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Jenny Palm

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Placing barriers to industrial energy efficiency in a social context: a discussion of lifestyle categorization

1. Introduction

Energy-related emissions constitute a major environmental load. Any major reduction in carbon dioxide emissions will require more efficient energy use by all users. Energy users constitute an important factor in developing and creating an energy system that is sustainable over the long term, and how and when they use energy determines our ability to create such a system. The users are also ultimately the ones who must pay for transforming or adapting the energy system, which increases their importance as a key component of the system. In this paper, I focus on two broad user categories, namely, households and industrial small and medium-sized enterprises (SMEs) in Sweden. Approximately one-third of the energy used in Sweden is used by industry (SEA 2004). The construction sector accounts for approximately one-third of Sweden's total energy use, the use phase accounting for approximately 85% of a building's total energy use (SEA 2004; Lindén 2004, pp. 91–102.).

In Sweden, national and municipal administrations are trying to influence energy use by providing information on various energy-saving behaviours, such as using public transportation and low-energy bulbs or monitoring idling time in commercial manufacturing and support processes. Energy guidance, where actors receive information on how to use energy more efficiently, has traditionally been institutionalized and developed in different ways in different groups, as is also the case with research into increasing energy efficiency. Most studies examine either industry or households. Comparing tools and conclusions from these two sectors is potentially useful, for example, some analytical tools can be picked up from one sector and adapted to another. Such comparisons let us identify and discuss how and why different understandings of and methods for improving energy efficiency appear in different contexts and whether opportunities and methods might be transferable to other sectors.

This paper compares how analyses of energy use and increased energy efficiency have developed in households and industrial SMEs (having fewer than 250 employees). I will focus on earlier studies of households that use lifestyle categories to understand energy use in homes, comparing them with studies of mainly Swedish industrial SMEs using barriers as a tool for understanding how and why companies work on improving energy efficiency. The main research question is how the use of lifestyle categories in household research can be picked up and adapted to the industrial sector.

Lifestyle categories and barriers are similar in that both approaches try to find main factors that can explain energy use. Lifestyle categories, however, try to take a comprehensive view of a family's everyday life, including many factors and relating them to energy use. Barriers try to identify obstacles to a company that explain why it does not implement cost- and energy-efficiency measures. What will happen if these two are integrated and barriers are related to a company's 'lifestyle'?

The paper begins by discussing the use of barriers in industrial studies, followed by a discussion of lifestyle categories used in studies of household energy use. Then I give examples of how lifestyle categories can be used in an industrial company context. The paper ends with conclusions regarding the possibility of applying lifestyle categories to industry.

2. Industrial barriers and family lifestyle as explanatory tools for energy use

In this section, I start by giving a brief overview of how energy use is discussed in industrial SMEs in relation to barriers to increasing energy efficiency. After that, I discuss earlier research into household energy use in relation to lifestyle categories.

2.1 The use of barriers in energy efficiency research into industrial SMEs

Barrier models are commonly used to describe the non-adoption of cost-effective energy-efficiency investments (Weber 1997). A barrier model has three features: the objective obstacle, the subject hindered, and the action hindered. The methodological questions for formulating a barrier model are the following: What is the obstacle, to whom, and affecting what aspect of energy conservation? (Weber 1997). Barriers to improving energy efficiency may be divided into three broad categories: economic, organizational, and behavioural barriers. In addition, some barriers may be classified as institutional barriers (Sorell et al. 2000; Thollander 2008).

Earlier studies of efforts to improve industrial and commercial energy efficiency emphasized that there was great potential for such improvements at companies, but that the appropriate measures were seldom implemented. The explanations of this implementation gap relate to economic barriers and include the fact that energy in Sweden had long been an inexpensive input. Another economic barrier is that the energy expenditures of Swedish industrial SMEs are often not particularly high. It is often noted that energy costs generally equal only 1–2% of company sales, so it can be difficult to use financial incentives to induce SMEs' to devote time to reviewing current energy use (cf. Edén 1991; Sandberg 2004; Rohdin & Thollander 2006). Accordingly, expectations of higher electricity prices *in the future* are often cited as justifying investment in energy-efficiency measures (Thollander 2008).

