

WHY DO SOME COMPANIES HAVE SUCCESS WITH ENERGY EFFICIENCY?

Mikael Togeby, Trine Pipi Kræmer, Lenette Gjesse and Jacob Klok,
AKF, Institute of Local Government Studies – Denmark
Christoph Clases and Friedemann Prose,
Project Climate Protection, Institute of Psychology, Kiel University, Germany

0. ABSTRACT

Most companies can survive on the market without carrying out specific energy efficiency activities. Nevertheless, some companies work systematically and continuously with these issues. Our primary research questions are: *What makes some companies focus on energy efficiency and why are they successful?*

Our study focuses on the human and organizational dimensions of change in small and medium-sized companies. The object is to identify cultural and institutional factors, embedded in the internal organization or in the external network, which have motivated the company actors to pursue processes of change which have led to concrete implementation of energy efficiency measures.

On the basis of 33 interviews a detailed understanding of the implementation process of energy efficiency in nine companies has been reconstructed. This paper presents some preliminary results of the analysis which will show different paths and types of success.

The way energy-efficiency issues are perceived and organized is often a result of the general tradition and company culture. Therefore, often it is not a question that is answered specific to the particular technical and economic issue of energy efficiency. Understanding the cultural aspects of processes of change can therefore be utilized as a ground for a more differentiated and targeted use of policy instruments towards the industrial sector.

1. INTRODUCTION

Most companies can survive on the market with only limited activities in relation to energy efficiency. Usually, energy cost only accounts for 2-3% of the total cost and partly for that reason only few resources (manpower and investments) are applied to the area. Many companies do not have a manager with formal responsibility for energy efficiency and most companies do not maintain a detailed energy-accounting system, e.g. where energy consumption is compared with production.^{1, 2, 3} Nevertheless, exceptions exist: Some companies are working seriously with energy efficiency. In this paper we will concentrate on such companies. We will describe and analyse how and why they work with the energy issue.

Often the terms “barriers” or “obstacles” are used to describe why companies do not carry out cost-effective energy projects.^{4, 5, 6} Seen from the industrial managers point of view the practise of few energy activities is easy to understand: Managers have limited time, limited information and are influenced by many uncertain external conditions. Satisfying solutions are sought and optimal solutions are seldom found.^{5, 7} As to the necessity to reduce complexity, locally established norms, rules, routines, and traditions will guide decisions. We regard this behaviour as a practical rationality based on experience at work, and influenced by the specific company culture.⁸

Norms, rules, routines and traditions of the individual company are not necessarily unique for each individual company. Companies interact with each other in a complex network and tend to develop common organizational traits. They might imitate the way issues are organized or share similar perceptions and beliefs concerning special areas, e.g. the importance of energy efficiency.^{9, 10, 11, 12} An intensified cooperation between companies may lead to new chances for organizational development and needs a special perspective on process

design.¹³

From a policy point of view the challenge of industry is that the issue of energy efficiency is not really on the agenda in the companies. Small cost areas are often squeezed out of the agenda in favour of areas perceived as more central like e.g. preservation of market shares, strategic development of new products and compliance with mandated environmental or workforce safety control.^{5, 14}

Kiefer et al.¹⁵ and Morill¹⁴ argue that economy and technology are not enough to make energy efficiency work. Without cultural factors like knowledge, beliefs and values technology will not work. From the perspective of participative social marketing¹⁶ the heterogeneity of context variables should be addressed by the active involvement of the demand side of the energy market stressing processes of communication and persuasion to influence socially established belief-systems.

In this study, which is part of the InterSEE research project funded by the European Commission, we will concentrate on companies that have been working actively with energy efficiency and the objective is to understand and interpret the cultural factors that have made these particular companies focus on energy efficiency.

2. METHODOLOGICAL APPROACH

Within the research project a qualitative research strategy is being pursued. The main assumption of qualitative research is that “... every human activity yet presupposes a certain understanding of reality, each interaction itself is to be looked upon as a process of interpretation and that these interactions and interpretations constitute our social world”.¹⁷ The approach chosen may be characterized by three decisive features: stressing of context, process orientation and intersubjectivity.

Firstly, we aim to describe the complexities of the organizational context that contributed to the different paths of successful implementation processes. Secondly, elements of process are specifically addressed as we study the implementation of energy efficiency as a social process and a development with different stages. Thirdly, in order to gain a detailed understanding, we focus on the interpretations and evaluations of the different actors involved. The project wants to identify and communicate the involved actors’ subjective perception of the different steps of a particular implementation process and the significance of the different actors involved.

The research methodology is related to Grounded Theory^{18, 19}, i.e., models will be based on the experience of those actors involved inside and outside the companies.

2.1. Framework

We have developed a semi-structured interview concept based on two dimensions: Time and actors. The distinctions between different stages of an implementation process and different levels of actors serve as the two key dimensions for pre-structuring the empirical data and preparing the analysis. The two dimensions are shown in figures 1 and 2.

The first dimension represents the development of the processes from the time before the initiation to the stage of continuation. The distinction between the respective phases is ideal-typical and does not indicate that real processes are so simple. Implementation can fail and stop at any of the suggested stages or fall back to earlier stages. However, the distinction provides a framework to conceptualize the investigation of trajectories of implementation processes in relation to the specific and often changing involvement of actors from different levels.

