Total Concept – for better decision-making about energy efficiency investments in non-residential buildings

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Abstract

In order to reach the 20-20-20 EU-targets it will be essential to increase the ambition among building owners to make refurbishments to achieve nearly zero-energy buildings. However, the measures that significantly reduce the energy need often entail considerable investments. If the measures are to be carried out they have to align with the property owner's expectations of long–term investments.

Until now, very little support is offered to the building owners regarding how to make the best decisions of investment in order to improve the energy performance of their buildings and reduce running costs. The decisions are often based on the profitability of single measures, and the feasibility is commonly evaluated with simple financial methods, e.g. simple payback method, which does not take into account the life time of the total investment and technical systems and rarely the future changes in energy prices. With this approach there is a great risk that only the simple measures, "the low hanging fruit", will be carried out while a number of other possible measures with great energy saving potential will be overlooked.

In order to overcome this obvious risk, a method called the Total Concept, has been developed and successfully applied on a large number of non-residential buildings in Sweden. The results from these pilot projects show that it is possible to achieve energy savings up to 40–70 %. Moreover, this is done within the profitability frame set by the building owner, expressed as expected internal rate of return for the investment. The basic idea with the Total Concept method is to form and implement a package of energy saving measures that together fulfil the profitability frame set by the building owner. In the method, the most financially profitable measures will assist the less profitable measures. The Total Concept method use a systematic approach throughout the whole building process of the energy retrofit, and includes both quality assurance of the process as well as a way of presentation of financial facts that provide guidance in how to make a decision in a complex situation with a lot of options.

The Total Concept method includes the economic realities a building owner has to take into account, and at the same time increase the ambition and makes it possible to achieve greater energy savings compared with traditional methods. Currently, the method is being tried out in Sweden, Denmark, Finland, Estonia and Norway.

Introduction

Improved energy efficiency and decrease of the total energy consumption in the building sector has been on the agenda during the last decades in most of the European countries. The ambitious vision of energy performance of European buildings requires that all new buildings must be "nearly zero-energy" buildings by the end of 2020. Moreover, minimum requirements should be set when buildings undergo a major renovation, to the extent that this is technically, functionally and economically feasible. Consequently, in order to reach the 20-20-20 EU-targets, it will be essential to dramatically lower the energy demand in a large proportion of existing buildings. This requires an increase in the ambitions among building owners to make refurbishments with energy performance towards nearly zero-energy buildings.

Previously completed energy retrofitting projects in existing non–residential buildings in Sweden have shown that it is relatively easy to identify a number of individual measures, each with a potential reduction of energy need in a building. It can, as an example, be adjustment of the heating system or time control of the ventilation system. Although some of these measures can be carried out at a low cost, the measures that significantly reduce the energy need often entail considerable investments, like installation of demand control ventilation with heat recovery or improvement of the thermal envelope. Essentially, investment that is deemed necessary must be paid for by the property owner.

Even though the possibilities for energy improvements seem to be considerable, national statistics show only a small (about 10–15 %) energy improvement in the non-residential sector from 1995 to 2002 in Sweden and thereafter until 2010 the energy use has more or less been stable (Statistics Sweden). The question is why greater improvements have not been performed were raised within the BELOK group. BELOK is a network connected to the Swedish Energy Agency with 18 large Swedish non-residential real estate owners, whom in total manage about 25 % of the Swedish non-residential building stock (about 35 million square meters). Interviews with the group showed that the reasons why greater improvements have not been performed were, among others, that easy carried out measures which were profitable in the short term, "the low hanging fruit", had already been carried out. Additionally, there were no coordination of energy improvements within ordinary renovation and there seemed to be a misunderstanding about the connection between saved energy in kWh and profitability in the communication between the technical department and the economical department. In practice, this meant that if the measures were to be carried out, they would have to comply with the property owner's or the client's terms and conditions for long-term investments, and the technical department didn't know how to present that.

Back in the late 2000s little support was provided to building owners on how to make the best decisions of investment in order to improve the energy performance of their buildings and reduce running costs. The decisions were often based on profitability of single measures, whereas the feasibility were often evaluated with simple financial methods, which did not take into account the whole life costs of the total investment/technical systems and rarely the changes in energy prices. With this approach, only the very profitable measures are commonly considered and carried out, "the low hanging fruits", while a number of possible measures with great energy saving potential will be overlooked. Furthermore, from experiences in the BELOK group, this way of working often only leads to energy savings of maximum twenty per cent. In order to reach the target of 20 % energy reduction until 2020 it is necessity that each building, when carrying out measures, makes an energy performance improvement of at least 50 %.

It was realized that another kind of financial method was needed in order to present the possibilities of larger investment, at the same time as the basis and the economic realities of the building owner are considered. The need was to be able to present the financial conditions of the possibility to go further with more carried out measures and still meet the profitability expectations set by the building owner. Therefore, a new and innovative working method was developed, called the Total Concept, which aims to motivate building owners to take a step further and make decisions on larger investments.

During recent years, a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements has been proposed by the European Commission (2012/C 115/01) in connection with the implementation of the EPBD (Energy Performance of Building Directive 2010/31/EU). This cost-optimal methodology is meant to assist the Member States in the implementation of the EPBD. The guidelines in the methodology are intended to facilitate the application of the Regulation and the reporting to the European Commission. In other words, the model is not meant to be used for a specific building.

