Web site for energy efficiency – a tool for sound investments

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Abstract

The City of Stockholm local green investment program has developed a web-site containing information on energy efficient (EE) products, the "EE product database" and an application for modelling the energy efficiency of buildings, "the Eco-house". The web-site is operating since November 2002 at www.klokainvetseringar.nu and includes:

The EE product database holds the best and latest products and services regarding energy efficiency. Criteria and demands for the EE products to be included in the database are developed in co-operation with authorities, trade associations and product experts. In connection with every product the user will find written information. The website will also give assistance in technical and joint procurement.

The "Eco-house" is an application where you can compare your own house (residential, office or single family building) with an eco building. The application will present the environmental impact from operating the building (electricity use, heat use and water use) and suggests different measures to transform your building into an Eco-house. It will also give you an estimate of the costs and the savings.

The city of Stockholm are introducing these two new interactive tools to facilitate developers, property- and real estate owners to visualize the economic and environmental benefits of choosing energy efficient products and product systems.

Both professionals and private persons have much to gain from setting procurement demands.

This web-site will also work as a basic model for a European version that will be developed during 2003 within the OPET (Organisation for Promotion of Energy Technologies) network.

Introduction

The local green investment program within the Office of Industry And Commerce in Stockholm has existed since 1998 (Stockholm, 2003), when the Swedish government handed out 635 million Swedish kronor (or about 70 million Euro) to increase the adaptation to eco-cycling (Swedish EPA, 2003). The program holds e.g. technical procurement, joint procurement, development – and demonstration projects, knowledge transfer and an environmental assessment tool for the built environment. Until today about 300 projects have been realized, including 25 technical procurements and 10 joint procurements.

During November 2002 the Stockholm local green investment program launched a web-site directed to owners and administrators of single family houses, multi family houses and offices. The purpose of the web-site is to aid users to evaluate their investments both economically and environmentally. Target groups identified as potential users of the web-site and the two applications are:

- Building owners, both public and private,
- Architects and engineers,
- Facility managers,
- Owners of single family houses.

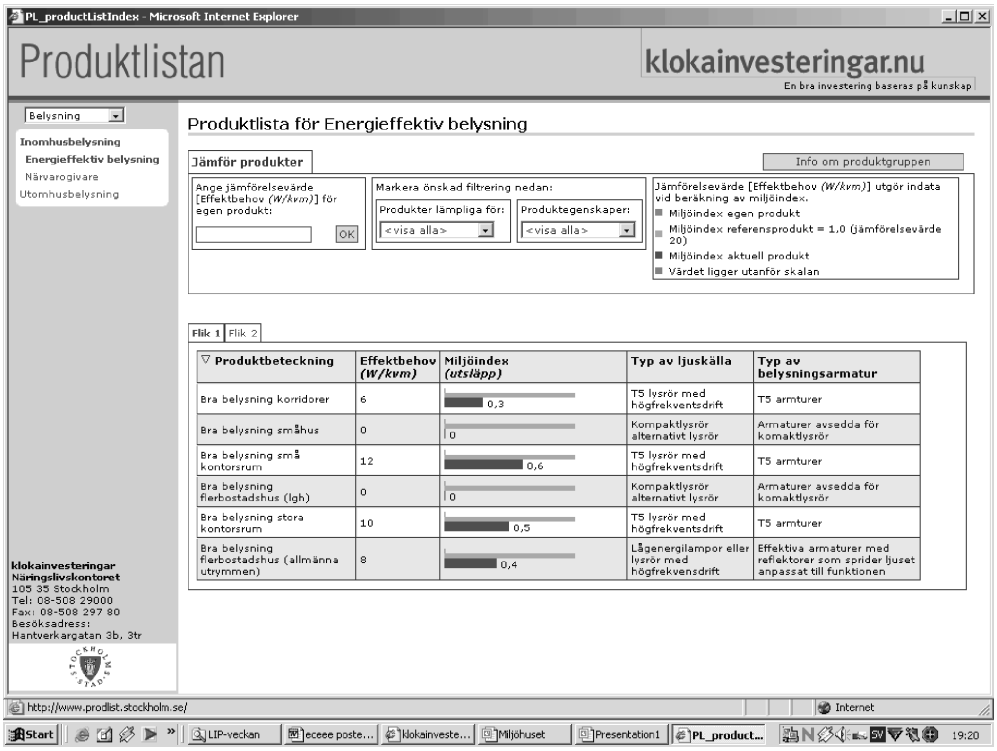

Figure 1. *A screen dump from the EE product database showing products presented under energy efficient lighting.*