The second dimension concerns the different actors involved in the process. The internal company factors can be separated into the level of individual actors and the level of interaction of formal and informal groups within the companies (e.g. departments, project teams). At the level of individual actors we distinguish between the decision-makers (DM) and the change managers (CM) as those being held responsible for the energy-efficiency activities in everyday practice and coordinating the implementation. We call the actors who are involved in the practical realization of the implementation change agents (CA). In some cases two or more functions are served

by the same actor. Also, 'other actors' (OA) within the company – not directly involved in the energy-efficiency measures – were interviewed in order to include their interpretation and receive data from a more detached perspective.

We do also identify different actors outside the company that may become relevant for the energy-efficiency activities: The relation of a company to similar firms on the market, its customers, energy suppliers, technology and energy-efficiency service suppliers, energy efficiency-programmes and all kinds of interest groups may be part of an external social network related to internal company activities. Additionally, the interaction of a company's activities with legal, economic and political frame conditions has to be taken into account.

The interview concept has been kept open for the independent comprehension of the interview partners. It has been sensitive to changes, ambiguities, partner interpretations, interactive processes of learning between the partner and the interviewer.

2.2. Data Sources and Analyses

The sample of case studies provides a wide structural variation of the research objects.²⁰ We have completed 9 case studies. The cases are based on 37 interviews and review of documents.

The companies and measures differ in character, scope and context. This heterogeneity will be used when we investigate the similarities and differences across the cases in relation to the frame conditions, company cultures, individual and joint activities etc. The selection criteria for the case studies have included the realization of efficiency potentials and continued change in internal company activity. As common in qualitative research, we have applied a multitude of perspectives. Therefore, multiple respondents at different levels of the companies and from different functional affiliations have been interviewed. We began our interviews with the actor who was (officially) most involved in the implementation processes. We have used the first interview to point out our next interview partners. We also used this method in order to find out which external partners were most important. A triangulation of different data have been used to achieve a detailed understanding of each case. The heterogeneity of the data about each case is regarded a necessary precondition for achieving reliable outcomes.

Data are analysed within each site as well as across sites to detect similarities and compare differences. The analysis transforms the variety of subjective descriptions and evaluations into an intersubjectively comprehensible form (i.e. our transformation of the observations can be verified by other researchers). The derived models are based on the analysis of the first nine cases and describe the processes in terms of an interaction of subjective perceptions, contextual conditions, actions, and consequences that may be considered as fostering factors for the successful energy efficiency activities. The search for systematic similarities reveals different dimensions of successful social change, and their fostering factors are related. Differences in organizational conditions and change processes allow useful contrasts to generate prototypes for generalization. The common logic within the different stages of research leads to a systematic proceeding according to our framework. By conducting an in-depth analysis in the different case studies, a closeness to the real-world processes is assured. The resulting models of change and the respective fostering factors thus are empirically valid as they can account for the unique data of each site. A constant comparison across the types of evidence will be pursued in the analysis of further cases to control the conceptual level and the scope of the emerging models.

3. INTRODUCTION TO CASES

Out of the nine cases, three cases are from Germany (no. 1-3) and six from Denmark (no. 4-9). All cases have been active in relation to energy efficiency – although the activities have many different appearances. All have been more active than what we consider typical for companies of similar size, energy intensity and branch.¹
^{2,3} The companies have different ways to approach energy efficiency, e.g. regarding organization and involvement of staff. The companies are small or medium-sized production sites and are not energy-intensive. Key features of the cases are:

- Company 1 – a cable producer with 190 employees – has been a pioneer in relation to implementing EMAS (Environmental Management and Audit System) in a medium-sized company. Persons responsible for energy are appointed in every department and the experience with involvement of staff in energy and

environmental issues is considered characteristic for this company.

- The largest energy savings have probably been realized in company 2 – a manufacturer of semiconductors, 300 employees. It has invested in a combined plant for production of power, cooling and steam. The management was used to complex projects and chose to coordinate the project itself. Still seven years after the investment the system is not working as expected. The process has been a negative experience for the company.
- Company 3 – a small galvanization firm with 35 employees – has set up an energy-management system and invested in computer-based process control and efficient air compressors. A catalogue of behavioural order has been established in case of reaching the capacity of the local electricity system.
- In company 4 – a manufacturer of plastic pipes with 400 employees – the energy activities are deeply rooted with other social activities like prevention of work accidents, water savings, and recycling of plastic materials. The company has a formal (written) philosophy stating that the environment must be respected and that it shall be an attractive working place. The company has won several prizes, including a EU prize for its environment activities. Many investments for energy efficiency have been made, e.g. in natural cooling.
- Although, company 5 – a printing company with 50 employees – is among the smallest in the sample, it has employed an engineer as environmental coordinator. The company has been a pioneer in relation to implementing an environmental management system. Energy and environment are integrated in the general management system – which includes an individual contract and detailed description of rights and responsibilities. Activities have included improvement of a new humidity and ventilation system.
- The success in relation to company 6 – a producer of juice with 300 employees – is in the continued use of energy management and the positive involvement of suppliers of equipment. The philosophy of energy management has been spread to other companies and to energy advisers through a professional association and lectures. The merger with another company has increased the time pressure on key actors, and has made it difficult to develop the activities further.¹²
- Company 7 – a manufacturer of chip boards, 50 employees – has been a pioneer with computerized data collection of key figures on electricity consumption and has realized several projects in relation to compressed air, motors and drives. Diffusion has taken place to the mother company and to other companies in the region. Harsh economic conditions put a damper on the activities and investments in energy efficiency.
- Company 8 – a producer of juice, 50 employees – has gone through two energy audits and have in both cases realized central parts of the recommended projects. The internal capacity in relation to energy is limited, but through the audits results have been achieved.
- Company 9 – a textile company with up to 230 employees in the peak season – has experienced a dramatic growth, and did not worry about energy costs before an energy audit report from the electricity utility was delivered. The success of this case is related to the decision to realize the seven large projects from the audit.

