reviewed for example by Golove and Eto (1996) and Eyre (1998), help the identification of and the prioritizing among the reasons, why investments in a particular energy efficient technology remain below the expected level. Studies dealing specifically with the market performance of CFLs frequently list high first cost as well as the lack of information among the main reason for lower-than-efficient CFL usage (Palmer & Boardman 1998; Martinot & Borg 1998; Geller & Leonelli 1997; Kjoerulf, 1997).

The key conclusion of the present research to market barrier analysis is that the single most important market barrier is the lack of information. While it was also shown that the availability of information and a high level of awareness are necessary, but not sufficient conditions for a market success, we would like to emphasise how it was and is the single most important market barrier in the domestic lighting market in Hungary. This argument has been demonstrated clearly above: a high level of awareness correlates highly with CFL ownership both in time and by market segment.

The most frequently cited market barrier in the CFL market, as highlighted above, similarly to many other energy-efficient products, is the “high first cost”. The authors of this paper argue that this is in fact not a valid “market barrier”. The argument for not buying a CFL because “it is expensive” is simply a cover for other market barriers, and not a legitimate barrier on its own. If the real reasons for a negative purchase decision are attempted to be uncovered behind the high first cost argument, the following is revealed. The “high first cost “ problem can sometimes imply liquidity constraints, or the lack of available capital. This is rarely the case for not purchasing the CFL due to its relatively low capital cost. This is definitely not a significant market barrier in Hungary with the exception of the lowest income market segment. While app. 60% of non-owners identified the high price of the CFL as the reason for not purchasing one, only 6% claimed they did not have enough money, and only 7% said they would buy one if they had more money (Szonda Ipsos 1999). The second market barrier the “high first cost” barrier can hide is the psychological barrier or an oversensitivity for first costs: if a lamp can be purchased for 40 HUF, 600 – 1000 HUF appears simply as too much. This in fact leads us to the final, and in our opinion, the most important market barrier: the lack of real understanding of the economic benefits.

When respondents were further asked about an explanation why they consider this technology expensive when it would save them a lot of money on a lifecycle basis, most respondents revealed a lack of real understanding of the economic benefits of the CFL. Irrational answers included such as “it is not worth for me, since I have a small flat”, and “it would only be worth it if I had changed all the lightbulbs, but that would be very expensive

The importance of the lack of clear understanding of the economic benefits can be further supported by the confusion between wattage and illumination. Half of all respondents have identified wattage with the measure of illumination. It is obviously hard to make people understand the energy savings benefits of the CFL if they measure light levels by wattage.

In addition, the fact that the highest market success during this rapid market transformation was reached among the most educated suggests that it was easier for them to understand the scale of economic benefits of the CFL.

In conclusion the authors of this paper think that the Hungarian case underlines the significance of information as the main barrier to CFL success - and agree with Veitch (1994), who stressed the high significance of advertisement and Kjoerulf, (1997) making the case for improved customer information in the Danish case. The authors emphasise that awareness does not necessarily imply an understanding of the real benefits, i.e. the longer lifetime, and the understanding of the real magnitude of energy saving. The difficulty of understanding of the extent of economic benefits probably applies for other energy-efficient technologies with a high first cost premium or different lifetimes as well.

Implications for Market Transformation Program Design

The implications of the prime importance of the information barrier to the design of market transformation programs are several. Our research suggests that advertising and information campaigns, educational programs and other awareness raising activities are the most important tool for the promotion of the CFL (and perhaps it is also worth investigating to what extent this applies for other energy-efficient technologies as well). However, since a high level of awareness is only a necessary but not a sufficient condition, it can only be effective if there is a real interest among the population already in place to save energy.

In addition, awareness raising has a different success rate in different population groups, mainly depending on the level of education. While those with high levels of education can understand and be convinced easily of the benefits, others need more sophisticated education of the economic benefits when the benefits are more complex (such as different lifetimes, very high first cost difference, etc.). Due to the complex nature of energy-efficiency cost/benefit calculations, it can be expected that not all population segments will be able to understand the real benefits. Hence, for these market segments different educational methods can be effective: those which concentrate on single, easily understandable benefits, such as the longer lifetime.

