

Increasing energy efficiency in government institutions

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Abstract

In Denmark, government institutions are subject to a circular (CIR no. 27 of 19 April 2005) to improve energy performance of buildings and enhance energy efficient behaviour, including purchase of goods and appliances. A dialogue between the governmental energy authorities, municipalities and regions has been initiated aiming at extending the regulation to all public institutions.

The potential for electricity savings in public institutions has been estimated to 1,2 TWh annually, or 30 %. The new circular aims at utilising this potential. 80 % will be achieved by efficient lighting, ventilation, IT and server equipment.

Another potential exists in heat savings. Most public buildings are already well managed, due to mandatory certificates that outline measures to improve energy performance.

The circular includes requirements with regard to:

- organisation of energy management
- energy efficient procurement policy
- implementation of projects (investments) with a pay-back time of 5 years or less
- cost effective maintenance and renovation of buildings
- energy sound behaviour of employees

An analysis has been carried out in 2006 to stipulate an expected cash flow from such investment in energy efficiency improvements with a pay-back time until 5 years. The result

of the analysis shows that from a 10 years perspective, it seems highly viable to introduce this part of the governmental circular to municipalities and regions.

Introduction

Energy savings in the public sector have had an ambiguous reputation in energy efficiency policies. On the one hand, the opportunities seem to be straight forward, on the other hand many efforts have stranded due to lack of motivation or too many barriers. As the request for energy efficiency measures grows, the focus on the public sector is also increasing.

In Denmark, energy use of the public sector is now being monitored and managed by comprehensive programmes for all state-owned buildings. One important element is the mandatory implementation of projects (investments) in energy savings with a pay-back time until 5 years. This scheme is now being carried out, and it is considered to expand it to also cover municipal and other public buildings.

Huge energy efficiency potential

Denmark is known world wide for its initiatives and results in energy efficiency, and maybe not least for its energy efficient buildings. For a number of years, Denmark has had the lowest energy intensity (energy-to-GDP relation) in Europe (in 2004: 5,0 compared to an EU average of 7,6 cf. Danish Energy Authority: "Energy in Denmark 2005"), indicating that production has steadily increased, while the overall energy consumption has been kept stable. One reason for this is that a number of energy efficiency policies and schemes have been implemented, targeted at all sectors of the Danish society. How-

Table 1. Identified energy efficiency projects in all municipal and regional public buildings

EE projects investment and savings			
Pay-back time	no. projects	Investment needs	Annual saving
		[Mill EURO]	[Mill EURO]
0 year	1.360	-	1,4
<1 year	3.962	1,2	4,2
<2 years	6.331	4,8	6,5
<3 years	8.260	9,4	8,4
<4 years	10.209	16,8	10,5
<5 years	11.827	26,4	12,6
<10 years	17.680	80,9	20,3
Unlimited	23.015	1.246,3	27,0

ever, even though Denmark has been leading in promoting energy consciousness and savings since 1974, the potential for energy savings is still huge. The Danish Energy Authority has estimated the feasible energy saving potential in the public sector alone to correspond to economic savings of 55 million DKK (7,4 million EURO) per year.

Over the years, a number of specific saving policy initiatives have been targeted at institutions at all levels: government institutions, regional authorities, municipalities and their institutions. The strategy has been that the public sector should demonstrate to be an exemplary frontrunner.

This paper focuses on the savings potential in the public sector, and in particular on how this potential can be captured by making energy certificates for large buildings an active tool, through regulation. The paper refers to an analysis of the volume of energy initiatives in municipal and regional institutions, which could be implemented within a reasonable pay-back time. The conclusions are based on a survey, which was initiated by the Danish Energy Authority and carried out by Birch & Krogboe in 2006.

Energy certificates as an active tool

It is a good idea to make energy certificates an active tool - by committing building owners to implement recommended energy efficiency projects.

The main philosophy behind the present Danish national energy policy is that energy saving measures must be cost effective. This will to a large extent lead to market driven results ("demand-pull"). However, years of experience has shown that this is not enough. Not all of the energy savings potential is realised automatically, even though internal rate of return of investments may look promising. A "regulation-push" will most often be helpful. At least this is the thinking behind Circular no. 27 of 19 April 2005 (the EE Circular), which at present has to be complied with by 19 ministries and a total of some 1200 government institutions.

