The Danish Curve Breaker Agreement model – a voluntary agreement to break the electricity consumption curve

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Abstract

Both the public and private company sectors are continually acquiring more electrically powered equipment. Consequently, electricity consumption has risen by more than 1% per year over the last 10 years in Denmark (Danish Energy Agency, 2008). Curve Breaker Agreements were introduced in Denmark in 2007 by The Danish Electricity Saving Trust, an independent institution led by a Board appointed by the Danish Ministry of Climate and Energy. The agreements commit organisations and companies signing the agreements to reduce their electricity consumption and 'break the rising electricity curve', typically over a 3-year period.

This paper describes the Curve Breaker Agreement model and analyses the effectiveness of initiatives and solutions in different agreements.

The analysis is based on empirical research covering 115 agreements concluded by 18 March 2009. The research also includes remotely metered electricity consumption data and interviews with agreeing partners.

The results showed that agreements should be concluded at macro level. An important precondition of the agreement follow-up process is that both parties should be able to track the electricity consumption of an individual organisation on a website. 115 agreements have been concluded in about 2 years, and by December 2008 the list of signatories included one third of all Danish municipalities, government ministries and public sector institutions, as well as a number of large private companies. The latest survey of electricity consumption in the Danish public sector indicates that the consumption curve by signatories of Curve Breaker Agreements has generally been broken, and is heading lower.

Introduction

In 2007, the Danish Electricity Saving Trust introduced its new 'Curve Breaker Agreement' concept (The Danish Electricity Saving Trust, 2008/3). Agreements are concluded between the Trust and Danish government and public authorities (ministries, regions and municipalities) and other large consumers of electricity, which binds the organisations to reduce their electricity consumption by a percentage amount over a specific period (e.g. 3 years) over the life of the agreement. The agreements have been very successful with 115 agreements concluded in approximately 2 years. By January 2009, The Trust had signed Curve Breaker Agreements with one third of all Danish municipalities, government ministries (including the Prime Minister's Office, the Ministry of Climate and Energy, and the Ministry of Finance) and public sector institutions, as well as a number of large private companies. The 115 agreements concluded within the past 2 years cover total consumption of 850 GWh, of which 470 GWh can be attributed to the public sector. It is estimated that electricity consumption in areas of the public sector that have not yet concluded Curve Breaker Agreements is 2,256 GWh, equivalent to the potential to be covered by future agreements.

The Trust's vision is for the growth in electricity consumption to stop in 2009 (The Danish Electricity Saving Trust, 2009/2). In fact, this has already happened in public sector institutions with which the Trust is working. In 2008, consumption has

Table 1. Facts about Denmark and energy consumption

Denmark
5.4 million inhabitants 2.4 dwellings Area: 43,000 km^2
3 administrative levels: 19 ministries/700 government organisations 5 regions 98 municipalities
Total Energy Consumption in Denmark (2007): 685 PJ, 130 GJ/capita Total Electricity Consumption in Denmark (2007): 121.4 PJ Total Energy Consumption in the Public sector: 25.8 PJ, 5 GJ/capita Total Electricity Consumption in the Public sector: 9.5 PJ Energy balance: DK has been net exporter of energy since 1997

fallen for this group by circa 2% compared with 2007. Conversely, consumption by other public sector institutions has risen by 0.3% (The Danish Electricity Saving Trust, 2009/3).

The Trust was established in 1997 with the purpose of promoting electricity savings in the household and public sectors. The Trust is financed by a Special Electricity Savings Charge of DKK 0.006/kWh payable by households and the public sector. The total annual proceeds amount to ca 12 million Euro (DKK 90 million).

Background, purpose and main conclusions

Electricity consumption by the public sector and by large private businesses has been rising by more than 1% per year on average since 1980 (Danish Energy Agency, 2008). Some of the reasons for this increase are that both the public sector and private business have acquired increasing amounts of electrical equipment, including IT and office equipment, lighting, and ventilation and cooling equipment. Despite the fact that these electrical appliances and systems have become increasingly energy efficient, the efficiency gains achieved have not been able to compensate for the absolute growth in equipment and appliances. Against this background the aim of the Curve Breaker Agreements is to break the upward electricity consumption curve.

This paper describes the concept behind Curve Breaker Agreements and analyses the effect of different initiatives and tools in the agreements. The conclusion is that the concept is very popular, and that it 'works' so that electricity consumption by the agreement partners is actually falling. Agreements should be concluded at a macro level (e.g. at municipal level, rather than with individual institutions), and it is important that agreements are signed by senior management of the organisations/institutions (e.g. agreements concluded with municipalities signed by the mayor). Finally, in order for the concept to be successful, it is vital that Curve Breaker organisations receive support in the form of coaching and tools with a view to helping them to achieve the target of lowering their electricity consumption.