All companies have invested in energy-efficiency projects. The success is clearest in five of the companies (1, 4, 5, 6, and 7). In these companies the activities are expected to continue and develop.

4. THE PATHS TO SUCCESS

We will now elaborate on the issue of the dynamics of implementing energy efficiency. By presenting our analysis of two selected cases we want to demonstrate the importance of social processes within the companies and the specific function of external contacts and the development of social networks. At the current state of research both issues seem to be of significance for a lasting success with energy efficiency. The two case studies are based on four in-depth interviews each. We will present the individual trajectories of energy activities in the companies and a common pattern of success. The patterns will be presented by describing the relations between fostering factors and activity. The research questions are: *Why and how did the success come through?*

4.1. Fostering Factors in the Process at the Cable Producer

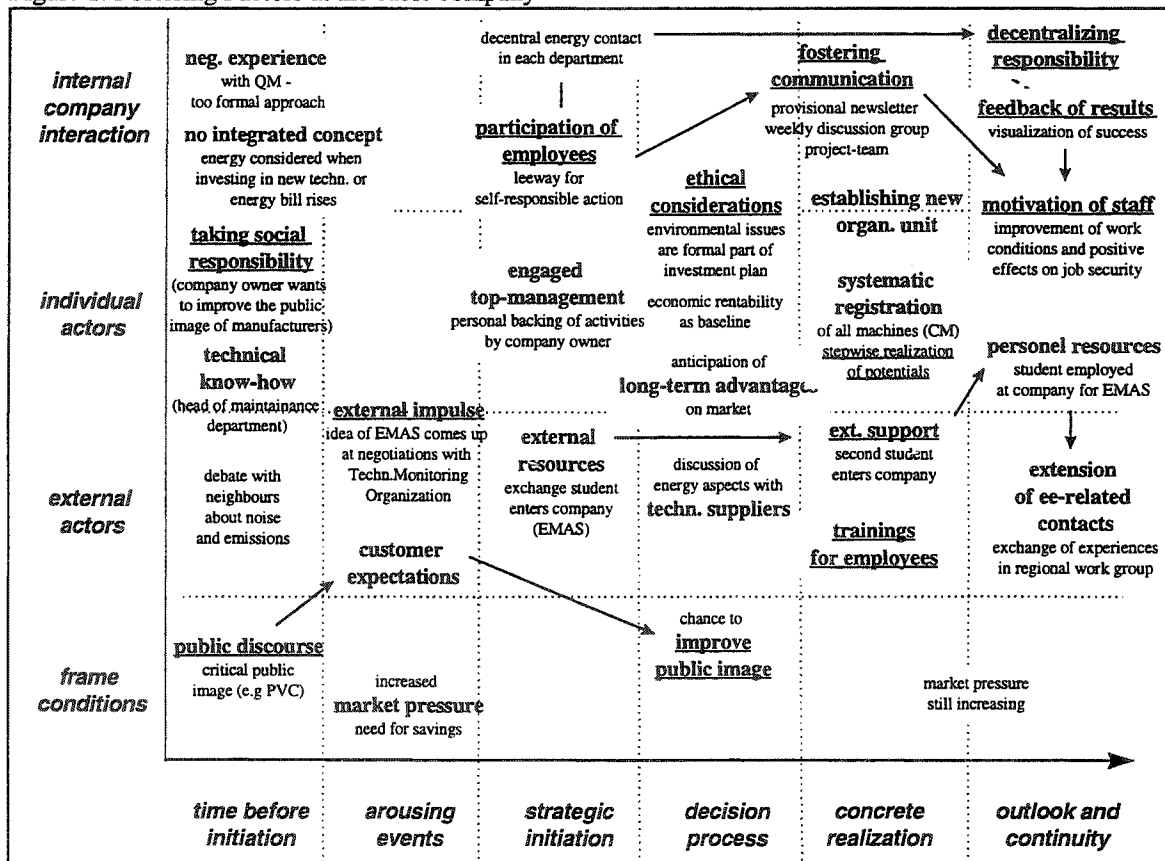
The first case study (see figure 1) is about the activities in company 1 – the cable company – in relation to implementing an environmental management system (EMAS). In this context they also focus on energy, e.g.

a ten-year-plan to replace all motors and drives.

In the past – before the initiation of the EMAS-project – efficiency measures were hardly undertaken. If any, the activity was a passive reaction to an unusual high energy bill or a sudden breakdown of equipment. Unsatisfying experience within a quality certification process (it is perceived as a too formal approach) made the company decide to develop an own strategy that is consequently oriented towards the special context and circumstances within the company and to the position on the market. The cable producer – using PVC in production – is well aware of the public discourse on this topic and started R&D-activities for halogen-free substitutes for certain applications. The decision-maker's (and company owner's) vision for the company reflects a will to take on social responsibility.