The web-site contains two applications, the Eco-house and the EE product database. By using these a potential user can calculate their energy costs and evaluate which economic and environmental effects different energy efficient measures will have. The Eco-house visualizes the operational costs, suggests measures which could optimise the operation and gives information on the energy and environmental performance of the building. The EE product database is a guide to environmentally adapted and energy efficient investments.

There is also editorial information on the web-site which describes products and product systems in order to hand the reader an overview of which techniques are available today, what technique is applicable in a certain context and also future technologies are described. The purpose is to inform the reader and to create a demand for new and better products. There is also general guidance on tools to use when performing a procurement e.g. advice on how to perform a LCC-evaluation (Life Cycle Cost) and directions to models and guides to carry out a LCC-calculation as simply as possible.

The EE product database – a guide to the right deliverer

The EE product database is a gathering area for the best products on the market from an energy and environmental perspective. The purpose of the database is to facilitate users to find information on which products there are, their performance and approximate price levels, and also which retailers there are. Only the products that are fulfilling the lowest energy demand level, set by the local green investment council, are incorporated in the database. The energy demand levels of the different product groups have been set on the basis of advice from experts, deliverers and retailers, and by going through standards, certification regulations and environmental declaration criteria. However, in most cases the levels have been adapted from technical procurement projects led by the Swedish national energy authority, the Environmental and technical delegation or the Stockholm local green investment council.

The goal has been to formulate the standards so that only the best products, from an energy and environmental point of view, will be included in the database. It is important that the standards are easy to recognise by both buyers and producers. If a standard is related to an environmental declaration, that declaration has to be known and accepted by the market actors. It is also an advantage if many buyers are supporting a standard, which is the case when a technical procurement project has been performed. The EE product database should present information that the real estate owner and administrator need to conduct profitable investments and at the same time make an effort for the environment. The environmental characteristics of a product are illustrated by an environmental index, which is compared to the index for a reference product. The reference product should be equivalent to an average product existing on the market today. If the user would like to compare the environmental characteristics with a product not included in the database a comparative value can be indicated manually. Through this the user could easily get an overview of how the products differ in their energy and environmental characteristics.

The EE product database contains about 50 product groups. The web-site will be updated two times per year