Organizational barriers include the following: a company involved in major restructuring or under time pressure may be compelled to concentrate solely on its core business, lack of personnel with time or interest to focus on energy issues, lack of energy expertise, and insufficient capital and limited investment resources (Persson 1990; Sorell et al. 2000; Sandberg 2004; Rohdin & Thollander 2006; Rohdin et al. 2007). Behavioural barriers include established routines and procedures that do not favour efficient energy use and an inability to process suitable information (Thollander 2008).

The research tradition in which industrial barriers are discussed and developed is problematized by Shove (1998), who states that:

... in simplified form, the conventional view holds that energy-related decisions are made by socially anonymous individuals, that knowledge comes from research, that technical change is a one-way process of technology transfer, and that social obstacles or non technical barriers impede technological progress. What is missing is an appreciation of the social contexts of energy saving action and of the socially situated character of technical knowledge. (Shove 1998, p. 1108)

Shove is taking an example of a person working in the public sector and designing housing. The energy-saving measures implemented will depend on various factors, such as internal accounting practices and local government priorities. If the same person changes jobs and starts working in the private sector, the designer's knowledge and decisions regarding what measures to implement will be governed by different considerations. Now other factors, such as producing marketable properties at a profit, will be prioritized and determine the technology to be implemented (Shove 1998, p. 1108). Practitioners identify and make energy-related decisions within different networks and different contexts, according to Shove: 'what qualifies as a reliable, cost effective, worthwhile energy saving measure in one socio-cultural domain might count for nothing in another' (Shove 1998, p. 1109).

The need to contextualize knowledge is in a way considered in these industrial studies. Several studies of industry conclude that information must be specific, i.e., individual energy audits are better than general guidance on cost savings. For an energy advisor, it is very important to become familiar with the conditions and assumptions under which an individual company is operating (Christoffersen et al. 2006; Russell 2006). The advisor can then offer, as far as possible, advice that demonstrates understanding of the company's problems and need for support. That energy management does vary between organizations and that there is no 'one size fits all' approach is highlighted (Sorrell et al 2000; Christoffersen et al. 2006).

However, Shove criticizes the lack of a social context in such research, citing the need to acknowledge that all knowledge is situated and urging the adoption of another ontological approach, to which a lifestyle perspective on industrial energy use can contribute.

2.2 Energy use in relation to lifestyle categories in households

There are two somewhat different approaches to analysing household energy use in relation to lifestyle categories. One is to sort energy users into lifestyle categories, those in each category sharing similar characteristics concerning, for example, age, gender, or income (Carlsson-Kanyama & Lindén 2002). The purpose here is more or less to analyse whether and how the energy use differs between different user categories. Shove et al. (1998) discuss how individual energy use reflects the context in which particular individuals live; this means that energy use is partly based on the identities people wish to create and maintain, which complicates efforts to sort people into different lifestyle categories. Characteristics such as age and income are too crude to be used as the sole bases for designing targeted information (Shove et al. 1998). This is the same criticism that Shove directed towards research into barriers, mentioned above. The other approach to lifestyle research reflects more on the context, focusing on how energy use is embedded in everyday life and result from a web of activities, routines, values, and symbolic conditions (Aune et al. 2002). I will use this second approach here.

One early study is that of Hallin and Petersson (1986), who monitored household behaviour with respect to energy issues in the 1980s, and developed different motivation groups to explain why households became involved in the energy system. One motivation was financial, insofar as the household saw such involvement as an opportunity to save money. Another motivation was a desire for comfort (e.g., keeping the house warm). Some households viewed exerting control over the energy system as a goal in and of itself. Yet another group exhibited elements of all of the previous groups, i.e., they wanted to save money, increase comfort, and exert greater control over their energy use.