Working methods

Empirical research was undertaken. The source material consisted of 115 voluntary Curve Breaker Agreements concluded with the Trust in the period to March 2009 (The Danish Electricity Saving Trust, 2009). The research was also based on remote meter readings of electricity consumption and interviews with agreement partners (The Danish Electricity Saving Trust, 2008).

The source material was evaluated using statistical methods and comparison.

The research primarily focuses on agreements which have been concluded with government ministries, regions, municipalities, and other public and private sector institutions.

The Trust's strategy

In 2007, the Trust outlined its comprehensive vision for halting the growth in electricity consumption by households and the public sector by 2009 at the latest. Simply stated, the electricity consumption curve must be broken, with consumption falling thereafter. This vision is a direct extension of the political goals which state that Danish energy consumption must decrease to a lower level, with significant reductions in both fuel consumption and the impact on the environment, as well as improving the security of supply. The current financial crisis will for a time damp down the sale of electrical equipment. This will underpin the Trust's vision of the electricity consumption curve being broken in the short term. However, for the Trust it is very important that the consumption curve is broken once and for all, even in circumstances in which the economy grows.

The Trust's strategy is to move the market in the direction of more energy efficient products and solutions (The Danish Electricity Saving Trust, 2008/2). This strategy is illustrated in the figures 1, 2 and 3.

STRATEGY IN RELATION TO THE PUBLIC SECTOR

The Trust's strategy in relation to the public sector is to establish electricity savings on the agenda both politically and at management level in the individual government ministries, regions and municipalities. In this connection, The Trust uses

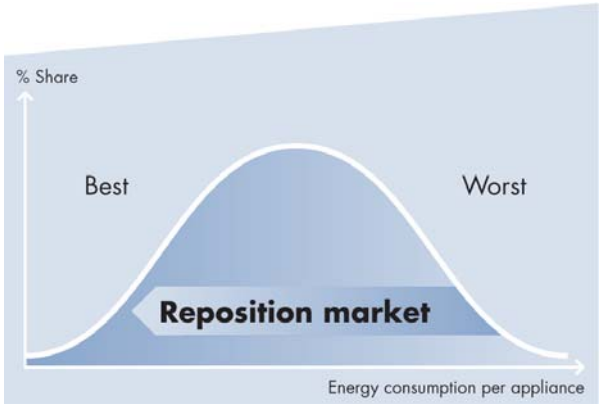

Figure 1. Moving the market. Moving the market occurs with the help of 'frontrunners', the use of benchmarks, voluntary agreements, purchasing guidelines, publicising electricity consumption and savings, etc.

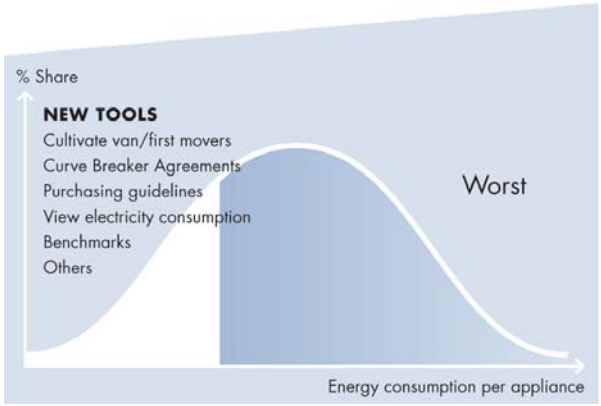

Figure 2. The 'new' tools. The 'new' tools and initiatives are important supplements to the more 'traditional tools and initiatives' such as legislation, bans, factual information, etc.

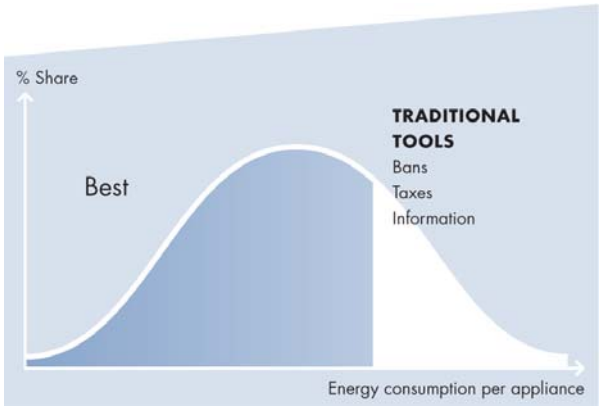

Figure 3. The traditional tools. The Trust therefore focuses primarily on 'new' tools and initiatives but also calls on the 'traditional tools and initiatives' in activities directed at the public sector for example.

a number of tools and initiatives. Some of the methods used by the Trust include public awareness-campaigns, and public debate. These activities are supplemented by campaigns and tools targeted at centrally located purchasing staff as well as decentralised purchasing and operational staff.