Even the most aggressive and wide-spread information campaigns will be ineffective in certain population groups, for instance those adults out of school who do not read and watch limited TV. For these population groups different, innovative marketing methods need to be applied, which are specially targeted to this market segment.

Acknowledgements

The authors would like to thank the following institutions and companies for funding this research: Central European University, GE Lighting Tungsram, and the Global Environment Facility. The authors would specially like to thank Monika Juhasz of Philips Hungary for her invaluable help on CFL market data, and Laszlo Beck of Medián for his readiness to answer endless questions.

References

Bacso, N. (1999). The activities of the Hera foundation.

Bergstrom, W. (1997). The DSM Programmes and Lighting Activities of the Danish Electric Utilities. Right Light 4, Copenhagen, DEF.

Blumstein, C., S. Goldstone, et al. (1998). A Theory-based Approach to Market Transformation. 1998 ACEEE Summer Study, Asylomar, CA, American Council for an Energy Efficient Economy.

Eyre, N. 1997. Barriers to Energy Efficiency: More than Just Market Failure. *Energy and Environment* 8 (1) 25-43.Golove, W. and Eto, J. 1996. Market barriers to energy efficiency: a critical reappraisal of the rationale for public policies to promote energy efficiency. Energy & Environment Division, Lawrence Berkeley National Laboratory. LBL 38059. Berkeley.

Geller, H. and Leonelli, P. 1997. Energy-Efficient Lighting in Brazil: Market Evolution, Electricity Savings and Public Policies. In Right Light 4 Vol. 2, 205-210. Proceedings of the 4th European Conference on Energy-Efficient Lighting. Association of Danish Electric Utilities and the International Association for Energy Efficient Lighting. Stockholm.

Hollander, J.M. and Schneider, T. R. 1996. Energy-efficiency: issues for the decade. *Energy* 21 (4): 273-287.

Kazakevicius, E., A. Gadgil, et al. (1999). "Residential Lighting in Lithuania." Energy Policy 27(10): 603-611.

Kjoerulf, F. 1997. Transforming the CFL Market By Consumer Campaigns. In Right Light 4 Vol. 2, 145-147. Proceedings of the 4th European Conference on Energy-Efficient Lighting. Association of Danish Electric Utilities and the International Association for Energy Efficient Lighting. Stockholm.

Kofod, C., L. Naser, et al. (1996). Market Research on the Use of Energy Saving Lamps in the Domestic Sector. Lyngby, DEFU.

Központi Statisztikai Hivatal (KSH) Various issues. Statistical Yearbook of Hungary. Various years. Budapest.

MACRO Consulting (1992). Perceptions of Compact Fluorescent Lamps in the Residential Marketplace. Palo Alto, EPRI.

Martinot, E. and N. Borg (1999). "Energy-efficient lighting programs. Experience and lessons from eight countries." Energy Policy 26(14): 1071-1081.

Navigant Consulting Inc (1999). Evaluation of the IFC/GEF Poland Efficient Lighting Project CFL Subsidy Program. Final Report.

Palmer, J. and B. Boardman (1998). DELight. Domestic Energy Efficient Lighting. Oxford, Environmental Change Unit.

Pesic, Radmilo, and Diana Ürge-Vorsatz (2000). "Lessons from the Restructuring of the Hungarian Electricity Industry." *ACEEE Summer Study on Energy Efficiency in Buildings.* Forthcoming.

Plexus Reseach (1995). 1994 Survey of Utility Demand-Side Programs and Services. Palo Alto, CA, Electric Power Research Institute (EPRI).

Szonda Ipsos (1999). Piacfeltáró elemzés a fényforrások használatáról, vásárlásáról, Philips Hungary Ltd, Confidential.

Veitch, J. 1994. The Psychology of Choices IAEEL newsletter 2/94

Vorsatz, D. (1996). Exploring US Residential and Commercial Electricity Conservation Potentials: Analysis of the Lighting Sector. Environmental Science and Engineering; and Energy and Resources Group. Los Angeles and Berkeley, University of California.

Vorsatz, D., J.G.Koomey, et al. (1997). Lighting Market Sourcebook, Lawrence Berkeley National Laboratory.

Weber, L. 1997. Some reflections on barriers to the efficient use of energy, *Energy Policy* 25 (10): 833-835.