Aune (1998) has further developed the use of lifestyle categories in relation to energy use, and her thesis is a study of everyday energy use in Norwegian households. She discusses energy use as both a determinant and a result of different constructions of the material and cultural spheres. She considers how culture is formed through energy consumption, and how energy use is interwoven with everyday life. The specific mixture is created through negotiations between individuals and technologies; the concept of domestication is used to describe how such negotiations are performed, including the practical, symbolic, and cognitive content of the process. Aune also develops the notion of energy culture and identifies four cultures with different implications for energy consumption, ranging from 'the self-indulgent' who do not reflect at all on their energy consumption to 'the environmentalists' who are deeply involved in ecological issues and sustainable resource use (Aune 1998).

In a later work, Aune (2007) analysed Norwegian households and identified three household categories characterized by different energy use patterns:

1. In the first category, 'The home as a haven', privacy and tradition are highly valued. Cosiness is important, and appropriate lightning, a comfortable indoor temperature, an open fireplace, and the use of hot water are central. According to Aune, taking a bath after a long day is one way to realize this understanding of the home. Aune concludes that authorities should not try to challenge these households' self-images when approaching them, but to appeal to their sense of privacy and cosiness when disseminating information.

2. In the second category, 'The home as a project', the home is constantly being created and recreated. New things continuously enter the home, or the home is being rebuilt or the furniture rearranged. Designing the home is connected to improved comfort and not to energy savings. The rebuilding activities could lead to greater energy demand, so such a household's understanding of comfort is energy intensive. Still, this household is well informed about energy in general and the energy-efficiency measures available. If

one wishes to reach such households, energy efficiency information must be related to product design and comfort.

3. In the third and last category, 'The home as an arena for activities', the home is where everyday life activities are performed, such as washing, cooking, baking, cleaning, and social activities. These households are not interested in designing their homes; rather, their homes need to be practical. Financial considerations are important and the households respond to rising prices and information about how to save energy. This category encompasses a range of lifestyles from a more conscious 'alternative and green' lifestyle to a traditional way of life.

These lifestyle studies emphasize the importance of using a flexible rather than a static model when examining the use of a technology. The studies cited above highlight that practical, symbolic, and material conditions are involved and that it is important to study energy use as a process. In the next section, I will discuss the possible outcomes of dividing industrial SMEs into different categories and relate these to energy use and improving energy efficiency.

2.3 Developing lifestyle categories for industrial SMEs

When earlier studies of industrial SMEs used categories, it was often different barriers to energy-efficiency measures that were grouped together or arranged in categories. One criticism of that approach, as discussed above, is that it leads to reductionism in research. I have found one Swedish study that tried to categorize industrial companies as had been done in household studies. Edén (1991, p. 18) describes five different types of companies that he, as an energy advisor, had found in the 1980s:

- The controlling company, which implements energy-efficiency measures to control expenditures
- The-jack-of all-trades company, which implements measures for other reasons than improved energy efficiency
- The active investor company, which only implements economically beneficial measures

- The delaying company, which does not implement measures, mostly because of ignorance
- The resistant company, which only implements measures that it understands

Edén discusses these as company categories, but it seems he may actually intend them to refer to individuals. The categories are not especially developed, but the principle is the same as in the household studies. The categories, however, are rather similar to barriers and they still lack the social context.

To elaborate on these ‘lifestyle’ categories, I will reuse interviews we conducted with representatives of 10 companies in Borås, Sweden (see Gebremedhin & Palm 2005). The purpose of the interviews was not to contextualize respondent energy use, but to evaluate an energy audit that the companies had received. In Borås, 10 commercial companies from different sectors were selected, including a slaughterhouse, textile company, and producer of technical exterior and interior lighting. The main criterion for selecting respondents at the companies was that they should be in charge of energy matters at their site and be involved in the energy audits; usually they were managing directors or production managers. For lack of better options, the above categorization will be used; the categories mentioned here should not be taken too seriously, but rather as exemplifying how such lifestyle categories could be used as a research tool.

As is always the case when using categories, one subject can be related to several categories, though some characteristics are more obvious than others. The point is to find the issues most important to the company when discussing increasing energy efficiency. Below are examples of four categories of companies that can be discerned from the interviews.