Since their introduction in 2007, the purpose of the Curve Breaker Agreements has been to encourage senior politicians and administrative staff to focus and support the prioritisation of electricity savings in ministries, regions and municipalities. The Trust's experience is that when ministers, or mayors in municipalities, sign a Curve Breaker Agreement, this event has been preceded by an internal process which ensures that the ministries, regions and municipalities in question can, and will live up to the targets set in the agreement. The fact that an agreement has been concluded by a political leader increases the impact, and simultaneously creates considerable commitment amongst the staff involved in discharging the agreement.

The Trust's strategy for the public sector is illustrated in the figure below.

DEVELOPMENT IN THE NUMBER OF CURVE BREAKER AGREEMENTS

The Trust's aim is to conclude as many of these Curve Breaker Agreements as possible, because the simple logic is that the curve will be broken if a sufficient number of agreements are concluded.

As mentioned above, 115 Curve Breaker Agreements have been concluded in the period to March 2009. The development in the number of agreements is expected to follow an approximate Gompertz figure:

The Trust expects that it will achieve a total number of agreements equivalent to around 50% of the public sector's electricity consumption. The electricity curve will be broken if this target is reached.

Figure 6 illustrates the rate at which the 100 Curve Breaker Agreements have been concluded since May 2007. As the graph illustrates, at the present time the Trust continues to find itself on the vertical element of the S-curve.

The Curve Breaker Agreement model and concept

Curve Breaker Agreements are offered by the Trust to ministries, regions and municipalities, and other public and private sector organisations wishing to save electricity. Entering an Agreement is free of charge; however, in order to break the curve, organisations will often need to invest in the necessary energy efficient equipment. In its standard form, the agreement is a 2-page document which describes the agreement partners' target, responsibilities and rights. Both parties sign the agreement, which typically runs for 3-5 years with the option of an extension after further negotiations (The Danish Electricity Saving Trust, 2008/4).

Agreements are concluded voluntarily between the Trust and companies or institutions in question. Once signed, an agreement binds an organisation to fulfil a target to reduce the total annual electricity consumption in relation to consumption in a defined base year (typically a reduction of 3-15% over a 3-5-year period). Furthermore, the signatory has to consent to the organisation's electricity consumption being registered on the Trust's 'View Electricity Consumption' website, which allows anyone (e.g. taxpayers, journalists and suppliers, etc.) to track the consumption hour by hour on the basis of read-