According to the cost-optimal methodology, life cycle costs for the energy efficiency measures should be estimated based on a calculation period of 20 years for non-residential buildings, and on a real discount rate of 3 %. (Additionally calculations can be done with other discount rates.) Moreover, the global cost includes the sum of the present value of the initial investment costs, the sum of running costs, replacement costs (referred to the starting year), as well as disposal costs if applicable. The principles of the method are illustrated in Figure 1.

Each number represents a package of measures: package 0 presents the existing building, package 1 the existing building with one measure, package 2 the existing building with two measures and so on. Package 6 gives the lowest energy use but also the highest lifecycle cost. Package 2 represents the cost optimal level where the life cycle cost is the lowest. Thereby, the method shows that if energy renovation has to be performed, package 2 is the most cost-effective solution to choose. However, it does not show if package 2 is cost-efficient, i.e. if it is profitable in terms of the conditions set by the building owner. Package 5 represents the package which will have the same global costs as doing nothing at all (i.e. running costs for 20 years). By doing the same calculations, but with a discount rate that complies with the profitability demand set by the building owner, it could be shown if the cost optimal point is cost-efficient and to which point it will be possible to go and still have the same profitability as doing nothing at all.

The Total Concept method is based on the same economical conditions, calculating the global cost of a package of measures as the cost-optimal methodology, but the results of the calculations are presented in a different way. The Total Concept method aims to present how it can be possible to go further with more measures carried out and still meet the profitability expectations set by the building owner.

The Total Concept method

Total Concept is a method for improving energy performance in existing non-residential buildings and applies a refined systematic approach to the work with energy issues in buildings, with the aim of achieving maximum energy savings in a cost efficient way. The method has been developed by taking into account the economic realities which the building owner needs to consider (Total Concept, 2014:1). This means, that in order carry out energy saving measures the following prerequisites must be fulfilled:

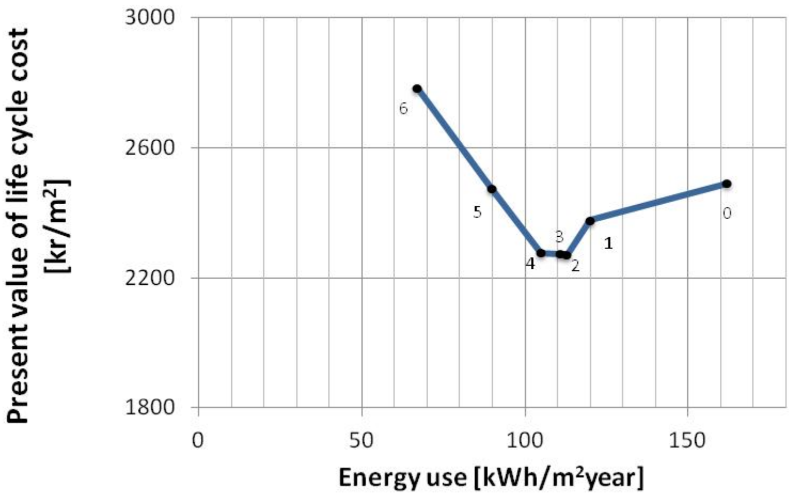

Figure 1. Illustration showing the cost-effective package of measure with the cost-optimal methodology proposed by the European Commission. Each number on the figure presents a package of measures and the cost optimal range is around points 2, 3 and 4.

- The investments deemed necessary to carry out the required measures must be profitable. In other words, the property owner's financial requirements for long-term investments must be met.
- The assessment of the necessary investments, and the future yearly savings on which the investment decisions are made, must be reliable.

Furthermore, when energy efficiency measures are carried out in existing buildings it is important that they are performed so that:

- The quality of the building and its usefulness is maintained or improved.
- The greatest possible savings are achieved using the allocated resources.

THE ECONOMIC MODEL

The Total Concept method is based on an action plan that comprise a package of measures that *as a whole* meets the profitability conditions stipulated by the property owner. In order to present the cost-efficiency in a simple-to-understand way, internal rate of return model is used. The prerequisite for attaining profitability is that the internal rate of return is higher than the investor's demand on investment and that the whole action package is implemented in its entirety.

In order to create an action package of measures, the procedure starts with a comprehensive audit carried out in the building; the building's energy certificate contributes to the identification of possible energy saving measures. All measures that may have energy saving potential should be considered.

When a number of energy savings measures have been identified and their investment costs and annual cost savings have been calculated, they can all be plotted as points in an internal rate of return diagram. In such a diagram, with the reduction of annual costs on the y-axis and investment costs on the x-axis, it is possible, for a given economic calculation period, to add lines which represent different rates of return (see Figure 2). Every energy saving measure implies a certain cost € and result in a certain decrease in the annual operating cost €/a, represented by a line in the diagram with a certain length and slope. The slope represents the internal rate of return which the investment creates. By arranging the different energy saving measures by their profitability an action package is created. Additionally, when a number of measures are considered simultaneously, their effects on each other must be taken into account. If a particular measure is carried out first, then the savings potential in another measure might be reduced, compared to if they were carried out the other way round. This means that the order in which the measures are carried out can have an impact on how much a specific measure can save. An action package is created by first taking the most profitable measure. In the next point, when the second most profitable measure is added, a new energy simulation is needed in order to consider the measures impact each other, and so on for the next measure and the next point.