The decision maker (DM) represents a type of entrepreneur with centralized power at the same time providing support and motivation for the staff. As to DM the arousing event for the activities to develop an environmental management system has been an external meeting with an official technical monitoring organization (TÜV): *"It was a more or less spontaneous decision to start an integrated environmental management. Many small things have been done. There was the chance to put it all together and to present it to the public."* Here the issue of customer expectations becomes clear.

Figure 1. Fostering Factors at the cable company



The permanent market pressure can be seen as a further contextual background that made the company look for energy-saving potentials. Furthermore, it shows the anticipation of long-term advantages on the market that have become especially relevant within the decision process. DM: *"Image building is possible and successful. Daily business results, however, are hard to identify and for the moment not very likely. In the long run we expect and believe in advantages. We want to be a company having a clean slate and demonstrate this. I really want to improve the image of entrepreneurship in the public"*.

In the **initiation** and the **realization** of the project external personnel resources have been used. When a student (EP1) entered the company to work with his practical traineeship, DM decided to put him in charge of the development of the environmental management system. The student became project leader working closely with CM, the head of the maintenance department. CM perceives the company owner's (DM) understanding of leadership as very helpful for self-responsible activities of middle management and employees. DM as the engaged top manager assured a personal backing of activities which was a fostering factor in the initiation of the project because – as a result – no personal risk has been perceived by CM or CA who are directly in charge of the implementation process. A second student (EP2) who entered the company during the realization of the measure states: *"The company leader's personal backing allowed us to establish ourselves in the company as a somehow accepted unit, but separated from normal production business. We had all the freedom we needed to experiment. There was no pressure for time or results and we always had a hundred per cent support and backing by the company leader."*

In the **realization** of the project, new organizational units have been established somewhat apart from the pressure of daily production. In order to create a dense internal cooperation an environmental committee was established. Energy responsible persons have been appointed in order to foster the participation of employees. DM summarizes his experiences: *"Environmental protection depends on the personal involvement and engagement of staff. An environmental committee meets once a week. Energy issues are of central importance. Additionally an energy responsible person has been appointed in every department, selected due to his already shown engagement for environmental issues in general, not regarding his hierarchical status."* External company training for the middle management and employees takes place regularly.

The external support by the second student (EP2) has become an internal support, because after finishing his studies he has been employed to continue his work at the company. The company managed to bring about further external support by initiating different external meetings on environmental issues and energy. This led to a further important fostering factor especially relevant for the continuation of activities: the extension of external contacts related to energy efficiency. The cable producer takes part in an official study on EMAS in small companies and helped to establish a regional cross-branch workgroup on environmental management. DM: *"A regional group has been established to exchange experience with issues related to environmental management. We have a very close, fantastic cooperation. We meet every two months and it is astonishing that everyone can learn from everyone in spite of the differences in branch, size and organization. We can provide the experience of staff integration, others have perfect technical management systems."*

For the **continuation** of activities the case shows that the communication and feedback of results is an important fostering factor. DM states: *"A crucial supportive success factor is the feedback of results, success has to be visualized due to its often abstract character."* As to the decision-maker the company has installed discussion groups and an informal newsletter to increase the internal communication of the topic and foster the motivation of the staff: *"The acceptance of efficiency measures is often supported by the resulting improvement of the working conditions (filters, noise reduction, better lighting). (...) The illustration of benefits, especially economic ones, is necessary. When informed, the staff realizes that energy savings contribute to the overall performance of the firm and thus to their personal job situation."*