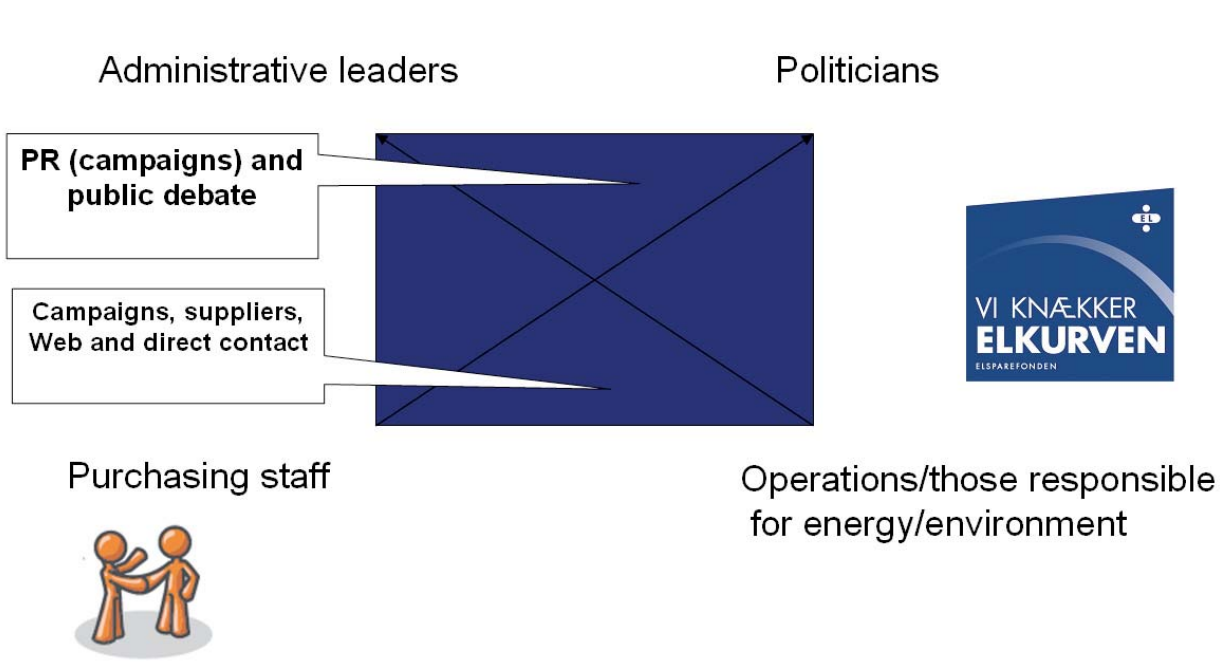

Figure 4. Strategy for the public sector

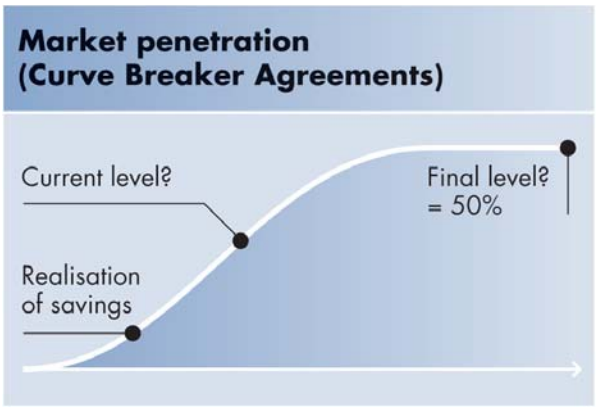

Figure 5. The Gompertz figure.

ings supplied by remotely read meters, which are automatically transferred to the website. Finally, the signatory is required to be open about how the organisation reduces its electricity consumption, so that others can learn from the experiences gained.

Organisations are free to adopt their own methods, and can choose how the target should be achieved. Both parties must work positively to achieve the target. The Trust therefore commits itself supporting partner organisations via the website and in the form of coaching, tools, guidelines and material for implementing, for example, staff campaigns (The Danish Electricity Saving Trust, 2008/3). In addition, agreement partners are invited on courses covering areas such as the energy efficient management of buildings and energy saving behaviour. The Trust's coaches and experts are also available to take part in themed meetings about energy and similar topics on the premises of agreement organisations.

There are obvious benefits for organisations concluding an agreement with the Trust. First and foremost, they receive support and help to implement the initiatives to which they are, in many cases, already committed in terms of circulars issued by the Danish government. For example, these involve commitments in connection with public sector purchasing and making electricity consumption visible (Ministry of Transport and Energy, 2005; 2007). Apart from this, organisations are obviously pleased to reap the financial benefits of any savings made. Finally, there is also a definite opportunity for organisations to benefit from greener and more socially responsible profiles in the media. The Trust tries to profile the curve breaker companies in the media, partly when concluding the agreement, and partly by collecting together a broad cross section of case stories featuring good positive ideas for saving electricity which have worked and produced results.

First and foremost, following up on agreements involves the Trust's coaches keeping in touch with curve breakers, by sending out newsletters and offers of courses on a regular basis, etc. The degree of follow-up is governed to a certain extent by the activity level of individual curve breakers. Those most active and achieving good results receive proportionately more advice and attention. In addition, the Trust is particularly keen to listen to ideas and suggestions for new tools from the most active curve breakers. The Trust attaches great importance to having guidelines and tools developed in partnership with users. Curve Breaker organisations stand out as organisations which are closely linked to the Trust. Consequently the Trust is very interested in having a two-way dialogue, and working with partner organisations on development of the Trust's new ideas and initiatives.

The concept is built round a dynamic relationship between the agreement partners. The first agreement was concluded in spring 2007, and since then the concept has been gradually fine-tuned and expanded with, for example, the addition of further offers when actual experiences have indicated the need for possible improvements.