The ignorant company

Ignorant companies have no special focus on energy-related issues, and they generally lack anyone working on these issues. Even if someone does have this responsibility, they commonly state: ‘Energy is something that I handle in addition to my main tasks,

but I am trying to integrate it into other issues. It is not a prioritized issue, however'. In general, they lack incentives to focus on energy issues, as shown in this comment:

We cannot really earn anything from it [energy efficiency]. Because we deliver to retailers and not directly to consumers, we don't have the same pressure as other industrial companies regarding these issues. It is up to the next level in the production line to make environmental demands.

When asked to think whether there was any incentive at all to taking an interest in increasing energy efficiency, one company representative made this comment:

Goodwill could be one aspect. But it must be shown whether there is such an aspect. It is not so easy to know in an organization, because one has limited knowledge of the [energy] area and one has limited resources. So then you choose the easy way out.

Companies can be in a process of establishing themselves on the market or experiencing problems of different kinds, in which case they must focus on their core activity. This is exemplified in the following:

Almost all our attention has been on creating a production process that is efficient in other ways. We have focused on building a factory and establishing ourselves on the market. In this process we have not considered energy-related issues to any great extent ... We have not had any resources for these issues.

To summarize, ignorant companies lack forces driving them to focus on energy issues. They are simply not important to them. Their energy costs are low and their customers do not demand that the company should act, for example, to deal with environmental reasons. Their focus is on the core activity and they lack personnel responsible for energy use, or they simply do not think energy is an important issue. A useful way to reach such companies is to provide information about why energy issues are important

from both the economic and environmental perspectives. Finding a person in the company willing to take on these issues could be a good strategy.

The implementer of easy measures

Another type of company is quite aware of the cheap and easy measures to reduce energy. As one company explained, ‘We have looked at ventilation and lightening ourselves, so that parts are efficient. ... It is hard to move on’. They are looking for measures with a quick pay-back and are not actively searching for information concerning energy reduction. One company was eager to find quick fixes that reduced energy consumption immediately, but was more reluctant to take a longer planning perspective on energy issues: ‘The easily captured things we will absolutely implement as fast as possible. The more stubborn and harder ones we will do if we have time and the strength’.

These companies are aware of the easy and relatively cheap measures to reduce their energy use. They are fairly satisfied with their activities in the energy area, and believe that only expensive and complicated measures remain, which they may take into account given appropriate economic incentives. For these companies, it is important that the pay-back time for the investments not be too long. These companies are not actively looking for information concerning energy reduction and respond best to personal meetings.

The economically interested company

These companies, like those that invest in easy measures, focus strongly on the pay-back time and the need for the investment to give economic benefits, as shown in these comments:

The investments must bear their own costs. A suitable pay-back time is two years.

We see it [energy efficiency] simply as the potential to save money. That is the driving force of the company, to become cost efficient. That motivation is behind most of our activities.

Measures that have a five-year pay-back time do not interest these companies. The starting point is the economic benefit of all activities undertaken. Another reason for such companies to look at reduced energy consumption is that the law requires it. If none of these incentives exists, then these companies find no reason to bother improving energy efficiency: 'We do nothing that the law does not require or that doesn't pay us back in other ways'.

To summarize, economically interested companies view reduced energy consumption and increased energy efficiency as means to cut costs. These companies cannot really see the usefulness of concerning themselves with energy issues. If they do implement a measure, then it must have a quick pay-back time or it is not interesting. Subsidies are something these companies repeatedly cite when considering how to reduce their energy consumption. Any measures suggested must be concrete, have calculable benefits, and preferably focus on technology. Behavioural issues are too 'fuzzy' and just for idealists, according to such companies. Useful policy approaches are economic ones, such as taxation and subsidies. Individual energy audit is another useful approach.