4.2 Fostering Factors for the Plastic Pipe Company

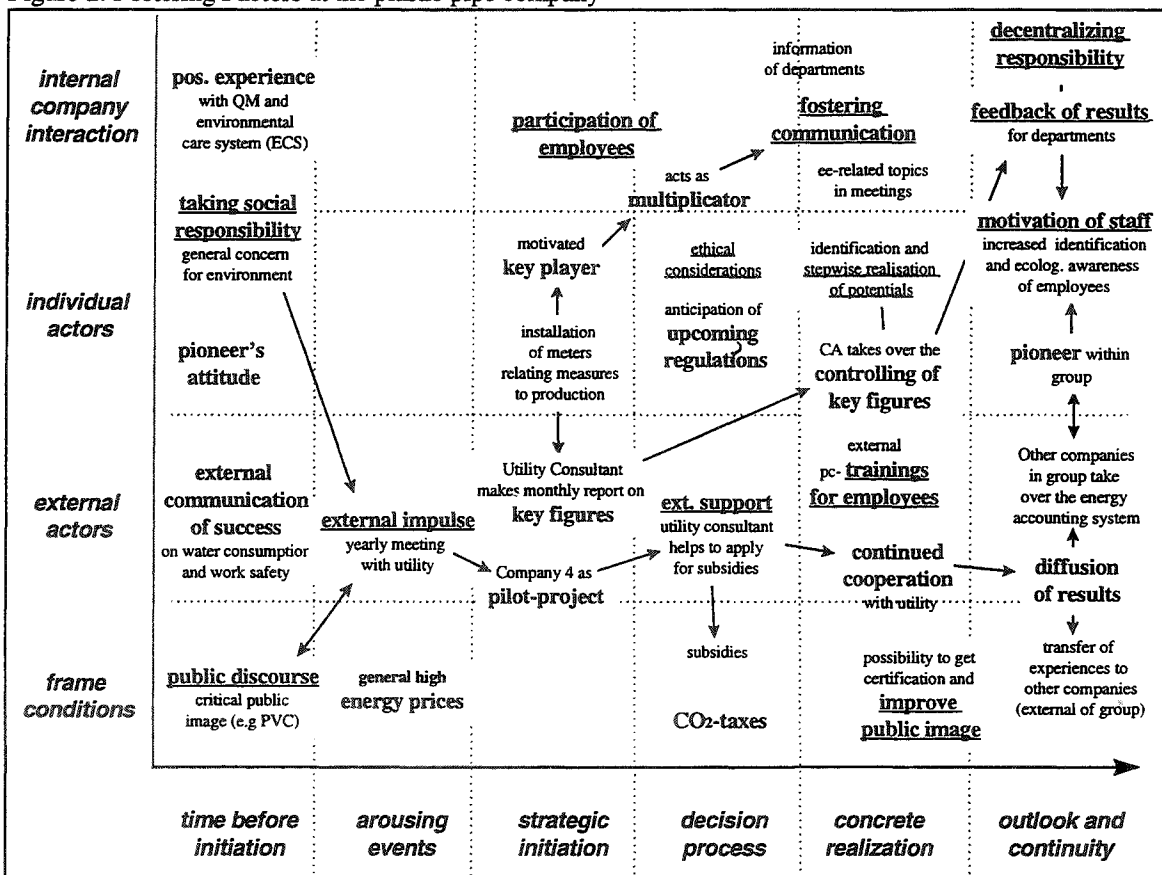
As our second example we analyse the successful implementation of an energy accounting system in company 4 – the plastic pipe factory (see figure 2). **Before the initiation** of the measure the company had already taken social responsibility in terms of a general concern for the environment (e.g. recycling of material, reduced water consumption, improvement of work environment). Energy is part of the company's strategy for environmental care. Having a positive image is perceived as important both in relation to customers and employees. The public discourse and critical public image of companies using PVC in the production can be seen as a fostering background variable for the environmental activities within the company. Within the company experience with quality management and an environmental care system existed. Looking back on the efforts of external communication the company's change manager (CM), who is in charge of the realization of the energy accounting system, reflects on the enforcement of the pioneer's attitude within the company: *"The reason for using the water savings in public relations, is that the area is so well documented that the medias care to write*

about it. The local water utility mentioned us in the annual report which is published in the local newspapers as those who did it again, and as a good example for others to follow. That's nice."

Data clearly show that there has been a decisive external impulse that served as an **arousing event** for the implementation of the energy accounting system. The local electricity utility proposed the pipe company to participate as a pilot project on electricity savings.

The utility consultant was an important external partner (EP) as well in the **initiation** as later in the **realization** of the project. During the stage initiation there has been a close cooperation between CM and EP. The change agent (CA), who has been in charge of the practical technical changes, also took part in this cooperation: "The first year of the energy accounting the consultants brought moveable measuring instruments. The production was seen in relation to the consumption, and it was decided to put up some meters. In cooperation with EP there has been a consideration about which type of over-consumption could arise from the production, and how detailed the meters should be put up." In the beginning the consultant took all measures home and made monthly reports. Later in the process CA took over this work and prepared detailed information on energy consumption for selected departments of the company in form of key figures. At this point a transfer of know-how can be observed.

Figure 2. Fostering Factors at the plastic pipe company



In the **decision process** a mix of motives has been relevant. The integration of environmental considerations in the company's overall strategy supported the decision. Energy savings, incentives (subsidies) and the anticipation of upcoming regulations (CO₂-tax) were decisive arguments in favour of the decision.

The pipe factory has made many investments in the **concrete realization**, but has also invested resources in the organizational dimension. They have involved all departments and communicate the concern for environ-

ment to all the employees. The participation of employees already started at the stage of the initiation. An intensified communication of energy issues in meetings and the feedback of monthly key figures to selected departments have led to an increased identification of employees with the company. Although only CM and CA are directly involved in running the energy accounting system a decentralization of responsibility in terms of energy consumption has taken place. The change manager states: *"It's important to decentralize the responsibility. The one who uses the energy must know it."* Another leader states: *"Today you can't use the robot-like discipline. Only a few people want to be told what to do, without thinking about it at all. Today, the attitude is that people want responsibility and varied work; that is the way we work in this department"* .