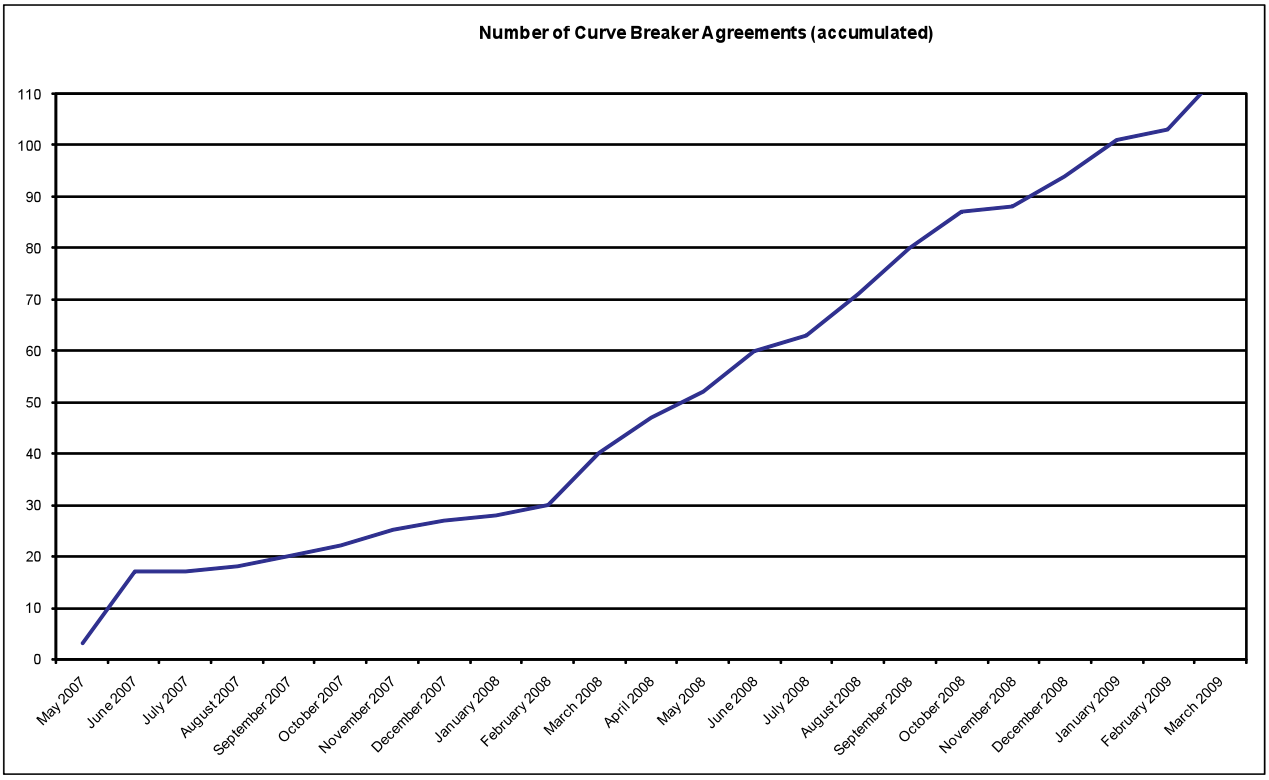

Figure 6. The growth in Curve Breaker Agreements since May 2007.

The Curve Breaker Agreement model: Tools and other offers

The actual offer of a Curve Breaker Agreement includes:

- Coaching
- Guidelines
- 'View Electricity Consumption'
- Self-check tools
- Staff campaigns and behavioural material
- Courses and training
- News by e-mail and newsletter

COACHING

Curve Breaker organisations are allocated a permanent contact person at the Trust who can be contacted by telephone and e-mail. The contact person should be regarded as a coach, i.e. as a sparring partner who can promote and facilitate electricity savings work in a curve breaker organisation. The coach has in-depth knowledge of the Trust's tools and solutions, and as such is responsible for disseminating this knowledge as required. A coach's job also involves taking the role as an 'initiator' in situations where electricity savings activities have come to a standstill and Curve Breaker organisations lack input when organising the work on an ongoing basis. Coaches act primarily as facilitators but their work needs to be continuously supplemented by services provided by in-house staff, advisers, suppliers, and other specialists (The Danish Electricity Saving Trust, 2008/5).

GUIDELINES

Coaches ensure that the Trust's guidelines are brought to the attention of Curve Breaker organisations. These primarily consist of the Trust's Purchasing Guidelines, Interior Layout Guidelines, and the Good Advice for Saving Electricity in the Server Room. These are all proven concepts which are published in brochure form and electronically as PDFs. To these should be added advice on night patrols and other guidelines which are developed and fine-tuned based on individual requirements. For many years, the Purchasing Guidelines have been a key tool in the Trust's selection of offers. These guidelines provide an overview of almost all electrical products and appliances which can be found in a public sector office organisation, including IT and office equipment, lighting, ventilation, pumps, large appliances, and consumer electronics. The product lists in the guidelines are accompanied by requirements on energy efficiency, which are fixed so that 20-25% of the products on the market can comply with them. The guidelines are updated every year in as much as requirements are tightened up and are therefore regarded as dynamic. The Trust has calculated that public sector organisations in Denmark can reduce their collective electricity bills by almost 95 million Euro (DKK 700 million) a year by purchasing energy efficiently (The Danish Electricity Saving Trust, 2008/6:3).