The innovative environmentalist

One group of companies is well aware of both energy and environmental issues in general, and they have worked successfully on these issues for some time. One company representative said, 'We have done a lot and we have been invited to Stockholm to talk about this!' They have set goals for reducing their energy consumption and formulated action plans for different parts of the process. They are also trying to find new innovative ways to reduce energy use:

We had Atlas Copco build us a compressor with a heat-exchange system that gives us 70-degree heated water. We put together the heat exchanger with the tap water that use when we take a shower.

Even if they have already done a lot, they still have many ideas:

We can do many more things, I believe. For example, we do not know how to use the heat that results from our processes. It would be great to be able to store the heat and redistribute it in winter.

These companies often have one or several people who are enthusiasts and constantly come up with new ideas.

I have found a special solution for the air compressors, so that they turn off automatically after 10 minutes when not in use. Previously, they were running 365 days a year, so I needed to make this improvement.

To summarize, innovative environmentalist companies have great environmental concern and have implemented both easy and more-complicated and costly measures. They have invested in efficient systems for ventilation, lighting, heating, and production processes. Often they have an enthusiast in the company who is a driving force for these issues. Energy efficiency is not seen as a problem but a challenge. They face customers who require that they take into account environmental concerns, and their managers are supportive of all kind of environmental activities. Money is not a problem and they constantly create new ideas for how to use energy more efficiently. These companies do not need subsidies or advice, but appreciate being suitably recognized for their efforts.

2.3.1 Discussion

The above categorization gives an indication of what a lifestyle analysis could be like, but the analysis above still ignores matters of situated knowledge and issues concerning routines and behaviour. A lifestyle analysis requires in-depth studies in a company, interviews being conducted with several internal actors and perhaps complemented by participatory observations. A lifestyle study would include questions about how employees talk about energy, environment, sustainability, costs, comfort, etc., how they

act in practical situations, and what attitudes, norms, and routines determine their actions. Then it would be possible to relate energy use and efficiency culture to social practices in the company. Barriers identified could then also be problematized in relation to the social context.

3. Conclusions

Lifestyle categories are used in analysing companies to find new ways of approaching a company's energy use that can give new insight or raise new questions. Lifestyle categories try to capture the energy culture of a company, and include issues such as how the company as a whole thinks about improving energy efficiency, what its habits and routines are like, and whether improving energy efficiency is seen as something that could build the company or just as something troublesome that takes time from other tasks. There can be many explanations of why a company perceives economic factors as hindering energy-efficiency measures. Perhaps the company simply lacks resources. It could also be that there is no one in the company who takes an interest in energy issues, or that economic factors are a legitimate reason the company can refer to put a stop to questions. Alternately, perhaps it is just an established myth in the company that energy-efficiency measures will not pay off, so economic factors are the fairly unreflective answer the company automatically gives out of tradition. Sorting these matters out is important when approaching a company to persuade it to reduce its energy use or to use energy more efficiently, and here the use of lifestyle categorization as an analytical tool can be helpful. It is important to approach barriers or hindrances from another perspective, using non-traditional analytical tools that can contribute new understandings or questions of why a particular barrier is perceived as important in a company.

Lifestyle analysis calls for the in-depth study of a company, including several internal actors. Basing a lifestyle study on interviews with just a few people, as I have done, is questionable; I did this only to capture the idea underlying the analytical tool. The approach aims to grasp the company's energy culture, to understand the context in which energy-efficiency goals and measures are discussed.

Problems arise when trying to generalize from specific cases. The categories used must capture the main driving forces in the company without ignoring the context in which they have developed. Studies of barriers indicate that there is extensive knowledge in the energy-efficiency area, but that important social aspects concerning myths, established ‘truths’, norms, values, and attitudes are often overlooked. Changing our analytical tools and using a lifestyle perspective can enhance the chances of these aspects being included in the analysis.

Using lifestyle categories in the analysis can also help in finding cost-efficient policy and guidance strategies that apply individually tailored information to SMEs in each category. We need to categorize companies if we are to direct specially designed policies towards larger industry segments. Putting barriers in their social context and dividing companies according to their energy culture are useful for policymakers when deciding on policy means. In this effort, an approach using lifestyle categories would be useful.

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