According to the Danish EE Circular, energy efficiency project investments, which have been identified in existing energy certificates to have a pay-back time of 5 years or less, *must*

be implemented within a 4 year period. In Denmark, energy labelling of large buildings has been mandatory since 1997. The certificates (the labels) contain a rating (at present the categories: A - G), as well as an energy plan, including suggested initiatives and investments aimed at improving the energy performance of the building. This information is extremely valuable; however, it was not necessarily used, until the EE Circular came into force. The Circular includes requirements with regard to:

- organisation of energy management
- energy efficient procurement policy
- implementation of projects (investments) with a pay-back time of 5 years or less
- cost effective maintenance and renovation of buildings
- energy sound behaviour of employees

A cash flow analysis based on given information in existing energy certificates indicates that, from a 10 year perspective, it is highly viable to enlarge the EE Circular to municipalities and regions as regards the requirement of implementing viable investment projects.

Based on detailed information given in databases including all existing Danish energy certificates on public buildings issued since 2004, we know that almost 12.000 investment projects in Danish municipalities and regions could be implemented with a pay-back period of 5 years or less. The needed investment is estimated to 196 millions DKK (26 MEURO), providing annual savings of 94 millions DKK (12,5 MEURO). Table 1 shows the number of defined energy projects given various pay-back times, and it indicates the cumulative investment needs and the corresponding saving.

With regard to the quality of data it should be noted that the energy plans included in the energy certificates are made by individual certified consultants. Thus the specific projects being suggested and the evaluation of viability are subject to estimates made by individuals. Consultants may to a high degree agree on the identification of measure, whereas the evaluation of viability is more uncertain. Availability of data is excellent given a mandatory regulation and the existence of standardised forms. Information from the total database is included in the survey.

Figure 1 shows the simple cash-flow (without discounting), given identified energy improving investment projects with a pay back time of 5 years or less as the "viability criteria". The diagram, which of course is based on actual energy prices, includes the total of all relevant projects. Changes in energy prices will certainly influence the number of viable projects. As can be seen from the diagram, we follow the requirement in the EE Circular that investments take place (linear) over 4 years. The cash flow figure given in diagram 1 does not show a fully realistic picture of the effect of enlarging the EE Circular to Danish municipalities and regions, because we should encounter that some investment would be made in any case. In the "worst case", this would happen for investments with payback periods of 1-2 years, which accordingly should be deducted from the diagram (fig. 1).

Figure 2 shows the "worst case" cash-flow when only encountering investment projects with pay-back time from 2 to