Figure 2 illustrates how an action package can be presented in an internal rate of return diagram. The number of energy saving measures that will be included in the cost-efficient action package is dependent on the criterion that the internal rate of return for the whole package must fulfil the investor's expectation of investments.

By working in this way, where the "package" of measures is carried out instead of just making the first very profitable measures, a major benefit is gained in terms of achieving much more energy savings within the profitability requirements of the real estate owner. The most profitable measures will assist the investments that, on their own, would have been unprofitable. However, the action package, as a whole, is still profitable. In this way it will be possible to show that a considerably larger energy saving can be economically feasible, which will help to improve the ambition of the building owner to take steps towards nearly zero-energy buildings.

In the example shown in Figure 2, the profitability requirement is that the internal rate of return must be at least 5 %. The complete action package (M1–M6) meets this demand with an internal rate of return of 7 % and leads to a halving of the an-

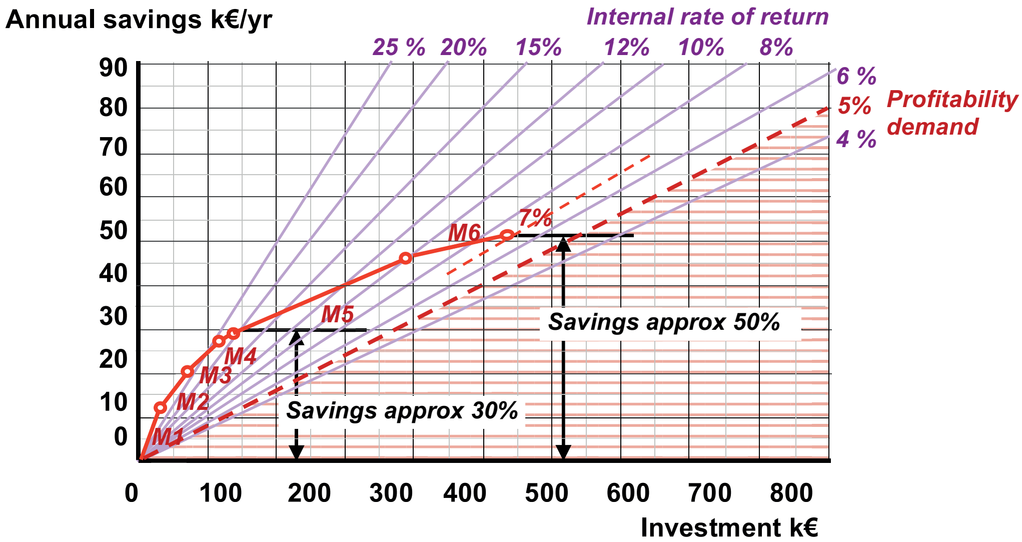

Figure 2. Presentation of an action package with six measures (M1–M6) in an internal rate of return diagram. The diagram shows the actual returns, as real interest levels, given by each investment. The property owners' profitability requirement for the investment is in this case an internal rate of return of 5 %. The whole package of measures in the example gives an internal rate of return of 7 %.

nual energy costs, which approximately corresponds to a halving of the use of energy. On the other hand, if only the measures that were profitable on their own were carried out (M1–M4) the savings would have been only 30 %. The complete action package is profitable since the most profitable measures make up for the other measures. It would be disadvantageous to first carry out the most profitable measures and postpone the others to a later date since the measures that were not profitable on their own, but important from an energy point of view, would most probably never be carried out. This is because there would no longer be any profitable measures available to make up for the unprofitable measures.

Development of the economic model for different economic lifetimes

Every internal rate of return diagrams is valid for a specific economic calculation period. It could be the same as the economic lifetime of a measure, but property owners/clients sometimes choose shorter periods. Energy saving measures in non-residential buildings often have different economic lifetimes. For example, technical installations often have economical lifetimes of 15 to 20 years while building components might have an economical lifetime of 40 years. However, it might be desirable to be able to show them at the same time in the same diagram. Therefore, they have been combined in one diagram where the slopes of the internal rate of return curves have been adjusted to the economic calculation period of each measure. If a number of measures, with different economic calculation periods are combined, it can be taken into account by correcting the savings effects of the different measures.

The common internal rate of return r_i for two simultaneous measures – B_{01} € with an economic calculation period of n_1 years and B_{02} € with an economical calculation period of n_2 years, with yields of a_1 €/year and a_2 €/year respectively – is determined when the sum of the present values of the yields covers the whole investment:

$$B_{01} + B_{02} = I(r_i,n_1)\cdot a_1 + I(r_i,n_2)\cdot a_2$$

where $I(r_i,n_1)$ and $I(r_i,n_2)$ are the net present value factors for the annual yields of a_1 and a_2.

It is quite time-consuming to do this manually but is simple to carry out using a calculation program such as the Total Concept calculation tool *TotalTool* (free to down load at www.belok.se). In Figure 3 an example is presented. With this tool it is also possible to take into account the relative energy price changes.