There is a widespread awareness that the project contributes to the development of the company and the protection of the environment. CA perceives the external cooperation with the utility consultants (EP) as a fostering factor in the stage of realization and **continuation of activities**. *"If new projects are started, and I do not have the time to investigate the field, we will use external consultants. The consultant makes a report, which gives proposals for the procedure, i.e. the consultants are now used to advise for specific projects."* Due to the success of the project a diffusion of experience and activities has taken place into two directions. On the one hand, the utility consultant uses CA's experience for the planning of new projects in other companies, and on the other hand, the group of companies of which the pipe factory is part decided to take over the system. CM said: *"I have raised the question about making [the energy accounting system] a part of the concern's policy. It is nice to be able to present a fully developed system, on computer, from being a development project to an everyday happening."* The positive feedback of results both from internal and external groups is a fostering and motivating factor for CM. The history of activities and the development of the company within the group have led to certain expectations resulting in a pressure for new investments. CM states: *"We have during the years established a position in the group, where the company in relation to the environment is seen as being in the front. This position works as a whip for us, because if we want to keep the position, we have to present a new initiative every year."*

4.3. Similarities on the Paths to Success

The analysis of the first cases proves that our framework provides a viable structure for proceeding – as well in data collection as in data analysis. The variety of the two cases shows that the successful implementation of energy efficiency may not be looked upon as an instantaneous event, but rather as a long-term process of social and technical change – especially when the companies tend to continue activities in energy efficiency. This calls for a strategic orientation and a systematic approach within the companies.

The outcomes of a comparative analysis point – despite all individual trajectories – at interesting similarities (underlined factors in figures 1 and 2). These common features will now be summarized on a more aggregated level. This has been done by relating the fostering factors to (1) the internal know-how in relation to technical aspects of energy savings, (2) the degree of decentralization of energy efficiency activities, (3) the dependence of activities on key actors within the processes, (4) the importance of technical and economic arguments, (5) the embeddedness of energy activities in similar activities concerning the environment, and (6) the importance of external impulses and the integration of external support.

Table 1 gives a view of each dimension in relation to the fostering factors across the nine cases and practical activities or supportive frame conditions that may bring about the fostering factors. We hold that these six dimensions are of central relevance as they were central topics in all the cases. In practice, the importance of the interrelations and mutual dependencies between the dimensions varies from case to case and leads to the specific dynamics for the single companies.

Table 1. Central dimensions of successful implementation of energy efficiency

Dimensions	Fostering Factors	Supportive Activities and Frame Conditions
Internal capacity in relation to technical aspects of energy savings	Internal company technical know-how Qualification of employees	Workshops and training
Degree of decentralization of energy efficiency activities	Participation of employees Decentralizing Responsibility Fostering internal communication Motivation of staff	Project teams, proposal system, suggestion contest Decentralized energy contact Information meetings, newsletters Feedback of results by visualization of success Communication of positive influences on job security and working conditions
Dependency of activities on key actors within the processes	Promotion by top management Motivated key player	Taking social responsibility Leeway for self-responsible action coordination of activities
Importance of technical and economic arguments	Perception of economic benefits Financial Incentives	Evaluation of pilot project Calculation of key figures Subsidies (e.g. for audits) Green taxes (e.g. CO ₂ -tax)
Embeddedness of energy activities in similar activities concerning the environment	Systematic and integrated approach Ethical considerations as part of overall strategy	Experience with environmental management Taking social responsibility by integrating environmental issues in investment plan
Importance of external impulses and integration of external support	Support by consultants Exchange of experience and diffusion of results Perception of long-term advantages on the market and chance to improve public image	Energy audits Extension of EE-related contacts, e.g. with other companies for new ideas and impulses External communication of activities

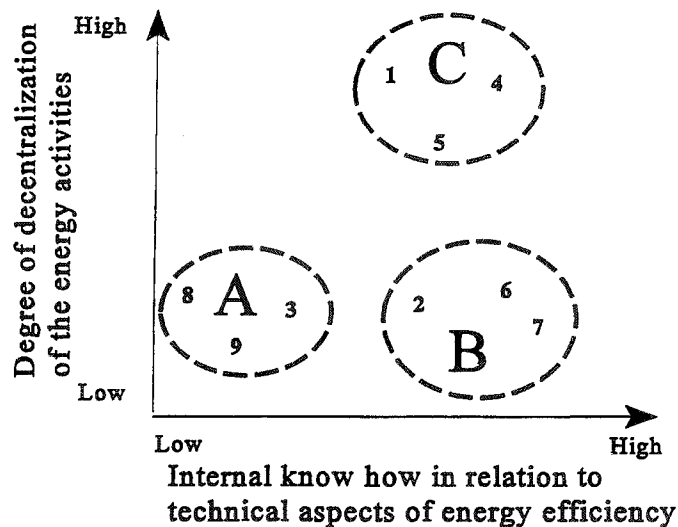
5. DIFFERENT TYPES OF SUCCESS

The nine cases are different in many ways. Two countries, eight industrial sectors and a variety of company sizes are represented. Nevertheless, if we look at the type of success, we can find some similarities despite formal differences. The "type of success" is based on an evaluation of today's activities according to the six dimensions outlined in the previous section.

The research team have judged each company on these dimensions. We have used all interviews from each company. When contradictions appeared, we have made our evaluation from our overall impression of the process. Figure 3 illustrates how the nine companies are distributed in the two first dimensions. The nine cases are grouped in three clusters. Each cluster represents a type of success.