'SE ELFORBRUG' – VIEW ELECTRICITY CONSUMPTION

Publicising electricity consumption is an important part of the work to achieve electricity savings. For this reason the Trust has developed 'View Electricity Consumption' (Se Elforbrug), which is a website that displays electricity consumption for an individual organisation hour by hour; displays key figures for electricity consumption; and provides opportunities to compare

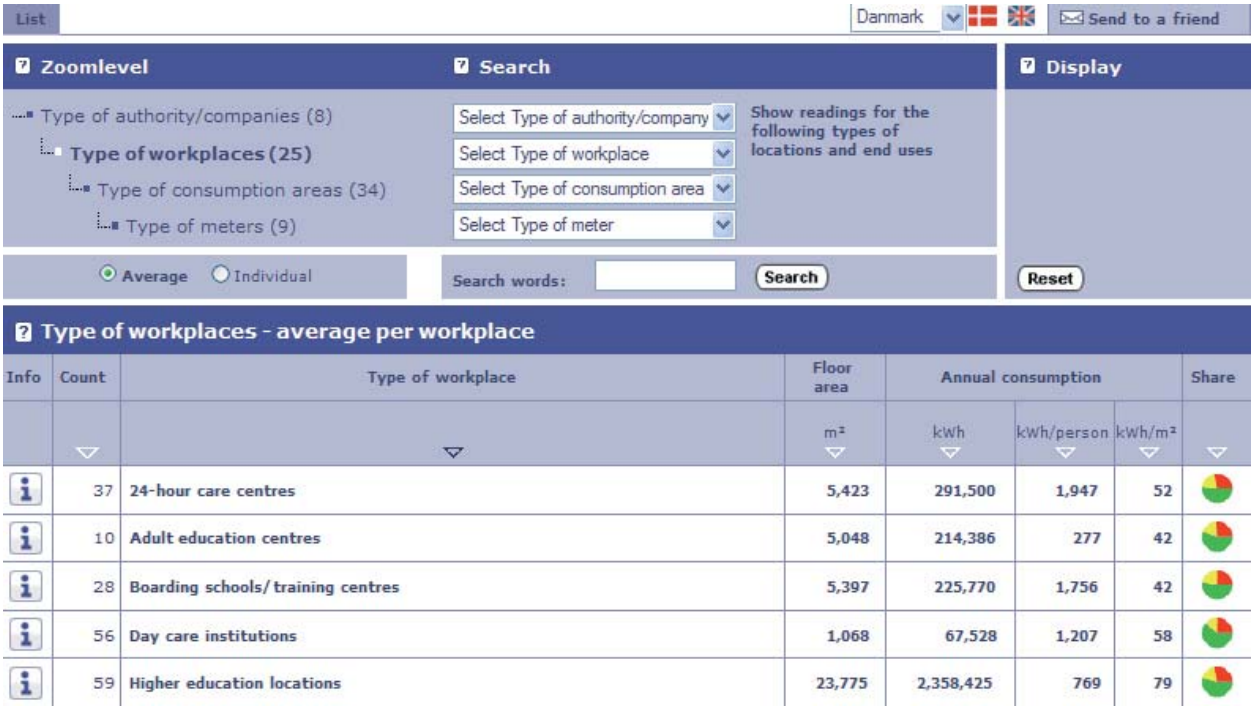

Figure 7. View Electricity Consumption – the web application

consumption with comparable institutions and organisations. As of January 2009, 'View Electricity Consumption' comprises 1,753 institutions including 302 schools, and 103 municipal administration buildings (The Danish Electricity Saving Trust, 2008).

Graphs on 'View Electricity Consumption' allow users to analyse consumption over 24 hours, and thereby identify any abnormalities or unnecessarily high consumption during the evening, night or at weekends. It is also possible to compare daily consumption with that used by other similar organisations.

SELF-CHECK TOOLS

To a large extent, the Trust's concepts are built on the 'help for self-help' principal. This is the reason why users can find several so-called 'self-help tools' on the Trust's website. These include tools for purchasing, lighting and server rooms, the purpose of which is to guide individual organisations to review and key in the solutions chosen by them. Using the built-in calculator tool, users will thereafter be steered towards a result by being shown whether the proposed solution is sensible, and how it can possibly be improved. In addition to this there are some specific energy consumption tools for daycare institutions, schools and offices, which include ventilation.