THE WORK PROCESS OF THE TOTAL CONCEPT METHOD

In order to quality assure that the expected saving actually will be reached, a systematic approach is important through the complete building process of the energy retrofit. To assure this systematic approach the work process of Total Concept has been structured into three main steps, as shown in Figure 4:

1. In Step 1 a comprehensive inventory is carried out in the building to identify all conceivable energy saving measures, the data from the energy certificates can be used as a starting point. Various calculations and an analysis based on the compiled data result in an action package and provide an information base presented in the internal rate of return diagram from which the owner of the building can make decisions.

2. In Step 2 the implementation of an entire action package in the building is carried out. The focus needs to be on the quality of the work, and to make sure that designed intent will lead to the expected energy savings. Step 2 is based on planning and designing the measures, construction work and installations, and functional and performance checks. Beside the added performance check of the building services, the process is basically the same as in any normal construction project.

3. In Step 3 the follow up of the implemented measures is performed, and involves measuring and checking procedures to ensure that the expected result of energy performance has been achieved. The energy use during at least one year after

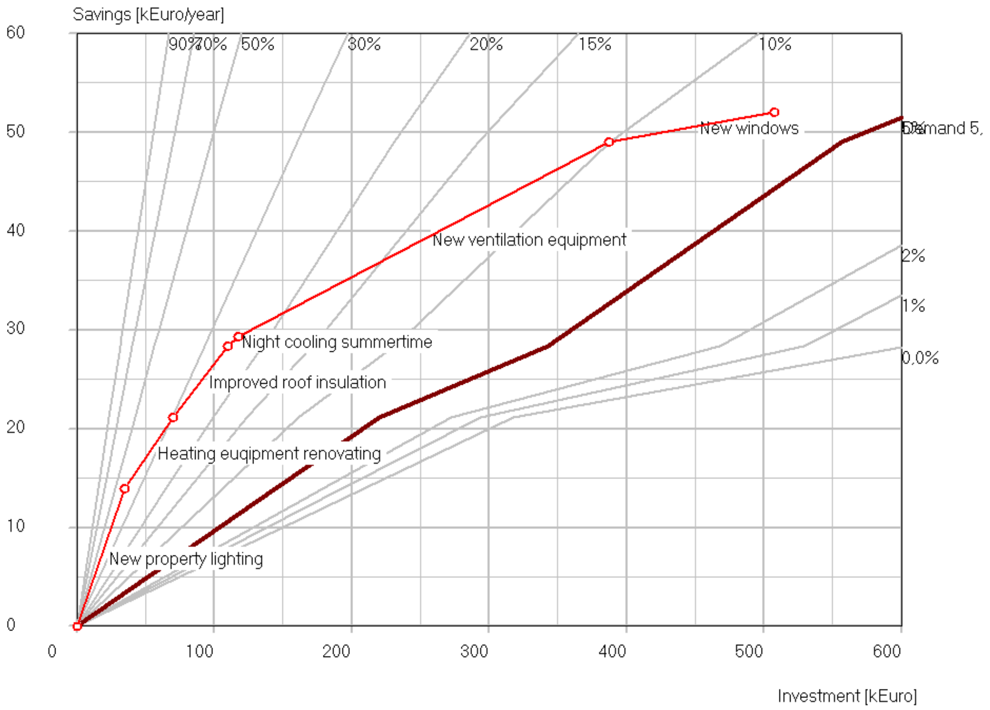

Figure 3. Example of how an action package is presented in the TotalTool. The economic lifetime for different measures are shown by the discontinuities in the internal rate of return lines.