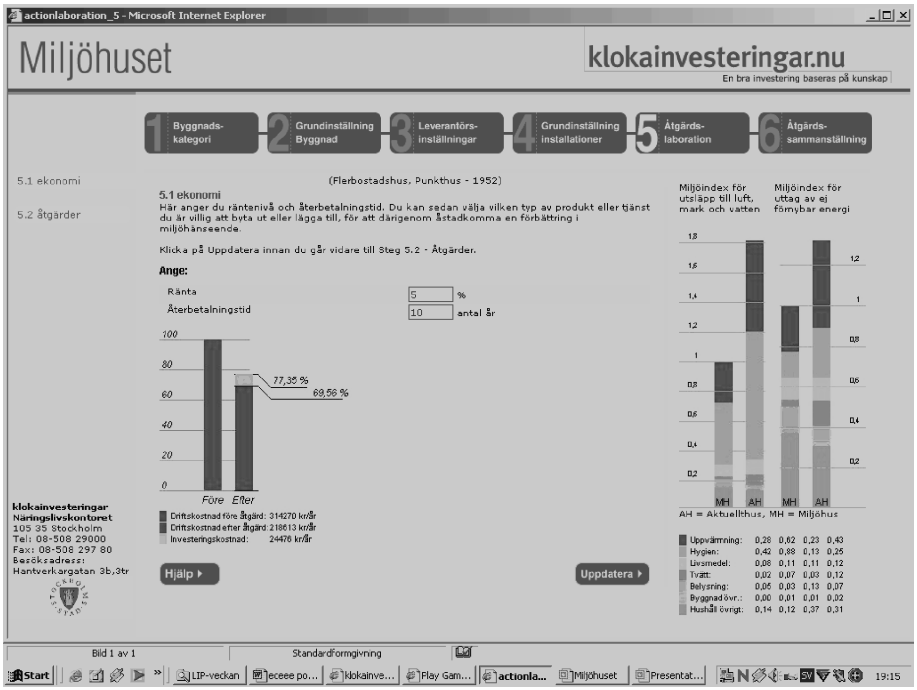

Figure 2. *An example of the result presentation in the Eco-house application. To the left is the economy chart where the left bar illustrates the operational costs before any measures are taken and the right bar illustrates the operational cost after measures are taken, including the yellow part of the bar which shows the investment cost for applied measures. The charts to the right shows from the left two bars for the environmental index and two bars for the energy index. The left bars illustrates the eco-house while the right bars illustrates the actual building.*

and the goal is that the database will hold current information on products in the front line of energy and environmental performance.

The Eco-house

The Eco-house is an application developed to make it easier for real estate owners of single-family houses, multi family houses and offices to conduct profitable investments and measures. The application contains a reference database with different environmental measures that an owner can apply on their property. In the Eco-house the environmental load is calculated based on the operation of the building (requirement of electricity, heat, gas and water).

THE STRUCTURE OF THE APPLICATION

The building categories represented in the application are: Single family houses (detached and terrace houses), multi family buildings (city quarters, disc-clutched houses and tower blocks) and office buildings. The building years represented in the application are: before 1940, 1941-1960, 1961-1975, 1976-1988 and 1989-2001.

The structure of the application is based on six steps through which the user is guided. In the first step the user has to enter building category and year of construction. In step number 2 the user has to input some obligatory data such as the building area in ground level, number of apartments, number of storeys, and the number of inhabitants. Some area specifications are now calculated automatically but can be changed by the user if he wishes. In step number 3 the user has to select heating source e.g. district heating, electrical heating or boiler, electricity and water supplier and the costs linked to these flows. Thereafter, in step number 4 the user is introduced to a number of parameters, which the user could adjust or accept freely. These parameters are presented within the following areas; Heating and ventilation, technical supply, hygiene, food handling, laundry, lighting and other installations. When all the parameters are accepted the results are presented in step number 5. Here three bar charts shows the energy use (non renewable energy sources), environmental index (emissions to air, land and water), and the difference in operational cost between the actual building before and after measures. If the actual building has a higher environmental index than the eco building there is a list of suggestions on which measures to apply to improve the performance. Examples of these measures are: additional insulation of the roof and outer walls, change of windows, installation of air heat exchanger, change of washing machine and change to energy efficient lighting. In step number 6 a table of applied measures are presented including their costs.

The difference in operational costs, before and after measures are taken, can totally or partially be considered as offsetting the capital costs for the environmental improvement measures. The goal for the Eco-house application is to function as support, give inspiration and to sharpen the effects of different energy efficiency measures on the economy and the environment.

TECHNICAL SPECIFICATIONS

The age distribution and technical specifications for the building categories have been selected based upon an investigation conducted on more than 1000 buildings during 1991 and 1992 (Norlén et al, 1993 and Björk et al 1983). Technical

Table 1: Data sources for the environmental index calculation in the Eco-House application.