CAMPAIGN MATERIAL

Many curve breakers have reached a point where they think it is not easy to achieve additional electricity savings with the help of technicians. Therefore in 2007, the Trust developed material with a view to promoting energy responsible behaviour. This material, which can be ordered and supplied free of charge, consists of a campaign guide, posters, stickers, door hang tags, guidelines for operation and maintenance staff on setting up equipment, and school material for use by the youngest classes (The Danish Electricity Saving Trust, 2007). In 2009 the Trust will be supplying new material to the municipalities especially targeted at schools with improved behavioural material. Coaches would like to help Curve Breaker organisations with guidelines in connection with organising and implementing energy saving campaigns.

COURSES AND TRAINING

Curve Breaker organisations receive offers to participate at no cost on various courses, and equally they can influence which courses are offered. In 2007 and 2008, the Trust offered courses on the following themes: energy responsible behaviour, energy savings in the server room and from IT, night patrols and publicising electricity consumption, intro course for curve breakers, and energy efficient purchasing.

NEWSLETTERS, ETC.

Finally, the Trust periodically sends out newsletters and e-mails to Curve Breaker organisations with information on new tools, courses and other offers from the Trust.

Results – do Curve Breaker Agreements work?

Curve breaker concepts are new, but there are already indications that they are working. In addition, at least it is possible to conclude that the concept is popular. Since March 2008, Curve Breaker Agreement have been streaming in with 7 new agreements a month on average, and this flow looks as if it will increase further in 2009.

The fact that Curve Breaker Agreements have become so popular, especially in the municipalities, dovetails with a growing interest by politicians and management to make an effort to save electricity. Today, Danish electricity production is based on a combination of coal, natural gas and renewable energy sources (wind turbines and biomass-based decentralised power

stations). In particular, the use of coal is responsible for a high level of CO_2 emissions, and electricity savings can contribute to reducing the amount of coal burnt.

At the same time, the municipalities traditionally play an important part in planning energy supplies and local energy and environmental work (e.g. Agenda 21), so in this respect Curve Breaker Agreements can make a definite contribution to this work.

Curve Breaker organisations have broadly made use of the Trust's concepts and have provided positive feedback about them. The dialogue is important for the Trust which, in return, continually adjusts and adapts the tools to achieve improvements and even greater impact.

The concept has been able to create awareness and encourage initiatives about electricity savings, and thus has been able to activate the positive wave in the public sector which is required to break the upward consumption curve. Government ministries, regions and municipalities, and other public and private sector institutions with Curve Breaker Agreements are placing electricity savings on the agenda, and are receiving positive press coverage. As awareness grows that savings are achievable so the positive spiral gathers pace.

In September 2008, the Danish Energy Agency commissioned a report of the potential to save electricity by government departments and ministries (Dansk Energi Analyse A/S, 2008). The survey revealed potential savings of 23% over a repayment horizon of up to 4 years, and 27% over a repayment period of up to six years.

Although electricity consumption in the Danish public sector has risen by nearly 1% over the past 10 years, provisional measurements show that electricity consumption is actually on the way down in the public sector (The Danish Electricity Saving Trust, 2009/2). This trend is more distinct for curve breakers, where consumption has fallen for this group by circa 2% in 2008 compared with 2007. Conversely, consumption by other public sector institutions has risen slightly by 0.3% (The Danish Electricity Saving Trust, 2009/3).

Case: The Municipality of Lyngby

The Municipality of Lyngby was the first municipality in Denmark to conclude a Curve Breaker Agreement. The municipality had been focusing on energy savings for many years, but in terms of electricity savings the target was to 'keep electricity consumption in check', in other words at an unchanged level. By signing a Curve Breaker Agreement the Municipality of Lyngby decided to raise the ambition level by setting a 3% reduction target over a 3-year period, and it was an advantage that it was the whole municipality led by the mayor which committed itself to the agreement with the Trust. Provisional results are shown below. The staff responsible for energy in the Municipality of Lyngby accepted that the Curve Breaker Agreement has been the catalyst in a reduction of electricity consumption in Lyngby. The municipality gives prominence to the Trust's guidelines, campaign material and offers of courses to its technical staff, just as coaching in a general sense has been of assistance to the municipality's efforts to reduce electricity consumption (Hegelund, 2008).