- A. *Little internal energy expertise.* Achieving success without investment in internal expertise is possible. Companies 3, 8 and 9 have done so. They rely heavily on advice from external expertise, e.g. when they arrange for an energy audit with years' interval. They use their general organization to deal with the issue of energy efficiency. The continued success in these companies are dependant on external actors.
- B. *With energy expertise.* Some companies have built up technical capabilities concerning energy efficiency. This can be in relation to energy accounting with collection of information on energy use and calculation of key figures. Also, the companies might have practical experience with carrying out various energy savings. These companies do not attach importance to involvement of staff in the process of energy savings. It is seen as a predominantly technical question. The companies 2, 6, and 7 are of this type.
- C. *With energy expertise and with involvement of staff.* A third type of companies have combined the internal technical capacities with an extended focus on organizational aspects like motivation of staff, inclusion of energy awareness in all practical aspects of the company, e.g. including development of products, production methods. Company 1, 4, and 5 are this type of success. In some companies it is regarded a strength that many employees know the arguments for energy efficiency and see the results.

Figure 3. The nine companies shown in the two first dimensions



Within our sample of cases we have not found examples in the upper left corner in figure 3. Involvement of staff seems only to take place after some internal expertise has been gained.

Key actor: The activities are often pushed forward by a key actor. In the type B and C companies we interpret the activities as dependent on the actor, the change manager. The role of the key actor is very ambivalent. On the one hand data clearly show that he has an important function in the process to foster and coordinate the internal and external activities. On the other hand, the institutionalization of a key actor may also lead to an isolation of his work. In some type C companies it is our impression that the future processes are less dependent on the present change manager because of the broad involvement of staff. The type A companies (without internal energy expertise) are generally vulnerable because the activities are only loosely connected with the organizations. The cost of this is a high dependance on external actors, like technology suppliers or consultants.

The importance of technical and economic arguments: In general the many interviews reveal a traditional cost-benefit view on the energy activities. In the type C companies we have found a broad understanding of economy, e.g. stating that many important issues cannot easily be expressed in monetary values. The A companies work with energy because it pays. Although, often the economic calculations are very rough and it is not possible to control that the expected savings have been realized. With the lack of internal technical capacity managers in these companies have to trust when the external actors say a projects is profitable. As shown above considerations about technical and economic arguments are sometimes being mixed with ethical considerations and the vision to improve the company's customer relations or the identification of employees. Technical and economic issues are mostly considered within the decision process. But in order to become aware of the potential benefits of energy efficiency external impulses seem to be important. This holds all types of companies – a strong link to the dimension on external support.

Environment: The three C-companies (with energy expertise and with involvement of staff) are all working seriously with both energy efficiency and environment. Often the two areas are closely integrated. The weight these companies put on the involvement of staff could rise from the fact that the issues of energy and environment together encompass most activities and that a central responsibility is not adequate. A link of energy savings to the issues of work safety and production quality is also perceived. These companies also seem to have a general company culture or philosophy of staff involvement and the activities in relation to energy and environment may be a suitable area to practise and support this philosophy. The way energy efficiency is organized has grown out of the general organization. Other reasons – far from the energy issue

– have formed the way each company organizes its production. While traditional energy accounting is technical oriented, environmental schemes like the European EMAS (Environmental Management and Audit System) include an obligation to communicate the procedures and the environmental policy to all relevant employees. This might move the company in the direction of decentralization. The issue on the environment is rooted in the public debate. The companies wish to have good relations to close by neighbours and local communities. A positive image can be valuable in relation to new employees and to customers. Environment is not an important issue in type A and B companies.

The importance of external actors. In all cases external actors have been active. Often advisors from the utilities and suppliers of technology have been used as important sources of information. The type A companies are very dependent on these external actors and in the two cases it has been the external actor (a consultant) who has taken the initiative to conduct an energy audit. Several of the type B and C companies are using free consultants from the utility and apply for subsidy from the government. Our impression is that they use these offers because the companies are active in the field – not visa versa.

We consider each of the nine companies successful, independent of how they have organized the work with energy efficiency. The type C companies are the most advanced, but this should not be considered as the best way to organize energy efficiency for all companies. Energy costs are marginal in most companies, and our case studies show the variety of ways in which energy can be handled.

6. CONCLUSION

How do these selected companies work with energy efficiency? We have focussed on companies with less than 500 employees from non-energy intensive sectors. All the selected companies have been active in relation to energy efficiency. With observation from the nine case studies we have argued for six organizational dimensions that can describe the way the companies work with energy efficiency. These dimensions are a first step in the direction of opening the "black box" model of companies.

It is our impression that the company culture encompasses all activities, and that the organization of energy efficiency activities is in many ways related to the overall company culture. If the company has a lean organization in general, this will influence the energy efficiency organization. If the company has a tradition of staff involvement this will also be found in the organization of the energy activities.

Why do these companies focus on energy efficiency? The companies that work with both energy efficiency and environment (the type C companies) seem to be "pro-active" in their approach to energy. They foresee a benefit of the activities: Better relations to the authorities, the neighbours, the customers and the staff. While the cost savings are the fuels for the daily motion towards energy efficiency, the foreseen benefits might be those arguments that start and maintain the process. These companies use the external offers, like free electricity audits and subsidy for investments, but the general impression is that they do so, because they already have started the travel along the energy efficiency road. They have not selected this road because of these offers.

The type A and B companies seem more "reactive". They react to new signals, like CO₂-taxes and subsidized energy audits, and start the work with energy efficiency. Especially the A companies need help from outside to cope with the challenge of energy efficiency. External actors like suppliers of technology or consultants are very important for the process.