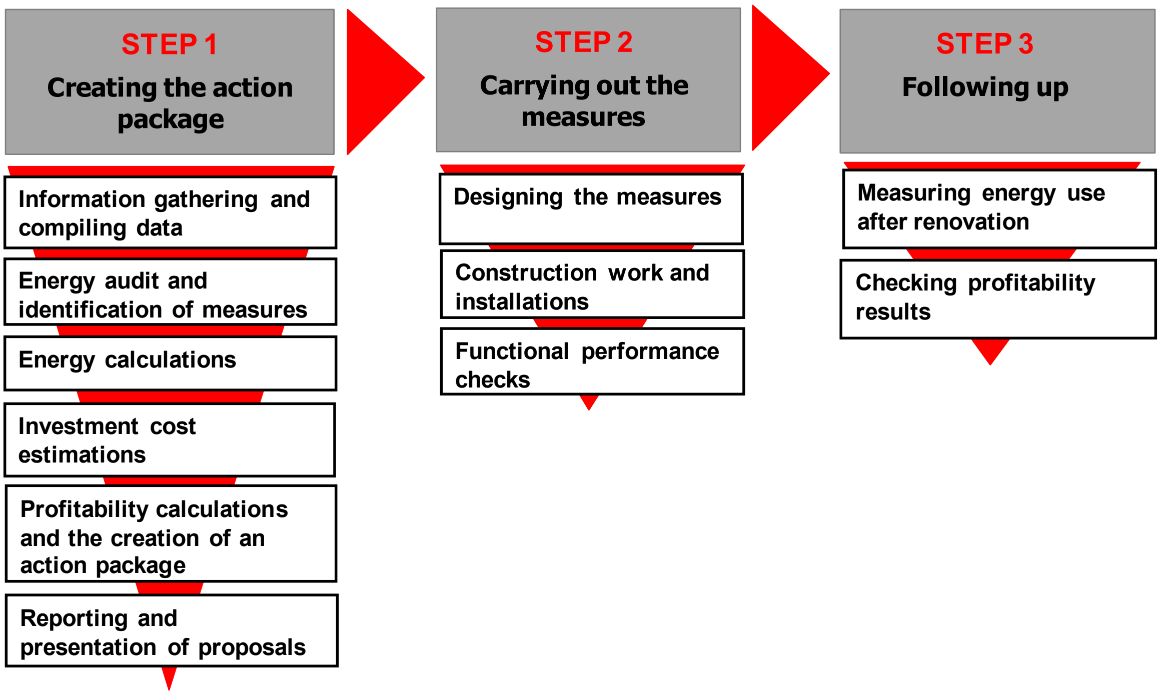

Figure 4. The work structure of the Total Concept method comprises three main working steps.

is compared to the energy use before implementation of the action package. If the measured energy performance differs from the designed values, the cause must be found and any errors or deficiencies corrected and remedied.

A HOLISTIC APPROACH

A holistic approach is applied when carrying out the technical assessment of the building and in the evaluation of the potential savings. In non-residential buildings large savings potentials can often be found in the different technical systems, such as systems for lighting, ventilation, heating and cooling. Building energy efficiency can be improved with a range of different measures in:

- Building envelope (changing the windows, additional insulation to the roof, etc.).
- Ventilation system (improving the heat exchanger, replacing the ventilators, changing to demand controlled ventilation, etc.).
- Heating system (improving the control, changing the thermostats, adding frequency inverters to the pumps, etc.).
- Cooling system (adding solar shading, decreasing internal heat gains, improving the control, replacing the thermostats, adding frequency inverters to the pumps, etc.).
- Lighting (adding occupancy control, changing to more efficient lighting).
- Optimising the system's operation and control.

STAKEHOLDERS AND KEY ACTORS

Experience shows that only by following all these three steps the aimed results can be achieved, which will give the building owner confidence that the method is reliable and should be used again in future project. Besides the systematic approach within the three steps, a professional execution is important, including good knowledge and awareness among the different stakeholders and key actors about their roles and responsibilities.

A number of stakeholders and key actors will directly or indirectly be involved in the process and they may have influences on the result of the energy improvement. These common stakeholders and key actors are illustrated in the scheme in Figure 5.

The stakeholders are the property owner/client, who will initiate and normally commission the project based on the Total Concept method. The term "client" can both refer to a property owner and another investor or decision maker, who has the interest to invest in energy saving measures in the building, for example a tenant company that pays for its own energy costs, an ESCO company, etc.

The in-house key actors are the personnel working in the building and/or for the property owner and they have a key role by knowing the relevant information about the building, its use and its operations. This group includes *property managers,* who are responsible for the buildings in question and might play an important role when it comes to investment decisions. Additionally, the group includes *facility management staff (maintenance staff),* who are responsible for the operation of all the systems in a building and can directly control, and have a long term influence of, the energy use in the building. Other in-house key actors are *the tenants* who have a significant influence on the energy use in the building and it is therefore essential for the property owner/client to keep the tenants well–informed and to be responsive to their needs. Additionally, in some cases carrying out energy saving measures can be the tenant's responsibility, e.g. measures related to the lighting system and the machines/equipment used for their work.

The external key actors are companies, who will practically carry out the different steps in the Total Concept method and offer their services and products to the property owner/client for the energy retrofit. This group includes *energy consultants*

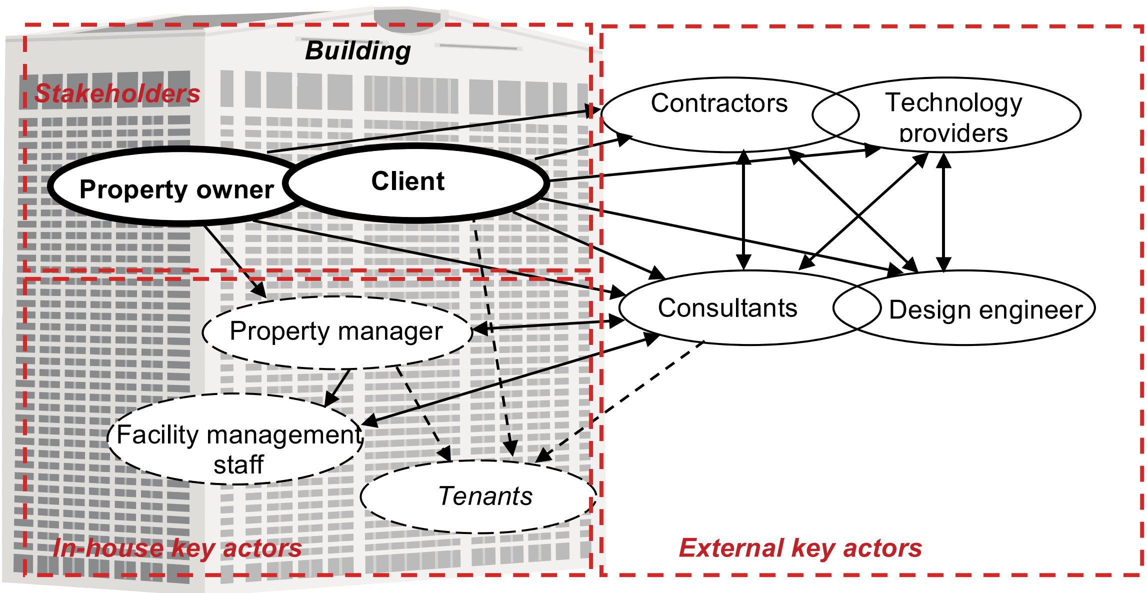

Figure 5. The stakeholders and key actors involved in the Total Concept method. The arrows mark the connection links between the different stakeholders and key actors.