cash-flow

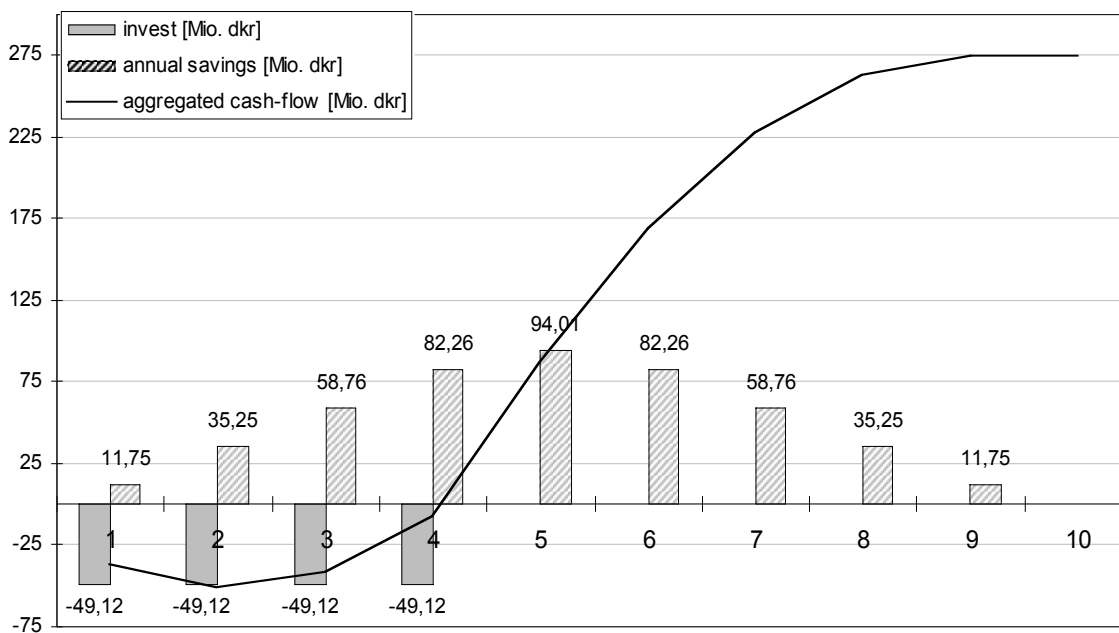


Figure 1: Aggregated cumulative cash-flow of investments in energy efficiency projects and expected savings (millions Danish kroner, 1 EURO = 7,45 DKK). Campaigns to improve energy efficient behaviour are included.

cash-flow (payback time 2...5 years)

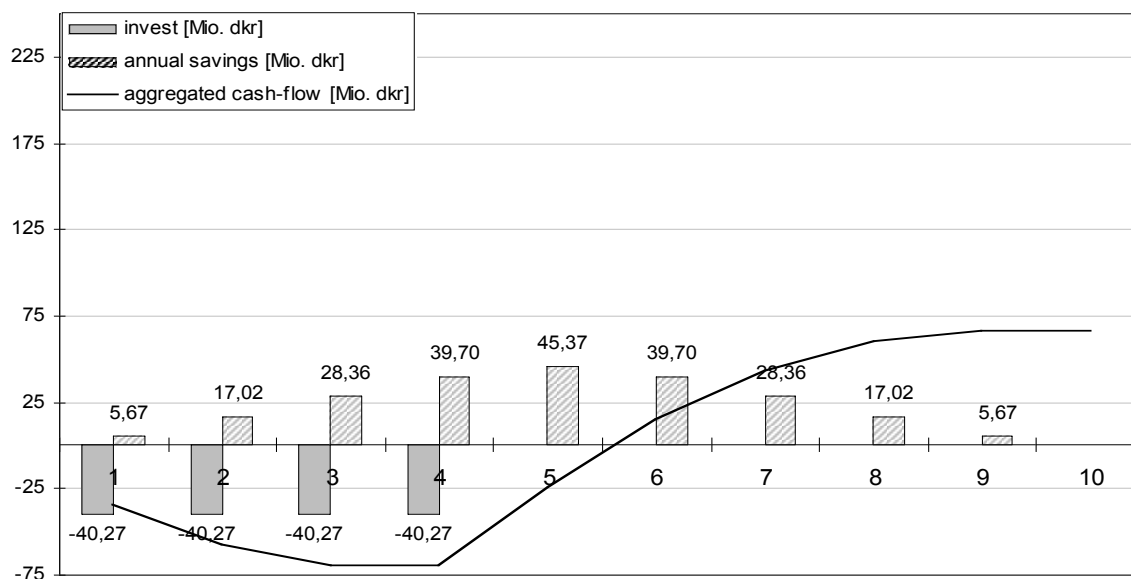


Figure 2: Aggregated cash-flow on investment in energy efficiency and expected saving, only projects with pay-back time 2-5 years (Millions Danish kroner, 1 EURO = 7,45 DKK).

5 years. In this situation one could argue that the lifetime of projects would be longer, which accordingly would increase the savings on the investment.

Conclusion

Even though Denmark has been a pioneer in creating energy efficient buildings, the energy savings potential is still huge, not least in the public sector. This potential can be captured by requiring institutions to implement all viable investment projects that have been or will be identified in the mandatory energy labels, which must include such recommendations.

Most of the identified improvement projects appear to have a very short payback time, less than 2 years. The volume of such potential investment projects confirms that the improvements do not happen automatically. Therefore, a measure like the circular on energy efficiency in government institutions, which has been introduced in Denmark is highly recommended.

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