Conclusions and lessons learnt

All in all, experiences with the curve breaker concept have gone well over the concept's first 18 months. The concept is popular, which contributes to the advancement of falling electricity consumption. Some of the important experiences gained from using the concept in Denmark are summarised below:

- Agreements should be concluded at macro level, i.e. with as large administrative units as possible.
- Agreements should be signed by senior management, e.g. the mayor of a municipality.
- It is important that the agreement parties can track the electricity consumption trend in an individual institution within a curve breaker organisation. In Denmark the Trust has developed 'View Electricity Consumption' where it is possible to compare electricity consumption and key figures with others (The Danish Electricity Saving Trust, 2008).
- Curve Breaker organisations require coaching and support in the form of tools and solutions with the aim of achieving the target of lowering their electricity consumption.
- Following up the agreements should take place throughout the agreement period, e.g. in the form of contact on the initiative of the coach and periodic reports which show and comment on the trend in electricity consumption. (NB. In Denmark, the latter point is covered by View Electricity Consumption)
- Curve Breaker organisations are particularly pleased with very specific tools, which are easy to use and translate into actions, e.g. the Purchasing Guidelines, self-check tools and campaign material.

The greatest risk of an advanced concept is that the scheme runs out of steam because results are slow at arriving, or because an agreement is either not sufficiently followed up, or not followed up for long enough. When launching a concept it is absolutely vital to follow it up. This is a resource-demanding process because the Trust's agreement partners must always feel that they are receiving something back from the agreement. Therefore it is important to ensure that resources are in place over several years to implement the concept.

Curve Breaker Agreements are proving to be particularly applicable and useful in Denmark because many of the features and tools such as the facility to view electricity consumption are already in place. Also, the Trust has a well-developed structure for implementing, monitoring and obtaining feedback about agreements in place.

Nonetheless, there has been considerable interest in the curve breaker model abroad. Examples include the recent decision by the Ministry of Public Works in Malaysia to enter into a collaboration with the Trust which will lead to the signing of the first Curve Breaker Agreement outside Denmark. Initially, this will allow 50 buildings to monitor their energy consumption at 'Se Elforbrug' (View Electricity Consumption).

Another notable example is the recent signing of a Curve Breaker Agreement by the French Embassy to send a clear signal that France is committed to tackling climate problems and supports Denmark's efforts in the run-up to the United Nations Climate Change Conference (COP15) in Copenhagen.

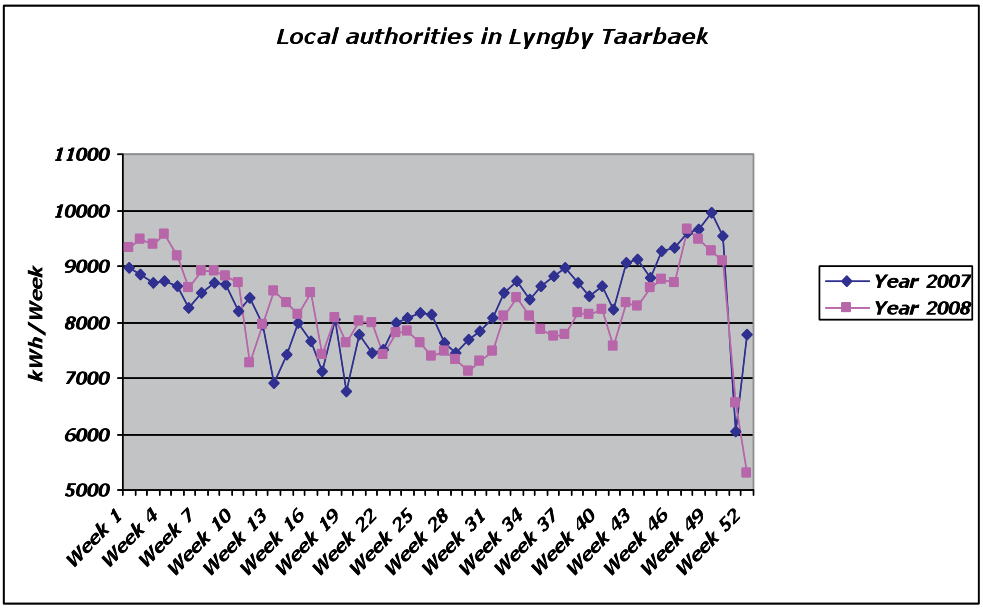

Figure 8. Consumption of Lyngby

Table 2. Facts about Lyngby

Total inhabitants: 52,000
Total of circa 200 municipal buildings spread across 50 institutions, including 12 schools
Electricity consumption in buildings in base year 2004: 12.5 GWh
Curve Breaker Agreement concluded for 3 years: 2007-2009
Agreement target: 3% less electricity consumption in year 3

These agreements, and others in the pipeline, indicate that the Trust's Curve Breaker Agreement model could be easily adapted to suit the individual circumstances of public sector organisations in other countries.

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