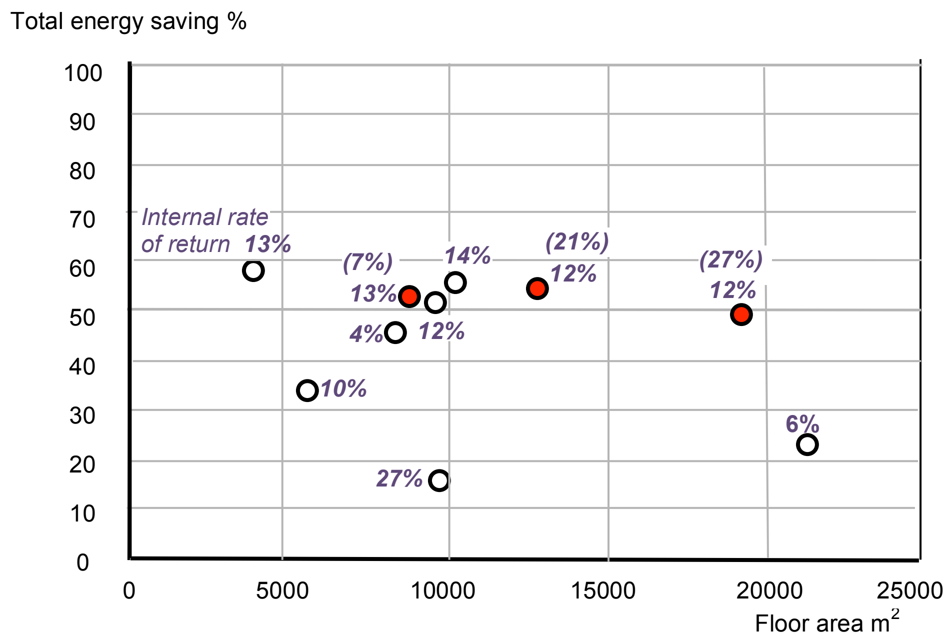

Figure 6. Energy savings and obtained profitability for a number of office buildings from the BELOK Total Concept implementation Programme. The buildings shown are in different stages of realization. The filled dots show buildings that have performed all three Steps and are finished. The hollow ones have performed Step 1 and are still in the process.

who are working with energy performance improvements; *design engineer* who will do the detailed design for the proposed measurers; *contractors* and *technology providers* who participate in carrying out the cost-efficient package of energy saving measures according to the consultants' proposals.

Experiences of Total Concept projects

The development of the Total Concept method was initially carried out within the BELOK group. The first projects to apply and develop the Total Concept was started up in five office buildings, six years ago by BELOK. The method has now extended to a number of other types of non-residential buildings, i.e. school buildings, hospitals and museums. In addition, a number of municipalities have begun, or intend to begin, to test the method. In these projects, the property owner have had the main manager function and consequently the incentive to go through all three steps in order to actually reach the expected savings.

BELOK'S EVALUATION OF SPECIFIC TOTAL CONCEPT PROJECTS

Within the BELOK group an extensive evaluation of performed Total Concept projects are continuously ongoing. So far, comprehensive action packages of energy efficiency measures have been drawn up for 18 properties. In a number of these, the packages are still being implemented. In others, the packages have been carried out and energy use is now being followed up. Three projects have been carried out to completion, including measurements of energy use during a whole year after handover. It has taken 3 to 5 years to carry out these initial projects, among other things due to the requirement to carry out the follow-up energy measurements for a whole year.

The results from the demonstration buildings in Sweden indicate that with the Total Concept method, it seems to be possible to obtain a cost efficient decrease of energy end-use by 40–70 %. This means improvements with large steps towards, or all the way down to, nearly zero-energy buildings. As an example, for the first Total Concept project that was completed the energy use was cut from 180 kWh/m^2 per year to 80 kWh/m^2 per year, which is at the level of building regulations for new construction that came into force in March 2015. The energy costs for the more than 8,000 m^2 building were reduced with €58,000 per year. The follow-up work that was carried out during the first year after handover confirmed that the action package had been profitable, providing an internal rate of return of around 13 %. Furthermore, the main benefit according to the technical departments in the real estate companies involved, is that with the Total Concept method they have gained the means to be able to convince the finance departments and the top management in the company to decide on larger investments and improve the company´s ambitions to strive towards nearly zero-energy buildings.

In Figure 6, the results from a sample of office buildings is demonstrated, forming a part of a Total Concept implementation programme arranged by the BELOK group. The programme also include schools, hospitals, university buildings, etc. but since they are not completely evaluated yet they are not presented here. The 10 projects in Figure 6 are described in Table 1. The demonstrated office buildings are in different stages of realization. The buildings marked red in Figure 6, have been finished and monitored during at least one year after reconstruction, i.e. both the costs and the energy savings are verified. Their internal rate of return values from the initial audit are shown in brackets. The only reason for the diversion is the cost estimations. The estimated and measured energy savings correspond very well. The buildings marked white in Figure 6, represent projects still in the process and are thus based on calculations performed in Step 1.