Media flow	Specification	Data sources
Electricity production	Nordic mixture	Swedish national energy agency, 2001. Uppenberg et al, 2001.
Heat production	District heating (Stockholm)	Fortum Heat, 2000. Uppenberg et al, 2001.
Heat production	Oil boilers (3 different age categories)	Swedish district heating association, 2000. Uppenberg et al, 2001.
Heat production	Combined oil and electricity boilers (3 different age categories)	SP, 2002. Uppenberg et al, 2001.
Heat production	Electricity based boiler (2 age categories)	District heating association, 2002. IVL, 2001.
Heat production	Wood chips boiler (2 age categories)	Swedish national energy agency, 2001. Uppenberg et al, 2001.
Heat production	Natural gas boiler	SGC, 2002.
Heat production	Electric heating	Swedish national energy agency, 2001.
Clean water production	Stockholm	Stockholm water, 2002.
Waste water handling	Stockholm	Stockholm water, 2002.

specifications for the last age category have been worked out within a project group linked to the local green investment council in Stockholm. The technical performance specifications for the measures included in the Eco-house application are based on the same criteria's as the products included in the EE product database. Some of the measures are related to the age of the building e.g. insulation measures (Carlsson, 1978).

ENERGY CALCULATION MODEL

The energy calculation model included in the Eco house application is based on an internationally standardised calculation according to prEn ISO 13790 (and the previous standard EN 832). The calculation of energy demand is done monthly starting from climate data for Stockholm (outdoor temperature and sun in shine for different cardinal points). An individual and functionality based procedure has been used to correlate domestic electricity use and water use to the amount of individuals living in the building (instead of using conventional model values) and to give an incentive for using energy and water efficient appliances.

ENVIRONMENTAL DATA

The environmental index is calculated based on the environmental load from the media flows electricity production, heat production, clean water production and waste water handling. The data sources are presented in the table bellow.

The environmental index is calculated based on four environmental impact potentials (acidification, eutrophication, global warming and photochemical ozone production) (ISO 14042:2000), radioactive waste and hazardous waste. To be able to add these parameters into one index the six different parameters are given the same relative weight (importance). The six parameters are then added and normalised according to the eco building, which is always given the value 1.

The energy index is only built up from one parameter, non-renewable energy, and as for the environmental index the energy index for the actual building is normalised according to the eco building, which is always set to 1.

DEFINITION OF THE ECO BUILDING

The eco building is primarily set to be a goal level for comparison of the actual building, why the eco building is built upon the prerequisites of the actual building referring to areas, age and technical design. The eco building is a building where most of the environmental improvement measures available for each building category in the application have been carried through. The possibilities to reach the level of the eco building are not based on economical limitations, which means that the costs for applying all the measures of the eco building can be unreasonable for an individual real estate owner. However, the primary purpose is to highlight possible environmental improvements reached by applying various energy efficiency measures.

ECONOMY

The profitability, referring to business economics, consists of the difference between the additional cost for the environmental adaptation and the savings in operational costs gained by the measure. The additional costs (the cost for the environmental measure compared to an average measure on the market) have been estimated on the basis that all measures are conducted in connection to normal maintenance. Included in the cost calculation for a measure are also the installation and assembly costs. Assumed in the economical calculation is also that the energy prices rise with inflation. The user has to choose an own interest rate for the calculation and a calculation period.

Marketing of the web-site

Marketing of the web-site has not yet been solved. As the council of the local investment program in Stockholm is terminating most of their work during summer 2003 the city of Stockholm wants to find new hosts of the web-site. Currently discussions are being held with various national authorities with the aim to make the web-site national instead of regional. This will demand some model changes as e.g. the addition of some data like more district heating productions to select from and climate data covering the whole country.

Discussion

The web-site has already gained interest from various stakeholders and in the opening column Egil Öfverholm is encouraging the target groups to apply the Eco-house application as there soon will be a demand for energy declaration of their buildings (European Parliament, 2002).

The web-site has also gained interest from European actors such as the OPET (Organisation for the Promoting of Energy Technologies). They intend to start a project during the spring of 2003 to develop a web-site to promote energy efficient measures within the building sector. OPET is a European network and the web-site will contain information from several countries within the European Union and from the other applying countries. The web-site presented in this paper might work as a basic model for building the web-site at a European level.

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