Policy implications: The case studies illustrate that the implementation of energy efficiency is a social learning process and show the importance of continuity and diffusion of activities. Energy-efficiency measures are complex products. We have found a mixture of motives for energy efficiency and see a possible synergy between energy efficiency, other areas like environmental care, the possibility of company development, the increase of production quality, and work safety. In order to support key players in companies and to promote a decentralization of activities the extension of internal and external company cooperation is a decisive area. Especially regular external partners of firms (utilities, equipment suppliers, consultants) have a key position in energy efficiency solutions. As to inter-firm relationships a process-oriented cooperation may contribute to the development of energy-efficiency related inter-firm networks.

The understanding presented in this paper will form the basis for a differentiated policy approach to industry. A policy focusing on the dynamic and social aspects of implementation processes including the identification of decisive actors on the demand side of the energy market.

7. ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial contribution of the European Commission (DGXII) and the Danish Ministry of Environment and Energy to the research project "Interdisciplinary Analysis of Successful Implementation of Energy Efficiency in Industry, Commerce and Service (InterSEE)" within the framework of the Socio-Economic Research Area of the JOULE Programme (Contract JOS3-CT95-0009). We also like to thank the InterSEE research partners: Wuppertal Institute for Climate Environment Energy (Wuppertal, Germany), Energieverwertungsagentur e.V. (Wien, Austria), Fraunhofer Institute for Systems Analysis and Innovations Research (Karlsruhe, Germany) as well as Amstein & Walthert AG (Zurich, Switzerland). A special thank you to the Wuppertal and Fraunhofer institutes who have supplied the data for the German case studies.

REFERENCES

- 1 Togeby, M. (1989): *Industriens erfaringer med energistyring og elbesparelser* (Energy accounting and electricity savings in industry (in Danish with an English summary). Copenhagen: AKF Forlaget.
- 2 Rosenberg, E.: M. Togeby and A.M.B. Christensen (1992): *Energi og investeringer – brugen af rentabilitetskrav i nordiske virksomheder* (Energy and investments – the use of profitability in Nordic companies) (in Danish with an English summary). Nordiske Semiar- og Arbejdsrapporter.
- 3 Togeby, M. and M. Kyhnau (1994): *Energisyn i mindre virksomheder* (Energy audits in small companies). Håndværksrådet.
- 4 Jochem, E. and E. Gruber (1990): Obstacles to rational electricity use measurements to alleviate them. *Energy Policy*.
- 5 DeCanio, S. (1993): Barriers within firms to energy-efficient investments. *Energy Policy*. Vol. 21, No 9.
- 6 Cebon, P.B. (1990): *Organizational Behavior and Energy Conservation Decision-Making*. ACEEE Summer Study on Energy Efficiency in Buildings.
- 7 March, J.G. (1988): *Decisions and Organizations*. Basil Blackwell Inc.
- 8 Schein, E.H. (1992): *Organizational Culture and Leadership* (2d Ed.). San Francisco, CA.: Jossey-Bass.
- 9 Powell, W.W. & P.J. DiMaggio (eds.) (1991): *The new institutionalism in organizational analysis*. The University of Chicago Press, Chicago.
- 10 Håkonsson, H. (1994): Economics of Technological Relationships. *Economics of Technologies*.
- 11 Pedersen, J.S. and F. Dobbin (1997): *Constructing Organizations: Neoinstitutionalism and Organizational Culture*. Papers in Organization, No. 21. Institute of Organization and Industrial Sociology. Copenhagen Business School.
- 12 Klok, J. (1997): *Successful Energy Conservation at Rynkeby*. Copenhagen: AKF Forlaget.
- 13 Wehner, T.; A. Raeithel; C. Clases and E. Endres (1996): Von der Mühe und den Wegen der Zusammenarbeit. Theorie und Empirie eines arbeitspsychologischen Kooperationsmodells. In: Endres, E. and T. Wehner (eds.): *Zwischenbetriebliche Kooperation*. Beltz Psychologie Verlags Union, Weinheim.
- 14 Morrill, J.H. (1994): *When the Straight Line is not the Fastest Route: Counterintuitive Approaches to*

Improving Energy Efficiency in Buildings. ACEEE.

- 15 Kiefer, K; W. LeBlanc and S. Feldman (1994): *Social Marketing: The Road to Maximizing the Sustainability of Energy Efficiency and DSM Savings*. ACEEE
- 16 Prose F. (ed.) (1994): Ansätze zur Veränderung von Umweltbewußtsein und Umweltverhalten aus sozial-psychologischer Perspektive. In: *Senatsverwaltung für Stadtentwicklung und Umweltschutz in Berlin: Neue Wege im Energiespar-Marketing, Materialien zur Energiepolitik in Berlin*. Haft 16, p. 14-23.
- 17 Lamnek S. (1993): *Qualitative Sozialforschung. Band I. Methodologie*. Weinheim 1993 (2nd Edition).
- 18 Glaser, B. and A. Strauss (1967): *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago.
- 19 Strauss, A.L. and J. Corbin (1990): *Basics of qualitative research: grounded theory procedures and techniques*. Sage, Newbury Park (3rd print).
- 20 Kleining, G. (1982): Umriss zu einer Methodologie qualitativer Sozialforschung. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, Cologne, p.224-253.