Table 1. Specifications of the office buildings shown in Figure 5.

Building	Owner	Locality	Floor area m²	Energy before kWh/(m²·year)	Energy after kWh/(m²·year)	Cost k€
Municipality centre	Storfors	Storfors	3,650	262	109	280
Garrison administration	FORTV	Gothenburg	5,700	102	65	120
Municipal administration	Stenungssund	Stenungssund	8,140	144	79	500
Offices "Getholmen"	Brostaden AB	Stockholm	8,500	162	80	400
Offices "Altona"	Stena AB	Malmö	9,500	196	94	540
Offices "Stampen"	Stena AB	Gothenburg	9,680	172	119	96
Offices "Glaven"	LOCUM	Stockholm	10,300	220	100	500
Offices "Pennfäktaren"	Vasakronan AB	Stockholm	12,600	287	120	690
Offices "Hägern"	Fabege AB	Stockholm	19,100	186	85	840
Administration "Johannes"	SFV	Stockholm	21,000	166	133	680

The energy need given in the table is the direct sum of heating and electricity for building operation. The tenant's use of electricity for appliances and other equipment is not included.

Based on the reference projects in Sweden, the investment needed to carry out a package of measures, enabling a 40–70 % decrease in energy use, is relatively high. As an example, for a 10,000 square meter non-residential building constructed around 1990, an investment of about €500,000 to €900,000 may be needed. A prerequisite for the building owner to make a decision to go through with such an investment is that the estimated costs and energy savings are reliable. The Total Concept method requires, like any other method for energy projects, a systematic approach and professional execution. In order to attain the desired results it is essential that a careful consideration and implementation is done in all steps of the work process and that the roles and responsibilities of the different actors are well defined.

So far, Swedish experiences show that the investment needed to carry out a Total Concept refurbishment project, that will halve the buildings energy use, will be roughly between €55 and €90 per square metre, see Table 2. This investment cost includes a detailed analysis of the building to identify energy saving measures, calculation of the investment costs and energy savings and formation of an action package, as well as the design work and implementation of the action package and the final functional performance check-up.

EXTENSION OF THE TOTAL CONCEPT IN SWEDEN

Besides the projects carried out within the BELOK group, there are also Total Concept projects initiated and implemented by other property owners outside the group. A recent investigation on the extension of the use of the Total Concept method in Sweden shows that the method has been widely distributed (Norbäck, 2014). Specific information regarding building type, location etc. have been confirmed for 159 buildings, however information indicates that the Total Concept has been used in over 260 buildings. The Total Concept method has been implemented by municipalities in school buildings, by county council in hospitals and also by state-owned buildings in railway stations, prisons and museums. Private building owners on the other hand, have mainly used the method in office buildings. The majority of the projects have been carried out in schools and offices. The Total Concept projects are geographically spread all over Sweden as shown in Figure 7, although most of the projects are located in the Stockholm region (61 buildings) and Region Västra Götaland (46 buildings).

REFLECTIONS OF THE BUILDING OWNERS

In order to understand how the building owners experience the Total Concept method, four of the larger and more experienced building owners who were first to try the method have been interviewed. A few key points could be recognized and their statements are described in more detailed below. The Total Concept:

- gives a holistic approach including construction, installation and rational economics,
- gives means to go from thought to action,
- saves energy, reduce working hours and gives a clear framework of how far one can go within the defined return requirements,
- provides an overview of the energy loss which helps to work in more structured ways,
- gives a new financial perspective.

An energy expert in a real estate company with 2.6 million square meters premises in Sweden says; Total Concept gives a holistic approach including construction, installation and economic rationales. It has clearly been profitable to work with the Total Concept and in one building the building owner reduced energy consumption from 287 to 124 kWh/m² per year and got an internal rate of return of 15 %. They use the experiences from that project in another major rebuilding project in Stockholm, where the goal is 55 kWh/m² per year and LEED Platinum certification.

Moreover, a technical coordinator in a real estate company with a total building area of 685,000 square meters, used for the transport business and found in towns and cities and at

Table 2. Investment costs in completed Total Concept projects.

Cost item	Cost in €/m^2
Carry out energy audit and identify energy saving measures. Investment cost calculations. Energy simulations and feasibility calculations for an action package.	3–4
Design work.	2–3
Carrying out the action package.	50–80
Final inspection and functional performance check-up.	1–2
Total (excluding VAT)	**55–90**
Annual savings €/(m^2·year)	7–11

important railway junctions says; the Total Concept helps them to go from thought to action and a notion like sustainability becomes not just a cliché. To them, the Total Concept represents the base model, which they have adapted to their own terms and conditions. They are using, or have used the concept in about 15 properties throughout Sweden. The use of a common methodology gives them many synergies. All their technicians use the concept and find it useful. A common model supports cooperation and exchange of experience between projects and it provides a greater efficiency and a better overall grip on energy consumption. The result of the method is also used as a management tool for decision-making.

A public facility manager of 1,500 premises with a total of 1.7 million square meters says; the use of Total Concept saves energy and reduce worked hours. Total Concept provides a clear framework on how far one can go within the defined return requirements. It gives the project manager a better opportunity to manage the project, and to see what is included and how far it is possible to go. With the method they do not spend time discussing various measures during the implementation of the project, as these are fixed from the start. Total Concept is their long-term method. They identify the whole package of measures to start, but implement them over a number of years, so they don't disturb the activities in the buildings too much. By documenting each energy measures, they can manage the whole package – and get a good grip on the entire building complex.

An energy and environmental coordinator of facilities for a county council says: the Total Concept provides an overview of the energy losses. Total Concept gives them an overview of the property's energy flow and makes it easier to discover where the largest losses occur. At the same time they get a package of measures with an overall greater energy saving effect compared with only focusing on the individual actions with greatest effect and best profitability. By using the Total Concept they become more structured in their energy efficiency work, and it has given them a new financial perspective. Today, they take into account the 'reinvestments' that is needed to finance the measures in full scale.

Figure 7. Geographical extension of the use if the Total Concept method in Sweden. The different colors represent an interval of number of buildings from 0 (white) with increasing intensity of the colors with an increased number of buildings.

EXTENSION TO NORTHERN EUROPEAN COUNTRIES

Because of the successful results of the Total Concept method implementation in Sweden, a cooperation project has been initiated between five northern European countries. The aim is to test, promote and further develop the Total Concept method and adopt it to the national conditions in Denmark, Finland, Estonia, Norway and Sweden. The reason why the action focus on countries in northern Europe is that they have similar needs in terms of climate conditions, technical solutions and policy strategies to adopt energy efficiency measures in existing non-residential buildings. The potential for implementing profitable packages of energy saving measures in the non-residential sector is big and by working together with a common approach the hope is that it will lead to major repeatable results over this region rather than local actions only. Moreover, the co-operation project has a focus to overcome the non-technical barriers, which influence renovation rates mainly with practical experiences in pilot projects and by providing suitable training material and training in all participating countries. The aim is to establish a reliable market driver for renovation that leads to less carbon dioxide emissions.

All of the participating countries will carry out a number of pilot projects to try out the Total Concept method. So far, Step 1 of the Total Concept method has been carried out in at least one project in each country. The experiences so far show that building owners and consultants are very positive to the concept and its way of thinking in the economic model. One important remark is that they have recognized the natural and logical way of thinking before, but without the method they haven´t been able to structure the conclusions into an understandable context.

The analyses of non-technical barriers and adoption of the method to national conditions shows that the Total Concept is quite general and can in many cases directly be applied in the neighboring countries without major changes (Total Concept, 2014: 2 and 3). However, some development of the method will be needed, for example a more clear definition of how to calculate the baseline is needed. The baseline is defined as a reference level for the energy saving measures, i.e. the energy performance of the building prior to the retrofit, which also takes into account if the requirements set for the building functions to be fulfilled. Since the level of profitability and the number of profitable energy measures that can be performed heavily depends on the chosen economic baseline in the profitability analysis it is important to have the right baseline. To set the right value of the baseline is often a difficult task and it will be further elaborated in the project.

Additionally, a number of new challenges have been realized during the pilot projects, which requires new approaches. These challenges include, for example, low energy prices (especially for electricity) and the fact that several building owners already have performed the easy measures, "the low hanging fruit", which lead to difficulties to further decrease the energy demand in a cost-efficient way. On the other hand, the demands from the uses of the building are increasing. More and more tenants requires that the buildings they work in, our use in other ways, should have a low environmental footprint, i.e. low energy use.

Final remarks

The Total Concept is a method for improving energy performance in existing non-residential buildings and applies a refined systematic approach to work with energy issues in the building, with the aim to achieve maximum savings in a cost efficient way. The Total Concept method is based on an action plan, comprising a package of measures which meets the profitability conditions stipulated by the property owner. A prerequisite for attaining profitability is that the whole action package is implemented in its entirety. The approach as a whole, combines different elements in a systematic way and presents the economic facts in a way that provide guidance for decision-making in a complex situation with lots of options.

The Total Concept method responds to EU objectives by giving support to major refurbishment in existing buildings in order to reach Nearly Zero-Energy Buildings. The method will tackle one of the major non-technical barriers by helping building owners both in the public and private sector to take decisions and go forward with the implementation of profitable packages of energy saving measures. With the Total Concept method a base is created for professional training both on technical and management level, by providing relevant support and knowledge transfer between different stakeholders.

Additionally, by implementing the Total Concept method in existing non-residential buildings the aim is to show that larger energy performance improvement projects in these type of buildings can meet the demands of profitability set by the building owner and thereby become a market driver for larger energy saving project in the participating countries. The Total Concept method includes the economic realities a building owner has to take into account, while it at the same time makes it possible to come much further with the energy savings than with traditional methods. The Total Concept projects that have been completed, or are still in progress in Sweden, indicate great possibilities to reduce energy use in existing non-residential buildings in a profitable way.

It should also be noted that the Total Concept method helps to organise the energy efficiency work among different stake holders and key actors. However, the results are totally dependent on the persons involved in the process and their ambitions to follow the method and to give feedback with their experiences so that the method can be continually improved.

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